LIGHTSABERS

4250

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LIGHTSABERS TEAM

Team Development

Our top goal this year was to field our strongest team and best robot to achieve more than in our previous seasons. We put significant effort into determining not only each student's strengths, but also how to use those various strengths to develop the best team.

To do this we completed a 3-phase approach:

1. Individual Assessments
2. Multiple Team Approach
3. One Team Merge

It was modeled after the MIT 2.009 Product Engineering Process Class that Woodie Flowers referred to in Aug 29, 2014 Ask an Expert YouTube video @27:30. https://www.youtube.com/watch?v=wwkbNqMYPgc

Individual Assessments:

In August, before the start of the season, each student and core mentors completed an assessment process. We wanted a system to help place each student in the key roles of our team: Designer, Builder, Programmer, Graphic Artist, Driver, Public Communicator, and Captain. Coach Vince developed an assessment that included 5 separate surveys:

1. Gallup STRENGTHSFINDER®
2. O*NET® Interest Profiler
3. Characteristics Self-Assessment
4. Personal Experience History Log
5. Personal Ranking of Interest in Team Roles

After completing the assessments, we realized we were missing a key role-Spirit! Some students had skills for connecting with others. They were interested in having fun as a team and were strong in the relationship-building strength domain according to the Gallup STRENGTHSFINDER® assessment. "Spirit" was added as one of our team roles. Appendix B contains the skills assessments.

Multiple Team Approach:

We divided our team into 3 separate teams. "Alpha" was comprised of veterans, "Beta" was our students with some experience, and "Gamma" was our rookie team. Each team had to design, build, and compete with its own robot.

Because we tested for skills, we knew each of the 3 teams would have the diversity to be capable of building a robot and functioning well as a team.

In the past, we have noticed that younger students sit back and let older students who know more do the work. Dividing into 3 separate teams allowed the younger students to develop skills and forced each of them to step up. A side benefit of having 3 teams is that it provided a variety of solutions to this year's game.

What we did not know was the cost of having 3 teams. The separate teams worked hard for their own team but were less concerned about the whole club. Also, having 3 teams was a lot of work for the mentors. We had originally thought we would combine the teams later in the season as they were eliminated in the competitions. But all the teams did so well, that none were being eliminated! So due to the "costs" and the desire to unify our team into one strong team, we merged on November 24 as team #4250. (The merge is evident in the notebook task entries by the change to the blue color.)

We had one more "surprise" within our 3 teams. The "Alpha" team had enough depth of skills that they were able to do research and development on an advanced robot design. (This "R & D" robot is noted in the notebook in the orange color.)

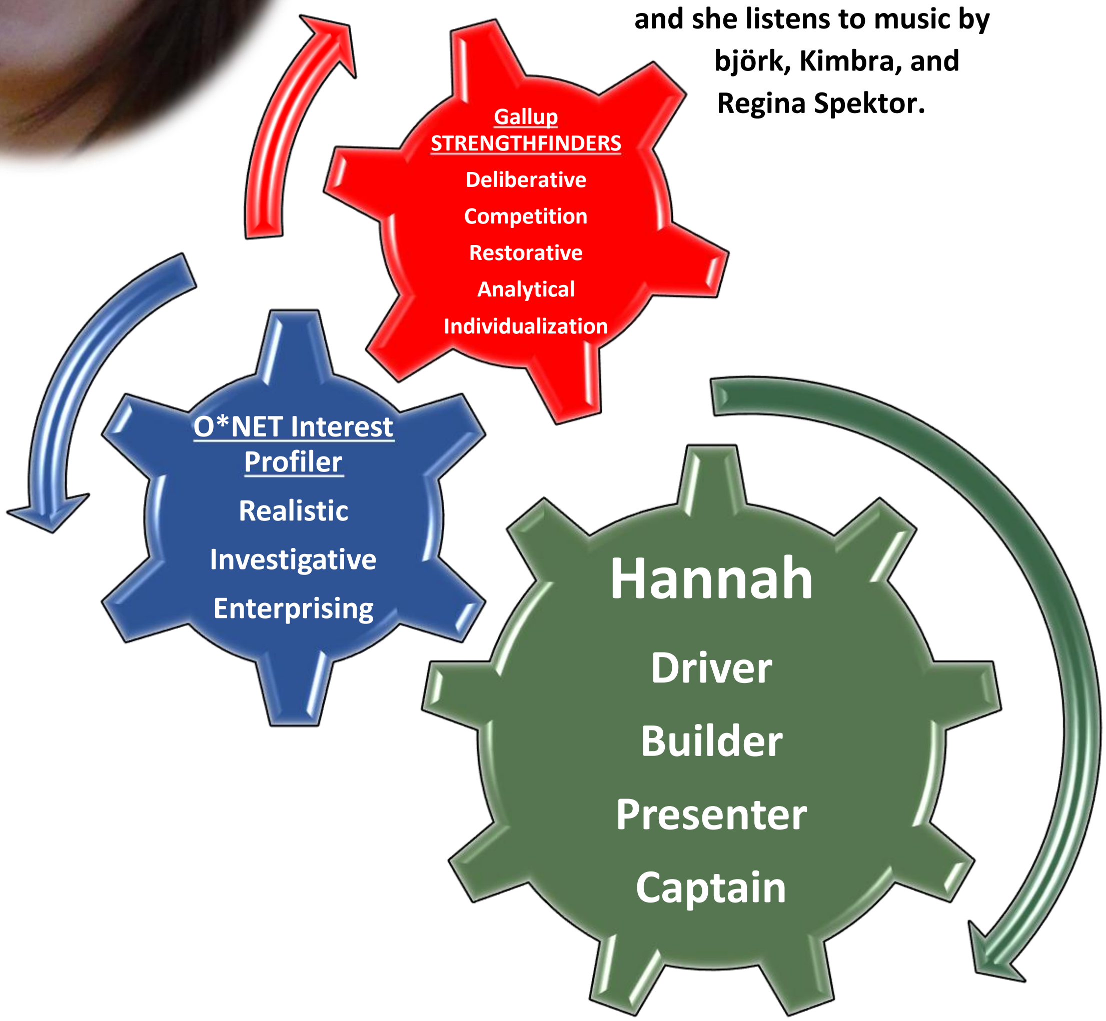
<u>One Team Merge:</u>

Now we have come back together as one unified team. Each student has specific roles based on the assessments and function within one team! With our original teams of 5-6 students, members had to fill multiple roles to get all the work done, even if it was not their strongest skill. With the larger team, the members can now focus more on their strengths.

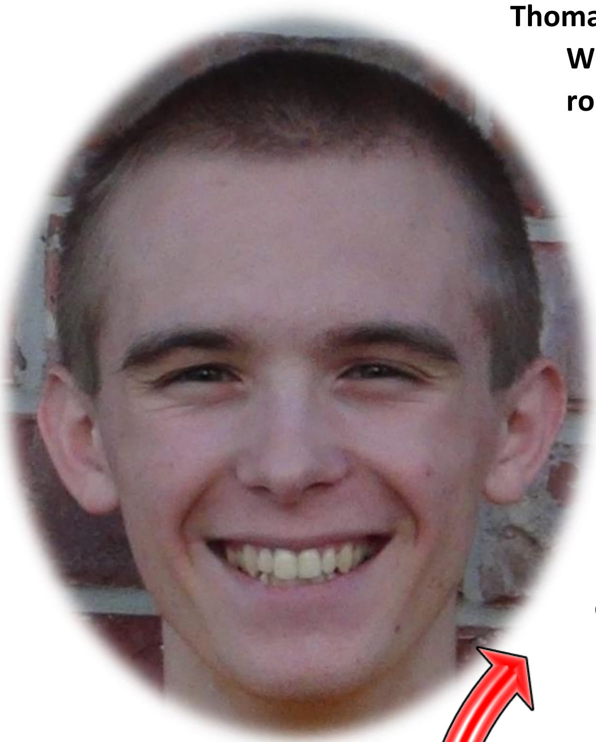
Each team kept a separate notebook until we merged into one team. When we merge we continued on with #4250 ALPHA's notebook for the whole team because it had the documentation for the R & D robot as well as most of the outreach. Appendix A contains #7798 BETA's notebook and #8982 GAMMA's notebook.

Team Members

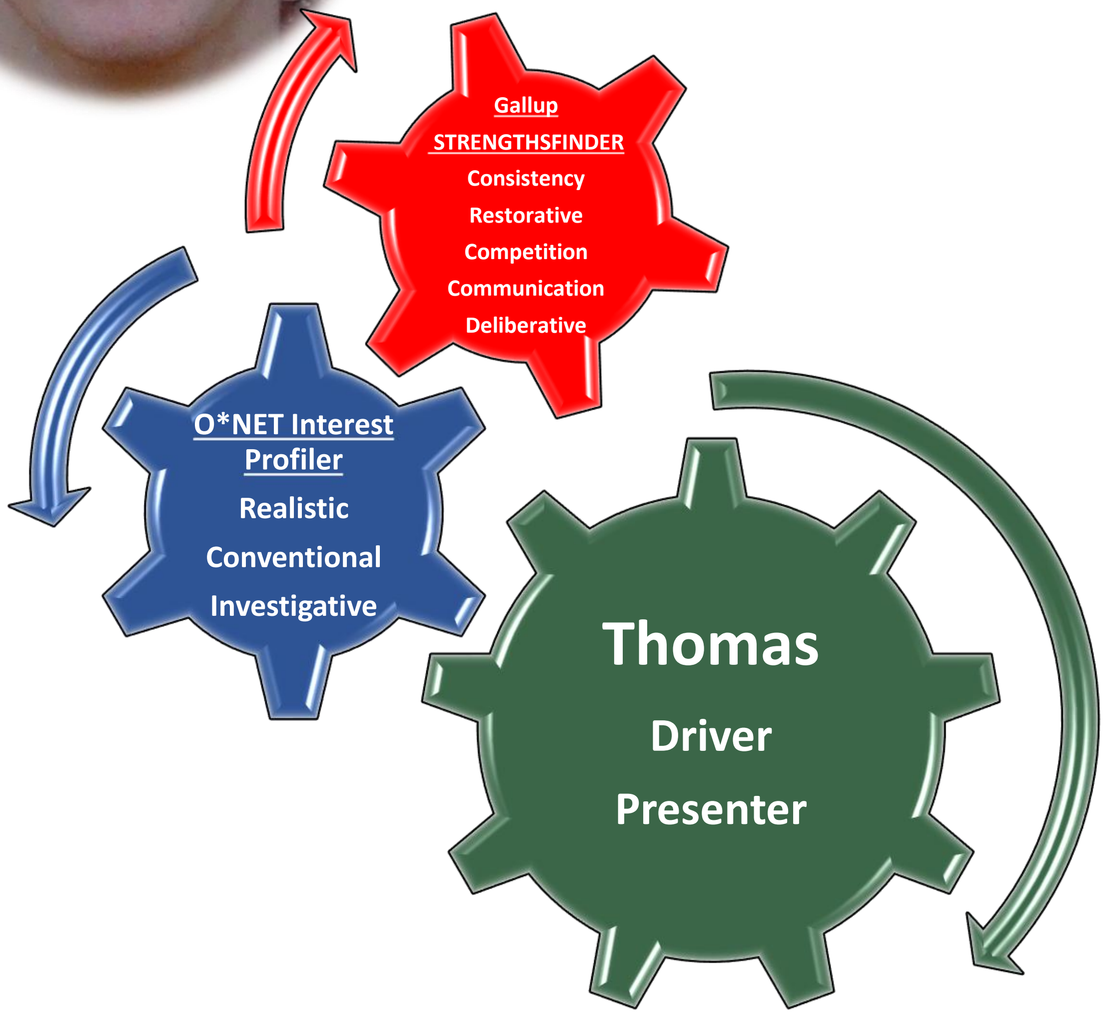
Hannah Liao is a 16-year-old home schooled student. She is beginning her 5th season with FTC® in addition to four years of FRC® experience. Although Hannah claims she joined robotics because she was drafted as a warm body, her favorite activities have become building, driving, and serving as team captain. Her most memorable robotics experience is winning FRC® at state and losing FTC® at Worlds because she learned so much from the experiences. Hannah would like to become a prosthetist in the future. In addition to robotics, she enjoys sculpting clay, PC gaming, reading and spending time outdoors. Pizza is her favorite food and she listens to music by björk, Kimbra, and Regina Spektor.



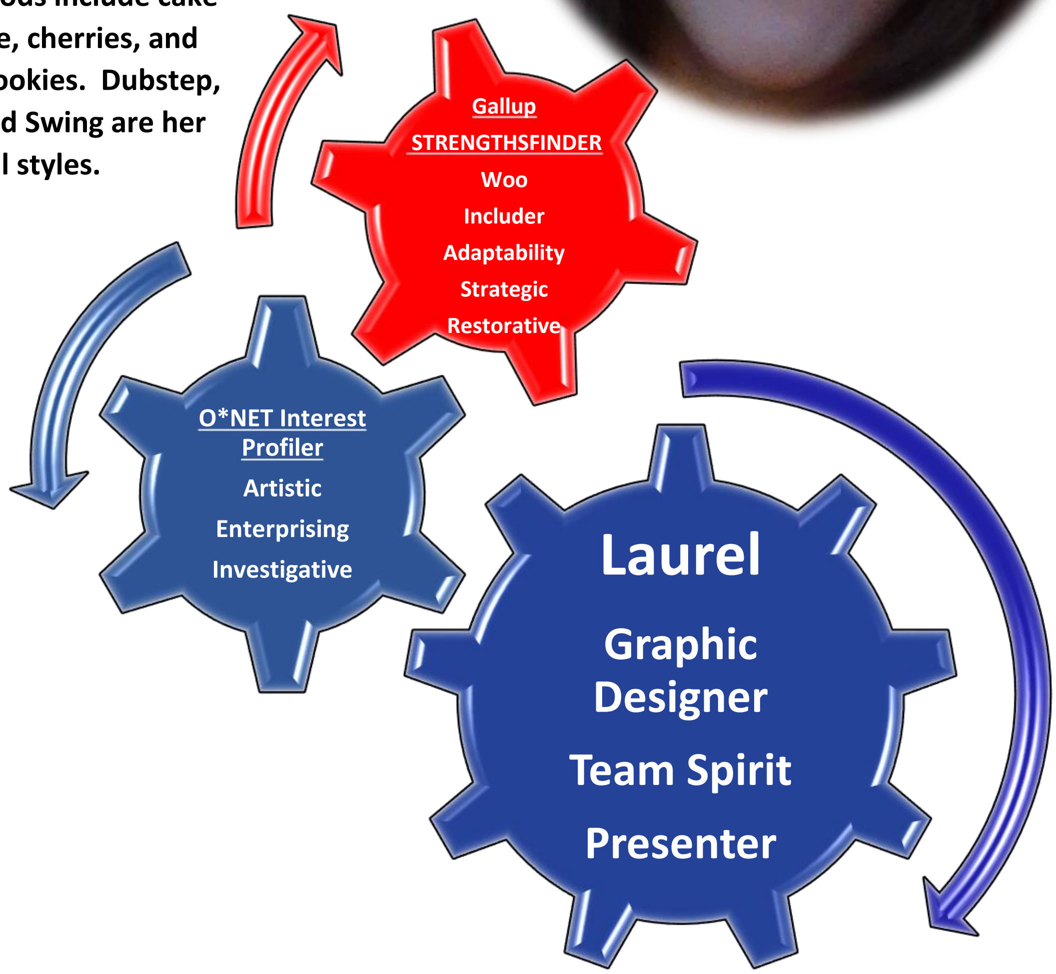
Jason-Elliott Hendricks is an 18-year-old home schooled student. With three years of robotics experience in FRC®, he is beginning his 2nd season in FTC®. Out of interest in robotics, he attended a meeting and decided to join. Presentation, building and design are his work preferences, and his most unforgettable experiences on the LIGHTSABERS are winning the OKC Regional Chairman's Award in 2013 as well as winning the OKC Regional Competition in 2014. Plans for Jason-Elliott include a career as a software developer or perhaps a position in cyber-security. He also plans to return to the team as a mentor. Reading, writing, playing video games, and hanging with friends are his other interests. Favorite foods for Jason-Elliott are quesadillas and chicken-fried steak, while his musical tastes embrace Punk Rock, Dubstep, and Hard Rock.



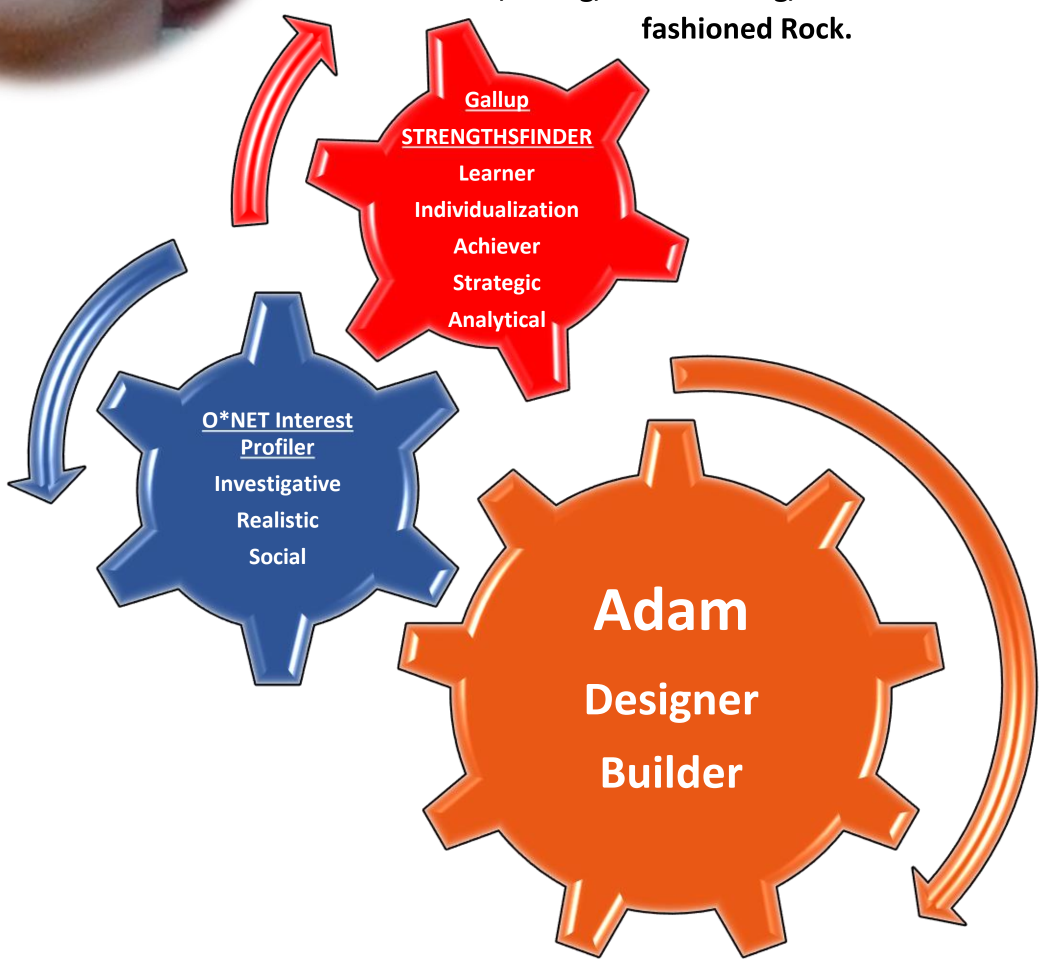
Thomas Lewis is a 16-year-old home schooled student. When he was younger, his interests in computers and robots drew him to robotics. Building is his favorite work because he enjoys putting things together and getting things accomplished. Driving is also his forte since he finds being on the competition field exhilarating. He believes there has been no better experience than going to Worlds as the team captain and main driver. Immediate goals for Thomas include winning at Worlds. He says that after losing by 7 points last year, he has resolved it will not happen again! He enjoys playing video games and eating pizza, chicken-fried deer, mac'n'cheese, biscuits and gravy. He listens to orchestral video game music and movie soundtracks.



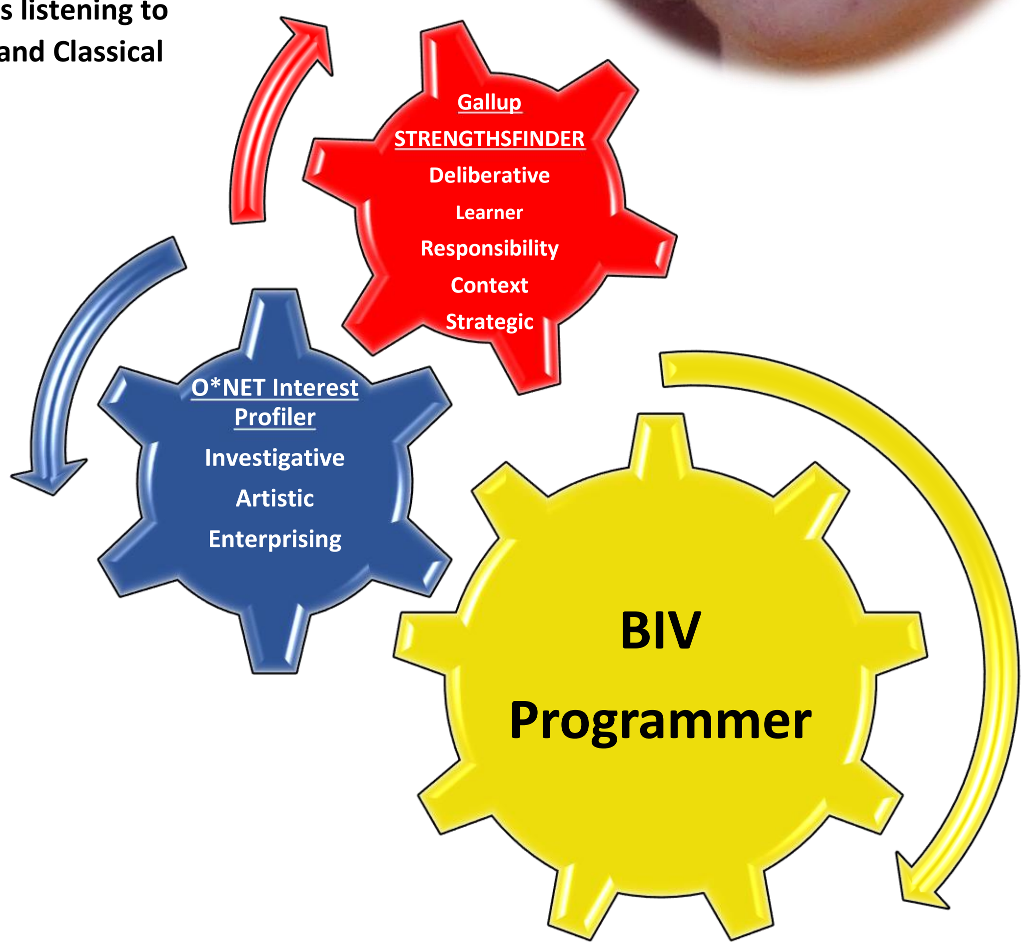
Lala Click is a 15-year-old home schooled student. She enjoys participating in robotics because it gives her a chance to use the things she has learned in school and life in a fun and exciting activity. Three years of FTC® and FRC® have provided her with many opportunities to do some of her favorite kinds of work, including graphic design projects for t-shirts and engineering notebooks, as well as building on the robot because there is always something to do. A fun moment for her in robotics happened when she and her twin sister were drivers in an FTC® finals match and in the last few seconds, they managed to throw one last ring onto the center floor goal with a 360° maneuver. Later in life, she hopes to work as a graphic designer or artist. In her spare time, she likes drawing, singing, painting, video gaming, playing the flute, listening to music and FUN! Favorite foods include cake bites, vanilla coke, cherries, and Ricotta Cheese cookies. Dubstep, Pop, Classical, and Swing are her preferred musical styles.



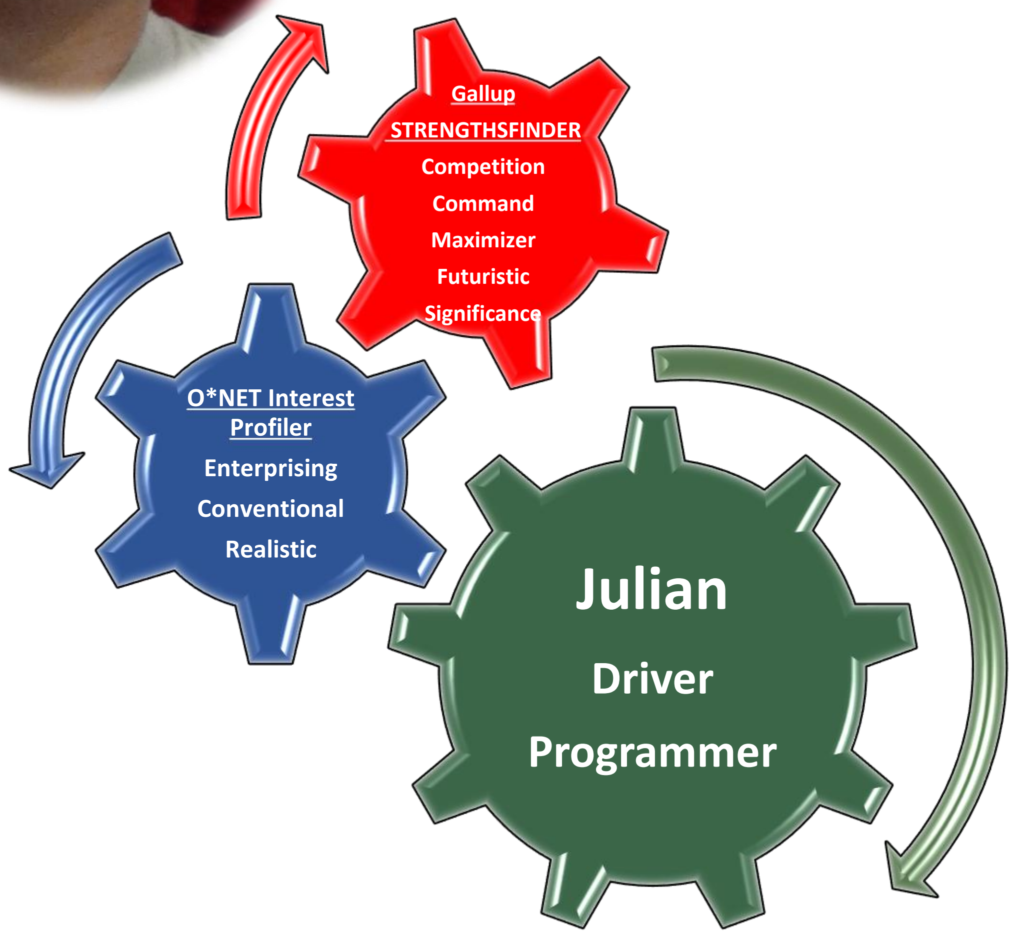
Adam Click is a 17-year-old home schooled student. This is his 4th season of robotics with FTC® and FRC® teams. He joined robotics in hopes of gaining an understanding of robotics and applying what he learns to design an exoskeleton. His preference in teamwork goes toward designing and building, although he feels it is almost wrong to separate the two. He loves coming up with efficient designs and making them a reality. His most memorable robotics experience is winning a state qualifier. Future goals include the design and construction of an armored exoskeleton. Nerfing, gaming, reading, and volleyball are also some of his interests. He enjoys eating burgers, fries and drinking Mountain Dew. Music preferences are 20's to 30's era music, Swing, Electro Swing, and old-fashioned Rock.



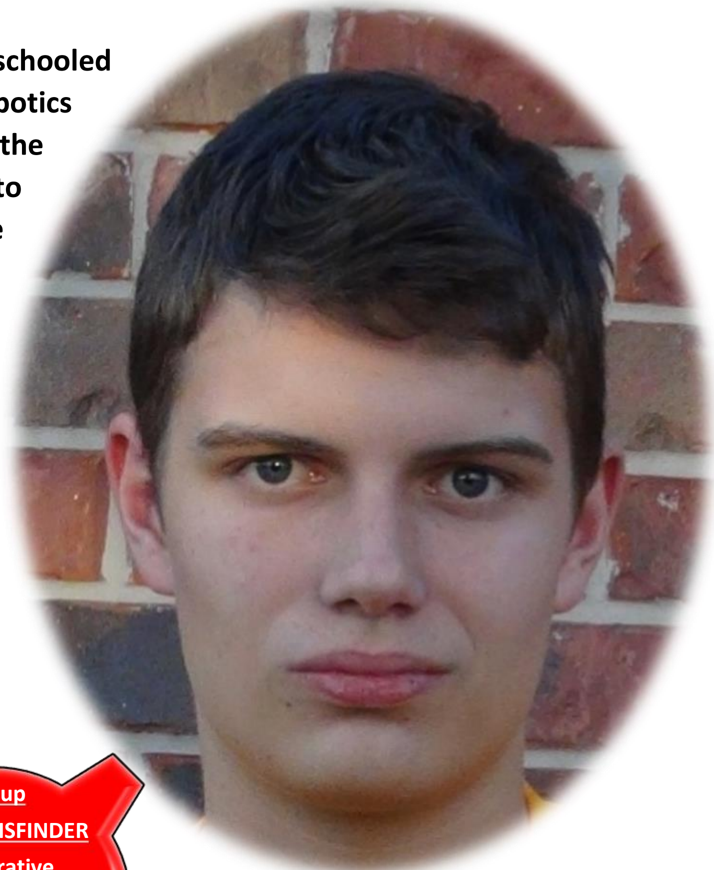
Biv Click is a 15-year-old home schooled student. This will be her 3rd season in FRC® and FTC®. She joined after seeing her older brother having so much fun in robotics. Her favorite work in robotics is when she's fully focused on her job, either hashing out code on the computer or speed-walking through the pits, scouting out future alliances and opponents. Her favorite robotics moment was at FRC® Worlds. The top half of the robot needed rewiring, so Biv and another teammate got to work soldering and wiring. Hardly anything was said and no questions were asked because they completely understood each other's tasks and methods. In the future, she hopes to find a profession that she is passionate about. Along with robotics, she enjoys volleyball, violin, playing video games, reading, taking walks and conversing. Fettuccine Alfredo rates high on her food list and she enjoys listening to Swing, Big Band, and Classical music.



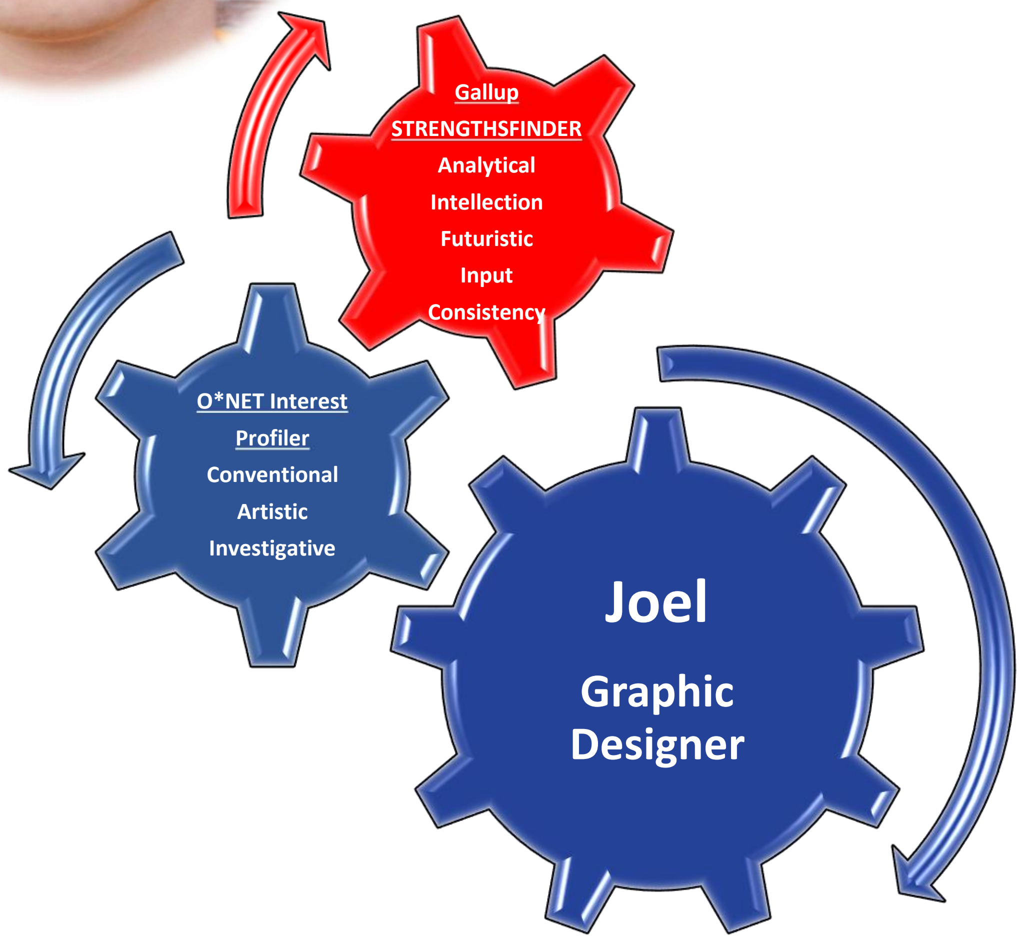
Julian Zwirtz is a 15-year-old home schooled student. He was first drawn to robotics because of his love for programming. Programming is his favorite job because he enjoys creating code to make the robot do his bidding. Driving is also his interest, because he finds that aspect of the competition exhilarating. His favorite experience was the Worlds competition as co-driver. Julian strives to win at Worlds and have the highest scoring autonomous. The loss at worlds last year by 7 points showed him just how much sweat and toil it takes to be the best. His favorite pastimes are video games and coding. He will also eat almost anything edible that you put in front of his face.



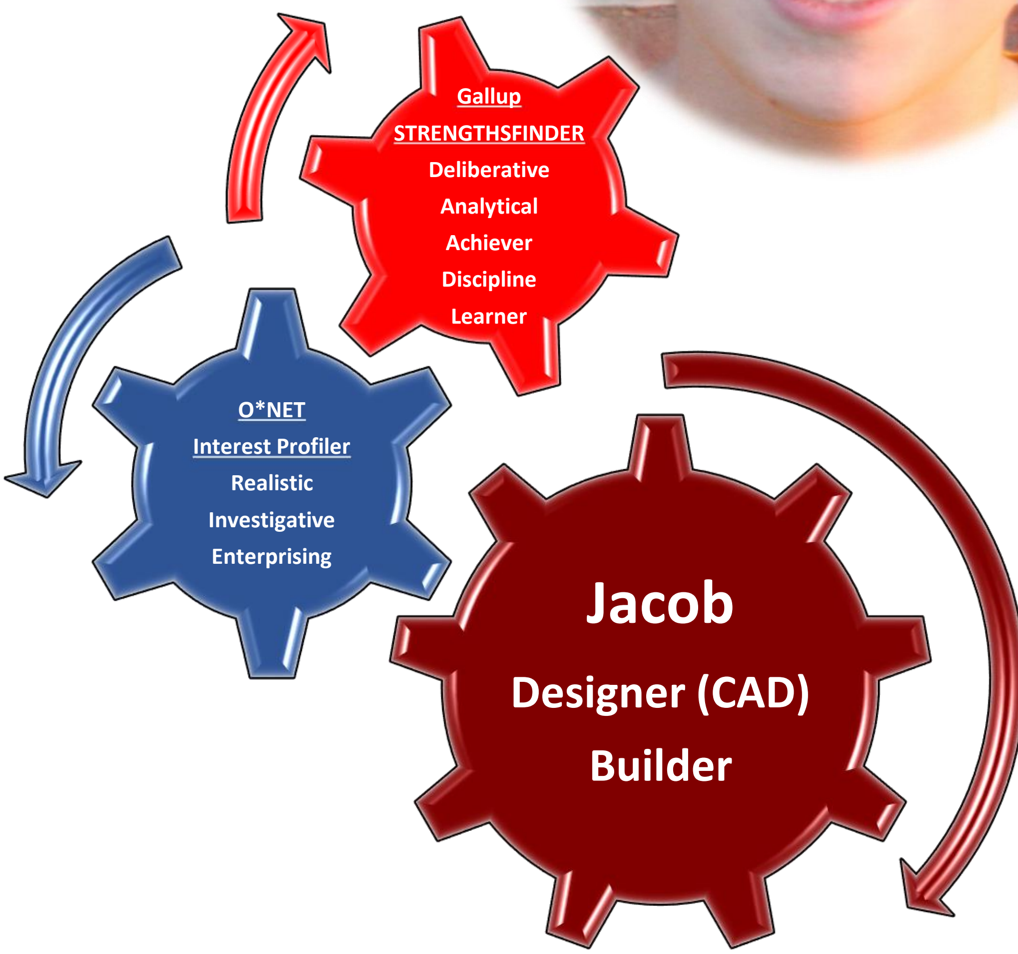
Lucien Zwirtz is a 14-year-old home schooled student. He was originally drawn to robotics because he enjoyed FLL® but wanted to be in the older league. His job on the team is to program; since this is his first year doing so he has help from his older brother, who is his mentor. He enjoys playing video games and his favorite foods are pizza, chili, and garlic bread. His favorite music is anything from the 1980s.

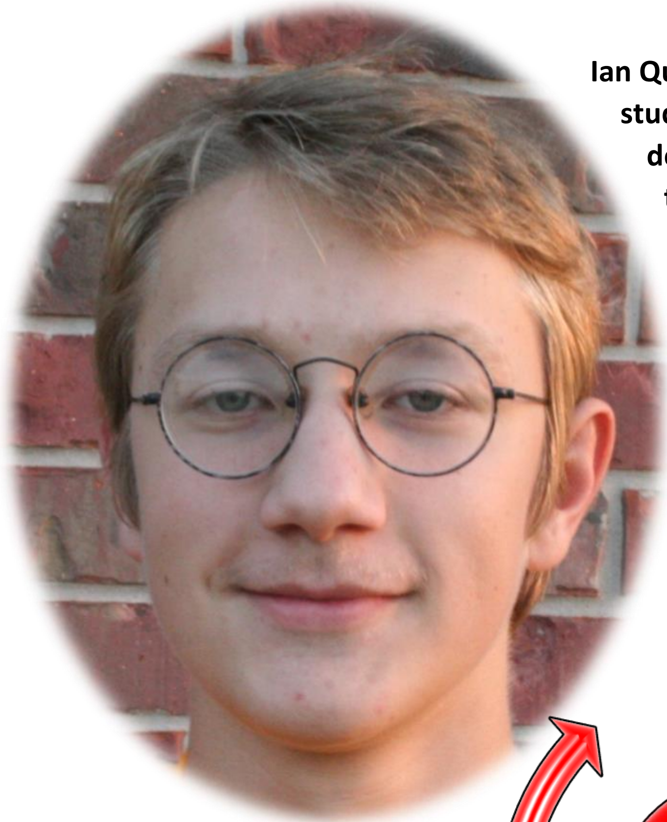


Joel Fowler is a 15-year-old home schooled student. Four years ago he wanted to learn more about computer software and robots, so he joined robotics. He enjoys the technical side of robotics, such as: Graphic Design, CAD, Photography, and Web Design. In his spare time he enjoys gaming, drawing, and listening to Indie-Alternate-Folk-Rock. His favorite foods are Ramen, Garlic bread, and Cheese.

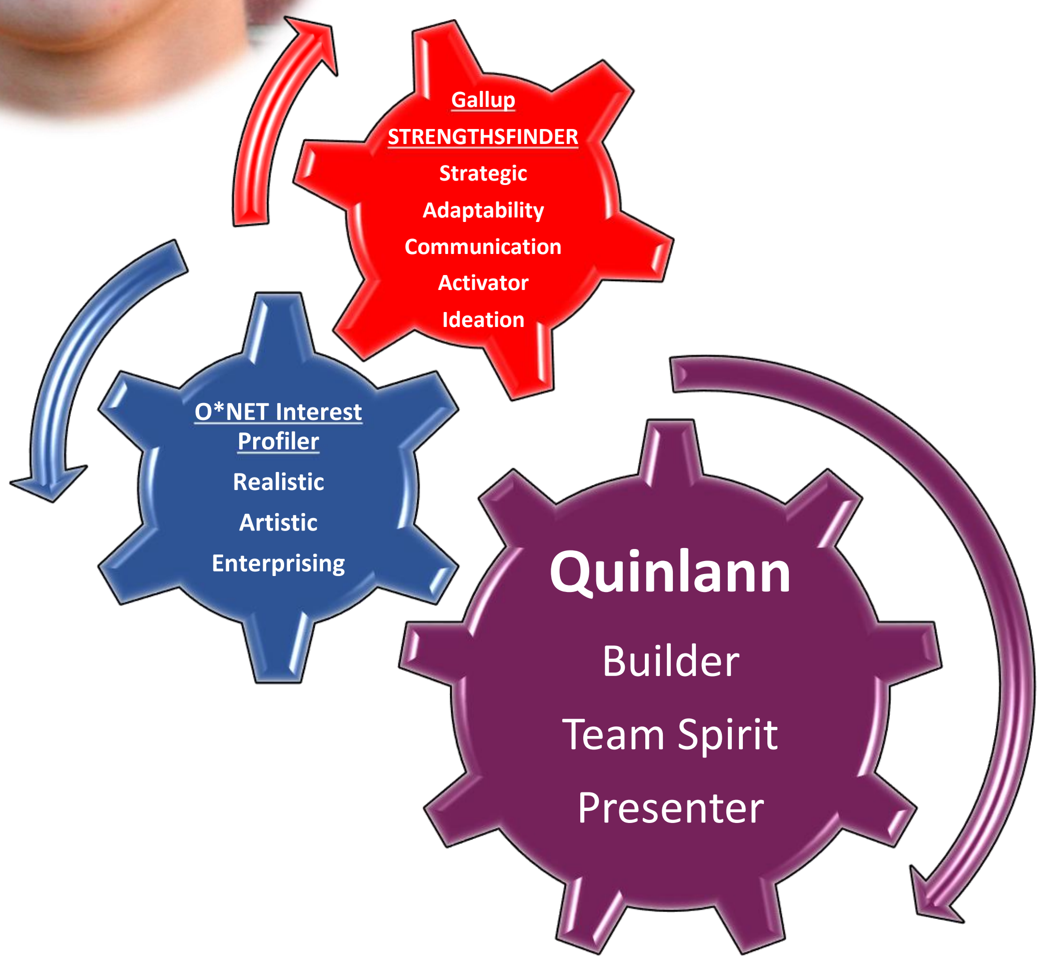


Jacob Liao is a 13-year-old home schooled student. When he was younger, he really loved building and creating LEGOs, and when he saw his older siblings doing robotics he decided to try it. Jacob started participating in FLL® and the next year he moved up to FTC®. He now is a CADer and builder for the team and hopes to be able to make it to semifinals at worlds. He likes building and creating things, playing board games, watching movies, eating burgers, Chinese food, and mashed potatoes.

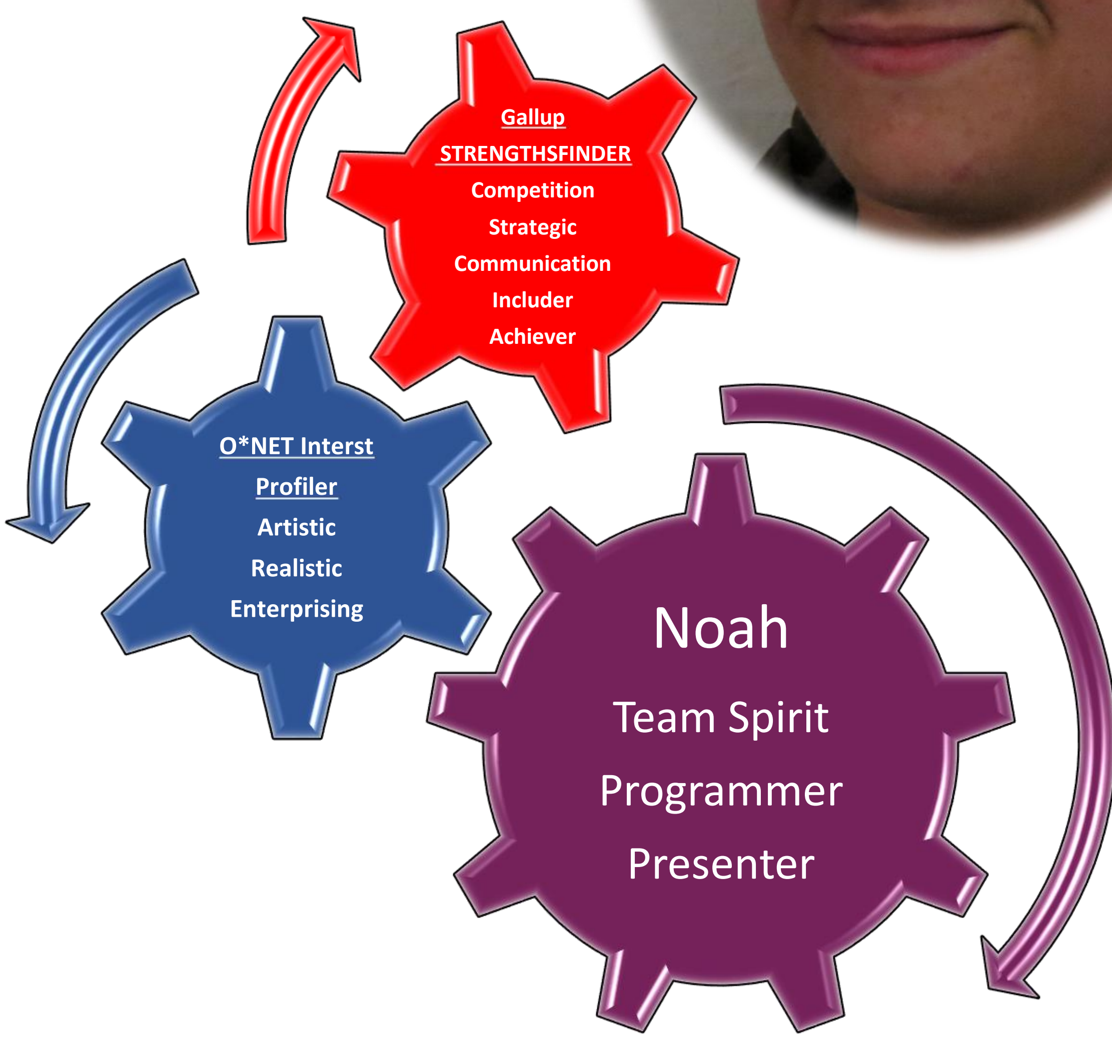




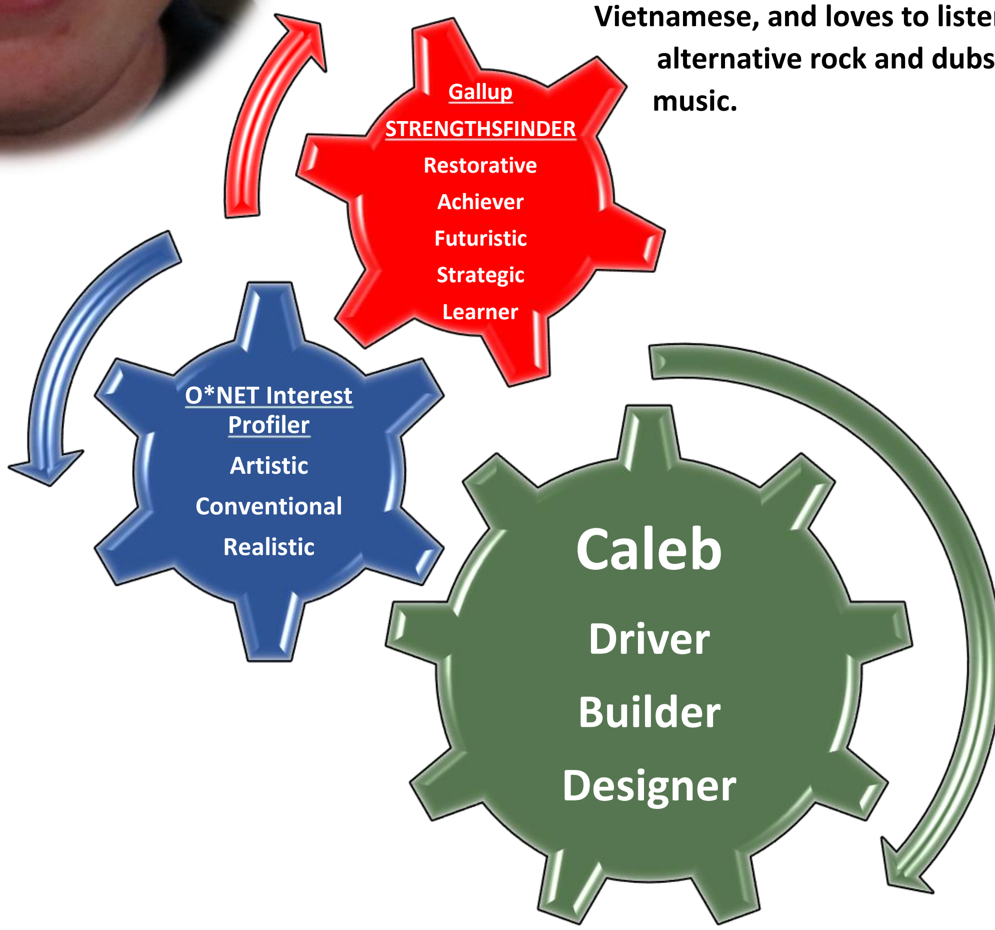
Ian Quinnlan King is a 15-year-old home-schooled student. Quinnlan has always loved building and designing things, so he fit perfectly as a builder on the team. Growing up he always made Lego spaceships, cars, and other things. As soon as he heard of robotics, he wanted to join. Quinnlan started out in FLL® and shortly after he decided to join the FTC® team. Quinnlan likes video games, good food, TV, movies, Legos, building, and designing things. He likes listening to 80's rock and electro music.



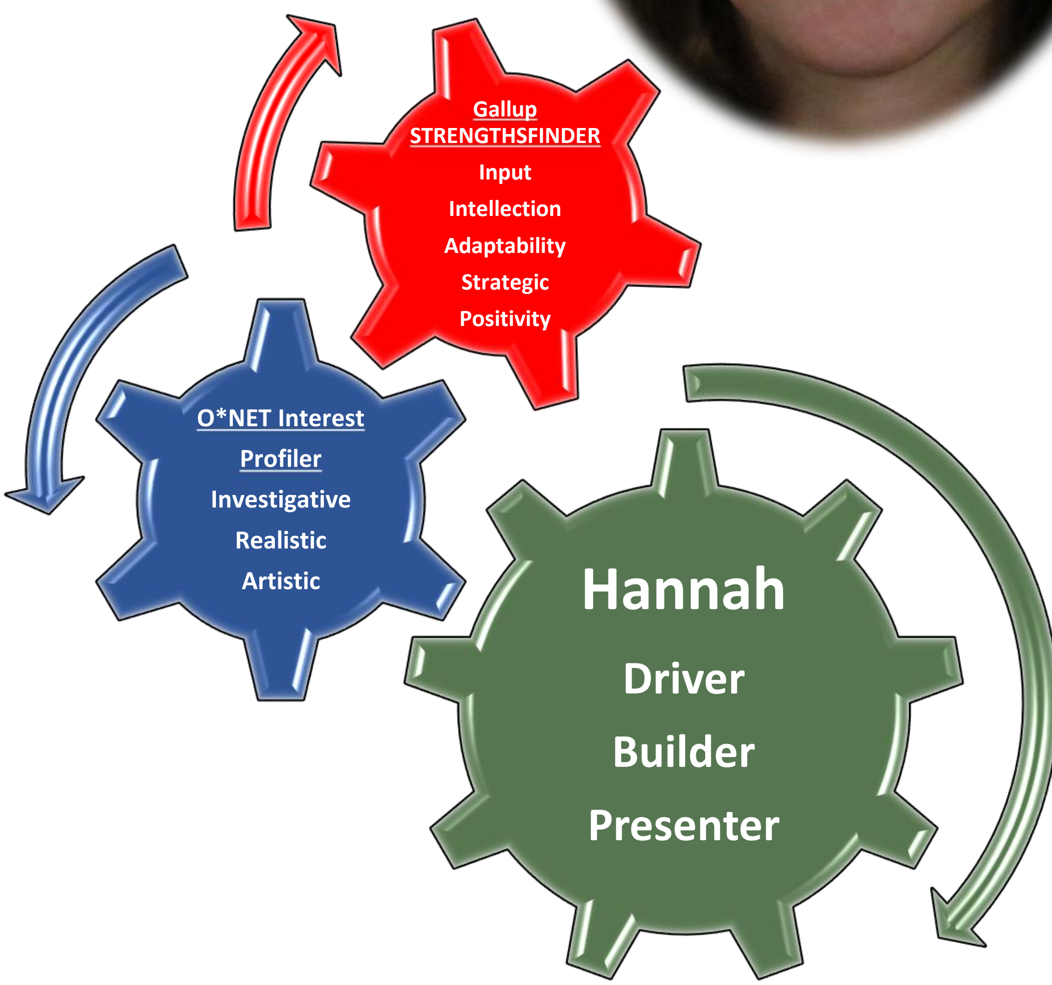
Noah Frost is 15 and in his first year of robotics. He joined robotics to learn new skills and have fun while doing it. He is now one of our programmers. One of his most memorable experiences is the day he found out that robots do not bounce. Some of his favorite things are video gaming, programming, and eating. His favorite food is any type of pizza ever! He enjoys country music.



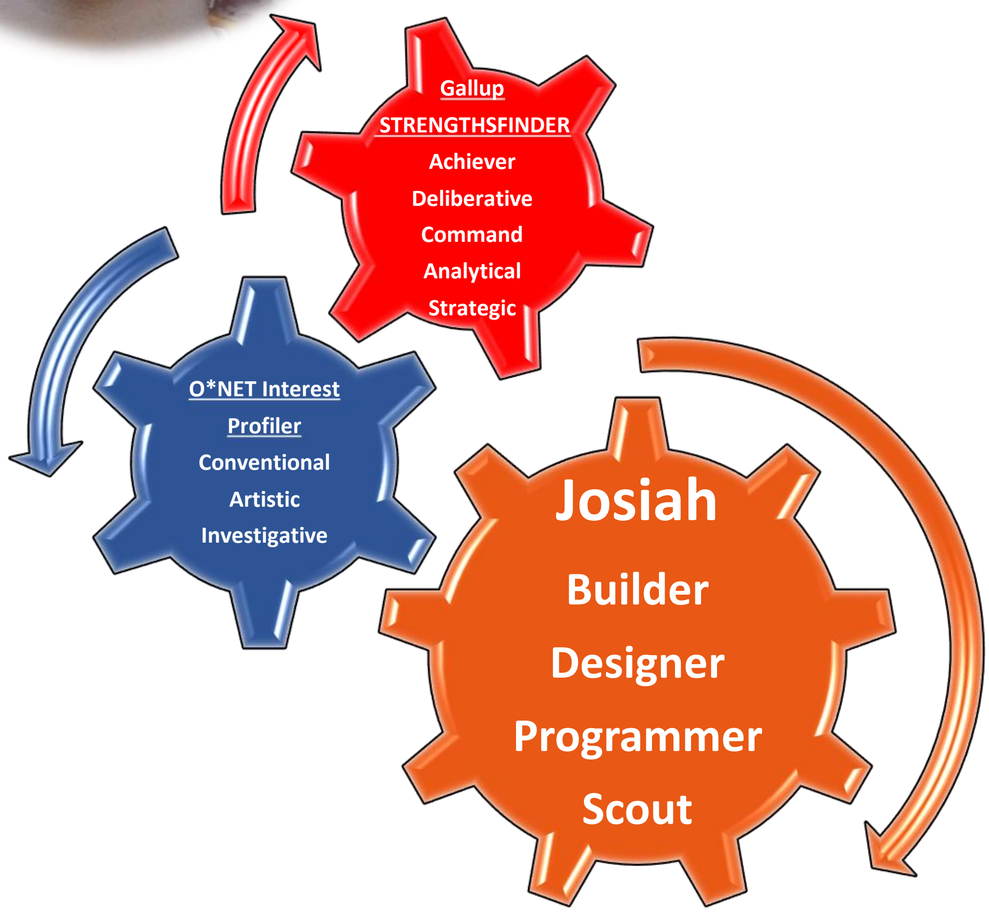
Caleb Smith is 15 and in his first year of *FIRST®* robotics. He joined robotics because he has always liked building and taking apart things, so when a friend told him about LIGHTSABERS, he tried it and loved it. His favorite types of work in robotics are building and prototyping. He likes to make things work and see the accomplishments of his team. His most memorable robotics experience was watching a world robotics tournament on TV, and thinking it was so cool that people were able to build a robot themselves and compete with it, and now he is excited to be one of those people. His hopes for his future are to someday be an engineer or designer of technology, like phones or computers and to one day own his own company. He likes fencing, building computers and robotics. He likes to eat pizza, Thai, and Vietnamese, and loves to listen to alternative rock and dubstep music.



Hannah Fowler, at age 14, is in her second year of *FIRST®* robotics, with one year's experience at the FLL® level. She joined robotics because it is a fun way to learn new things. She especially enjoys building and driving. Her most memorable experience so far in FTC® is watching the robot move for the first time. She hopes Gamma will earn some awards at competition! Other interests outside robotics include drawing, music, and reading. Her favorite foods are garlic bread and ice cream, and she enjoys music of the 70s and 80s.



Josiah Murphy is 13 years old and in his third year of *FIRST*® robotics. He has spent two years on FLL® team LIGHTSABERS Gold Squadron but this is his first year of FTC®. He joined robotics because he thought it would be cool to build and program robots. His favorite types of work in robotics are programming and design. His most memorable experience is once in an FLL® qualifier his team's robot was in second place but was actually (temporarily) in first because the points were wrong. He hopes that his team will make it to Worlds. His favorite hobbies are karate and robotics. And he loves mentor Heather Fowler's "to-die-for" chicken enchiladas.



Elijah Frost is 12 and this is his first year in FTC®, but he was on the LIGHTSABERS Red Squadron FLL® team for 1 year. He joined robotics to learn and have fun. He is on the build team, and his most memorable experience was making 4th place in the robot in the FLL® state competition. He likes 3D graphic design, reading, and gaming. He loves to eat sesame chicken, and enjoys listening to dubstep, Coldplay, bluegrass, and the Beatles.

Coach Vince Liao

In 2010, Vince Liao taught a robotics class to homeschoolers that led to the start of the LIGHTSABERS FTC® team. He did not stop with an FTC® team, but was courageous enough to have us become an FRC® team as well. With limited resources (a 3-car garage with basic tools) and an inspired group of students, we built our first robot with the kit base, plywood and PVC pipe. We won the All Star Rookie Award and were the fifth seed at our regional. We learned that with solid, simple principles and a little imagination, we could compete with teams that had machine shops, years of experience and resources we did not have. Four of our six students had never touched a robot before that season. Seeing our younger siblings and friends also needed STEM opportunities, he pursued having all the programs of *FIRST®* in our local homeschool community. He inspired other adults to get involved, mentored them on how to coach teams, and now our one FRC® team has grown to the LIGHTSABERS *FIRST®* Progression of Programs that includes 9 teams (Jr.FLL® through FRC®), 50 students, and 32 mentors.

In just four seasons, Vince has mentored our teams to dozens of awards, World Championship competitions, and last year, the Regional Chairman's Award. Each year, he sets new goals to improve our skills and add to our knowledge. Last season, we built four different motion base types on our off-season to be prepared for the next season. This year, we learned a rapid build process. He is creative, forward thinking, and meticulous in solving problems as he walks us through the process of finding solutions; we learn career skills as well as life skills. He pushes us past our comfort zone, teaching us to face the challenges and struggles of building a competitive robot.

He encourages us to volunteer for *FIRST®* and community events, supporting us as we teach classes on programming and game strategy to FTC® teams, lead workshops, and mentor young students. He believes that "doing robotics" is not enough; we must lead, and he has taught us to be leaders by serving others. He has a vision for a greater level of competition in our state, and this year helped start an alliance of teams for collaboration, showing us how to work together with other teams for everyone's benefit. He has taught us to think like engineers, grow as individuals, and has given us opportunities that we would not have otherwise.

Mentors

Our Coach **Vince Liao**, an engineer working as the Flight Simulation Project Manager with the Federal Aviation Administration, has been involved in robotics for seven years.

Nathan Parrow, maintenance Engineering Specialist at the U.S. Postal Service has 16 years' experience maintaining and modifying a multi-million dollar fleet of automated mail processing machines, leading a team of 38 maintenance technicians comprised primarily of mechanics and electronics technicians. In addition, he is Owner / Mechatronics Engineer at Oklahoma Robotics LLC with 5 years designing custom robotic / mechatronic systems including both the mechanical and electronic design. He leads a team of eight freelance engineers and designers in the creation of custom systems including custom circuit board design, hardware, firmware, and software, and interfacing with machine shops, vendors, and contract manufacturers. With the LIGHTSABERS, he mentors in mechanical design and fabrication including CAD, soldering, machining, laser cutting, plasma cutting, welding, etc.

Wayne Hendricks, employed by the Oklahoma Corporation Commission, also works as a Master Electrician and electrical contractor. He has also had a coaching career in high school football and baseball, little league baseball and other sports. Mentoring the LIGHTSABERS for the past three years, he continues to guide the students in scouting, strategy, and tactics.

Michael Lewis, software engineer at the Science Applications International Corporation, enjoys teaching kids to work with not only software, but also mechanical and electronic components because it prepares them for a future that these disciplines will improve. This will be his 4th season with the LIGHTSABERS.

Former FTC® and FRC® student **Matthew Graham** is a software developer with BirdDog Software. He works with the interested parties in programming and helps them get their environment set up as well as mentoring them on techniques and methodologies for software development and robot autonomous/teleop design. His favorite part of the robotics experience comes after spending weeks of designing/programming/building the robot and then finally having that one meeting when everything starts to merge into the final robot that works and performs well. Matt begins his fifth season of robotics this year.

Also, a former student, **Xavier Zwirtz**, software engineer with BirdDog Software mentors the team in programming. His favorite part of robotics is the melding of software with the real world and the exposure to advanced concepts it gives to students. This will be his seventh season of robotics.

Rebecca Liao, Coach's wife and home school parent is the mentor for documentation and presentation. In her fifth year of mentoring, she loves being part of a team!...and the laughter.

Robin Zwirtz, aka Darth Vader, is President of BirdDog Software Corporation. Mentoring the team in game strategy, presentation, and software, his favorite part of the season is the competitions. This will be Robin's seventh season.

Kelsy King works in construction maintenance and customer service. As a first-year documentation and organizational mentor, she enjoys watching the team members work and interact with each other.

Brian D. Frost is an IT Manager for Seagate, working in Enterprise Networks and Storage. He coaches the build and programming teams. He loves working with the students and helping them grow as individuals. This is his 2nd year of being involved with *FIRST*® robotics.

Doug Smith is an Auto Technician at Eskridge Lexus of Oklahoma City. He is a build mentor and this is his first year in robotics. He likes learning about robotics and helping the team learn as they solve problems and develop skills.

Heather Fowler is a homeschool parent and documentation mentor. This is her 4th year to be involved in robotics. She loves the excitement of competition and seeing kids grow in multiple ways through robotics.

Sarah Click is beginning her fourth season of robotics as a non-engineering mentor. She likes to help wherever there is a need, but her favorite activities are learning about each new game and enjoying the spirit at the competition events.

OUTREACH

New Teams Added This Year

Starting Five New FLL® Teams

This year Hannah, Jacob, and Thomas helped form the new FLL® teams and pick their lead mentors. When the students arrived, they split into the five new teams based on their location. We explained the *FIRST®* Progression of Programs to them and discussed how the FLL® teams fit, and the features and goals of FLL®. After we explained the *FIRST®* Progression of Programs, we told them that they could, through the LIGHTSABERS, move up from FLL®, to the FTC® level, and then to the FRC® level. As they broke up into their groups, they each had to pick the dates and times when they would meet and designate a team leader and their lead mentors. They also reviewed costs for the year and the expenses that might arise throughout the season.

Hosting Workshops and Camps

LIGHTSABERS Volunteer at FLL® Oklahoma State Competition

The LIGHTSABERS volunteered at the FLL® Oklahoma State Competition to be judges, referees, and other various tasks. Thomas, Jacob, Julian, Lucien and Joel attended the competition, as well as some of the FRC® level members. The competition was a very fun experience, and now, for those of us who were judging, we understand what we need to do to our own presentation in FTC®. It gave us a behind the scenes look at how a *FIRST®* competition runs.

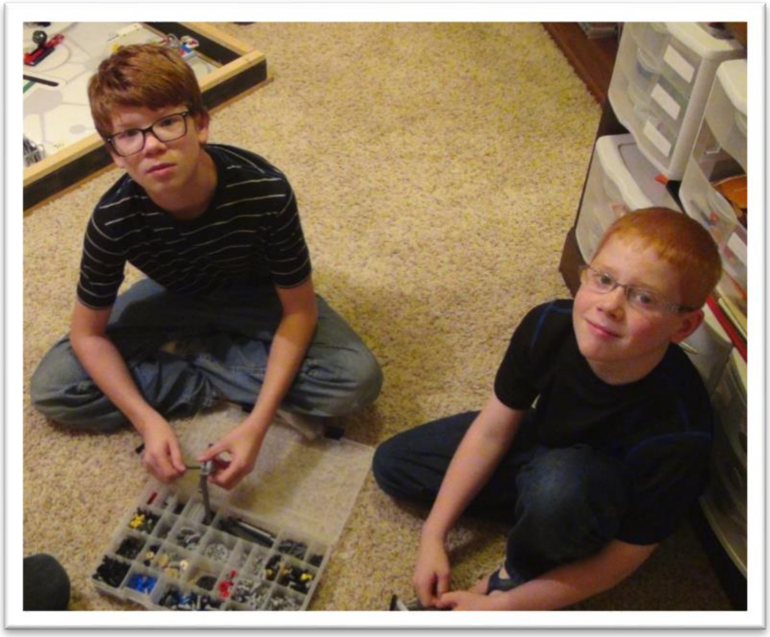
FLL® Kickoff

Coach Vince, Mentor Rebecca, Jacob, and I brought the FTC® and FRC® robot to the FLL® kickoff to demo it. We also had a table designed to help the FLL® teams learn about how people learn best. We had a quick test they could take to discover how they learned best. We handed out candy and talked to mentors and children.

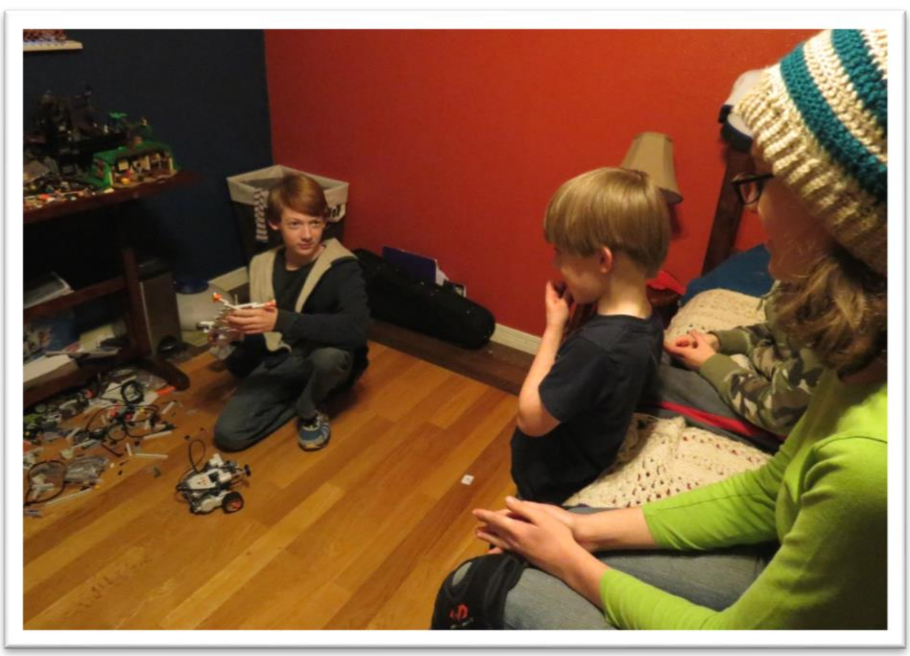
FLL® Games Strategy and Robot Design

Starting new teams and helping teams is important to LIGHTSABERS. Tonight we talked to five new FLL® teams about this year's game and explained rules and point's value of each field element. Then we discussed game strategy to give them a head start and teach them the pros and cons about the best ways to score and accomplish the missions. We also taught about robot design and increasing reliability. To teach teamwork, we did an activity where they learn to work together by drawing a picture of a robot and working out who does what and how. Last, we had a question and answer session to be sure everyone understood what we taught. It was a lot of fun to help!

Helping FLL® Teams Build New Robots



We helped younger kids build a LEGO Mindstorm NXT robot. They had built a robot and were learning about the sensors and programming. They really seem to enjoy learning how to build robots and we are enjoying working with them.



FTC® Help Document

This year, I created an addendum to the 2014-2015 Wiring Guide produced by *FIRST*®. Inside the addendum, I listed several items that were inside the guide, with pictures and descriptions of each as well as website links. Pictures and descriptions came from the item's webpage directly, for an accurate presentation of the items. There are also 3D printed objects by our team in the notebook with CAD drawings included.

LIGHTSABERS

2014-2015 FTC WIRING ADDENDUM

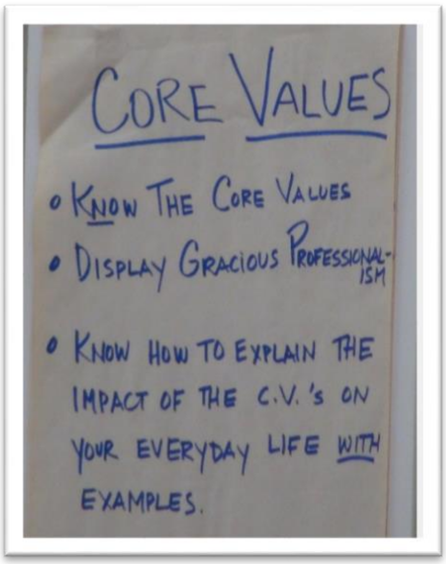
SUPPORTING: FTC ROBOT WIRING GUIDE & ADDRESSING NXT LOCKUPS

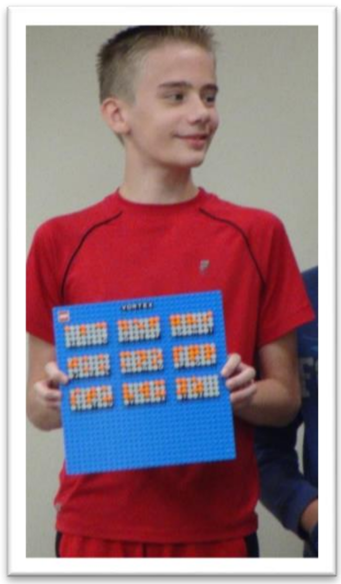
http://www.usfirst.org/sites/default/files/uploadedFiles/Robotics_Programs/FTC/Team_Resources/FTC_Robot_Wiring_Guide.pdf

http://www.usfirst.org/sites/default/files/uploadedImages/Robotics_Programs/FTC/FTC_Documents_and_Updates/Addressing_NXT_Lockups.pdf

LIGHTSABERS FLL® Mini-Meet/Judging Robot Design

The FLL® Mini-Meet took place October 25, 2014, at the Norman Public Library. I got to be one of the robot design judges. It was great to see all the different ways that each team accomplished this year's mission. It felt almost weird in a lot of ways to be judging a robot's design when normally it is the other way around. My favorite part is when you find that one kid in a group who really enjoys robotics and loves talking about it. Judging has always made me nervous, and I am 17 years old! I cannot imagine what it is like for kids 8-10 years old, so I was happy to do anything I could to help them prepare for it.



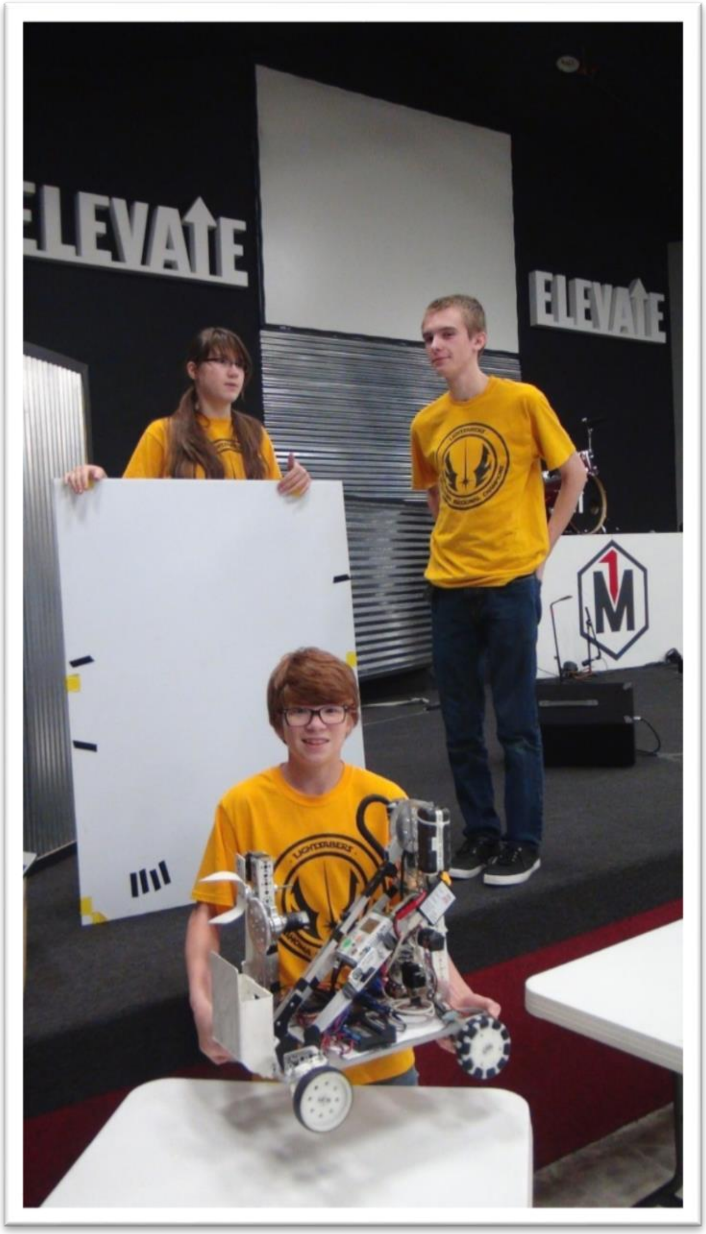


LIGHTSABERS FLL® Mini-Meet/Judging Teamwork

Tasked with judging the teamwork session of the FLL® Mini-Meet, Elliot and were able to see the differences between our FLL® teams, but the kids had the hard part of this session. They had to either build a castle of cups without touching them, or build a tower out of very limited supplies that would hold a small polar bear. In the end, all the kids seemed to learn that teamwork is key to accomplishing their goals.

Community Outreach

MYHELP Open House Demonstration



To help with our outreach Hannah, Jacob, and Thomas volunteered at the MYHELP Co-op kickoff and displayed the robot. We demonstrated the robot to the students before they officially started their home schooling year. Many of the students were interested in the *FIRST®* program and we gave them the information for the different FLL® teams if they wanted to know more.

Home School Outreach

In the Homeschool community, STEM potential is greatly underserved. To help fill this need, we reached out to the families in all 20 listed homeschooler co-ops reaching over 1000 families. We sent all of them an application to our team and information on *FIRST*® and robotics.

The groups we reached are:

LIGHT
FISCHE
TCHE
NAHE
ETC
COACH
EXCEL
ECHO
SHINE
EHE
Homeschooling in the OKC Metro
HOPE
MYHELP
Oklahoma Home School Moms Info Network
S.A.L.T.
Council Road Homeschool Enrichment

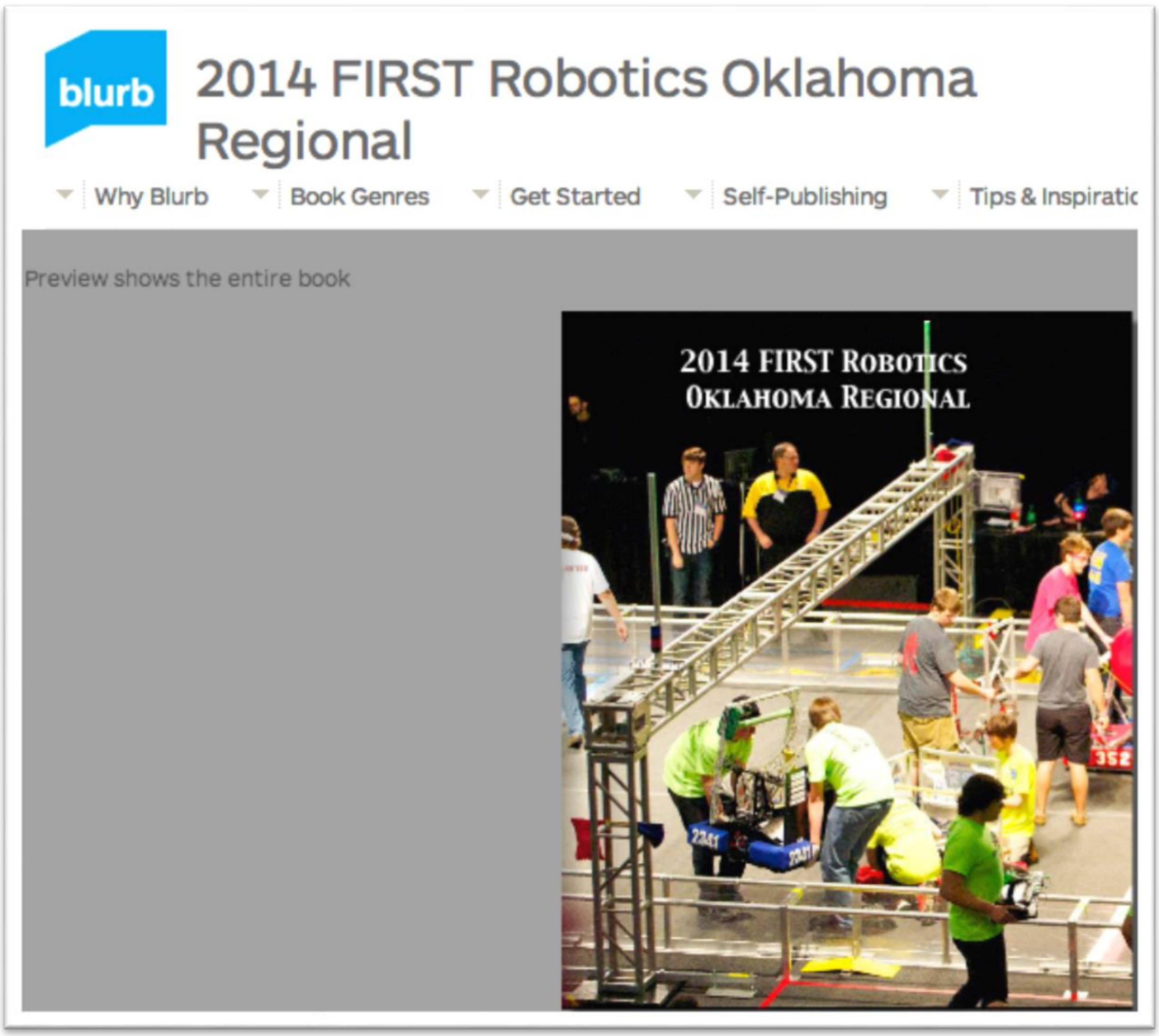
Public Relations

LIGHTSABERS Present Lt. Governor Todd Lamb with Chairman's Award

Two years ago, our team interviewed Lieutenant Governor Todd Lamb to promote *FIRST*® and STEM in Oklahoma. Participants from all our teams revisited him and presented him one of our trophies to thank him for supporting and promoting STEM in Oklahoma. We also invited him to attend an FRC® competition.

FRC® Oklahoma Yearbook

This year Coach Vince had me make the Oklahoma Regional Yearbook. The yearbook helped gain bigger sponsors for the Oklahoma Regional. I got all the pictures from Harold Holly, the Regional Director and started picking out the pictures that I wanted for the yearbook. I arranged them in the yearbook and after I had made the first draft, I sent it to Harold Holly who passed it on to the other board members. They emailed me corrections and I then fixed the errors in the book. After I fixed all of them, Coach Vince helped me order a physical book for the board, who approved the book. When we finished the book, Harold Holly donated $1000 to our team.

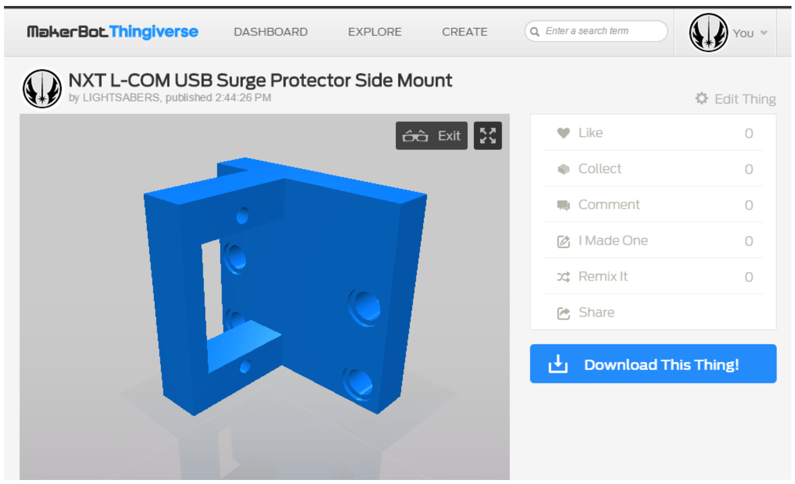


Sharing 3D Printer Creations

Jacob posted the CADed Surge Protector Mount and LIGHTSABERS symbol to Thingiverse: a CAD sharing site where people can make your creations with their 3D printer.

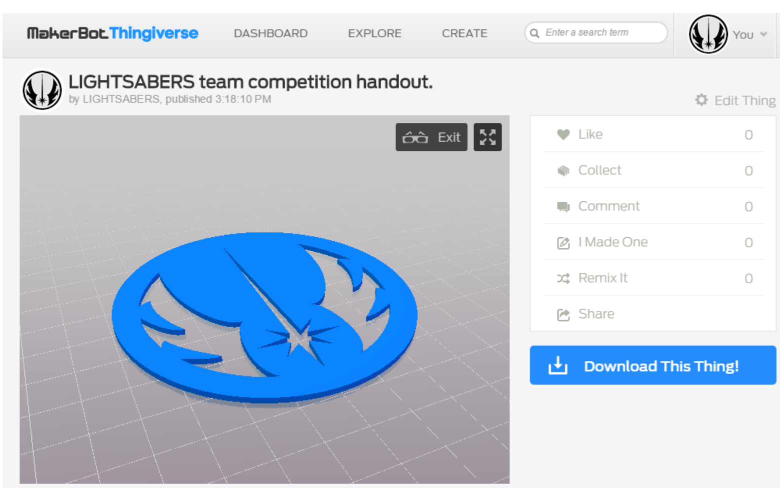
The webpage that the USB surge protector is on is:

http://www.thingiverse.com/thing:507574



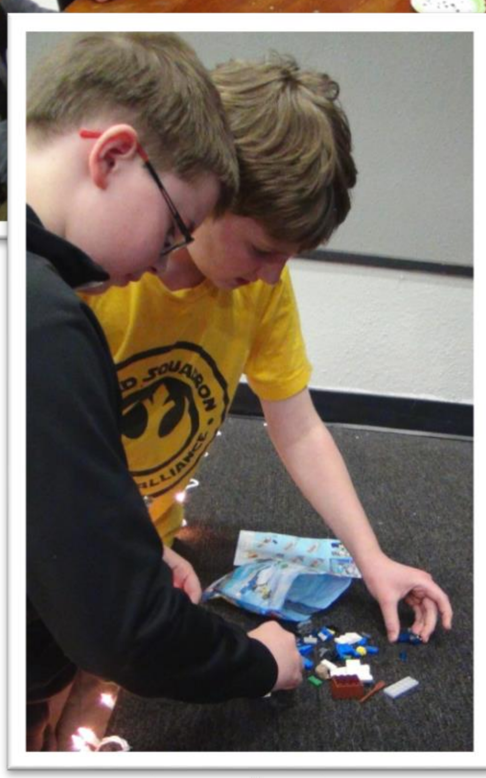
The webpage that the LIGHTSABERS symbol is on is:

http://www.thingiverse.com/thing:507605



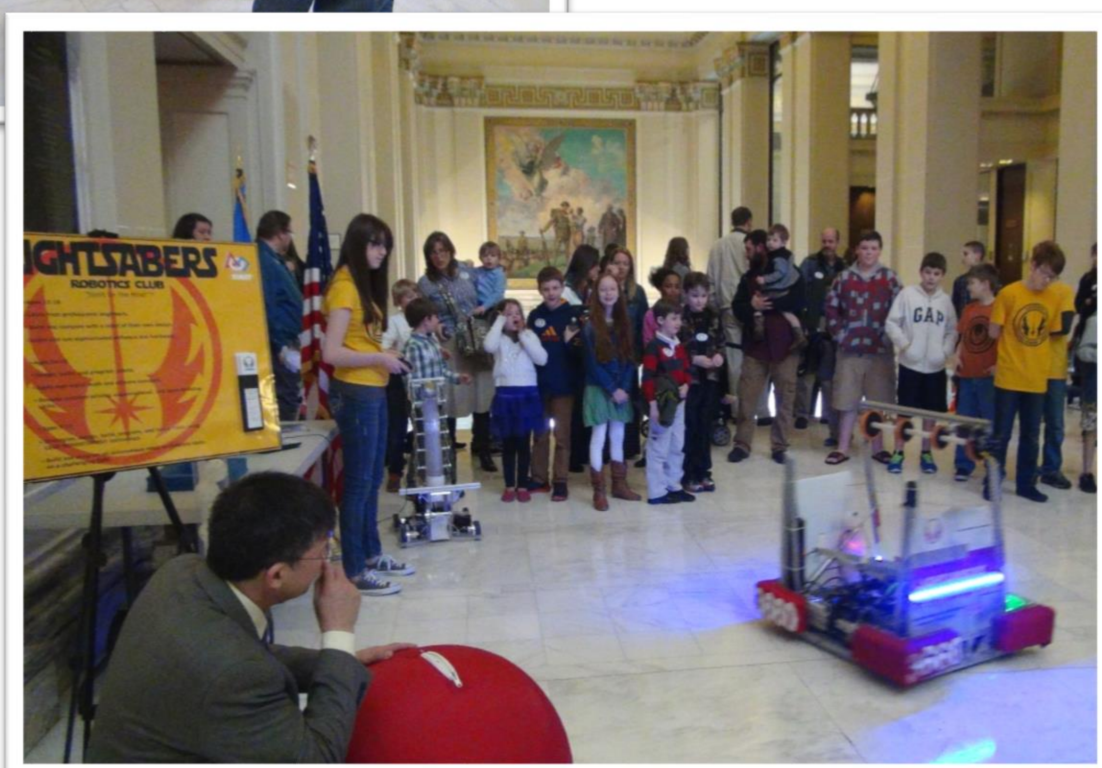
LIGHTSABERS Christmas Party

This Christmas our entire team gathered at First Baptist Church Mustang to celebrate the season and hang out. A parent who was also a mentor for the team put on the event. All age groups from the LIGHTSABERS attended, Jr. FLL®, FLL®, FTC®, and FRC®. For the younger students there were games and activities that involved LEGO and building things. Each game had a LEGO prize given at the end. Older students sat at the tables to hang out and have fun and talk about the season thus far, and mentors and parents did the same. Each family brought a food item for the potluck and contributed to the massive amounts of food. The party was fun and everyone was able to celebrate the season and relax from robotics for a small amount of time before it kicked back up again.



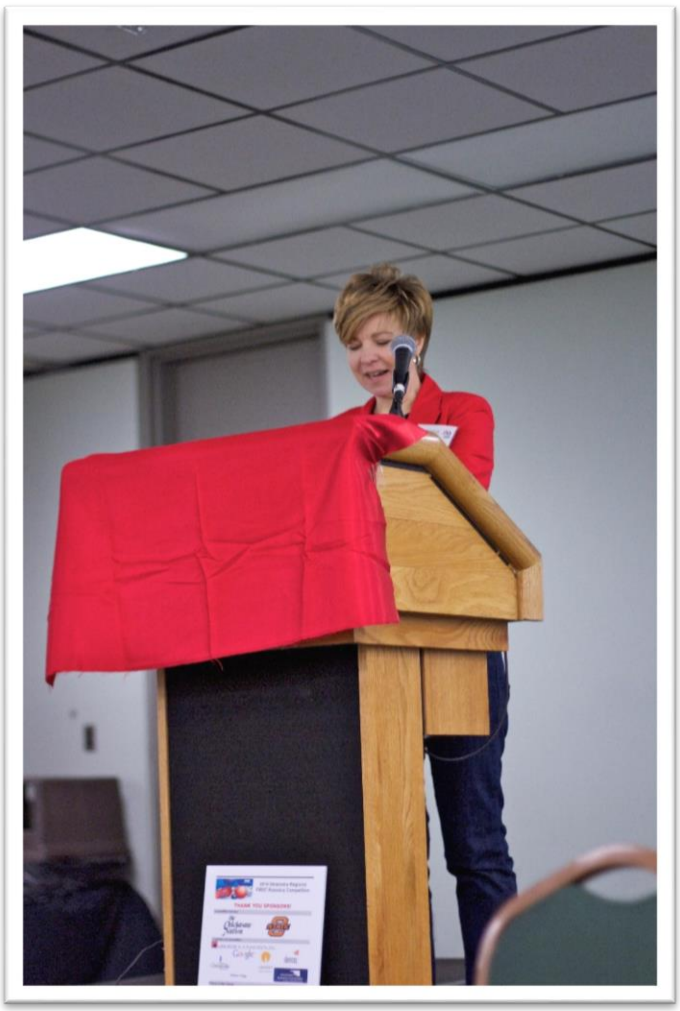
Capitol Day 2015

We took the Alpha FTC bot, the popper bot, and the FRC robot from last season to the capitol. We handed out slips of paper with the information people who wanted to join the teams would need to know, such as the Coach's email, the age groups of the levels of ***FIRST*®**, and the type of experience one can get from each level. We answered any questions people had and demonstrated the robot. We would pass out balls from this year's game and would have the kids feed the balls to the robots. We also shot the ball out of the FRC bot and had them catch it. Overall, it was a lot of fun.



Impacting the State of Oklahoma at Oklahoma *FIRST*® Planning Committee VIP / Special Guest Luncheon

Team mentor, Rebecca Liao, and senior student, Wesley Liao, had the opportunity to speak to a group of *FIRST* supporters at the VIP & Special Guest Luncheon, held during the FRC® OK Regional at the Cox Convention Center. Wesley was able to share with the audience how *FIRST* has impacted his life and helped steer him toward a degree in engineering. He noted how involvement with FIRST has helped him in many aspects of his life. Rebecca told the story of the LIGHTSABERS, how the team started, how it has grown, and how *FIRST* has personally impacted her family. Rebecca has been asked by the OK FIRST Regional Director to speak again this year at VIP & Special Guest Breakfast to be held at the OK Regional, Cox Convention Center.



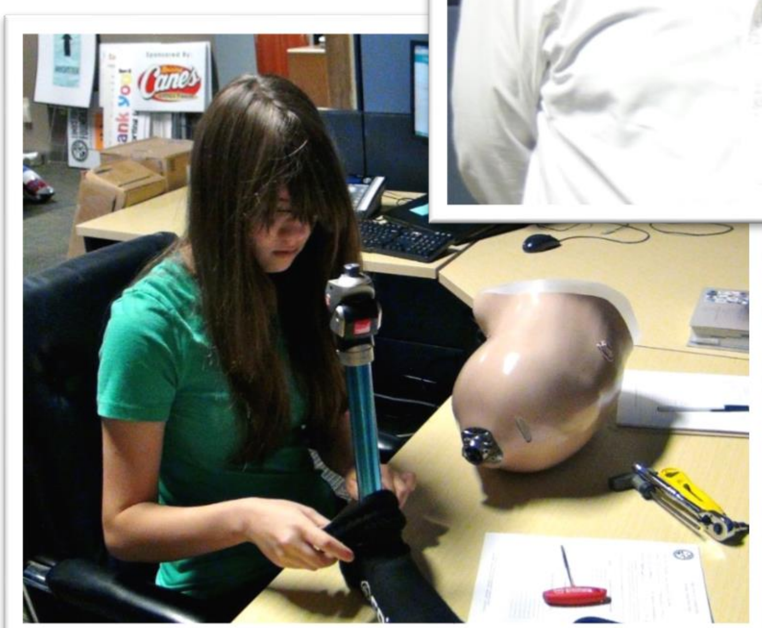
Volunteer Opportunities

Habitat for Humanity

Because our team desires to do more than just robotics, we were going to assist a family build their house with Habitat for Humanity in December. However, the day we had committed to doing so was too icy to help and we were busy any other time they would have needed us to help. Because of that, we decided that instead of helping build the house, we would help them move into the house when it was finished. When the house was finished in May, the team showed up to the family's home and helped move everything from one house to the other and had the whole house moved before sunset.

Limbs for Life Student Individual Volunteering Hours

The Limbs for Life Foundation is a global nonprofit organization dedicated to providing fully-functional prosthetic care for people whose insurance won't give them a prosthesis or orthotic. Because I am interesting in becoming an Orthotics and Prosthetics Technician, I volunteer there for 2 hours every Wednesday. I typically help by unpacking boxes sent in, cataloging the contents of the packages, packing orders, shelving items, and dismantling limbs sent in. I work with a retired engineer that also volunteers. One of the most exciting things about volunteering there is when someone sends in an above-the-knee prosthesis, I get to learn, with help from the engineer, how the piece works.



Limbs for Life Run

I have also volunteered an evening for their run. Every year the Limbs for Life Foundation holds a run to help get funds and to spread awareness. I helped by signing up people for the run and giving directions. Over 500 people showed up for the run. I also got some posters from the Executive Director, Lucy Fraser that I handed out to the moms on our teams that run.

2014-15 BUSINESS PLAN

LIGHTSABERS

C-1

Team Summary

The LIGHTSABERS is a community based robotics club, made of mostly homeschooled students from OKC, Moore, Norman, Mustang, Yukon, and Edmond. The team was founded in 2010 with 6 students & 1 mentor but has expanded to 50 students & 35 mentors for 9 teams (FLL® to FRC®). All of this is part of our seamless Progression of Programs, which allows children to start at a young age in FLL® and move up through FTC® and then all the way up to FRC®. Our commitment and enthusiasm for *FIRST®* has earned us 97 awards in 5 years.

Strategic Planning Process/SWOT

Each year we assess our program to keep our strengths and develop a plan to address our weaknesses. The goal for this year was a 3 phase approach to determine student roles: Student skills assessment to place students on a team, Multiple Team Approach – Varsity, Jr. Varsity, and Freshmen, then merge into One Team – One Force. Our new hope is to reach the highest potential of each student and team to develop our best FTC World team.

Strengths	Weakness
• Community Based Club • Funding from Student Dues • High Student Commitment • >30 Mentors • Strong Family Involvement • History of Success • Continued Growth • Full *FIRST*® Progression of Programs	• High Student Costs • Not 501c3 • Undeveloped Skills Training • No Dedicated Building/Facility
Opportunities	**Threats**
• Skills Assessment Program • Develop Student Secured Sponsorships • Off-season Training • Develop Machine Shop Collaboration • Develop Collaboration with other Teams to Strengthen *FIRST*® in Oklahoma	• Loss of Sponsorships • Loss of Mentors • Loss of Students

Team Impact/Outreach

The LIGHTSABERS Team impacts our members and other *FIRST®* teams through mentoring, implementing the Progression of Programs, promoting *FIRST®* initiatives and active partnering among the *FIRST®* community through service and volunteerism. The LIGHTSABERS Team has increased interest in STEM and spread the message of *FIRST®* in the community.

Starting new teams each year:

- 5 FLL® Teams (2014) (one team graduated to FTC® in 2014)
- 3 FLL® Teams – one an All-Girl FLL Team – Lego Leias (2013)
- 3 Jr.FLL® Teams (2013)
- 2 FLL® Teams (2012) (one team graduated to FTC® in 2013)

Hosting Workshops and Camps teaching classes every year:

- FLL® State Championship (12/6/14)
- FTC® Help Document (10/27/14)
- LIGHTSABERS FLL Mini Meet (10/25/14)
- 3D Printed NXT USB Surge Protector Mount (10/19/14)
- FLL® Game Strategy and Robot Design (9/2/14)
- FLL® Kickoff Learning Styles (8/26/14)
- FLL® Team Forming Meeting (5 Teams) (8/19/14)
- FLL® State Championship (2/22/14)
- LIGHTSABERS FLL Mini Meet (10/26/13)
- FTC® Workshop @ GCTC - 4 Classes (10/12/13)
- FTC® Kickoff @ Mustang HS - 2 Classes (9/14/13)
- FLL® Game Strategy and Robot Design (9/3/13)
- FLL® Team Forming Meeting (3 Teams) (8/20/13)
- FLL® Programming camp (8/17/13)
- FLL® State Championship (12/1/12)
- FTC® Kickoff – Build Strategy class (9/8/12)
- FTC® OKC Qualifier Judging (1/28/12)
- FRC® Software & Hardware Beta Testing (Sept – Dec 11)
- FTC® Quick Build Workshop (10/15/11)
- FTC® Kickoff – RobotC class (9/10/11)

Outreach

Demonstrations: The team gives presentations and robot demonstrations from our sponsors to local education groups and schools:

- **MYHELP Open House demo (8/12/14)**
- **Homeschool STEM Outreach (> 1000 families) (7/9/14)**
- **New Team Recruitment (FLL®, FTC®, FRC®) @ Mustang HS (5/3/14)**
- **OK School of Science & Math demo (7/19/13)**
- **LIGHT Showcase demo (5/16/13)**
- **Homeschool Convention (5/3-4/13)**
- **YMCA After-school demo (9/14/12)**
- **LIGHT Open House demo (8/16/12)**
- **Liao Robotics Club info meeting (7/24/12)**
- **Homeschool EXPO demo (7/23/12)**
- **Northrop Grumman demo (5/21/12)**
- **LIGHT Showcase demo (5/10/12)**
- **Women in Science conference (10/4/11)**
- **Edwards Elementary Reading Camp (7/7/11)**

Public Relations: Promoting Science, Technology, Engineering, and Math

- **Oklahoma *FIRST*® Planning Committee VIP/Special Guest Breakfast Speaker (scheduled 3/26/15)**
- **Oklahoma Capitol Day Demonstration (2/10/15)**
- **Oklahoma *FIRST*® Planning Committee VIP/Special Guest Luncheon Speaker (3/26/14)**
- **FRC® Oklahoma Yearbook (9/25/14)**
- **Lieutenant Governor Todd Lamb Award presentation (2/18/14)**
- **FRC® Oklahoma Yearbook (7/25/13)**
- **SWOSU Science & Math Academy radio broadcast (6/25/13)**
- **ECU Robotics Camp (6/21/13)**
- **FRC® OK Regional Photographer (3/30/13)**
- **FRC® Oklahoma Yearbook (9/12/12)**
- **OK Legislator Outreach (2/7/12)**
- **Boeing Meet & Greet (10/13/11)**

Volunteer Opportunities:

- **Limbs for Life Student Volunteering hours**
- **Limbs for Life 5K (8/16/14)**
- **Habitat for Humanity – Hendricks Move (5/10/14)**
- **Cancer CureSearch Walk (10/19/13)**
- **Children's Center demo (8/24/12)**

Presentation to Lieutenant Governor Todd Lamb

FTC® Budget Planned vs Actual (as of 4/15/15)

INCOME	Planned	Actual
Club Dues (collected throughout the season)	$6400	$6400
Student Sought Sponsorships	$4000	$3588
SWOSU Team Requiting Sponsorship ($50 x 5 teams)	- 0 -	$250
===		
Total	$10,400	$10,238

EXPENSES		
FTC® Registration ($275 x 3 teams)	$825	$825
FRC® Robot Parts	$6500	$6126
Shirts & Handouts	$775	$947
FTC® Qualifiers (2 Qualifiers x 3 teams)	$600	$600
FTC® Oklahoma State Championship*	$200	$200
Southern Super-Regional Championship*	$500	$500
FIRST® World Championship*	$1000	$1000
===		
Total	$10,400	$10,198

*Championships are budgeted for. Each student or family pays travel individually. Additional funding needs are paid by student-sought sponsorships.

Sponsorship/Fundraiser

Student-Sought Sponsorships

All the FTC® students have a goal to seek a $250 sponsorship throughout the season to help keep the dues low. Goals like this help us to extend our connections into the community for support.

Many parents of the students on the FLL® teams worked to get sponsorships from their employers to lower the costs of the FLL® dues. Here is a listing of what each team raised:

FTC® Team #4250 students raised $3000

FTC® Team #7798 students raised $250

FTC® Team #8982 students raised $250

All the FLL® Teams together raised $2500

Blue & Gold Sausage Fundraiser

As part of our business plan, students from Jr. FLL®, FLL®, FTC® and FRC® can sell Blue & Gold products. The money raised directly offset the dues paid by families for their student's participation in robotics. Last year we sold over $4000 of Blue and Gold products for a total profit of approximately $1000.

Sponsorship Benefits

Sponsorship Levels:

$2500+	**Platinum Partner**	**Name announced when competing (+ Previous levels benefits)**
$1000+	**Gold Partner**	**Logo printed on robot and on display in pit and team booklets and brochures (+ Previous levels benefits)**
$500+	**Silver Partner**	**Logo listed on website (+ Previous levels benefits)**
$250+	**Bronze Partner**	**Name or Logo printed on shirts**

Any amount of donation is most appreciated!

A partnership with the LIGHTSABERS provides many opportunities to businesses, from helping with the company's community awareness to raising future employees.

Team Contact Information

Website: LightsaberRobotics.org

Main contacts:

Head Coach Vincent Liao

Email: vince@LightsaberRobotics.org

Phone: (405) 745-7674

Sponsorship Information:

Checks should be made payable to Liao Robotics Club

Mailing Address:

9100 Woodrock Dr.

Oklahoma City, OK 73169

Award Summary

99 Awards in 5 Years

– *FIRST* World Championship Participation Every Year –

2014-15 (35 awards)
FTC World Championship
FTC Southern Super-Regional Think Award
FTC Southern Super-Regional Championship
FTC Oklahoma Championship Inspire Award
FTC Oklahoma Championship Winning Alliance Captain
FTC Oklahoma Championship Think Award
FTC Oklahoma Championship Rockwell Collins Award
FTC Oklahoma Championship PTC Award Finalist
FTC Deans List Finalist – Hannah Liao

FTC Oklahoma State Championship – Alpha Team #4250
FTC Tulsa Qualifier Winning Alliance Captain – Alpha Team #4250
FTC Tulsa Qualifier Think Award – Alpha Team #4250
FTC Ada Qualifier Inspire Award – Alpha Team #4250
FTC Ada Qualifier Winning Alliance Captain – Alpha Team #4250
FTC Ada Qualifier Think Award – Alpha Team #4250
FTC Ada Qualifier Control Award – Alpha Team #4250

FTC Oklahoma State Championship – Beta Team #7798
FTC Mustang Qualifier Finalist Alliance Captain– Beta Team #7798
FTC Mustang Rockwell Collins Award – Beta Team #7798
FTC Ada Qualifier 2nd Place Inspire Award – Beta Team #7798
FTC Ada Qualifier Winning Alliance – Beta Team #7798
FTC Ada Qualifier Motivate Award – Beta Team #7798

FTC Oklahoma State Championship – Gamma Team #8982
FTC Mustang Qualifier Winning Alliance Captain – Gamma Team #8982
FTC Mustang Qualifier 3rd Place Inspire Award – Gamma Team #8982
FTC Mustang Qualifier Think Award – Gamma Team #8982
FTC Mustang Qualifier Control Award – Gamma Team #8982
FTC Tulsa Qualifier 2nd Place Inspire Award – Gamma Team #8982
FTC Tulsa Qualifier Winning Alliance – Gamma Team #8982
FTC Tulsa Qualifier Judges Leadership Award – Gamma Team #8982

FLL Oklahoma Championship 2nd place Programming – Phoenix Squadron
FLL Oklahoma Championship – Phoenix Squadron
FLL OKC Qualifier 2nd place Robot Performance – Phoenix Squadron
FLL Oklahoma Championship – Rogue Squadron
FLL OKC Qualifier 2nd place Robot Design – Griffin Squadron

2013-14 (25 awards)
FRC World Championship
FRC Oklahoma Regional Winners
FRC Woodie Flowers Finalist (mentor) Award – Vincent Liao
(FRC Team) FTC Oklahoma Championship
(FRC Team) FTC Ada Qualifier Inspire Award 3rd place
(FRC Team) FTC Ada Qualifier PTC Award
FTC World Championship
FTC Southern Super-Regional Championship
FTC Oklahoma Championship Winning Alliance
FTC Oklahoma Championship Inspire Award 2nd place
FTC Oklahoma Championship PTC Award Finalist
FTC Muskogee Qualifier Winning Alliance
FTC Muskogee Qualifier PTC Award
FTC Ada Qualifier Inspire Award
FTC Ada Qualifier Winning Alliance
FLL Oklahoma State Championship 2nd place Gracious Professionalism - Lego Leias
FLL Oklahoma State Championship 2nd place Strategy & Innovation - Red Squadron
FLL Oklahoma State Championship 3rd place Programming - Gold Squadron
FLL OKC Qualifier 3rd place Championship Award - Lego Leias
FLL OKC Qualifier 2nd place Robot Design - Lego Leias
FLL OKC Qualifier 2nd place Robot Performance - Red Squadron
FLL OKC Qualifier 2nd place Project - Gold Squadron
JrFLL Oklahoma State Championship - Rising Star - Ewoks
JrFLL Oklahoma State Championship - Construction Innovation - Wookies
JrFLL Oklahoma State Championship – Younglings

2012-13 (22 awards)
FRC World Championship
FRC Oklahoma Regional Chairman's Award
FRC Oklahoma Regional Imagery Award

FRC Oklahoma Regional Dean List Winner - Wesley Liao
FTC World Championship
FTC World Compass (mentor) Award – Vincent Liao
FTC Oklahoma Championship Inspire Award
FTC Oklahoma Championship Winning Alliance Captain
FTC Oklahoma Championship Rockwell Collins Award Finalist
FTC Oklahoma Championship Connect Award Finalist
FTC Oklahoma Championship Motivate Award Finalist
FTC OKC Qualifier Inspire Award
FTC OKC Qualifier Winning Alliance
FTC OKC Qualifier Rockwell Collins Award
FTC Ada Qualifier Winning Alliance
FTC Ada Qualifier PTC Award
FLL Oklahoma State Championship 2nd place Robot Strategy – Gold Squadron
FLL Oklahoma State Championship – Red Squadron
FLL OKC Qualifier 1st place Robot Design – Gold Squadron
FLL OKC Qualifier 2nd place Robot Performance – Gold Squadron
FLL OKC Qualifier Elimination Award – Gold Squadron
FLL OKC Qualifier Judge's Award – Red Squadron

2011-2012 (9 awards)
FTC World Championship
FTC Oklahoma Championship Inspire
FTC Oklahoma Championship Finalist
FTC PTC Design (twice)
FTC Compass Award
FTC Rockwell Collins (Honorable mention)
FTC SWOSU Qualifier Inspire
FTC SWOSU Qualifier Winning Alliance

2010-2011 (8 awards)
FRC World Championship (declined)
FRC Oklahoma Regional All-Star Award
FRC Oklahoma Regional Highest Rookie Seed
FTC World Championship
FTC Oklahoma Winning Alliance
FTC Dallas Winning Alliance
FTC Rockwell Collins Design (twice)

DESIGN PROCESS

Meeting Documents

DATE:	START TIME:	STOP TIME
September 6, 2014	10:00	5:00

TASKS	REFLECTIONS
LAN Party Thomas	To celebrate our kickoff this year, I invited the LIGHTSABERS teams to come to my house to play a LAN party of Team Fortress 2. We started off by playing games for the first hour or so until the game was released. After the game was released, we went downstairs to eat and discuss the games and throw out some basic ideas.

LAN Party

TASKS	REFLECTIONS
Kickoff Thomas	Mustang High School was hosting an official kickoff this year so we went there to see the actual playing field and talk with the other teams. We continued to discuss ideas with each other and eventually got onto the field where we tested our FTC® BLOCK PARTY!℠ robot from last year to see how well it scored the balls into the goals. After testing, we decided that our old design could possibly work if we modified it to fit the game rules and designs, but we were not set on an actual design yet.

4250

Kickoff Field Orientation

Game and Robot Brainstorming

DATE:	START TIME:	STOP TIME
September 8, 2014	6:30	9:00

TASKS	REFLECTIONS
Brainstorming CASCADE EFFECT℠ Robot Ideas Thomas	All three teams joined to discuss the game and talk about design ideas and where each team might go. Some of the design ideas we discussed were using a grabber or a puller to move the rolling goals, or a pushing mechanism so that we can drag or push the goals around with us as we score. We considered using sweepers, claws, and conveyor belts to pick up the balls, and score them. As for the lift mechanism, we talked about using a scissor lift or telescopes to lift the balls into the tubes. At the end of the meeting, we had not come up with a clear idea of where we were going, but some of the ideas that our team personally had were to use an arm connected to a sweeper to sweep in the balls, and then drop them in the tubes.

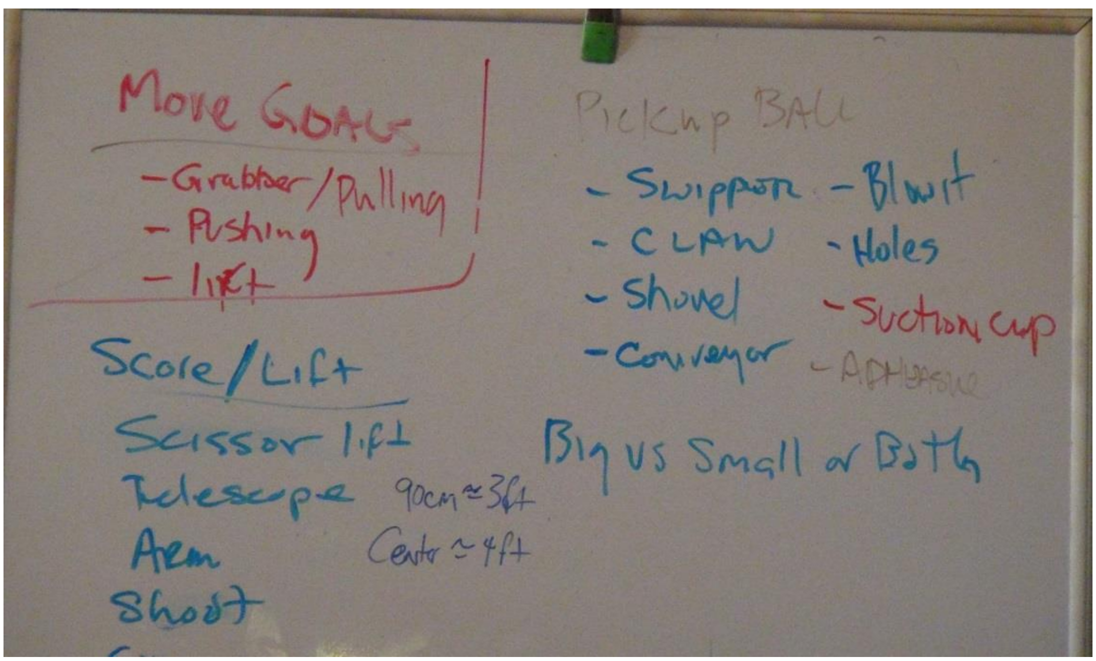


Figure 1 Brainstorming

Sharing Ideas after Kickoff

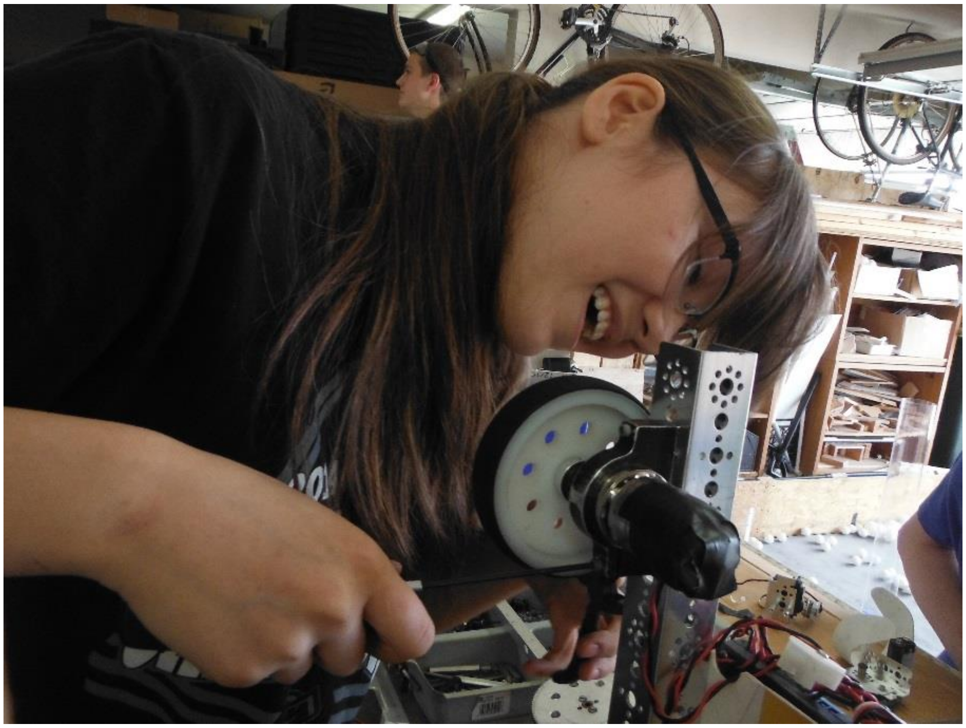
TASKS	REFLECTIONS
Program Ideas Biv	Tonight I focused on calculating the best autonomous path and listening to the general ideas of the builders. In autonomous, it seems optimal to first drive forward until the goals are reached, score in a goal, and then take them back to the parking zone. Once we release the goal, we then take the IR or Sonar values to determine which path to take to each specific position. Only after scoring in the center goal should the robot knock off the kickstand. How many goals we can drag into the parking zone and where we can score the autonomous balls is completely dependent on robot design, so it'll be later in the season before we can diagram an autonomous structure in the code.

DATE:	START TIME:	STOP TIME
September 14, 2014	1:00	5:00

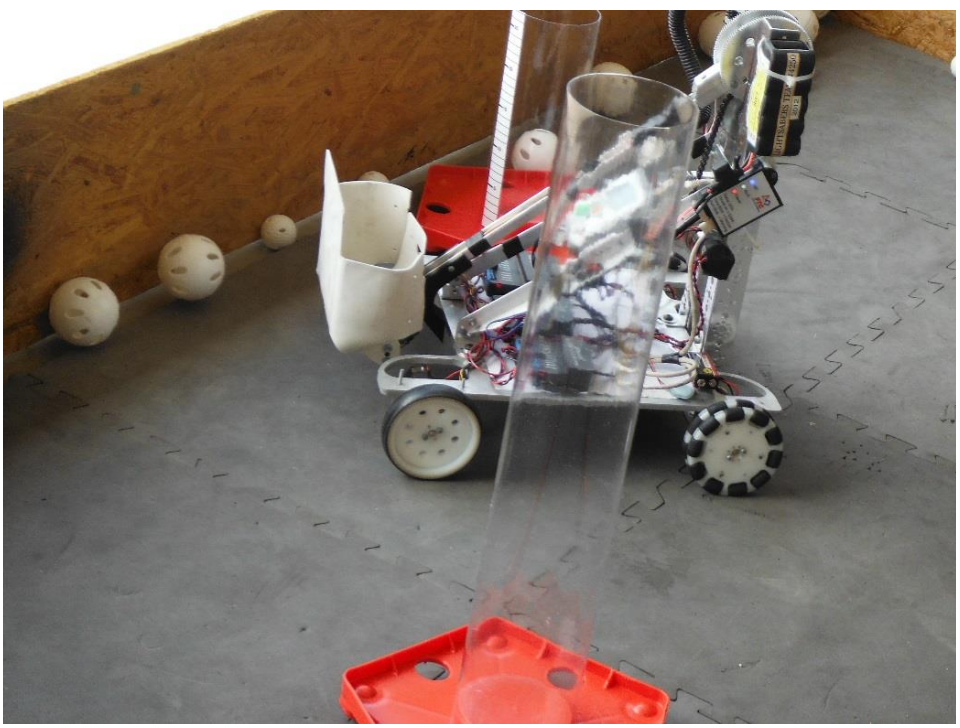
TASKS	REFLECTIONS
Design Discussions Adam	Today we wanted to decide what our end effector would be. At first, we thought about using a claw like in previous years, but as we experimented with the old robot's claw, we found that it would have a hard time keeping up with faster designs like a sweeper or bucket.

End Effector Possibilities

4250



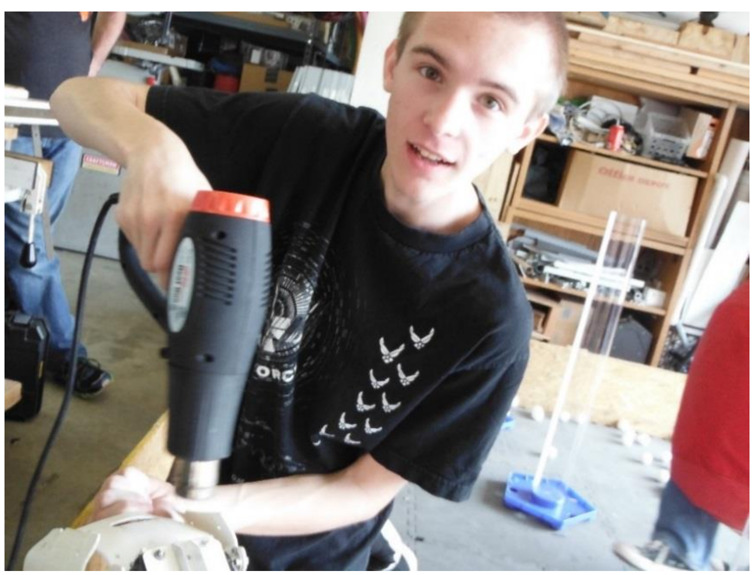
Modifying Last Season's Robot



Prototype Scoop

TASKS	REFLECTIONS
Building the ramps Lala	To get started on the field, Elliott and I began to build the ramps, but we soon realized we did not have enough wood. Thomas and Elliott drove out on a short errand to pick up more wood. We followed the directions from the field build instructions on the *FIRST*® website to build the ramps. Soon, with Adam and Thomas' help, we had both ramps built and ready for robots.

Wood for Ramps



Working on Scoop

DATE:	START TIME:	STOP TIME
September 15, 2014	6:30	9:00

TASKS	REFLECTIONS
Strategy Hannah	The meeting started at 6:30 and Mrs. Liao told us the building parameters and goals for the meeting because Coach Vince was on a business trip. The 3 FTC® teams split up at the end of the meeting as directed to talk and plan ideas for their robots. Hannah and Adam had already been hashing out ideas for the past week or so and had a clear idea of what they thought would work. Hannah and Adam shared their plans with the rest of the team. The team had already decided to go for speed, and at this point in the game, only the bigger balls. The team agreed that making the base out of the super light 1-inch aluminum would be good for speed. Hannah proposed that because the ramps were narrow and slippery that a smaller sized base could present an advantage. The team agreed and they decided to build a 10-inch wide base, 5 inches shorter than previous years. The team decided to try mounting the motors on the base instead of directly driving the wheels and gearing them up using beveled gears. The next part of the game the team tackled was the rolling tubes. They all agreed that pulling the tubes along during the game could be done with a simple PVC pipe hook driven by a servo. They also decided that being able to push tubes from the front and back would be useful and planned to leave a space in the front of the base open to allow pushing. The main discussion for the night was a way to reach over 4 feet to score in the highest goals. The team originally had been thinking a bit about slides, but after some research discovered they would have to make a 4-part slide themselves to reach the top. They also concluded that it would be very hard to make one that would be fast. Adam had found a video by the Holy Cows who had made a very fast slide. After studying what they had done, the team decided to try to find a different way to reach the top goals. Mentor Nathan suggested that we try using roll springs to help reach the top with a slide. The team instantly liked the idea and decided that a triangle of beveled gears powered by a motor with roll springs attached to the slide would be a quick and efficient way to reach the top goals. The team

	had not quite finalized the design by the end of the night. They decided that they did not think they could make the spring idea in the 3 remaining weeks until the qualifier so they decided to throw together a quick slide that could reach the middle tube. They figured that they could finish that robot in 2 meetings leaving 2 weeks to work on the spring idea.

Design Discussions

4250

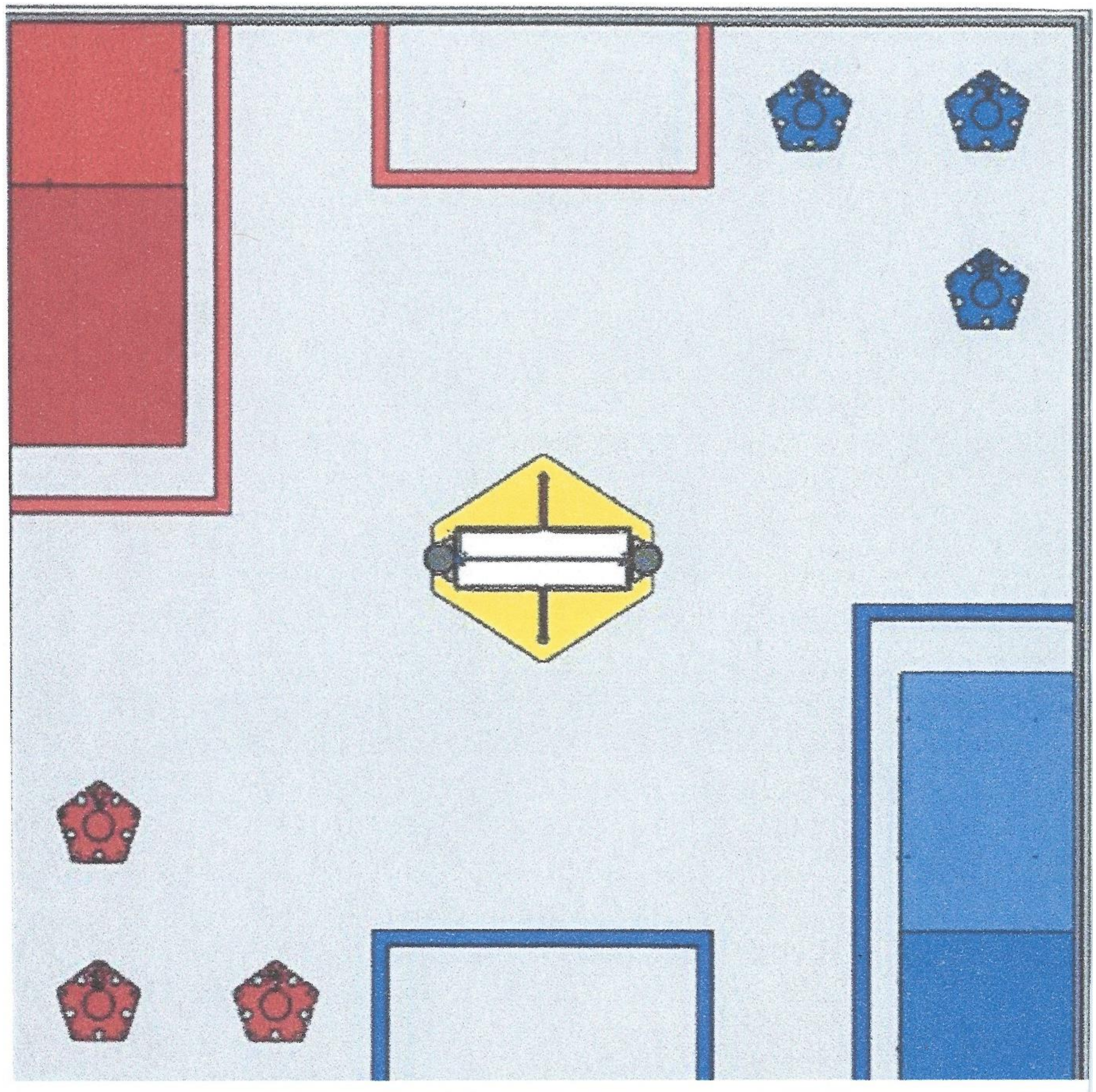


Figure 2 Game Strategy Chart

DATE:	START TIME:	STOP TIME
September 18, 2014	6:30	9:00

TASKS	REFLECTIONS
Design and strategy discussion Lala	Before talking about the design of the robot, we had to pay attention to the game. Coach Vince and Mr. Hendricks helped us break down and learn the game and we began throwing around possible strategies. There are tons of different ways to score so we had the challenge of figuring out which is the best. After discussing it for a while, we went into another conversation about the actual robot and talked about it for the rest of the meeting.

Scoring and Strategy Possibilities

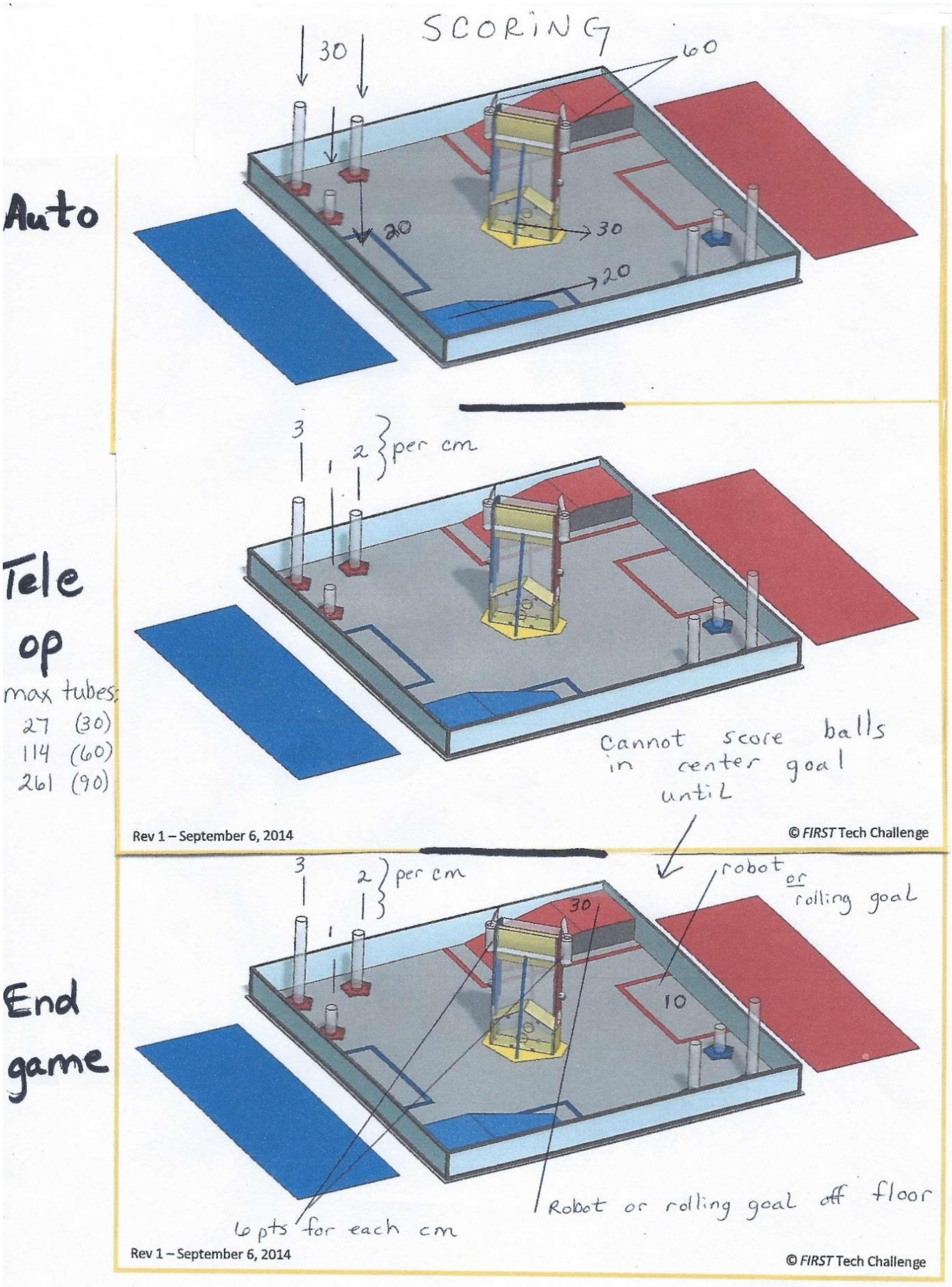


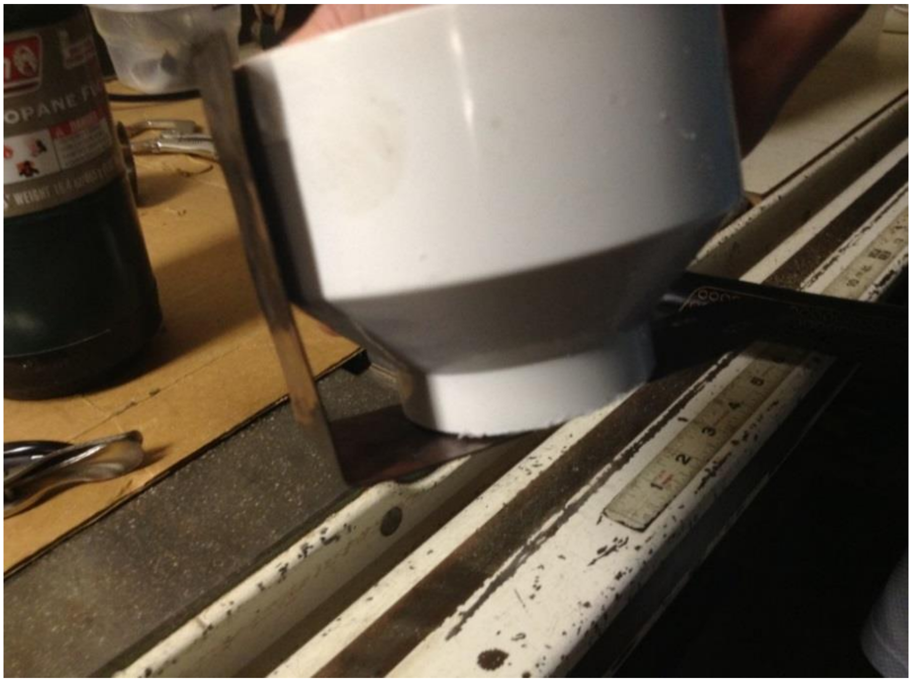
Figure 3 Game Breakdown

So Many Ideas, So Little Time

R & D Robot

TASKS	REFLECTIONS
Build Ball Launcher Adam	Tonight my goal was to design a mechanism that could launch the balls into the highest goal. This mechanism would not only have to launch the balls high, but fast as well. My first design was with a flat spring pulled downwards by a motor and then released, slamming the spring into an awaiting ball. The balls could not be touching the spring when it fired due to the amount of power they would lose so we gathered a few parts from around the shop and threw together a funnel that would hold the ball just above the spring. While we were gathering the parts, we found a few roll springs, so we decided to use them as a pseudo flat spring. Once we had completed the prototype, we tested it by firing a few balls through it. The results were very encouraging, the mechanism launched the balls above and beyond the highest goal, and though it was a bit inconsistent, with the proper guides it could be perfectly accurate. This design was very lucrative because we would not have to design a lift mechanism to raise the balls anymore, and it scored balls much faster than a lift could.

4250



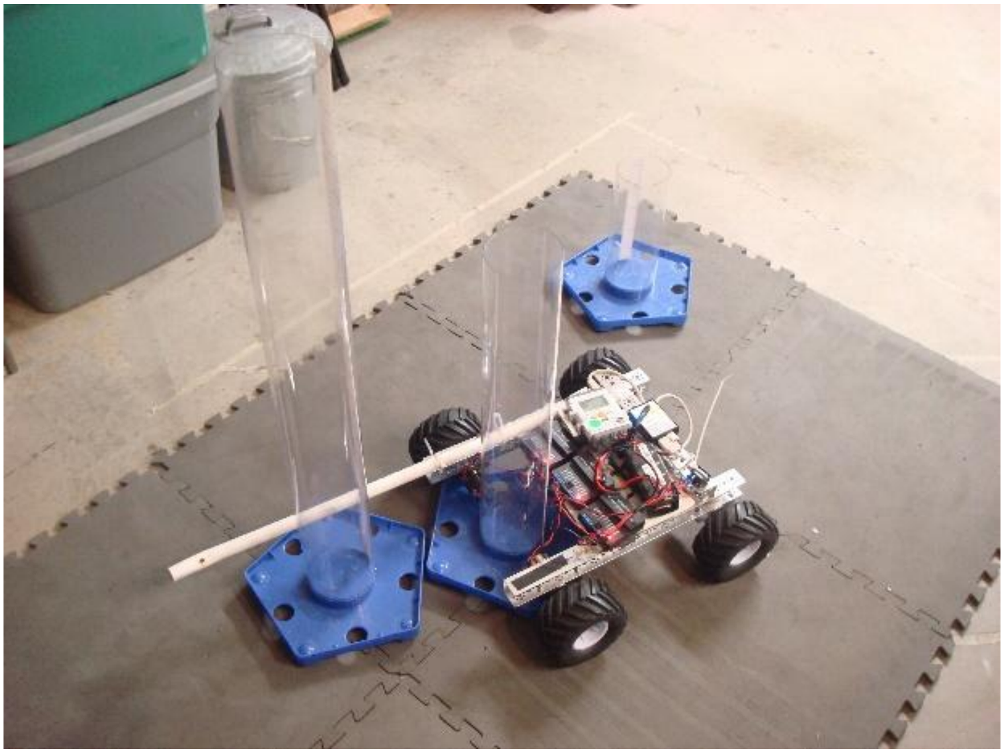
Ball Launcher

Ball Launcher

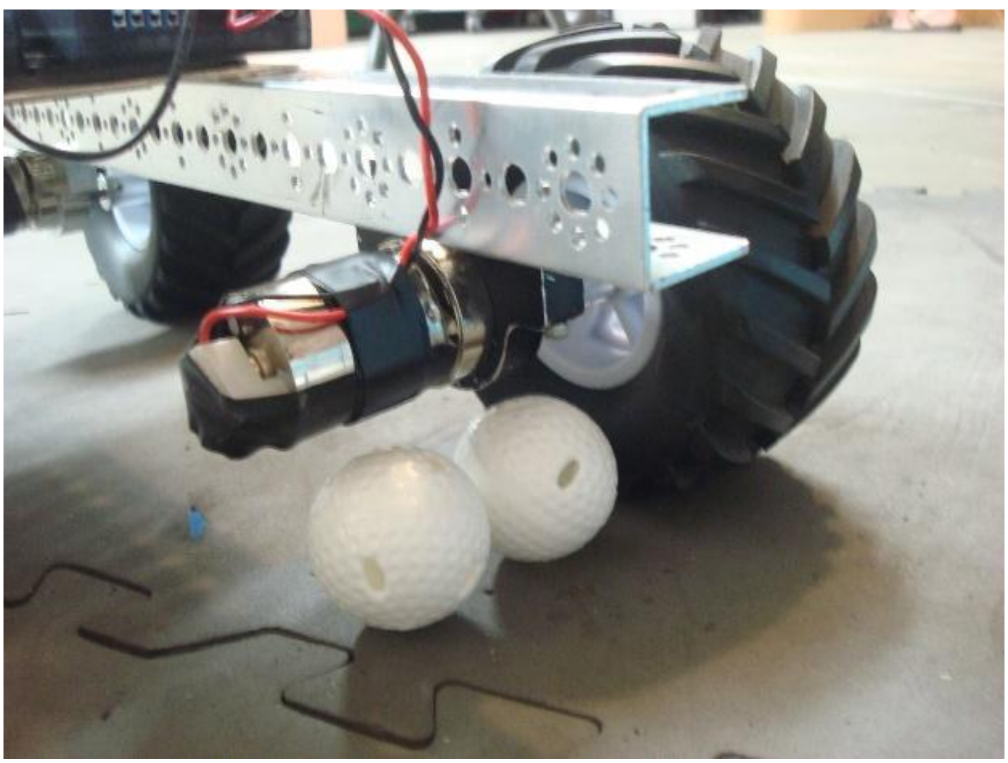
DATE:	START TIME:	STOP TIME
September 20, 2014	1:30	8:00

TASKS	REFLECTIONS
Build Moving Goals Raise Robot Working Robot Hannah	Hannah's goals for today were to find a way to move the goals without them getting stuck under the robot, to raise the robot so that the small balls would not get stuck under the motors, and to make a working robot to test ideas on. She started out with fixing up an old base. It was dusty so she cleaned it up and rewired it. She put on the 5" Max all terrain tire from Tetrix. They are 1" bigger than the Max Wheels by Tetrix. From her observations, the base being ½" higher would allow the balls to go under the motors and she thought that it might help moving the rolling tubes as well. She drove the robot to try it out and was able to push a rolling goal with no issues unlike before. Hannah wanted to see if the robot had trouble pushing 2 rolling goals around so she quickly zip-tied a piece of PVC pipe to the robot that stuck out about 16." This worked well and was able to push 2 tube goals. The smaller balls also went under the motors without any issues. At the end of the day, Hannah accomplished all that she had hoped to and plans on setting up the field tomorrow to try the robot and see how it works and to make a prototype sweeper to pick up the balls.

The Old Base



Robot with PVC Pipe Zip-Tied



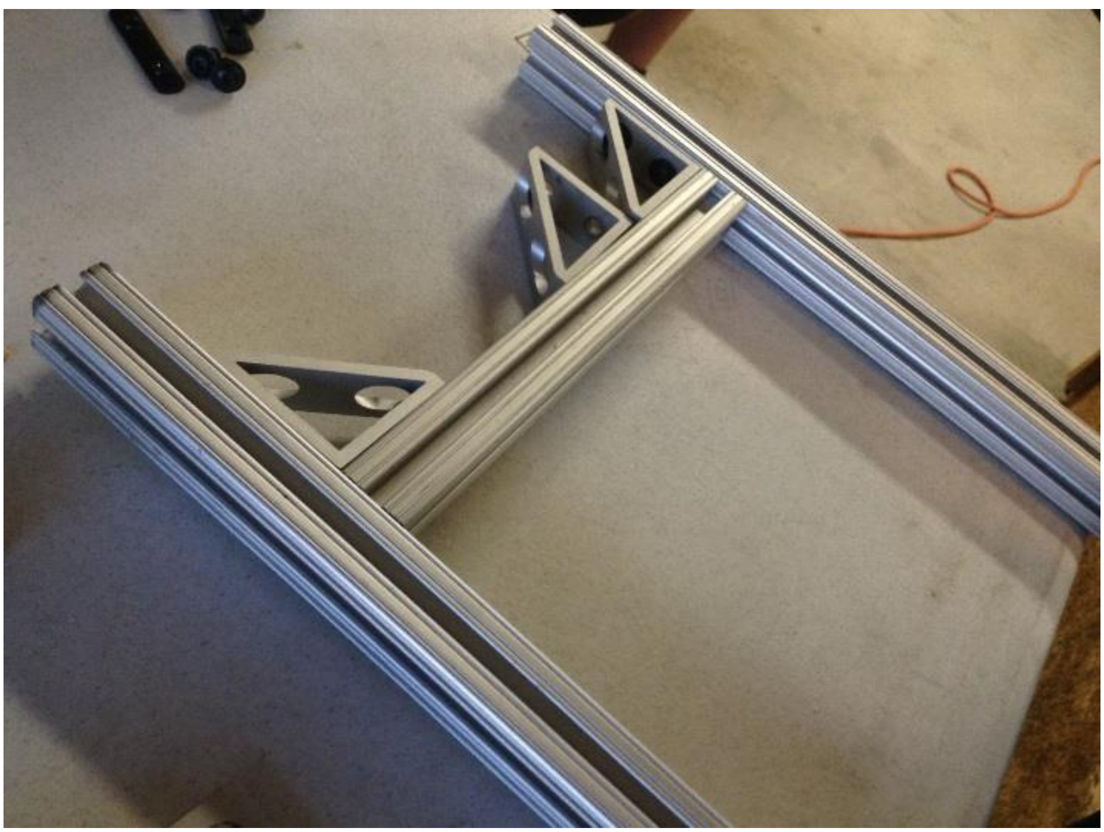
Small Balls under the Motor

R & D Robot	
TASKS	**REFLECTIONS**
Build **Ball Popper** **Thomas**	**On Thursday, we had discussed possibly using a “ball popper” mechanism to get the balls into a scoring mechanism, or to score the balls into the tubes. While Nathan and Thomas were working, Nathan went to the store to pick up a couple of items where he found two pieces of PVC that would be great for it (fig.4). Thomas took the pieces to see how they might fit together and how they might go on the robot. After thinking it through and discussing it with Hannah they decided that it may be best to make our own version out of much lighter PVC, and use a longer shaft to allow for better launching.**

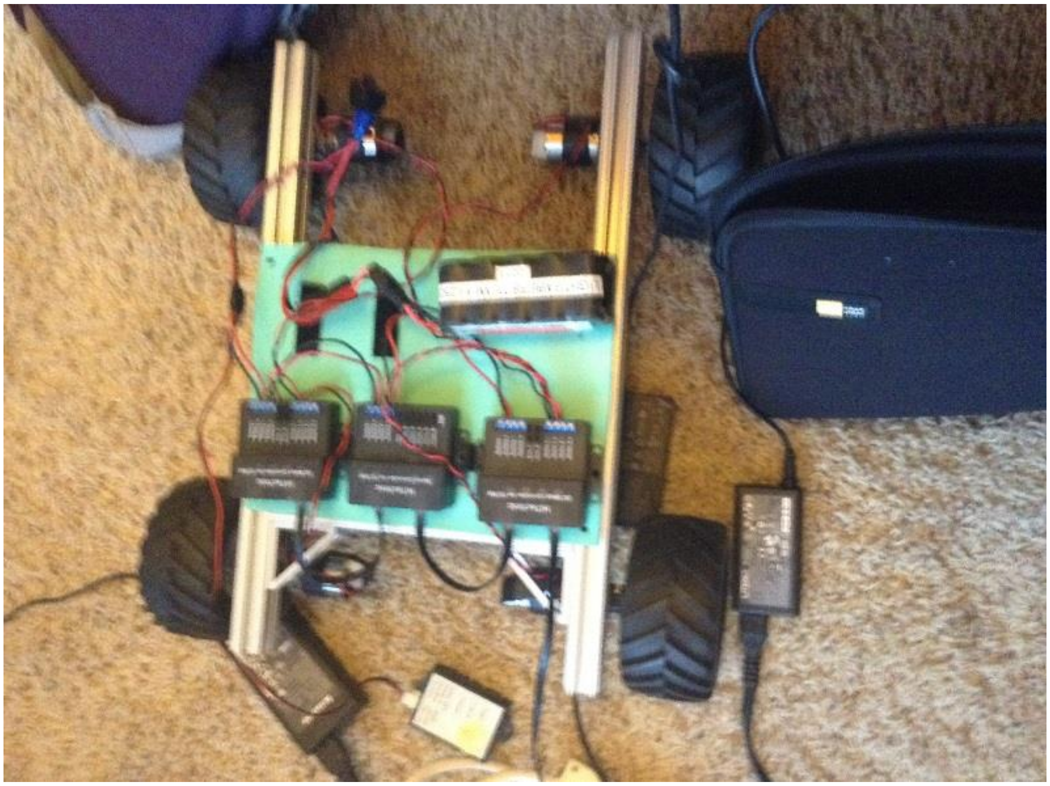
PVC Pipe Ball Popper

DATE:	START TIME:	STOP TIME
September 22, 2014	6:30	9:00

TASKS	REFLECTIONS
Build Chassis Thomas & Hannah	This year we wanted to change out our base design, so Hannah came up with the idea of an "H" type base that would allow us to have all of our mechanisms inside the robot. Laurel and I started taking apart the different 80/20 pieces we had until we found one 9" piece, and two 18" pieces for the layout. To connect the pieces, we used two angle brackets to allow for more space on the top of robot, and we put them in the back so that it did not get in the way of any mechanisms. After we put the pieces together, we started putting on the motor mounts and the motors and placed them as far back as we possibly could.



The Base "H" Plate



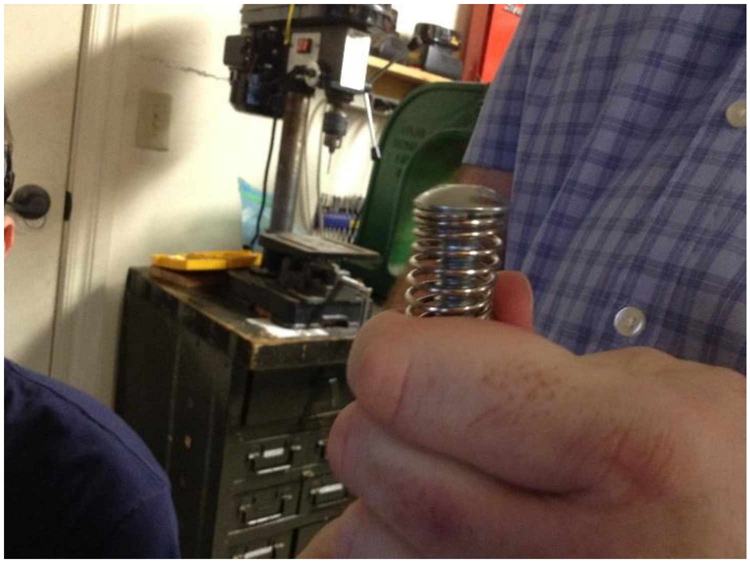
Motor Controllers

TASKS	REFLECTIONS
Program Created sonar reading program for autonomous Biv	Today my aim was to set up the NXT brick with my computer's version of Robot C. It was simple and took a matter of minutes. With all the remaining time, I wrote a simple program that takes values from the sonar and displays it on the NXT. Xavier, Matthew and I then went out to test the values it read at specific distance from the different tower positions. For each position, the values returned were consistent and accurate. This year the sonar seems to be the better choice over the IR. Next, we decided to begin making a very basic format for the autonomous using last year's structure. I worked on coding some of the beginning steps like reading the sonar and moving a goal. Xavier helped me with some of the formatting and answered some questions I had about specific functions and commands in Robot C. In the end, I got about a third of the way through the autonomous. Without the robot built yet, most of the autonomous was just pseudo Code with theoretical values just so that I have a plan and structure to work with. Next meeting I am hoping to finish it up.

Sonar Value Reader

R & D Robot	
TASKS	**REFLECTIONS**
Build **Working on lift** **Adam**	**We decided to explore some designs that would launch the ball instead of lift it. The first one we prototyped was a spring-loaded piston that would launch the balls vertically up a guide into the scoring tubes. The main problem with this design was that it took up a lot of space vertically, meaning that in order to get the balls into the launching mechanism we would have to raise them up at least 14 inches to get them above the piston. Once we decided that this design was too cumbersome, we moved onto an idea that would use a flat spring instead of a regular coil. The flat spring design did not take up nearly as much room and would be much easier to compress and release than the coil design. Now all we needed to do was build a guide for it.**

4250

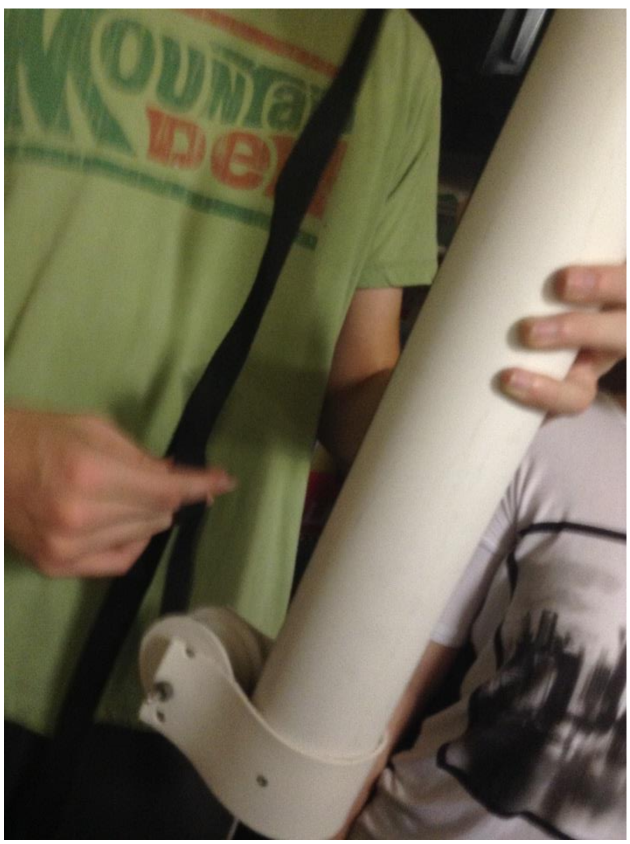


Coil Spring for Prototype

Prototype Ball Popper

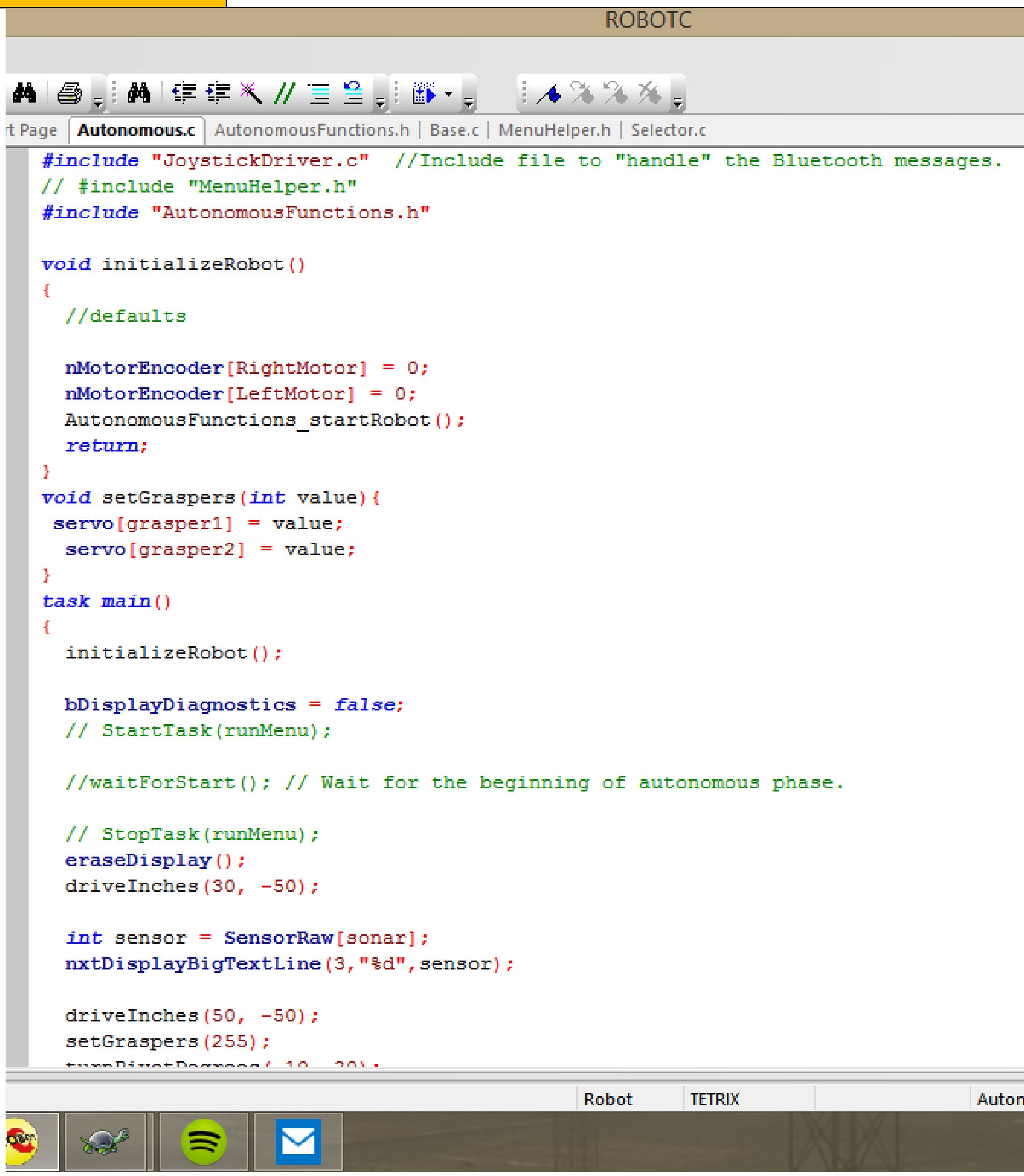
DATE:	START TIME:	STOP TIME
September 25, 2014	6:30	9:45

TASKS	REFLECTIONS
Build Prototype conveyor Adam	Tonight my goal was to figure out whether or not a conveyor belt lift could work for our ball scoring mechanism. I used a 3-inch diameter PVC pipe that was 2 feet long for the tube, and made some brackets for the top and bottom pulleys out of heated PVC. Once I had assembled the mechanism, we ran a few balls through it. The balls passed through the tube fine, but the claws that grabbed them did not have enough strength, so they frequently dropped balls. Also, the maximum height that the conveyor could be is 18 inches, so unless we wanted to design a telescoping conveyor belt system, then we had hit another wall.



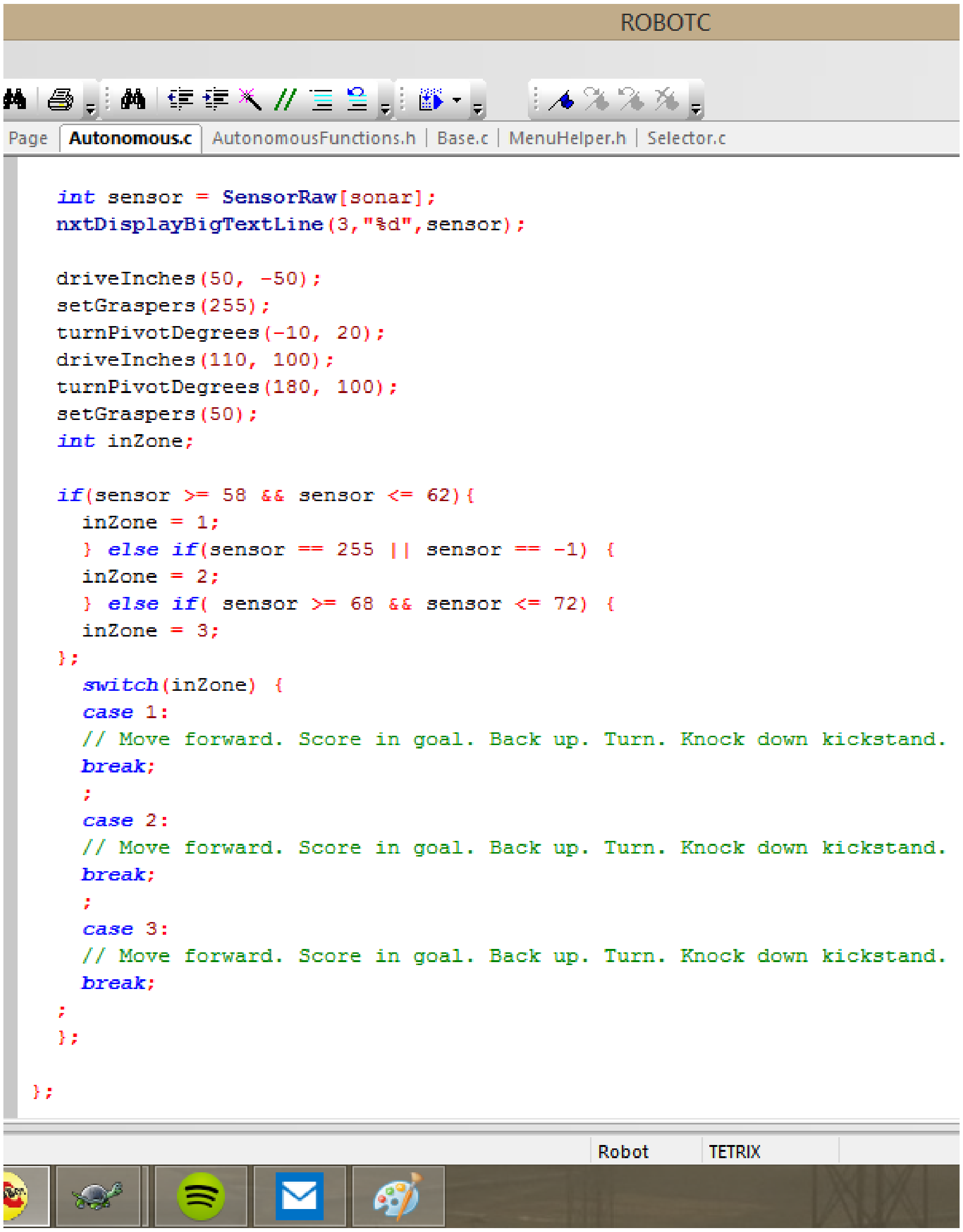
Game Pulley Mechanism

TASKS	REFLECTIONS
Program Autonomous Biv	Tonight Matthew and I finished up the mock-up autonomous with approximate drive measurements and no center goal scoring code. We had to wire in the encoders and mount the sonar for the autonomous to run. With the basic robot base built, we ran it on the field.




```
#include "JoystickDriver.c"  //Include file to "handle" the Bluetooth messages.
// #include "MenuHelper.h"
#include "AutonomousFunctions.h"

void initializeRobot()
{
  //defaults

  nMotorEncoder[RightMotor] = 0;
  nMotorEncoder[LeftMotor] = 0;
  AutonomousFunctions_startRobot();
  return;
}
void setGraspers(int value){
 servo[grasper1] = value;
  servo[grasper2] = value;
}
task main()
{
  initializeRobot();

  bDisplayDiagnostics = false;
  // StartTask(runMenu);

  //waitForStart(); // Wait for the beginning of autonomous phase.

  // StopTask(runMenu);
  eraseDisplay();
  driveInches(30, -50);

  int sensor = SensorRaw[sonar];
  nxtDisplayBigTextLine(3,"%d",sensor);

  driveInches(50, -50);
  setGraspers(255);
```

Figure 4 Programming Autonomous Part 1




```
int sensor = SensorRaw[sonar];
nxtDisplayBigTextLine(3,"%d",sensor);

driveInches(50, -50);
setGraspers(255);
turnPivotDegrees(-10, 20);
driveInches(110, 100);
turnPivotDegrees(180, 100);
setGraspers(50);
int inZone;

if(sensor >= 58 && sensor <= 62){
  inZone = 1;
  } else if(sensor == 255 || sensor == -1) {
  inZone = 2;
  } else if( sensor >= 68 && sensor <= 72) {
  inZone = 3;
};
  switch(inZone) {
  case 1:
  // Move forward. Score in goal. Back up. Turn. Knock down kickstand.
  break;
  ;
  case 2:
  // Move forward. Score in goal. Back up. Turn. Knock down kickstand.
  break;
  ;
  case 3:
  // Move forward. Score in goal. Back up. Turn. Knock down kickstand.
  break;
;
};

};
```

Figure 5 Programming Autonomous Part2

TASKS	REFLECTIONS
Build **Thomas**	**Some sketches were given to me to create a passive mechanism to hold on to the rolling goals throughout the match. I asked our mentor Wayne how I might go about creating it and he showed me that I should "build" it with cardboard to get the basic idea, and then really build it based on how the cardboard worked. After deciding on a design, I cut out a long piece of PVC and used the heat gun to get the proper shape, tested it, reheated, tested, and reheated again. After**

	numerous tries, I was finally able to get the proper angles to where it worked as intended.

TASKS	REFLECTIONS
Media T-shirt design, notebook cover, and photos Laurel	The shirt design began as a pencil sketch that I had to draw across 2 sheets of paper. After completing enough of the basic sketch, I scanned it and opened it in Photoshop Elements. In Photoshop Elements, I redrew the pencil sketch on my tablet using a black brush to make the drawing look as if it was made out of shadows. When I got to the hand however, I shadowed it like the rest of the drawing but then copied it and reversed the image to use it for the other hand so that the design would look symmetrical and professional.


TASKS	REFLECTIONS
Build Elliott	Tonight, I built and cut three 15" wheels out of thin wood. This was to facilitate a system of passively collecting the large balls. One wheel would be on one side of the robot while the other two would be on the other side. The two wheels would be just far enough apart so that the large balls would squeeze between them. This would allow the two wheels to collect the balls passively, fulfilling the goal. To draw out a proper circle, I drew four perpendicular points, all 7.5" from a center point. I then used a nail and a piece of string, marked at 7.5" and made marks in a circle. I completed the circle and cut out the piece with a bandsaw. I smoothed down the sides to a near perfect circle with a sanding machine. Now that I had one complete circle, I used it as a template to sketch the other

	two circles. I sanded the two new circles out and set them aside to use later.

15" Wheel Design

R & D Robot	
TASKS	**REFLECTIONS**
Build Prototype Ball Popper Hannah	I created a quick PVC pipe spring and screwed it onto a 2 by 6. I was able to make small balls score but the larger balls were more elusive. After I closely studied the small balls shooting, I noticed the smaller balls would always rest in the same spot, while the larger balls positioning changed every time. I concluded that a ball popper would be possible with a bit more effort. I planned on making a larger version to try to make the larger balls always go to the same spot.

DATE:	START TIME:	STOP TI
September 27, 2014	2:00	4:00

R & D Robot	
TASKS	REFLECTIONS
Ball Popper Designs Thomas	Mentor Nathan and I discussed our ball popper idea and how exactly it was going to work. I ran up to the store and bought two rat traps so we could pull the springs out and figure out how exactly it was going to come together. Nathan drew up a sketch of it and we continued to discuss the functions and design of it. That night I emailed Adam and had him build a concept of it that he would be able to bring to us the next time we met and see how it might fit together.

DATE:	START TIME:	STOP TIME
September 29, 2014	6:15	10:00

TASKS	REFLECTIONS
Sonar in Autonomous Biv	First I worked on correcting some of the drive distance measurements in autonomous. Just a few minutes of trial and error and the path of the goals to the parking zone was accurate, but the code for each of the center goal positions wasn't running. The sonar was not reading the correct values. So during the time it read the values I set it to bleep however many times for each position it read. It always played the error tone and displayed odd values that were over a thousand. I checked the sonar; we plugged into the wrong port. After fixing that mistake I ran the sonar reader program and re-adjusted the values in autonomous. It worked fine, except in position two, the values reflect incorrectly off of the kickstand. I will have to set the robot to stop and read at a different position at autonomous to avoid the kickstand.

TASKS	REFLECTIONS
Tweak Passive Clamp Thomas	Last week Wayne and I worked on a passive clamp mechanism that would allow us to just run into the rolling goals and hold on to them for the rest of the match. Even though we decided that the passive clamp would work, we wanted the ability to grab on to and let go of the rolling goals at will. Our first idea was to use U channels to grab hold of the lip, however this would not have worked due to the small ramps on the edge. Then we thought of using smaller U channels to grab the lip in between the thin ramps on it. In addition, we would use an L-shaped piece to grab it from the bottom. We briefly discussed the idea of using a "pin dropper" mechanism that would drop a pin into place, but we decided that it was an unnecessary mechanism and would be annoying to fidget with. In the end, we decided that the U channel and L-shaped pieces would be the best course of action for the clamp idea, and we would implement it after the first qualifier.

Passive Clamp

Clamp and Rolling Goal

4250

TASKS	REFLECTIONS
Concepts and ideas Jason-Elliott	A lot of the night was spent in discussion of concepts and ideas. We prototyped a ball popper as well as a ball popper guiding system. The guiding system was made out of large PVC tubing. This was to test how well the balls could be guided.

Ball Guiding System

R & D Robot	
TASKS	REFLECTIONS
Ball Popper Lala	I helped Adam assemble the ball popper. Nathan taught me to use paper to place a level line on a cylinder.
TASKS	REFLECTIONS
Ball Popper Adam	Our goal was to design a ball popper prototype that could launch the balls at least 5 feet into the air, and do it quickly. The first obstacle was getting enough power to fire the ball without the mechanism taking up too much space. The second was how to make it fire quickly while retaining all of its power. We experimented with several different kinds of springs, from roll springs to flat springs, but we finally settled on using a torsion spring wrapped around an axle. The original inspiration for this idea came from us observing a mouse trap; despite their small size, the torsion springs generated an enormous amount of power. However, we did not want to incorporate an entire mousetrap into our robot, so we took the springs off one and slid them onto our own axel. Now that we had a strong power source the question was how we were going to pull such stiff springs back rapidly, release them, and re-grab them quickly. Our first answer to this problem was that we would just drive the axel that the springs were on back and forth to wind and release the springs, but as we experimented with it, we decided that it took too much time, and that we needed a more efficient design. Our next design was to place the axel with the torsion springs in a hole on the outside edge of the gear, and then rotate the gear above a flat surface, thus loading the springs as the gear rotated about its center. What was also ingenious about this design was that as the gear rotated; it would compress the springs as it went downwards, but release them as it began traveling upwards again. Once we realized this, we attached a thin aluminum plate to the same axel as the springs and loaded the springs onto it. This plate would serve as the part that would actually contact the balls. The final version of the prototype required only one motor and was able to launch the large ball well over 8 feet into the air. In fact, the ball popper was so powerful that it even split one of the small balls in half. Power was not the poppers only upside, the fire rate was impressive as well, able to fire over a ball a second. While the prototype itself was rather large, it could easily be streamlined for implementation onto the robot. One of the only flaws in the design was that the springs stored so much energy that when they were released, they literally bent our FTC® axels out of shape. So when we build the final version we will use thicker axels to alleviate this problem.

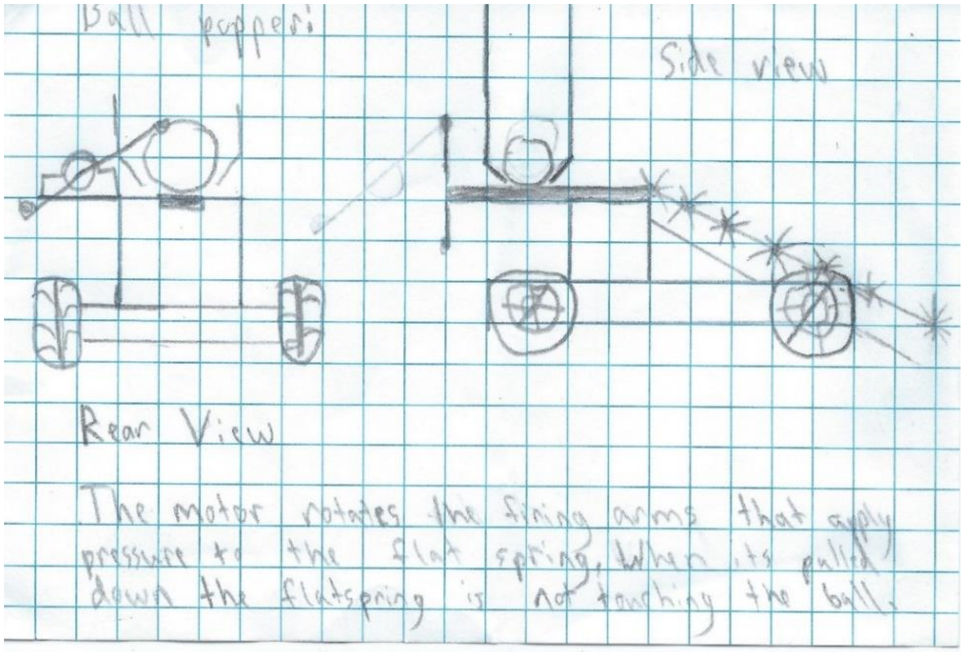


Figure 6 Design Sketch Ball Popper

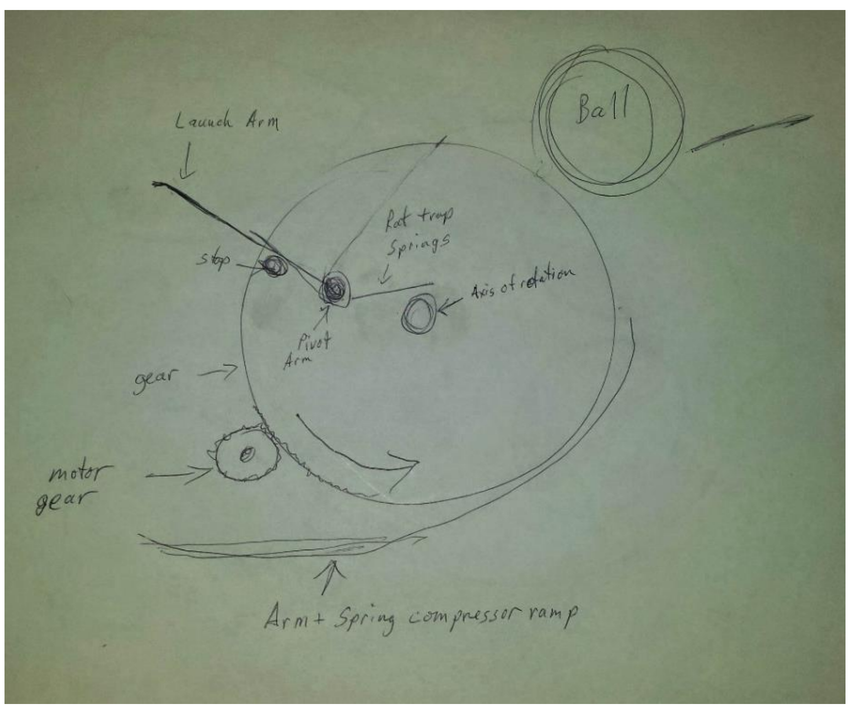
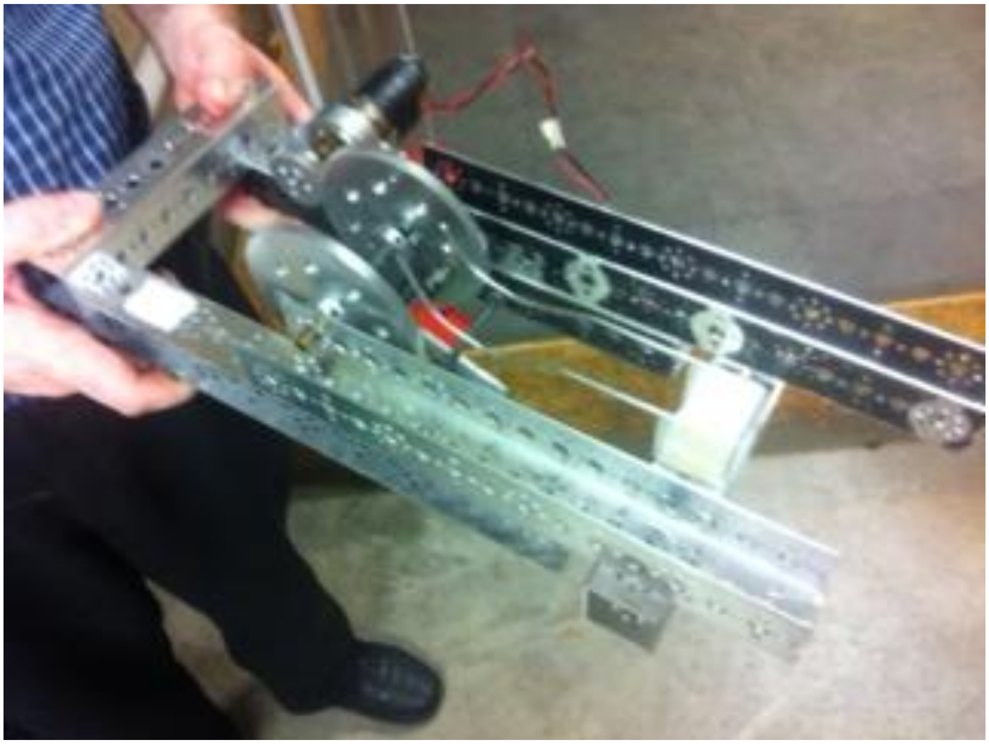


Figure 7 Design Sketch Arm and Spring



Ball Popper

Ball Popper

DATE:	START TIME:	STOP TIME
October 2, 2014	6:15	9:00

TASKS	REFLECTIONS
Build Qualifier Robot Hannah	I was tasked with building a simple arm robot that can pick up big balls and score them in the tall and lower tubes. I had already made something of this nature for the RING IT UP!℠ game 2 years ago so I simply redesigned for this game. Since we have 3 FTC® teams, we are rather short on parts and unable to allow each team to have 2 robots, one for programmers and another for builders. Obviously, this creates a conflict as the programmers and the builder will be trying to work on the same robot the whole night. However, it worked out as Biv's RobotC license expired and I was able to use the robot for the whole night. We had been using the Tetrix MAZ All Terrain tires and Coach Vince said that he thought the wheels might make it harder to drive and pick up balls because of the increased traction and the lack of Omni wheels. I have driven the robot for several years and some quick testing proved that the bigger tires did not affect my driving much. Coach Vince and I concluded that keeping the same base and wheels with slight modifications would allow us to progress to the state level. We took apart the robot and began working on putting it back together when we ran out of time. I planned to work with Coach Vince more before the next meeting to have the robot ready for the competition.

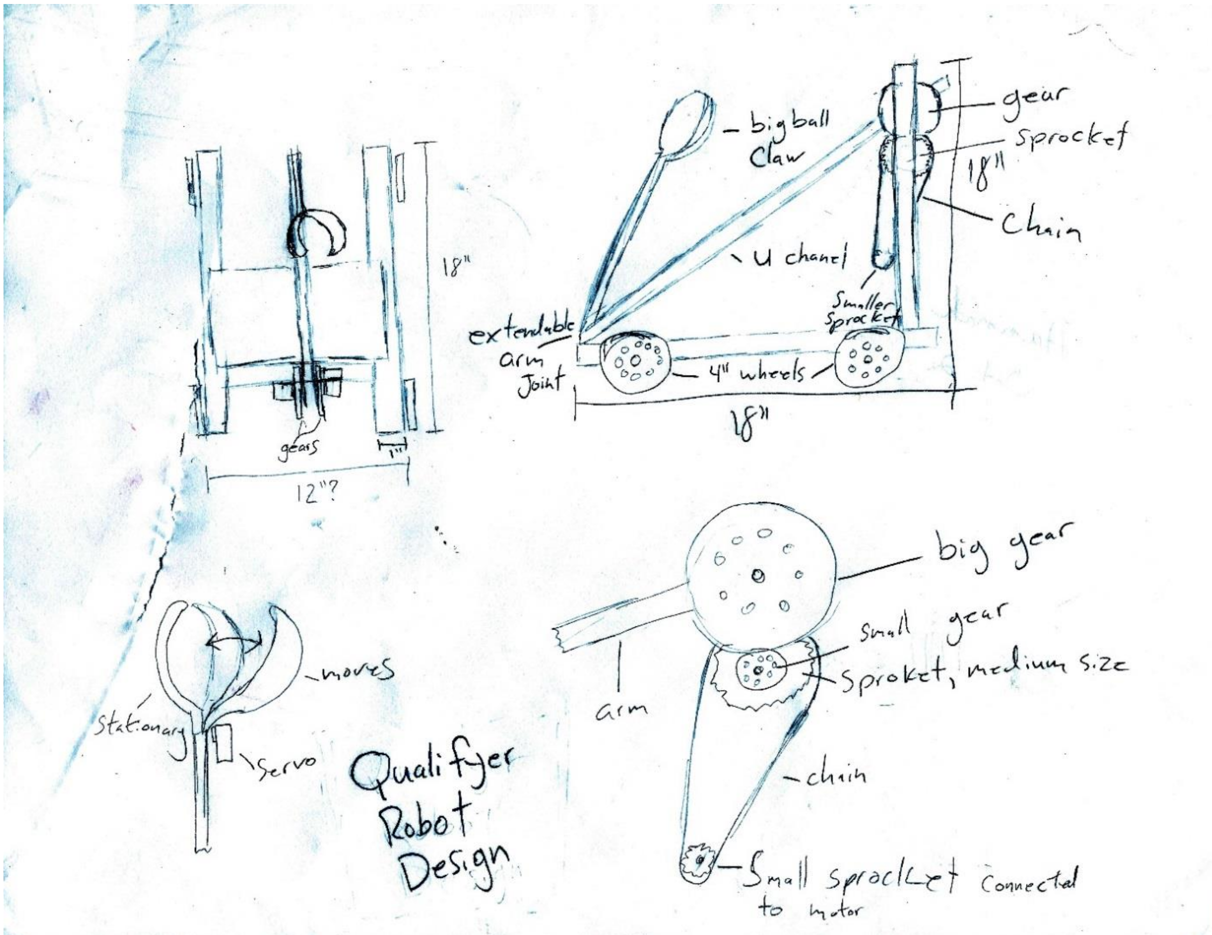


Figure 8 Design Sketch Qualifier Robot

R & D Robot	
TASKS	**REFLECTIONS**
Designing Lift Mechanism Adam	**Tonight I needed to design a guide for the ball popper. The guide was not going to be difficult; it was the raising it up 4 feet in the air that would be hard. I knew I wanted the guide itself to telescope, but I was not sure about the mechanism that would raise the guide. I could either use a roll spring to raise the guide, or several linear slides. The roll spring method would be much faster and lighter than the linear slides, but lacked stability. The linear slide method would be slow and heavy, but would be considerably sturdier. I prototyped a simple telescope mechanism so I could test the ideas. First up was the tape measure idea, so I duct-taped the top of the tape measure to the highest point of the telescope. As I extended the tape measure, instead of it pushing the telescope upwards, it simply bent under the**

load. The linear slide idea ended up being too cumbersome, so it was time to try something else.

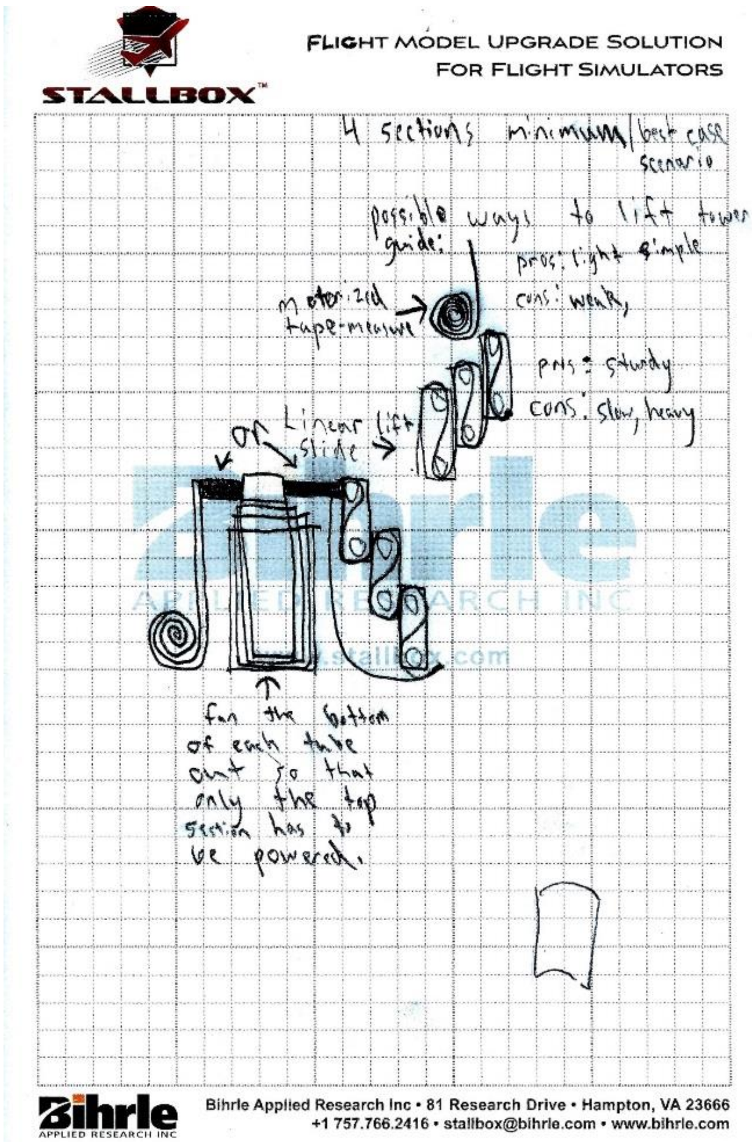
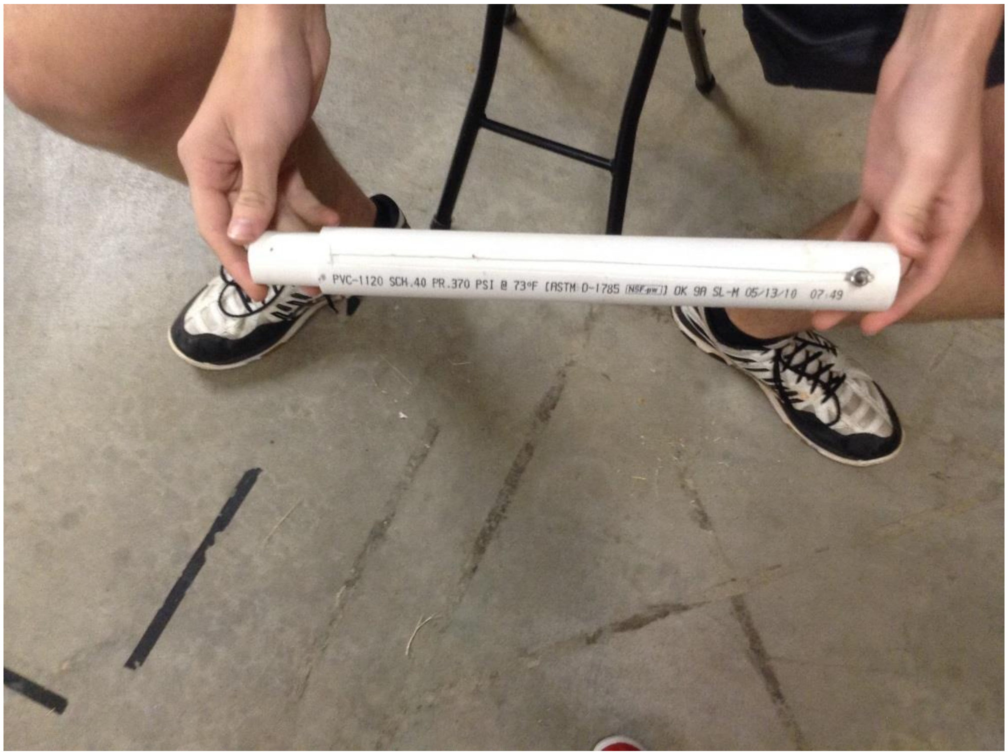


Figure 9 Sketch Design for Lift



Telescope Prototype Collapsed

Telescope Prototype Extended

DATE:	START TIME:	STOP TIME
October 4, 2014	9:00	3:00

TASKS	REFLECTIONS
Programming **Electric** **Biv**	This morning while waiting for the build team to put together the competition bot, I started on creating the electrical schematic. I used an example schematic on a computer document for reference while I was drawing out the final electrical schematic. I stopped after documenting the NXT, battery, Samantha, ultrasonic sensor, power connectors and the first motor controller. Then I went back to the autonomous and reversed a few of the values to accommodate the robot starting backwards. Need to add USB surge protector.

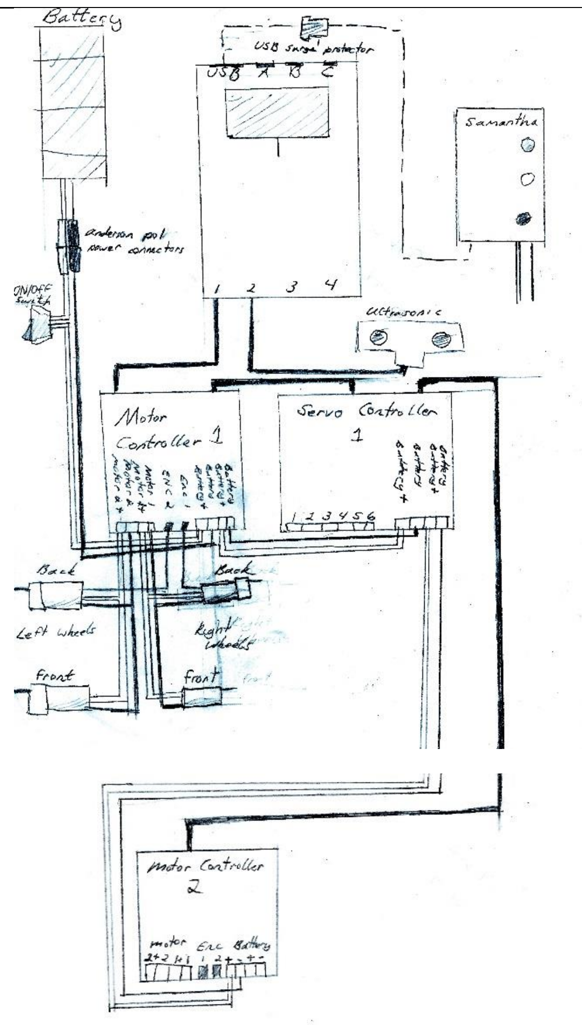
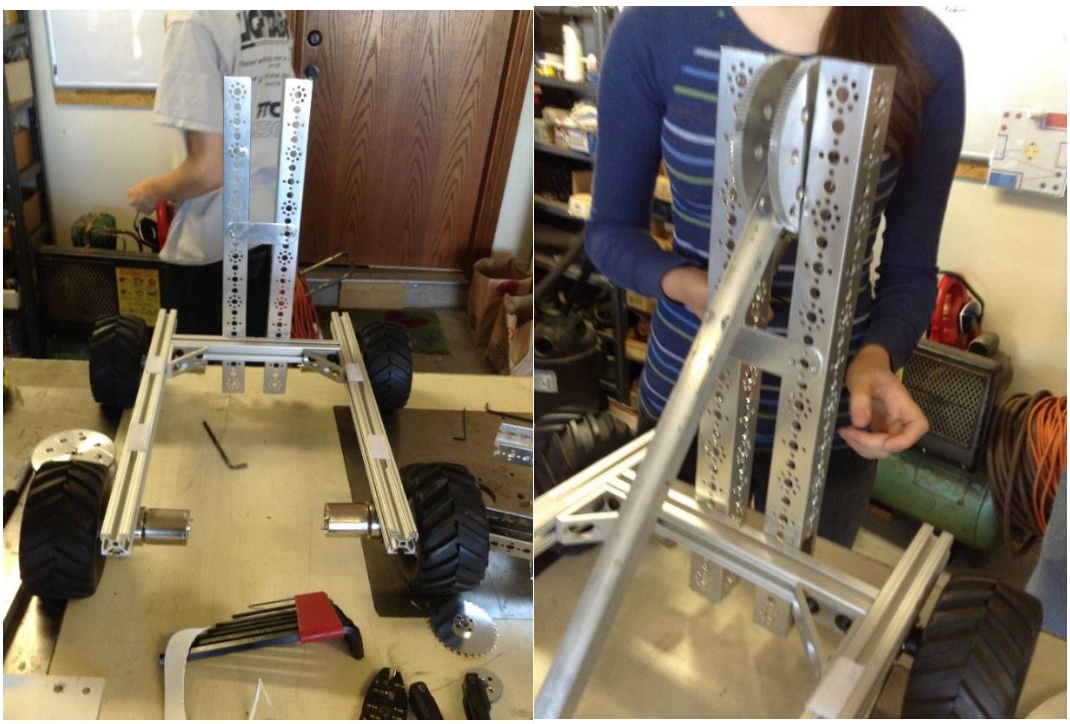


Figure 10 Electrical Schematic (Work in Progress)

TASKS	REFLECTIONS
Building on robot Lala	Today I have accomplished a good amount of work on the robot. I added the arm and tower. Sadly, the tower is not straight because of the brace that holds them together, but it works well enough. After that, Hannah designed a simple PVC shape to hold the towers to the back of the robot. I got to build the actual pieces and add them to the robot.



Base with Arm Tower on Back

Rolling Goal Clamps

TASKS	REFLECTIONS
Build Ball Hand Hannah	I built the ball hand out of PVC pipe like I was planning to. I also adjusted the arm in preparation for putting the hand on next meeting.

Ball Hand

TASKS	REFLECTIONS
Work on the Base and the gear sprocket Thomas	I started helping Lala with the tower for the back of the robot and helped locate screws and other miscellaneous items that were needed. Because we are going to use last year's design but our Beta team was using it, we had to recreate our gear and sprocket design to move the arm up and down. First, I had to take the screws and cut them to the proper length, and then I had to re-thread the screws so that they would fit in the holes. At first, the screws would not go into the holes that I had made so I continued to grind them down and smooth the end in hopes that they would fit, but it never seemed to work. After fighting with it for over an hour, I finally decided to consult Hannah while she was busy and she almost instantly pointed out that I was using a broken piece and I had no idea. So I got the new piece and had to continue fighting for an hour until the screws went all the way in, and then it was usable. I also had to reheat the two pieces on the back of the robot that Lala had made so that they would fit on the rolling goals better.

R & D Robot	
TASKS	**REFLECTIONS**
Building lift mechanism Adam	Since the linear slide and tape measure method did not work, we decided to try something tried and true: a scissor lift. The design was relatively simple, so we started working on a prototype immediately. We used several pieces of old L-brackets and cut them all to 16 inches. Once they were all uniform, we started drilling holes in them so we could begin attaching them. Each scissor lift took 6 L-brackets to construct so we made twelve in all. Once all the pieces were pinned together, we extended the lift to see how high we were getting. Even without full extension, the lift reached 42+ inches, and once we added the top part of the guide to it we would be well over the required 48 for the highest goal. When it was lowered, it stood a mere 5 inches tall and about 16 inches long and only required 10 inches of travel for it to reach the 42 inches. Now all we had to do was decide how to motorize it.


Scissor Lift Collapsed and Open

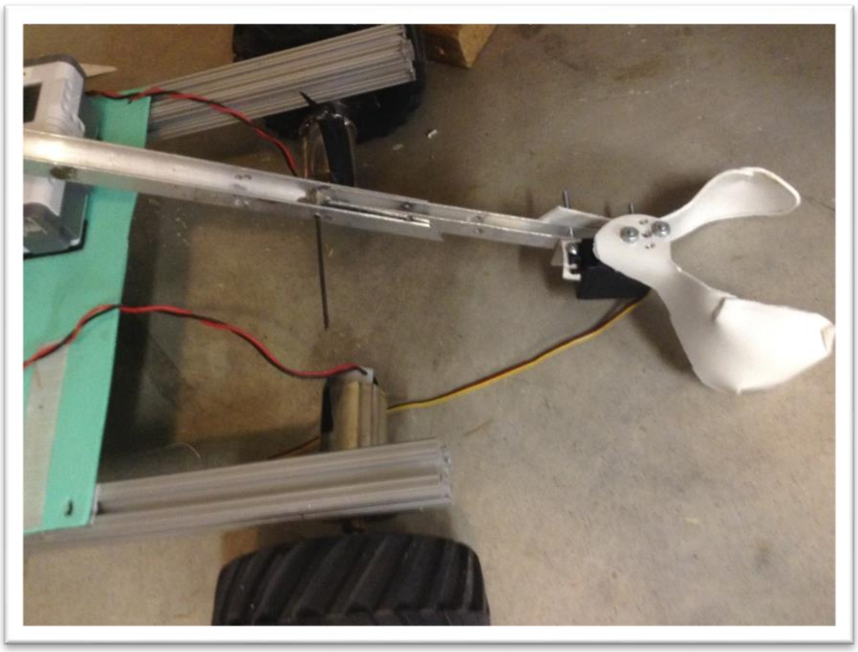
DATE:	START TIME:	STOP TIME
October 6, 2014	6:15	9:30

TASKS	REFLECTIONS
Programming Biv	Tonight I focused on studying last year's selector and menu autonomous to learn how to format it for this year's game. Then the build team needed to switch some things in teleop. So I added in the new arm motor and claw servo. The up and down on the arm is set to buttons 6 and 8 while the claw is button 1.

Figure 11 Programming Controller Schematic

TASKS	REFLECTIONS
Build more ball tower holders Lala	The task I was given was fairly easy! I helped build small L-shaped PVC walls and then rebuilt some more tower clips that are also made out of PVC and duct tape. The way to build them is to use the heat gun to bend some thin PVC into a 40 or 30-degree angle and then tape it onto an L shaped piece of PVC. Then you drill the holes to match the holes on the back of the robot and screw it on tightly. If your drilled holes are slightly off then u can easily heat gun the PVC and bend in to the level you originally intended.

TASKS	REFLECTIONS
Building Qualifier Robot Hannah	I built the ball hand out of PVC pipe like I was planning to. I also adjusted the arm in preparation of putting the hand on next meeting.



Ball Hand

TASKS	REFLECTIONS
Assist Hannah with the hand Thomas	I could not find another project to work on so I assisted Hannah. First I had to drill the holes into one side of the hand to attach it to the motor, and then we had to search for the screw to the servo, and then attach the hand to the servo

R & D Robot	
TASKS	REFLECTIONS
Actuate scissor lift Adam	We threw around several ideas about how to power the lift, ranging from surgical tubing to cables, but in the end, we decided to do a linear actuator. We started the prototype with a piece a square tubing, some all-thread, and a coupler nut. The plan was to power the screw at one end and have the bolt slowly slide along through the square tubing. However, the all-thread would not fit the lock on our sprocket, so we took it to a lathe and turned it down to 6 mm. Now that we could bind it into our sprocket it also had to be bound to the other end of the square tubing somehow. We took a thick block of plastic, cut it down to the size of the square tubing, and tapped it down into the tube for a snug fit. The coupler was not going to travel through the center of the tubing due to having another nut welded onto its side so the hole in the plastic block had to be off center, but this was not a problem because we just measured it with a caliper and used the difference to find the new center.

DATE:	START TIME:	STOP TIME
October 9, 2014	6:15	9:00

TASKS	REFLECTIONS
Wiring Programming Biv	This meeting was a catch up on the flowchart and wiring diagram. Both of them were hand drawn on paper, so I had to convert them digitally. Starting with the flowchart, I worked in PowerPoint taking shapes and arrows and assigning them specific to autonomous. Then I tackled the wiring diagram in Photoshop using pictures of the NXT, motors, sensors and motor controllers from the internet and wiring them with black and red lines.

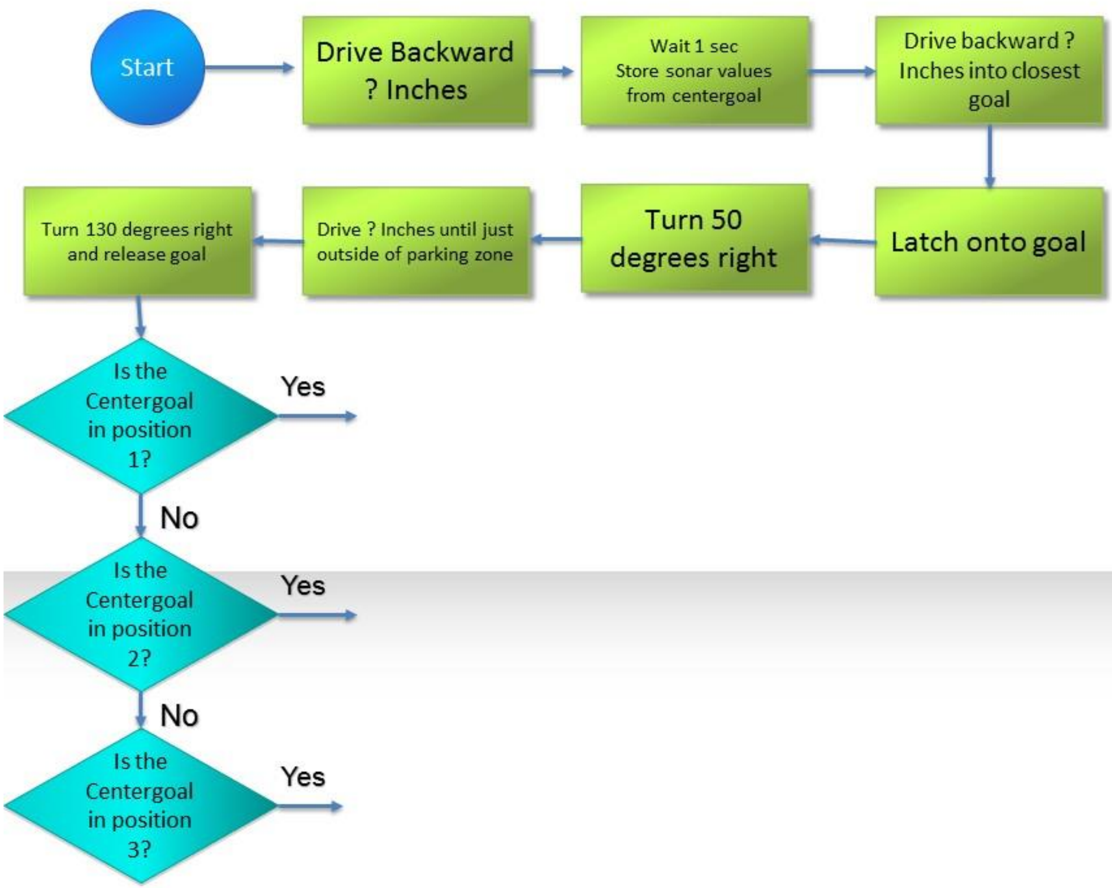


Figure 12 Programming Flow Chart

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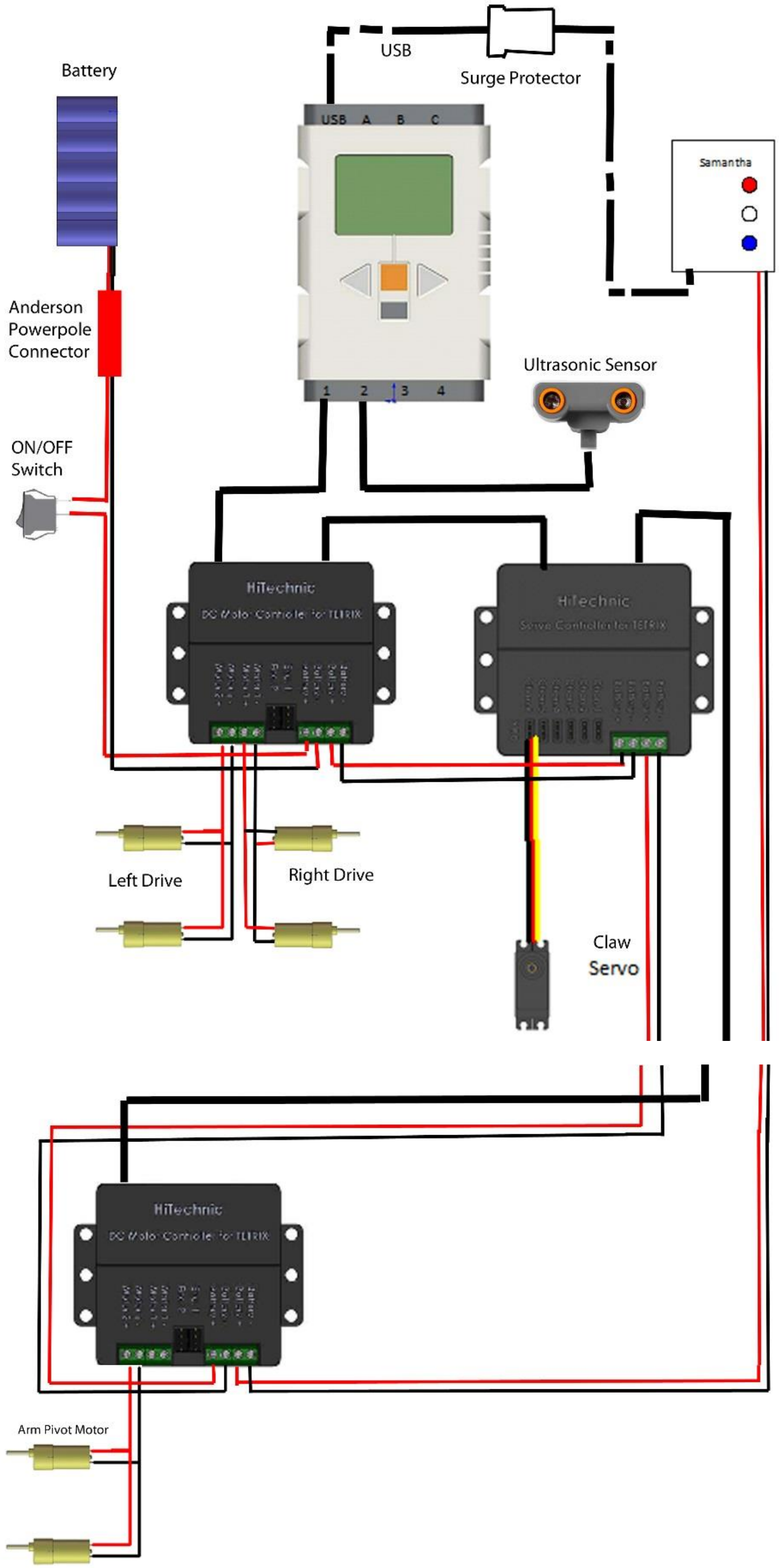


Figure 13 Electrical Schematic

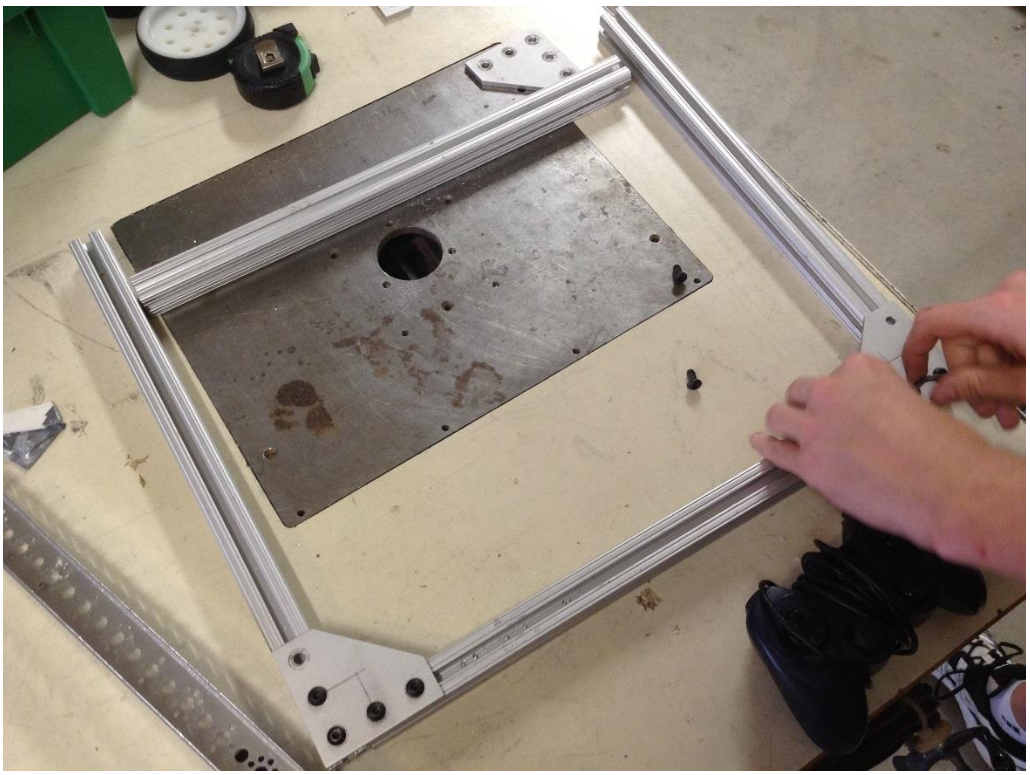
TASKS	REFLECTIONS
Building Lala	In this meeting, we were confronted by a problem: the balls kept running under the wheels and making the robot lift up and let go of the ball tower. So, Coach Vince let me design and build my own wheel guard that would protect the wheels from the balls.

Wheel Guard

TASKS	REFLECTIONS
Building Hannah	Today I worked on tweaking the hand to work better at putting the balls into the high goal. After that, I drove on the field and was able to put 7 balls in the big goal in about 2 minutes. This is nowhere close to what I wanted it to be. I decided to take what I learned and began building a new hand. Laurel and I also worked on making a way to keep the balls from going under the wheels. We made some prototypes and decided that my idea where the guide goes all around the robot was best, but we should use a heavier PVC piece. I started work on that. I will finish the guards and the hand over the weekend.

4250

R & D Robot	
TASKS	REFLECTIONS
Building prototype base Adam	Since it was just a base for the ball popper to be thrown on, the measurements didn't have to be perfect, so I grabbed a few pieces of 80-20 and threw them together in a basic square. I used a few homemade sliders for the 80-20 that would allow me to bind Tetrix to it. By the end of the night, I had put together a base with four motors and wheels that allowed us to start visualizing where the ball popper would fit.

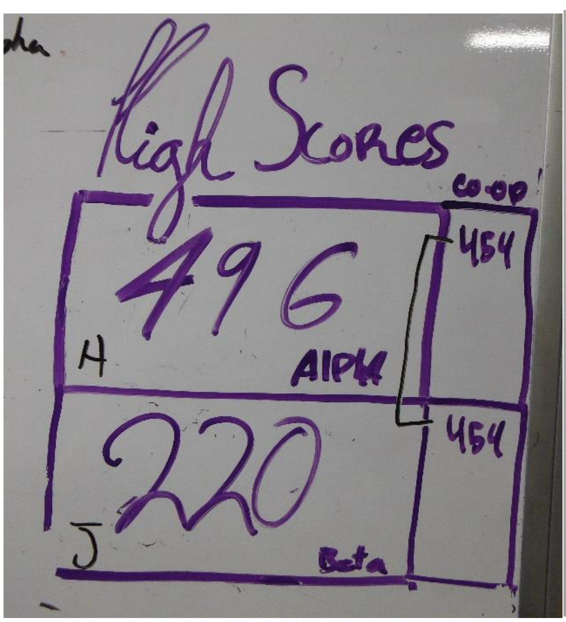


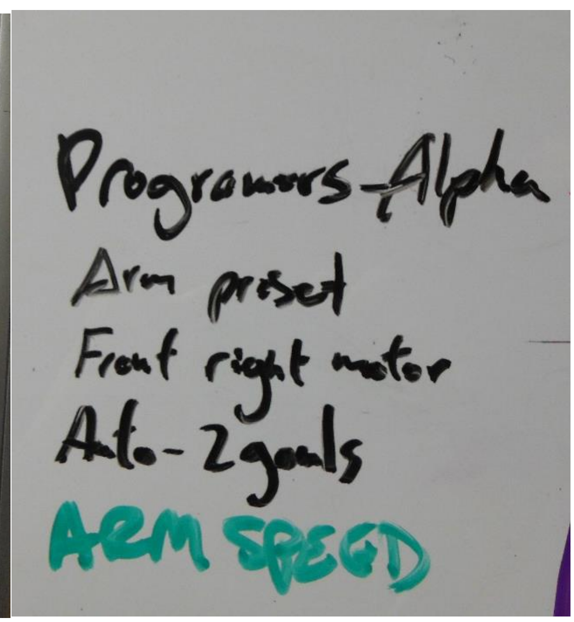
Prototype R&D Robot Base

4250 LIGHTSABERS 4250

DATE:	START TIME:	STOP TIME
October 11, 2014	3:00	8:00

TASKS	REFLECTIONS
Qualifier, Finalizing the Hand Hannah	Today I worked on making a more final design of the hand. After I finished the basics, I played a few matches to see how well it worked. I added another piece of thinner plastic to the top of the hand to help insure that the balls go into the tube. After I perfected the design, I invited Thomas over and Jacob, Thomas and I drove some matches. I was able to get a high score of 496, with an average of around 400. Jacob and I played a match where we were on the same team, as opposed to Jacob playing blue and me playing red. We were able to get 454 together. I came up with a new autonomous for the programmer and learned that a preset for the arm at the up position and the down position would be very useful and driver error was causing us to drop a fair amount of balls. The speed the arm travels at could also be improved. Coach Vince and I made a list of things that the Programmers needed to do for the robot.





R & D Robot

TASKS	REFLECTIONS
Actuate the scissor lift. Adam	Since we had already turned the ends of the all-thread down I started on making the plastic blocks that held the screw in place. One of the blocks was already done so I used it as a template and made the next 3 based off it. Now we had to weld the smaller nut onto the coupler nut. The welding was simple, but bound the two together without any hassle. We also had to cut a slit for the bolt to travel through, so we used the lathe to mill the slit. I threw it together to make sure there was not any binding going on within the square tubing, and there wasn't so we were good to go. We now had one of our linear actuators complete.

Linear Actuator

DATE:	START TIME:	STOP TIME
October 13, 2014	6:30	9:00

TASKS	REFLECTIONS
Programming Biv	The meeting started with a few practice matches. After autonomous has run the whole field is an unpredictable obstacle course; Balls are littered about every inch with the kickstands sprawled out in the center. The worst part is at the ramp when the robot is trying to push the goal up and some tiny little ball gets stuck in the way at the base, impeding the whole process. All the robots this year are going to have a clumsy moment or two while the builders are trying to figure out the best way to install guards around the wheels and sides. With those rounds learnt from and finished, the whole robot and field was promised to the programmers for the night. Hannah and Coach Vince wanted an autonomous that could grab two goals instead of our previous one. The new autonomous was supposed to drive backward, turn a few degrees left, drive backward until lined up in front of the tallest goal, turn right 90 degrees and drive backwards again, shoving the tallest goal into the goal clippers on the back of the robot. Then it needed to turn left and drive forwards into the middle goal and then take the middle goal with it while it drove into the parking zone. It did not seem too hard: just a few extra steps and changed values. I had coded and tested all the steps up to the turn after grabbing the tallest goal. When it tried to turn left, the tallest goal on the back was running into the wall. Here Matt helped me to try and solve this problem. We started with just trying to inch out a little, turn left a bit more, then inch out again and so on and so forth, but by the time we were turned fully we were out too far forward to get the middle goal and we were running into it without our left wheel instead of catching it into the middle of the robot. Matt coded a function that ran both sides of the robot during a turn so it could rotate in place, but the meeting ended before we could test it out and fine-tune it.

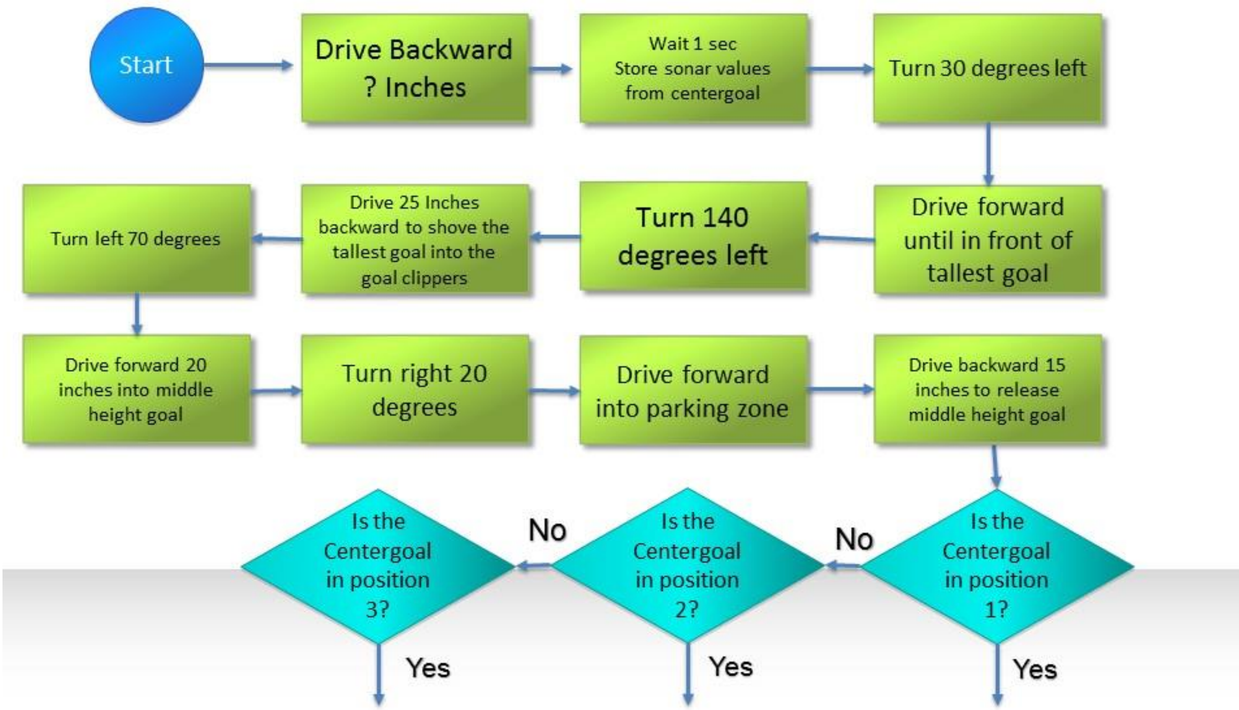


Figure 14 Improved Autonomous Flow Chart

```
turnPivotDegrees(30, 50);
driveInchesSmooth(30,100);
turnPivotDegrees(-135, 50);
driveInchesSmooth(40, 100); // ram into first goal
driveInchesSmooth(-2,100);
turnDegrees(25, 50);
driveInchesSmooth(-2,100);
turnPivotDegrees(30, 100);
driveInchesSmooth(2, 100);
turnDegrees(25, 100); // final turn for second goal
driveInchesSmooth(-20,75);
turnPivotDegrees(-40,60);
driveInchesSmooth(-90,100);
driveInchesSmooth(15,100);
```

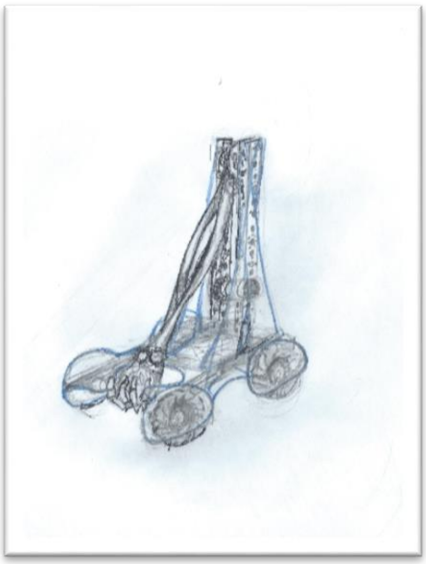
Errors

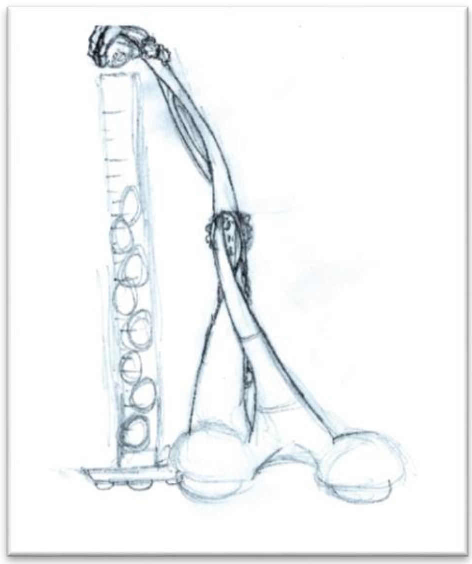
Figure 15 Autonomous Steps (Work in Progress)

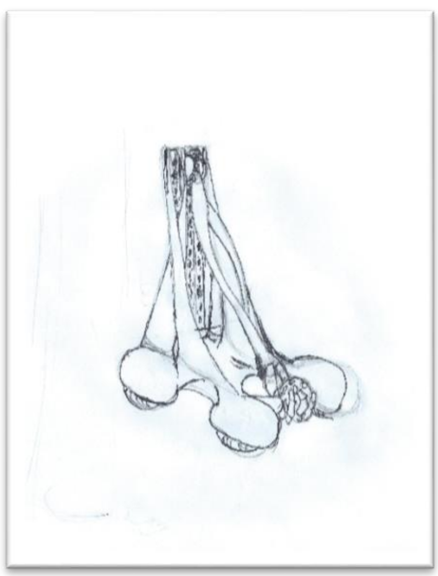
TASKS	REFLECTIONS
Folding arm clip Thomas	For our qualifier robot, we went with the idea of doing an arm that would pick up the balls and score them in a goal behind us. To allow us to reach the tall goal, we had to use some form of a folding or telescoping arm that would have it start inside of the 18 inches, and then fold out to the desired height. Two years ago in the RING IT UP!℠ game, I had designed a clip made from PVC based off of a remote control battery compartment. I dug through our old pieces until I found the clip I had created. The clip was too shallow to work on this arm, most likely due to wear from the competition it was used in. Because it was too shallow, I sanded it down until the angle was about right, and then re attached it to the arm and used a rubber band pulling it in such a way that it would lock it into place when it was deployed.

Arm Clip

TASKS	REFLECTIONS
Concept Art Lala	After listening to some ideas from the other kids, I started sketching out the robot. I drew a basic sketch of the robot and drew a skeleton hand for the claw, then started adding some shell. Now I must edit it all on Photoshop to make it look clean and professional.





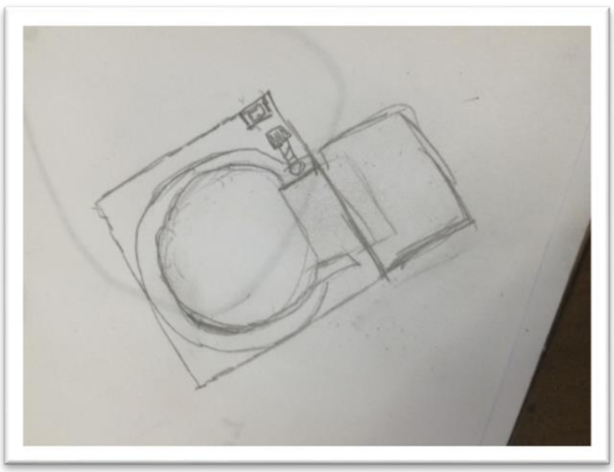


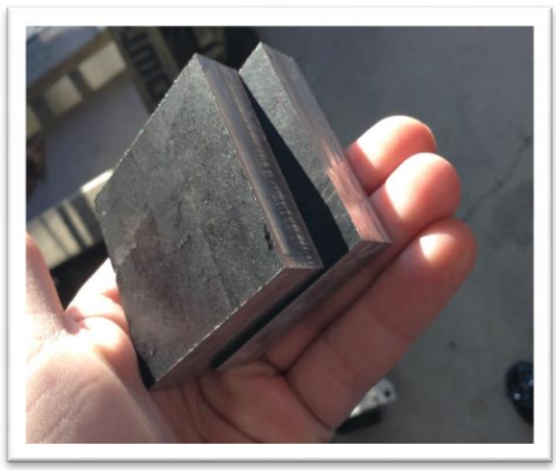
Concept Art

TASKS	REFLECTIONS
Guides for Wheels Jason-Elliott Hannah	At the beginning of the day, we had Beta and Alpha play a few game mock-ups with their robots. Our robot had an issue with the balls disrupting the smoothness of our drive. The guards we had on the front of the robot to prevent this were not doing the job so we had to make new ones. I measured the distance around the wheels so Hannah and I could fabricate guards. We wanted them to be as close to the wheels as we could get them so that we could stay within the 18x18x18" constraints. We cut two strips of 0.125" PVC. We determined that a strip of 1.5" by 17.5" PVC would do the job we needed it to. We curved the strips into rectangles and screwed them together.

Guides

R & D Robot	
TASKS	**REFLECTIONS**
Build Motor holder **Lala**	**At Nathans house, Biv and I got started on building something to hold the motor onto the side of a slide. We could not drill into the slide so we needed to design something that could be welded onto the side. The original motor holders were too big to fit on the side of the slide so we cut out some smaller aluminum squares that can easily be made into the right size of motor holder.**





Design to Hold Motors

R & D Robot	
TASKS	**REFLECTIONS**
Increase ball launcher durability **Adam**	**We machined two stainless steel axels to bridge the gap between the two sides of the ball popper. These axels had to be threaded, so we took them to the lathe and threaded them by rotating the lathe by hand. We also had to turn down the ends of them so they would fit into the holes of the FTC® gears. Once we had both of them done, we started reattaching the ball popper to its base. Now that the mechanism was solid, we needed more motor strength due to the heavy load almost burning out the single motor we had attached. We added the second motor on and the ball popper had no problem rotating now, and we were not even using a good battery.**

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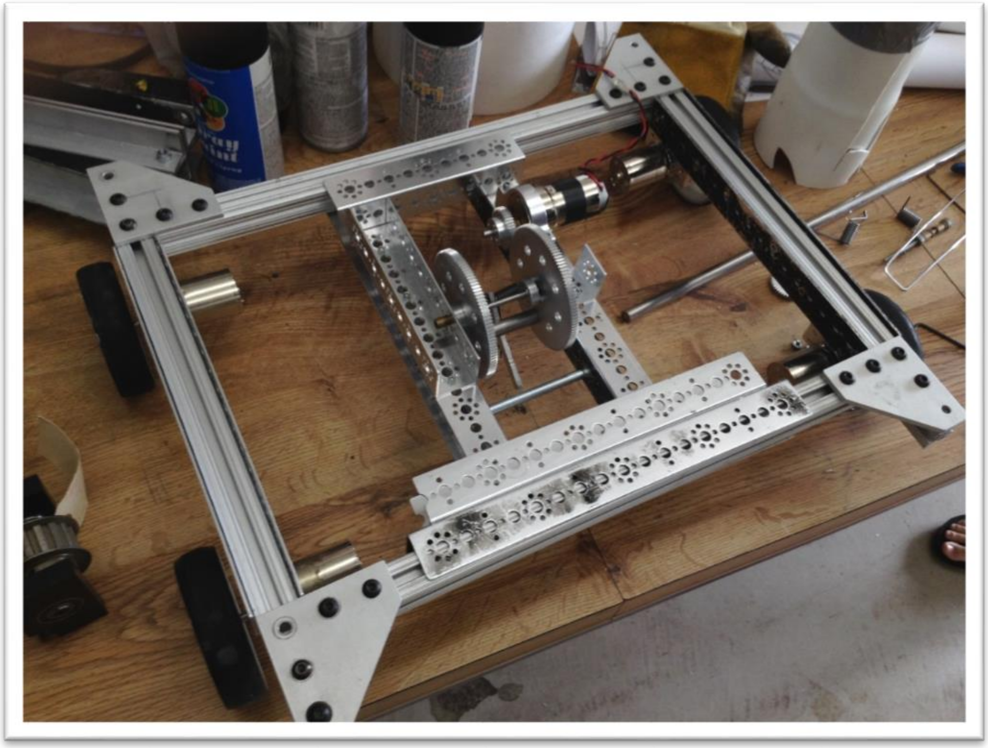


Ball Popper on Chassis

DATE:	START TIME:	STOP TIME
October 16, 2014	6:15	9:00

TASKS	REFLECTIONS
Programming Biv	With the encoder installed on the arm pivot motor, Matt and I got to work editing teleop. Hannah wanted presets for the floor position and high goal position. To start we first found the values for each possible position with an encoder-reading program we made. Then we opened a new file, defined each of those values, and used them in a switch case, giving each of the positions its own case. In teleop when a certain button is pushed one of those specific cases is referenced. However, the values we used were too exact, so we created a function that checked if the difference between the desired encoder target and the current encoder value fell within a specified threshold. If it did not, another function would run that checked whether the current encoder value was less than or greater than the target. If it was greater, the robot arm was told to run downwards until it fell within the previously defined threshold and vice versa, if it was less. Once it fell within the threshold, the motors were supposed to stop. When we tested it, the arm would stop at the floor position, but when you pressed a different button to change the position the arm would not move. The only way you could get it to change was by manually forcing the arm outside of the threshold.

rt Page | TeleOp.c

```
}

void Arm()
{
if( toggleJoyBtn_RB.pressed)
  {
    CurrentArmPosition = 5;
  }
  if( toggleJoyBtn_RT.pressed)
  {
    CurrentArmPosition = 2;

  }
MoveToCurrentPosition();
}
```

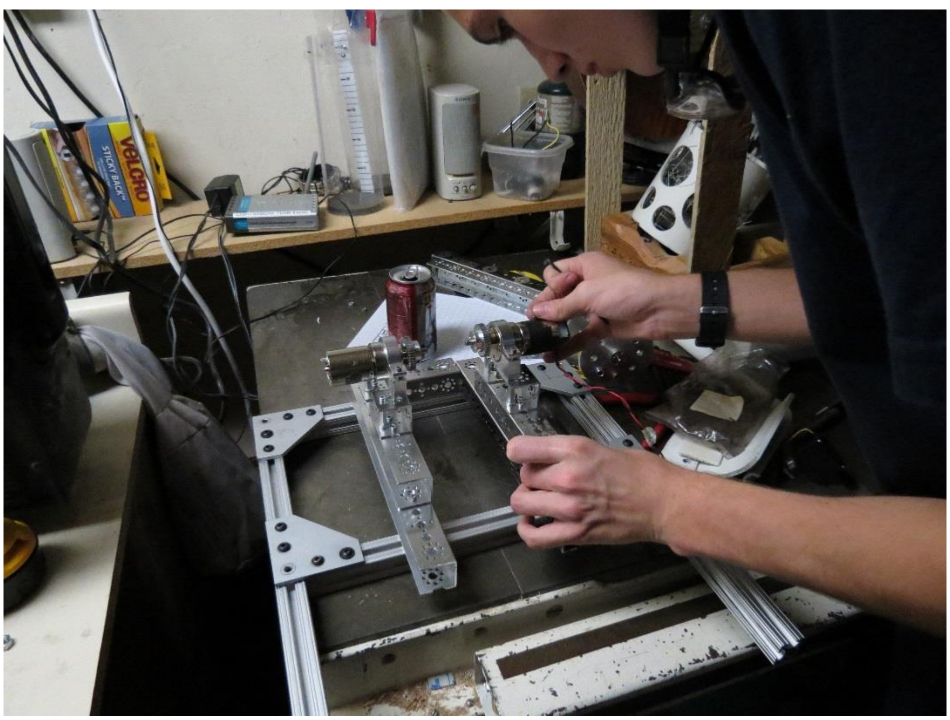
Figure 16 Teleop Arm Button

rt Page | TeleOp.c | Arm.h

```
bool MotorCloseThresh(int encoder, int threshold) {
  return ((encoder - abs(nMotorEncoder[ArmPivot]) < threshold) || abs(nMotorEncoder[ArmPivot]) < threshold);
}

#define armPositionStart 0;
#define armPositionFloor  202;
#define armPositionLow  820;
#define armPositionMiddle  1364;
#define armPositionHigh  2638;

int CurrentArmPosition = 1;
int CurrentArmTarget = 0;
void MoveToCurrentPosition() {
  int Encoder = abs(nMotorEncoder[ArmPivot]);
  nxtDisplayTextLine(3,"%d",Encoder);
  nxtDisplayTextLine(4,"%d",CurrentArmPosition);
  switch(CurrentArmPosition){
  case 1:
    CurrentArmTarget = armPositionStart;
    break;
  case 2:
    CurrentArmTarget = armPositionFloor;
    break;
  case 3:
    CurrentArmTarget = armPositionLow;
    break;
  case 4:
    CurrentArmTarget = armPositionMiddle;
    break;
  case 5:
    CurrentArmTarget = armPositionHigh;
    break;
  };
  if(!MotorCloseThresh(CurrentArmTarget, 100)) {
    if(Encoder > CurrentArmTarget) //go down
    {motor[ArmPivot] = 25;
    }
    else if(Encoder < CurrentArmTarget) {
      motor[ArmPivot] = -25;
    }
  }
  else{
    motor[ArmPivot] = 0;
  };
};

void  IncrementArmPosition(){
  if(CurrentArmPosition < 5) {
    CurrentArmPosition = CurrentArmPosition + 1
  };
};
void DecrementArmPosition() {
  if(CurrentArmPosition > 1) {
    CurrentArmPosition = CurrentArmPosition - 1
  };
};
```

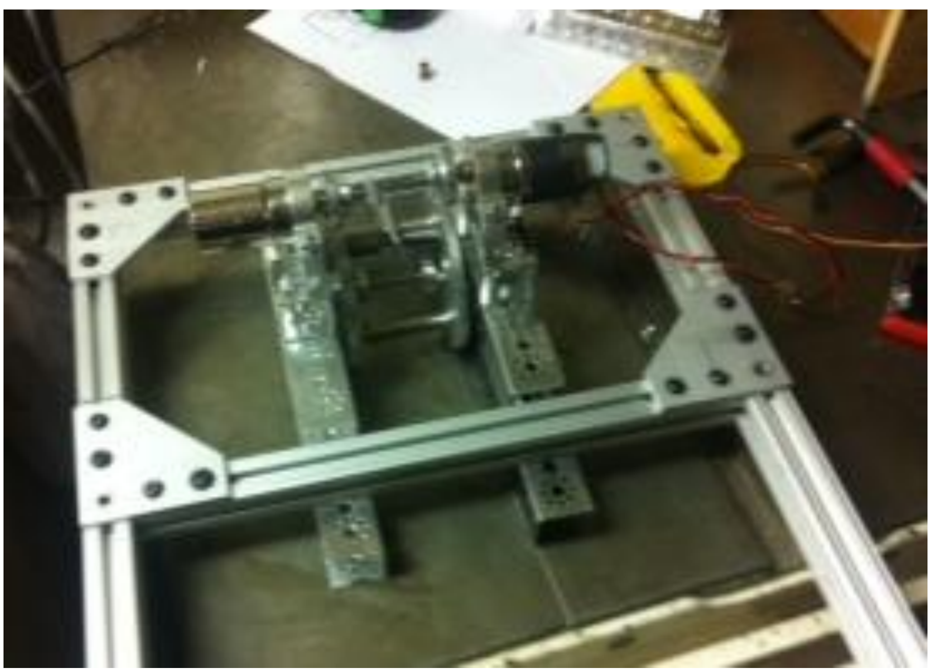
Figure 17 Arm Logic File

R & D Robot	
TASKS	**REFLECTIONS**
Design and Build Intake Adam	**I started trying to envision what type of intake would work the best with the ball popper so I started sketching a few rough designs for a sweeper. The design was simple enough, but without a base to size it to, it became too difficult to try and design it without dimensions in mind. In order to get some concrete dimensions I started resizing our prototype base into the required 18” by 18”, and moved one of the sides into the base itself. Once the base was complete, I ran into yet another issue: without the ball popper being mounted, I still would not have a clear idea on how much room I had to work with. Mounting the ball popper was going to be a pain due to its length, so instead of having the motors drive the popper by sitting next to it I moved them to the top, which trimmed about 2 inches off the length. With just a few more adjustments, the popper now had an effective length of just 6 inches. Now that the popper was smaller I set about mounting it the base using some homemade 80/20 FTC® sliders. It felt great to have a real base to mount things onto, and I could finally start getting a better idea about how to size all the other mechanisms.**



Smaller Popper

Smaller Popper (side view)



Final Popper Mounted To Base

DATE:	START TIME:	STOP TIME
October 18, 2014	10:00	4:00

ASKS	REFLECTIONS
Programming Biv	I began with autonomous. Previously I was having problems with the turn toward the highest goals and the few steps following it. The turn, using a function that runs only one side of the robot's motors, was swinging out too far. So I switched it to a different function that turns both sides of the robot so that it moves in place. Unfortunately, after much trial and error testing, the function was inaccurate and I switched back to the single side turning function. After working more on fine-tuning the turn for the second goal, I took a break and focused on creating a single goal autonomous and menu selector in case the two-goal autonomous couldn't be finished in time for the qualifier. The menu helper program opens parameters and displays them on the screen of the NXT. Then from the screen they can be set to different values (bool or int) depending on the parameter type. The autonomous code then takes those values and runs different blocks of code according to what values were specified. The menu display logic was prewritten from last year, so all I had to do was create the desired parameters. There are four, the first is a bool type, which sets the autonomous to run either the one goal code or two goal code. The second is another bool type that sets the code for running the kickstand code to true or false. The third is an integer type used for delaying autonomous and the third is a bool that is used for testing. I plan to add another parameter for the different starting positions sometime in the future meeting. The menu helper and autonomous ran smoothly the first time with only three parameters set, but on the addition of the fourth the NXT would freeze. I tried a few things, but it was taking up too much time and the menu helper was only a luxury not necessary for the coming qualifier. The original autonomous needed to be finished. Returning to the original autonomous, it ran through fine, grabbing both the first goal and the second and reaching the parking zone. Second test everything was thrown off, the turns had changed and it was having trouble coming off the ramp. It took much analyzing to figure out a motor had stopped working. The builders quickly replaced it, but the new motor threw off some of the distance values. The values were easily changed. Lastly, the encoders were out of sync since one kept going after the other stopped. Matthew edited the

drive inches function to stop both sides after one had stopped. The following test runs went well with a few minor hitches. Next meeting we should be able to fix those and proceed to finish it.

Time for teleop! Last meeting Matt and I were having trouble getting the arm to stop at certain positions. This was fixed with some different logic that team Beta let us use. Some of the target position values needed editing, the highest goal value went too far and the floor position didn't go down enough. We adjusted those correctly, but Hannah wants a manual override in case the positions get off somehow. Hopefully we can integrate that before competition.

rt Page | TeleOp.c | Autonomous.c | MenuConfig.h | MenuHelper.h

```
bool goal = false;
bool kickstand = true;
int delayTime = 0;
int test = 0;

void setupMenu(){
  menuLength = 4;
  //how many lines (array index starts at 0)
  menuParameter parameters[4]; //same number as one above

  parameters[0].name="Goal:";
  parameters[0].var=&goal;
  parameters[0].type='b';
  parameters[0].trueDisp="two";
  parameters[0].falseDisp="one";

  parameters[1].name="Kickstand:";
  parameters[1].var=&kickstand;
  parameters[1].type='b';
  parameters[1].trueDisp="yes";
  parameters[1].falseDisp="no";

  parameters[2].name="Delay: ";
  parameters[2].var=&delayTime;
  parameters[2].type='i';
  parameters[2].min=0;
  parameters[2].max=15;

  parameters[3].name="Testing: ";
  parameters[3].var=&test;
  parameters[3].type='i';
  parameters[3].min=0;
  parameters[3].max=30;

  menu = &parameters;
}
```

Figure 18 Menu Helper Parameters

ROBO

rt Page | TeleOp.c | Autonomous.c | MenuConfig.h | MenuHelper.h | Arm.h

```
void oneGoalAuto()
{
  driveInchesSmooth(56, 35);
  wait1Msec(1000);
  int sensor = SensorRaw[sonar];
  nxtDisplayBigTextLine(3,"%i",sensor);

  int inZone;

  if(sensor >= 95 && sensor <= 110){
    inZone = 1;
    PlaySound(soundFastUpwardTones);
    } else if(sensor == 255 || sensor == -1) {
    inZone = 2;
    PlaySound(soundFastUpwardTones);
    wait1Msec(15);
    PlaySound(soundFastUpwardTones);
    } else if( sensor >= 117 && sensor <= 123) {
    inZone = 3;
    PlaySound(soundFastUpwardTones);
    wait1Msec(15);
    PlaySound(soundFastUpwardTones);
    wait1Msec(15);
    PlaySound(soundFastUpwardTones);
    } else {
    PlaySound(soundLowBuzz);
    inZone = 1;
  };

driveInchesSmooth(35,100);
driveInchesSmooth(-4,100);
turnPivotDegrees(-28,50);
driveInchesSmooth(-90,100);


if(kickstand)
```

Figure 19 Code for One Autonomous Goal

age | TeleOp.c | Autonomous.c | MenuConfig.h | MenuHelper.h | Arm.h

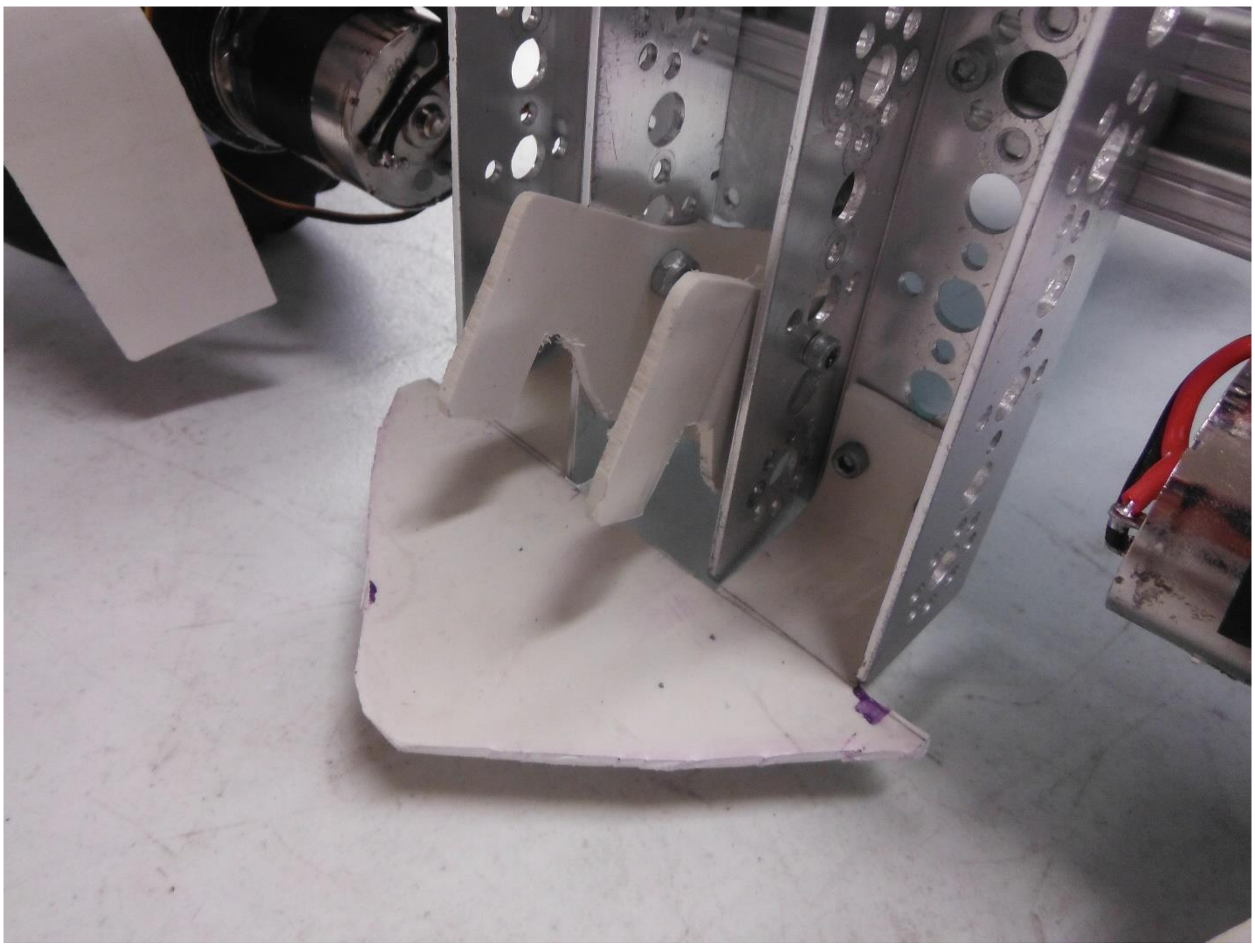
```
void twoGoalAuto()
{


  driveInchesSmooth(35, 100);
  wait1Msec(1000);
  int sensor = SensorRaw[sonar];
  nxtDisplayBigTextLine(3,"%i",sensor);

  int inZone;

  if(sensor >= 95 && sensor <= 110){
    inZone = 1;
    PlaySound(soundFastUpwardTones);
    } else if(sensor == 255 || sensor == -1) {
    inZone = 2;
    PlaySound(soundFastUpwardTones);
    wait1Msec(15);
    PlaySound(soundFastUpwardTones);
    } else if( sensor >= 117 && sensor <= 123) {
    inZone = 3;
    PlaySound(soundFastUpwardTones);
    wait1Msec(15);
    PlaySound(soundFastUpwardTones);
    wait1Msec(15);
    PlaySound(soundFastUpwardTones);
    } else {
    PlaySound(soundLowBuzz);
    inZone = 1;
  };


 turnPivotDegrees(30, 50);
 driveInchesSmooth(18,100);
 turnPivotDegrees(-135, 50);
 driveInchesSmooth(25, 100); // ram into first goal
 driveInchesSmooth(-1,100);
 turnDegrees(20, 50);
// final turn for second goal
 wait1Msec(2000);
 driveInchesSmooth(-10,75);
 turnPivotDegrees(-40,60);
 driveInchesSmooth(-80,100);
 driveInchesSmooth(15,100);


if(kickstand) {
  switch(inZone) {
  case 1:
    driveInches(-10,100);// Move forward. Score in goal. Back up. Turn. Knock down kickstand.
    break;
    ;
  case 2:
    driveInches(-30,10);// Move forward. Score in goal. Back up. Turn. Knock down kickstand.
    break;
    ;
  case 3:
    driveInches(-3,50); // Move forward. Score in goal. Back up. Turn. Knock down kickstand.
    break;
    ;
  };
};
```

Figure 20 Code for Two Autonomous Goals

```
'age | TeleOp.c | Autonomous.c | MenuConfig.h | MenuHelper.h | Arm.h

    CurrentArmTarget = -CurrentArmTarget;

    int currentArmPosition=nMotorEncoder[ArmPivot];
    int armDifference=abs(currentArmPosition-CurrentArmTarget);
    nxtDisplayCenteredBigTextLine(3, "%i",currentArmPosition);
    if(armDifference > 3){
      int desiredSpeed=(armDifference/7)^3;

      if(desiredSpeed > 100){
        desiredSpeed = 100;
      }

      if (currentArmPosition < CurrentArmTarget){
        motor[ArmPivot] = desiredSpeed;
      }
      else if (currentArmPosition > CurrentArmTarget){
        motor[ArmPivot] = -desiredSpeed;
      }
      } else {
      motor[ArmPivot] = 0;
    }

  };

  void  IncrementArmPosition(){
    if(CurrentArmPosition < 5)  {
      CurrentArmPosition = CurrentArmPosition + 1
    };
  };
  void DecrementArmPosition()  {
    if(CurrentArmPosition > 1)  {
      CurrentArmPosition = CurrentArmPosition - 1
    };
  };
```

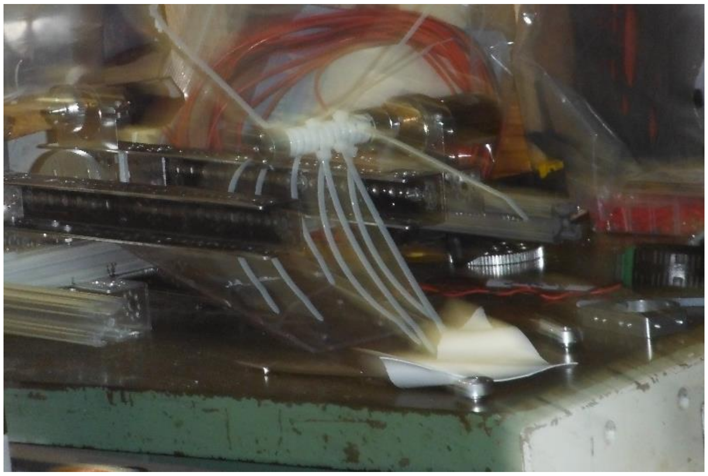
Figure 21 New Logic for Arm in Teleop

TASKS	REFLECTIONS
Ball Guards, Goal Grabber, and Wiring Hannah	I attached the ball guards to the robot and tested it to see if the guard rubbed against the wheels. I made a few adjustments with the heat gun and fixed the rubbing. Coach Vince helped me make a new servo driven grabbing mechanism for the goals. Olivia had left at this point so she will have to program the servo next time she comes over. I also redid the wiring for the robot. Instead of using the standard connectors, I soldered 18-gauge wires directly to the connectors of the motors. I routed the wires in a more orderly fashion and added the wiring for the servo for the goal grabber.

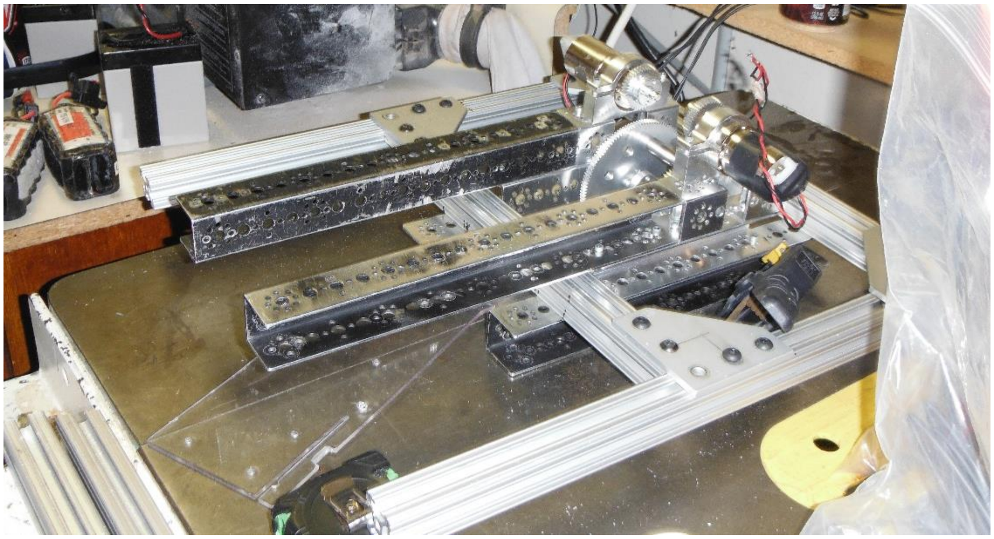


Goal Grabber

R & D Robot	
TASKS	**REFLECTIONS**
Prototype sweeper **Adam**	Since the ball popper was now mounted it was time to move onto the sweeper. The first decision was whether to use a wide sweeper or a short sweeper. The wide sweeper would have a higher intake rate, but may end up taking in too many balls and violating the 5-ball rule. The short sweeper would be easier to build but would not sweep as many. I went with a short sweeper because despite its lower intake rate, it should still be fast enough that it exceeds our launch rate due to the large clusters of balls. I mounted two pieces of tetrix to the ball popper that stuck out just past the edge of our frame and attached a motor housing to one of the ends. Now that I had the length of the sweeper, I could make the ramp that the balls would be swept along. I bent the edge of a piece of lexan and used it for the ramp, and mounted it to the bottom of the two pieces of tetrix. All there was left to do was put a sweeper onto the motor axle. I took one of the motor axle collars and attached an FTC® pillar holder to it. I then ran several zip ties along the length of the pillar, creating the sweeper. It worked surprisingly well and was able to sweep in both large and small balls. However, it flung several of them out once more than 2 or 3 were placed inside, but this can easily be fixed by placing some guides around the intake.



Sweeper



Sweeper Mounts

DATE:	START TIME:	STOP TIME
October 20, 2014	6:15	9:00

TASKS	REFLECTIONS
Programming Biv	The builders had added a new goal grabber powered by a servo on the back of the robot, so I mapped two different servo positions to the Y button on the controller that toggles between them when pressed. With that change, I switched to autonomous and edited the distance the robot runs into the highest goal and added a step that grabs it. However, when it was tested the autonomous never reached the point of running in the goal due to inaccurate turns. Matthew and Xavier thought of using a gyro to fix those inaccuracies. We installed one on the robot and wrote a program to read and display the values. The gyro measures the change in speed and then returns to a default value once it has stopped moving. We will have to find some logic or write our own to convert it to measure degrees.

Figure 22 Controller Schematic as of 10/20/14

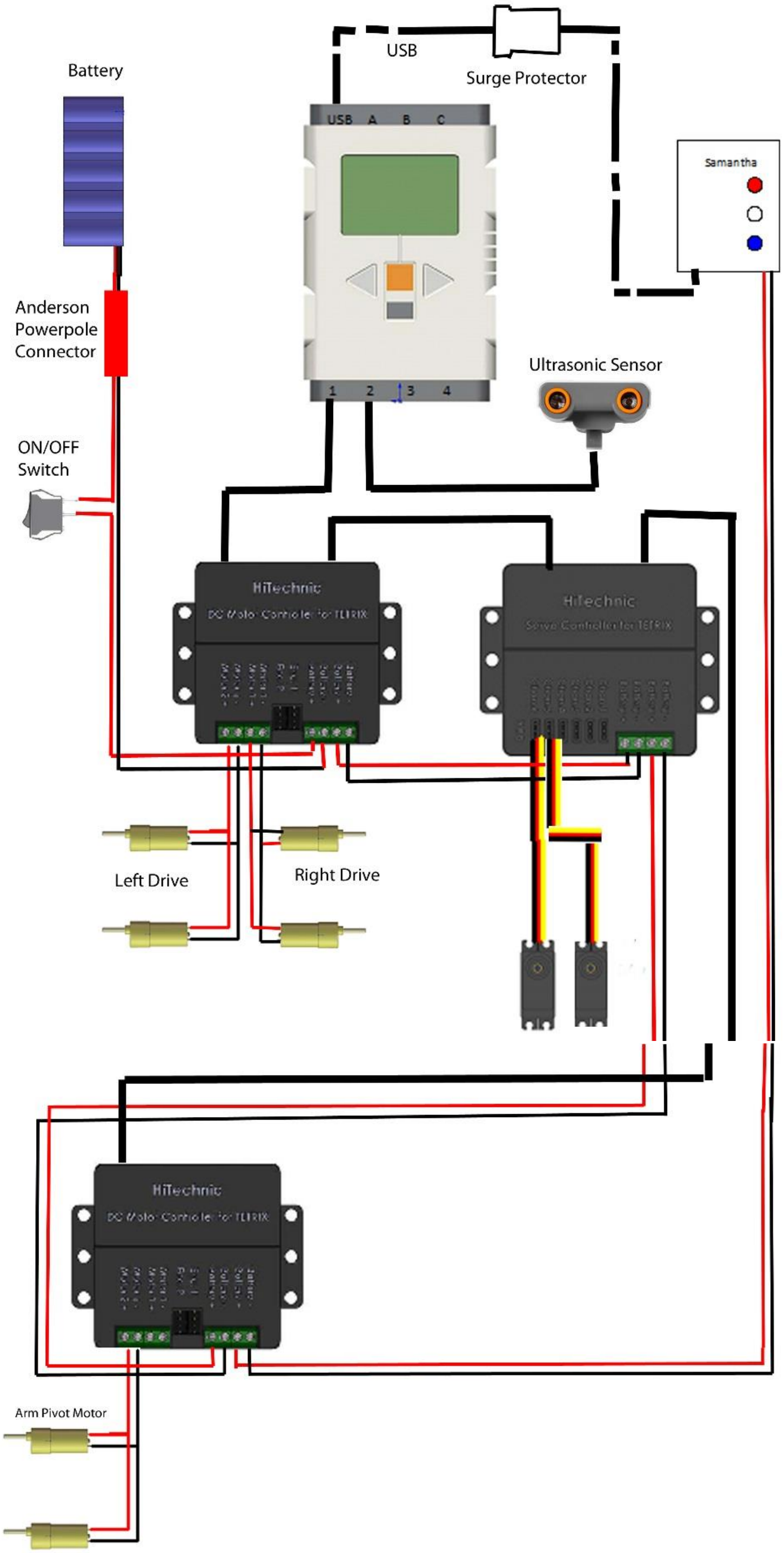


Figure 23 Added Grabber Servo to Wiring

TASKS	REFLECTIONS
Presentation Lala	Tonight, we began practicing our presentation skills. Coach Vince and mentors Robin, Nathan and Rebecca helped us begin plotting our game plan for the interview. We are each trying to think of highlights from our responsibilities this season to share with the judges in the interview. We really want to communicate our team's story to the judges in an exciting and interesting way that will inspire them.

DATE:	START TIME:	STOP TIME
October 22, 2014	6:30	9:15

TASKS	REFLECTIONS
Programming Biv	Matthew and I worked on getting the gyro working for accurate turns on autonomous. Soon we had it turning a precise 360-degree angle. But before testing it in the two-goal autonomous, we had to finish up the one goal autonomous so that we could have something working at the qualifier. There was trouble grabbing the first goal; the grabber was running into the goal instead of over it and then latching on. The builders changed the servo position for that and the problem was solved. On the turn towards the parking zone, we used the gyro turn and it worked perfectly. After the qualifier, we will have to integrate the Sonar, kickstand and two goal autonomous.

Figure 24 Controller Schematic as of 10/22/14

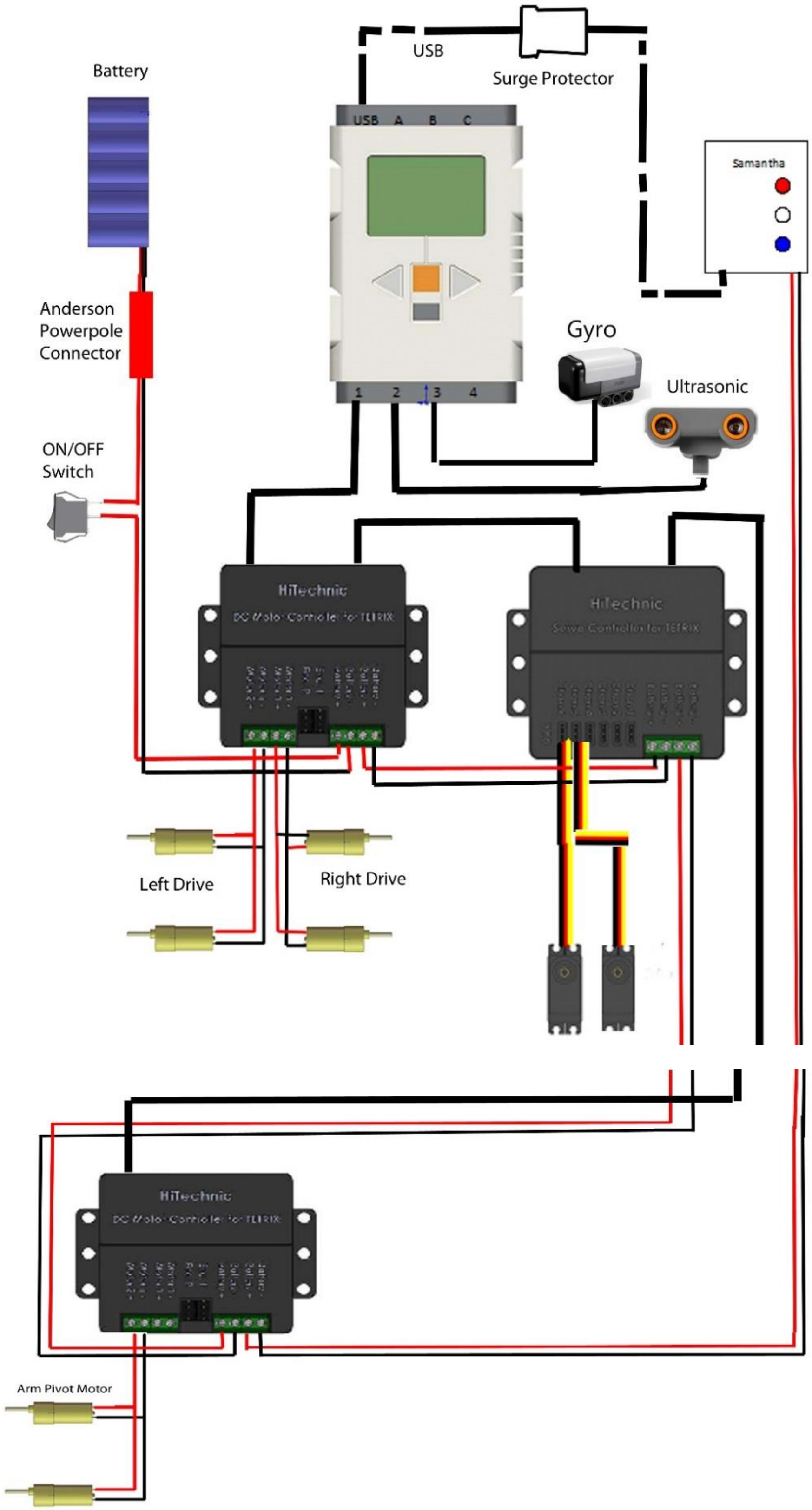


Figure 25 Added Gyro to Wiring

4250

DATE:	START TIME:	STOP TIME
October 23, 2014	6:30	9:00

TASKS	REFLECTIONS
Presentation Hannah	Today we talked more about the direction we want the presentation to take. At the end of our talk, I made up an outline and showed it to the team. We talked a little about who will do what parts and then I put the outline into the Google Drive document for people to fill out.

- Intro
    - Name, Experience, Jobs
- How to Prepare For Worlds
    - Gone to Worlds for 4 years
        - Past experiences
- Bot for now and a Bot for then
- Preparing for worlds by:
    - Fundraising
        - Business plan
- Ensuring team members for next year
- R&D bot
        - More complicated
- Preparing for now by:
    - Notebook
    - Team Spirit
    - Competition bot
        - Get us to state
        - Gives us more time
- Conclusion
    - Experiences
    - Planning for Worlds
    - Where we are going from here

TASKS	REFLECTIONS
CAD and Rendering Thomas	Tonight I finally had enough dimensions and CAD files to begin drawing our robot in Autodesk Inventor. I had used Inventor prior, but I was never interested enough in doing it until recently when I realized that our team desperately needed a CAD worker. After fiddling with the controls and tools for some time, I began to relearn how to use the tools, and started using the offset work planes to prevent certain pieces from sliding, and using them to position pieces in a specific position. When I finished downloading all of the files, I started by extruding and shortening the 80/20 pieces into the 17" and 9" pieces, and then attaching them together with the four hole gusset mounts. Next, I created our 11x8" Lexan electronics plate and gave it the translucent polycarbonate look, and then mounted it to the robot. After the electronics plate and the base frame was finished, I added the two tetrix tower pieces on the back, and then mounted the wheels and motors to the underside of the robot. Finally, I added in the gears, bushings, and axles to the tower for the arm, but I was not sure of exactly how we set our sprocket piece up so I decided to wait until the next meeting to figure that portion out. I rendered the image at a high resolution to test out the rendering tools and the capabilities of my hardware, but the shadows turned out too strong to use, so I will need to re-render them with different settings.

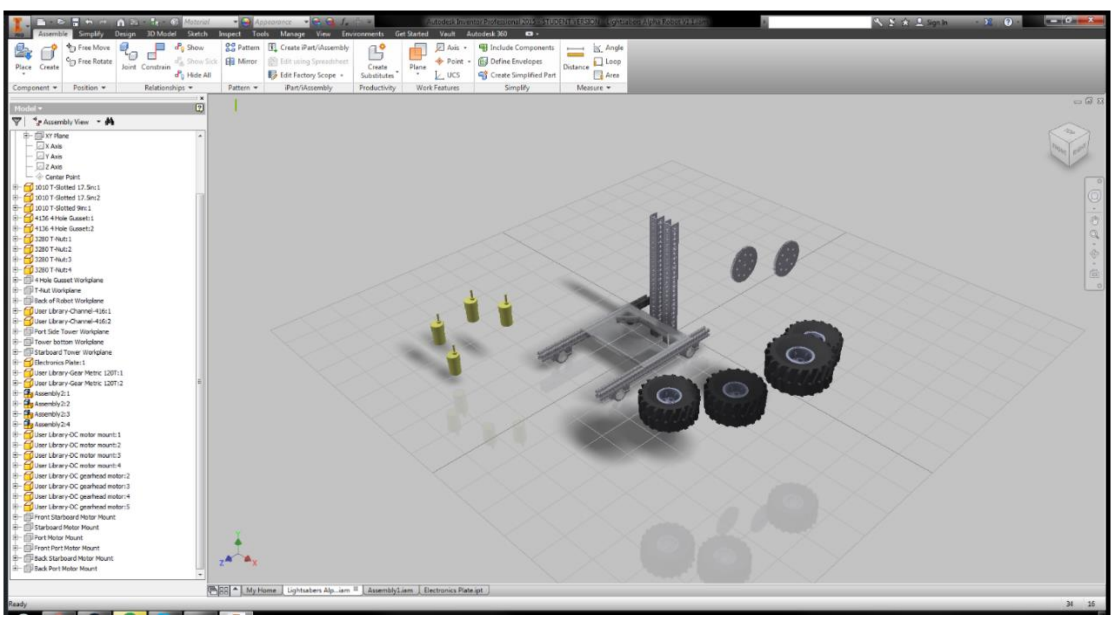


Figure 26 CAD Electronics Plate and Base Frame 1

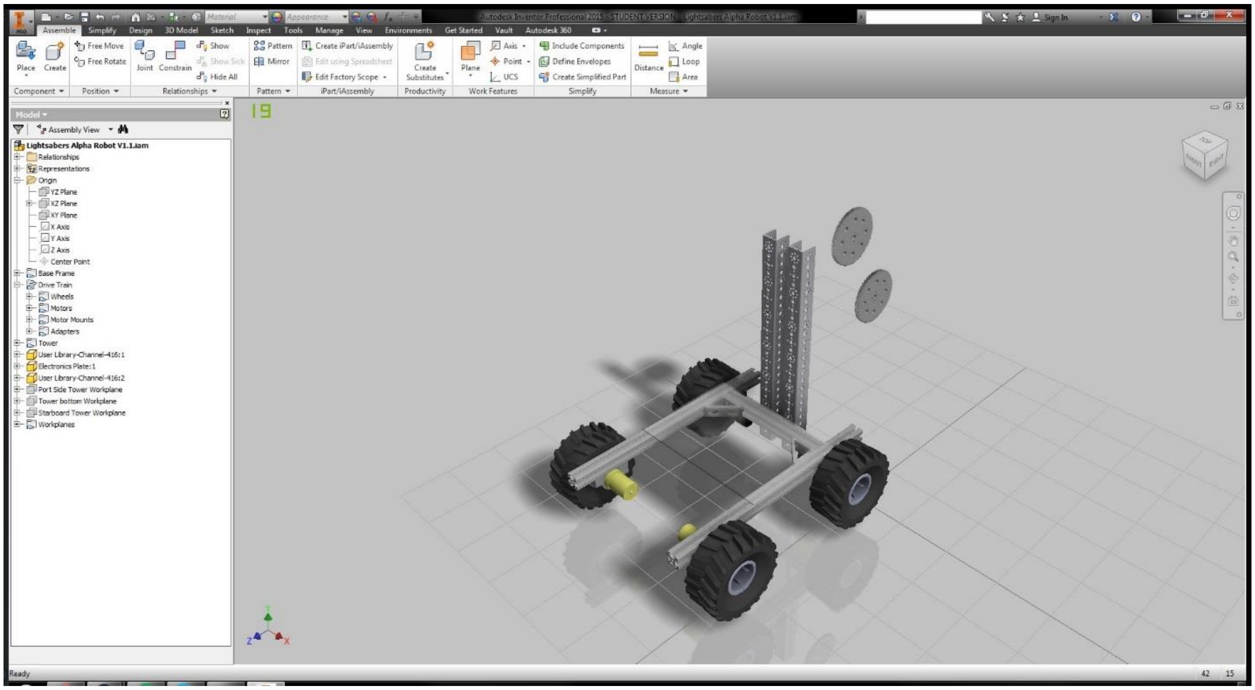


Figure 27 CAD Electronics Plate and Base Frame 2

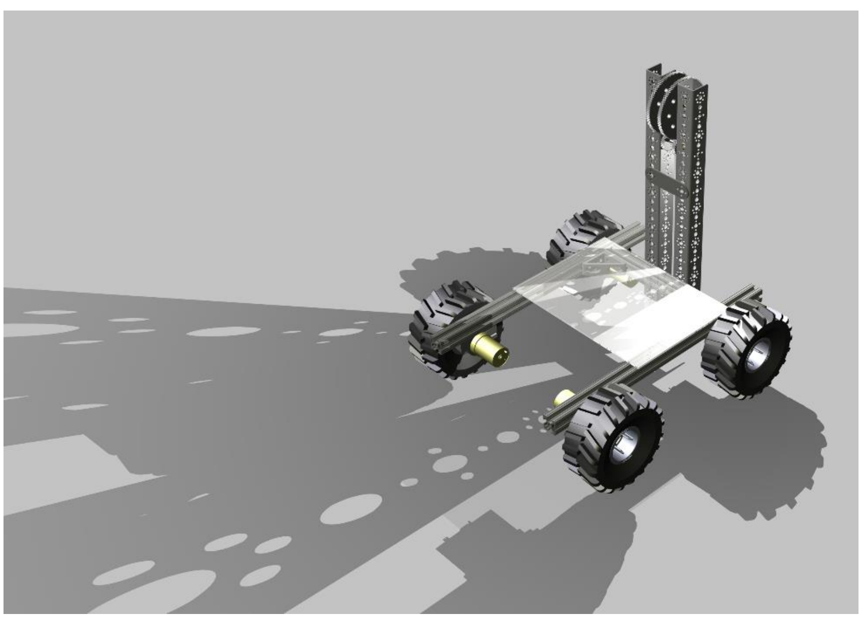


Figure 28 CAD Tetrix and Motors Added

DATE:	START TIME:	STOP TIME
October 28 & 29, 2014	4:30 10/28 4:00 10/29	7:30 10/28 8:15 10/29

TASKS	REFLECTIONS
Programming Biv	The current one goal autonomous could only go forward and grab the middle goal and take it back to the parking zone without scoring a ball because the middle goal isn't the correct height for the arm. So I got to coding a new autonomous that goes to the highest goal, scores the ball and then drives back to the parking zone with the goal. With some trial and error I got it to work about 70% of the time, but occasionally depending on the angle of the base of the goal the robot would go in to grab the goal and push it too far into the wall, stopping the robot. I needed a program that could read the rate of the encoders and tell it to continue on to the next steps if they were not moving. Here Matt helped me to write some logic that takes the current encoder position and an encoder position from a fifth of a second before and checks the difference between the two. If it falls lower than a specified threshold, the DriveInchesSmooth function is told to finish. Now the autonomous consistently grabs the goal and scores it in the parking zone, but scoring the ball isn't completely accurate yet. There is one other thing to watch for, when Hannah cleaned the wheels, all the autonomous values were flawed since the robot ran farther. That was an easy fix since now we just have to keep the wheels clean to have the drive distance values stay constant, but in competition the values may have to be changed again depending on the field there.

```
void oneGoalAuto()
{
  driveInchesSmooth(39, 35);


  int sensor = SensorRaw[sonar];
  nxtDisplayBigTextLine(3,"%i",sensor);


  int inZone;

  if(sensor >= 95 && sensor <= 110){
    inZone = 1;
    PlaySound(soundFastUpwardTones);
    } else if(sensor == 255 || sensor == -1) {
    inZone = 2;
    PlaySound(soundFastUpwardTones);
    wait1Msec(15);
    PlaySound(soundFastUpwardTones);
    } else if( sensor >= 117 && sensor <= 123) {
    inZone = 3;
    PlaySound(soundFastUpwardTones);
    wait1Msec(15);
    PlaySound(soundFastUpwardTones);
    wait1Msec(15);
    PlaySound(soundFastUpwardTones);
    } else {
    PlaySound(soundLowBuzz);
    inZone = 1;
  };
  wait1Msec(1000);
  driveInchesSmooth(6,100);
    turnDegreesGyro(35);
  driveInchesSmooth(22,100);
  turnDegreesGyro(-65);
  driveInchesSmooth(21,33);
  wait1Msec(1000);
  servo[claw] = 255;
  setGrabber(True);
  wait1Msec(3000);
driveInchesSmooth(-.5,25);
setGrabber(True);
wait1Msec(1000);
driveInchesSmooth(-25,50);
turnDegreesGyro(30);
driveInchesSmooth(-80,100);
turnDegreesGyro(-80);
driveInchesSmooth(-10,100);
```

Figure 29 New One Goal Autonomous 10/30/14

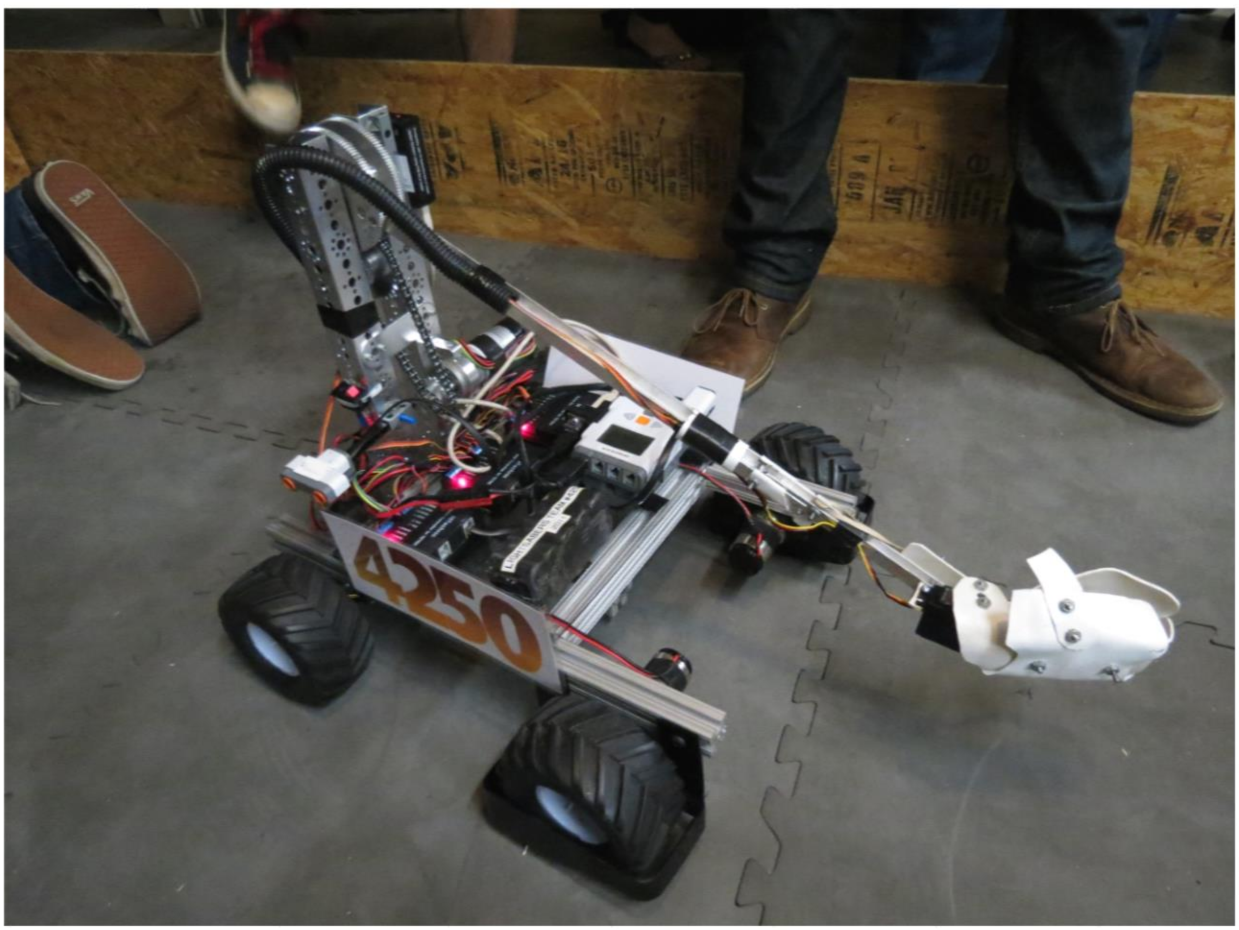
```
bool bDriveMotorsStuck = false;
task haltDetection()
{
    int iCurrentRotation = abs(nMotorEncoder[LeftMotor] + nMotorEncoder[RightMotor]);
    int iLastRotation = iCurrentRotation;

    bDriveMotorsStuck = false;

  while(true)
  {
    wait1Msec(200);

      iCurrentRotation = abs((nMotorEncoder[LeftMotor] + nMotorEncoder[RightMotor]) - iLastRotation);
      nxtDisplayCenteredBigTextLine(5, "%i", iCurrentRotation);
      nxtDisplayCenteredBigTextLine(3, "%i", iLastRotation);

    if (iCurrentRotation < 30)
    {
      bDriveMotorsStuck = true;
      playSound(soundBeepBeep);

      break;
    }

    iLastRotation = abs((nMotorEncoder[LeftMotor] + nMotorEncoder[RightMotor]);
  }
};
```

Figure 30 Logic for Stuck Motor

4250 **4250**

DATE:	START TIME:	STOP TIME
October 30, 2014	6:15	9:00

TASKS	REFLECTIONS
Presentation Jason-Elliott	Presentation was the focus of our meeting tonight. After a couple of presentation rehearsals, we felt confident enough with it to focus on other things. We made a few tweaks to the presentation itself but left it as it was for the most part. Questions are always a big part of the presentation, so we made sure to go over questions as well. Our mentors drilled us on hard questions, ensuring that easier questions would provide no difficulties for us.



Competition Bot

4250 LIGHTSABERS 4250

DATE:	START TIME:	STOP TIME
November 1, 2014 Qualifier	8:00 a.m.	5:30 p.m.

TASKS	REFLECTIONS
Ada Qualifier Lala	This qualifier was awesome! We won first and a few other awards but the best part was the actual experience! It was great to see all the other teams again and to cheer and dance! We yelled a lot for our team but we really need a team cheer! And we are also hoping to up our game in costumes and are planning to have something fun in our pit for other people to sign. But this qualifier was great because it gave us a little competition experience that helped us to find out competitions robots strength and weaknesses. Now it is time to prepare for the next qualifier!

TASKS	REFLECTIONS
Ada Qualifier Jason-Elliott Hendricks	As the competition began, I made sure to hit all of the team pits and ask them if they needed any help. I handed out the Wiring Guide Addendum to teams as well as made sure that their batteries were all tested. I also let the teams know that we would be available for helping with troubleshooting. Starting with this first qualifier, I am planning to continue doing this at every competition.

TASKS	REFLECTIONS
Driving the Robot Thomas	The Ada qualifier was our first qualifier to allow us to test our driving skills and the robot. Throughout the matches, Hannah and I switched off every other match and both did fairly well in our matches. Unfortunately, our driving was not what we had expected. We had many issues with the kickstand causing us to lose the rolling goal, and then losing time in trying to grab the goal again. After the competition, we truly realized that this robot would not be able to take us past state, and we would need to use our ball popper in order to stand a chance against further competition.

Ada, Oklahoma Qualifier

 4250

Ada, Oklahoma Qualifier

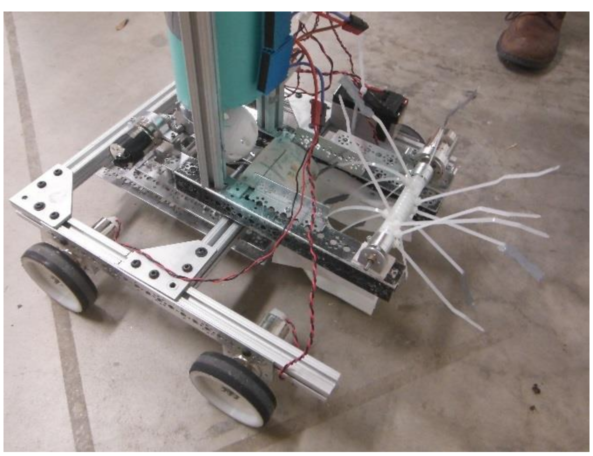
4250	LIGHTSABERS	4250

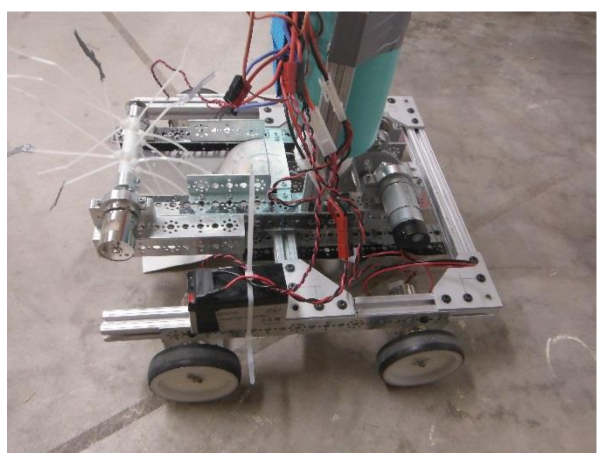
DATE:	START TIME:	STOP TIME
November 3, 2014	6:15	10:15

TASKS	REFLECTIONS
Competition Review Biv	After the mentor meeting, all the students were called in to talk about the competition. We had earned four awards: the Think, Control, Winning Alliance and Inspire award. It was a great success, but partially due to the fact that it was a super-early qualifier and most of the teams were underprepared. Right now, our team is way ahead of the game, but we will have to keep up the hard work in order to be competitive in the same awards at states. Following that discussion, Mr. Hendricks brought up improvements to the scouting. He offered better ways to format the scout sheet and communicate with the driver so they always know how to interpret it. Also that it would be helpful if more team members assisted with the scouting so that more information about the teams could be recorded. And Mrs. Liao requested that a student always be at the pit in case one of the judges swing by. There are plenty of jobs for the next qualifier. Soon after, the meeting disbanded and everyone resumed their work. Matthew, Xavier, Mr. Liao and I came together to discuss and clarify the mistake at the qualifier. The issue was the programmers had updated to the wrong branch in Mercurial and deployed incorrect code. Under normal circumstances, the mistake would have been easy to catch, but it was just before the match and I had unintentionally tagged the branches with confusing names. The greatest error in our process was not in the making of the mistake itself, but that we deployed under such poor circumstances. In order to avoid such a problem from happening again, we have decided that we should freeze all working code before competition and only change it if it is necessary with the consent of the drivers. Even at home meetings we should document any changes or new code we want before it is written and check it over with Mr. Liao. This mistake has given me a much deeper understanding of the importance of details in the programming process and has helped to remove much of my ignorance of the ins and outs of Mercurial. Needless to say, we are fortunate it happened at an early qualifier.

DATE:	START TIME:	STOP TIME
November 4, 2014	3:00	9:30

R & D Robot	
TASKS	REFLECTIONS
Get the R&D robot running Adam	We had a lot of work to do so we started at 3 and worked till 9:30. We already had the ball popper and sweeper mounted to the base, so I started working on building a better ramp while Hannah began attaching the wheels. Instead of going with a simple incline for our ramp, we went with an "S" shape. The "S" shape helps to take some of the force off the balls as they roll into the loading prongs. Once Hannah had the wheels on, we could adjust the bottom lip of the ramp to the right angle. Now that the ramp was mounted, we realized the sweeper was slightly offset to the right, so we took it apart and readjusted it to fit properly. Since both the ramp and sweeper were finally complete, we could tell what the real path of the ball was going to be, which allowed us to attach our ball guide with just two simple bolts. We rigged all the motors into a battery and ran a ball through to make sure everything was working. The sweeper picked the ball right off the ground, up the ramp, into the prongs, and the ball popper finished the rest, launching it straight through the guide and into an awaiting goal. Now we had to actually wire up to an RC controller. We attached most of the electronics to the edge of the guide with Velcro and a bit of duck tape. It took some time but we finally got it driving AND popping at the same time. Even though we had first expected the movement involved in driving to mess with our popper's launch, it actually had little to no effect. Now we were ready to move out of the prototype stage.





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DATE:	START TIME:	STOP TIME
November 6, 2014	6:15	9:45

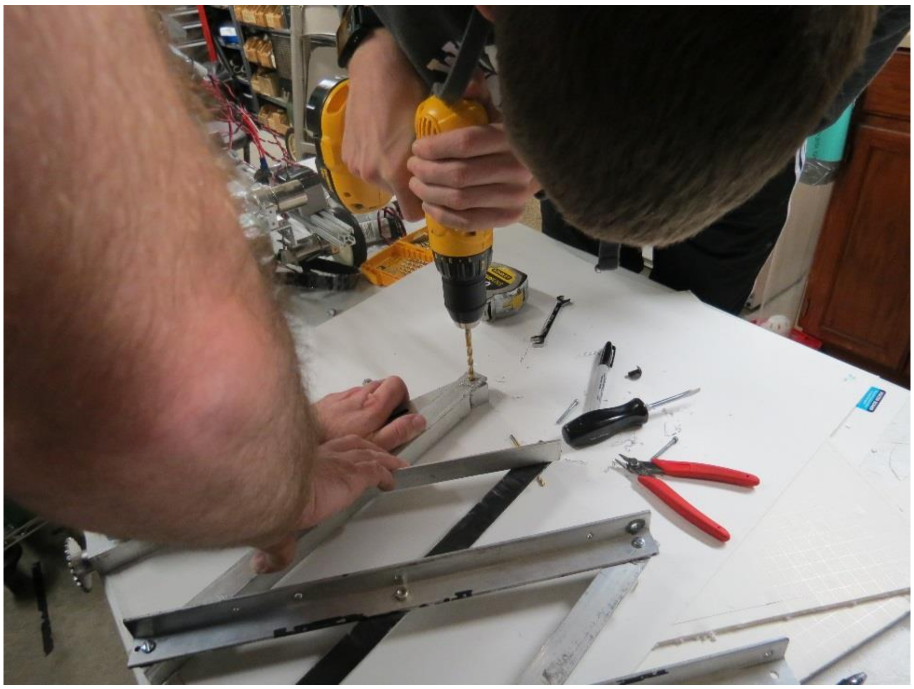
TASKS	REFLECTIONS
Rear Wheel Guards **Hannah**	**At the qualifier, we still had some issues with balls. I decided to try wheel guards on all the wheels. I tasked Elliott and Laurel with building them. I helped them up and put them on the robot. I will spray paint them like I did the others if they are helpful.**

Rear Wheel Guard

R & D Robot	
TASKS	REFLECTIONS
Test Scissor Lift Speed Adam	**Now that the sweeper and popper were running our next step was to test the scissor lift. We attached the 2 lifts to the linear actuators and mounted them to two pieces of tetrix with zip ties. We then bolted a sprocket onto the end of each of the actuators and drove them both off of a single motor. The speed was unimpressive to say the least and the lifts were far too long. So our solution was to shorten each individual section and add 2 more for 5. Since we were using screw**

	drives as our actuators, very little torque was needed, so we also decided to gear our drive motor for speed.

Scissor Lift



Attaching Lift to Actuator

Fully-extended Lift

4250 LIGHTSABERS **4250**

DATE:	START TIME:	STOP TIME
November 10, 2014	6:15	11:00

TASKS	REFLECTIONS
Presentation Programming Biv	To start the meeting, Alpha was invited to present for Gamma so that Gamma could get an idea of what it is like to put together a presentation and recite it for the judges. After we presented, the mentors had a comment or two to fine tune our presentation like mentioning how we helped a team get their robot's programming working to compete or giving Laurel more talking time before Adam comes in to introduce the R&D bot. We all then resumed our jobs. The one-goal autonomous was designed to go down a wood ramp, so at the Ada qualifier there was an accuracy problem related to the wheels on the official ramp. So far, the ramp problem can only be addressed at the competition and even at that, there is no guarantee the robot will consistently go down the ramp with little variation. Here I decided to make a new autonomous that drives from the parking zone instead of the ramp. It did not take much trial and error to tune it up since it is almost an exact clone of the one goal ramp autonomous. With that finished Matt and I decided to move onto a kickstand autonomous that uses dead reckoning instead of the sonar to keep it simple for the upcoming Tulsa qualifier. The robot just drives forward a certain distance, backs up a tiny bit, turns left and drives forward again so that when the robot is positioned in a certain way the kickstand in position one or two is knocked down when the robot is first driving forward and if the kickstand is in position three the left turn and forward movement knocks it down. Finally, Matthew, Michael and I worked on implementing the menu selector. Even though we had switched back to an older version of the selector, the same bug that occurs when something is changed in the parameters popped up. We worked on narrowing down the cause by first seeing if the bug came from adding a certain parameter type, but it did not matter if it was a Boolean or an integer, the screen still froze up. Next, we started changing the name of the parameter to something other than the original. That worked! It was having trouble with the variable name we had initially set, which somehow conflicted with other keywords in the system. With it fixed, we gave the kickstand auto and parking zone auto a parameter. Also, we kept the ramp autonomous and added it to the selector just in case it was necessary in the competition.

	Now I need to work on adding all the autonomous options to the engineering notebook and updating the autonomous code and control award sheet.

```
void parkingZoneAuto()
{
  driveInchesSmooth(5, 100);
  turnDegreesGyro(-7);
  driveInchesSmooth(62,100);
  turnDegreesGyro(-15);
  driveInchesSmooth(25,33);
  wait1Msec(1000);
  servo[claw] = 255;
  setGrabber(True);
  wait1Msec(3000);
  driveInchesSmooth(-.5,25);
  setGrabber(True);
  wait1Msec(1000);
  driveInchesSmooth(-25,50);
  turnDegreesGyro(30);
  driveInchesSmooth(-80,100);
  turnDegreesGyro(-80);
  driveInchesSmooth(-10,100);
};
```

Figure 31 One Goal Parking Zone Autonomous

```
void kickstandAuto()
{
  driveInchesSmooth(-50,100);
  driveInchesSmooth(1.5,100);
  turnDegreesGyro(60);
  driveInchesSmooth(-10,100);
};
```

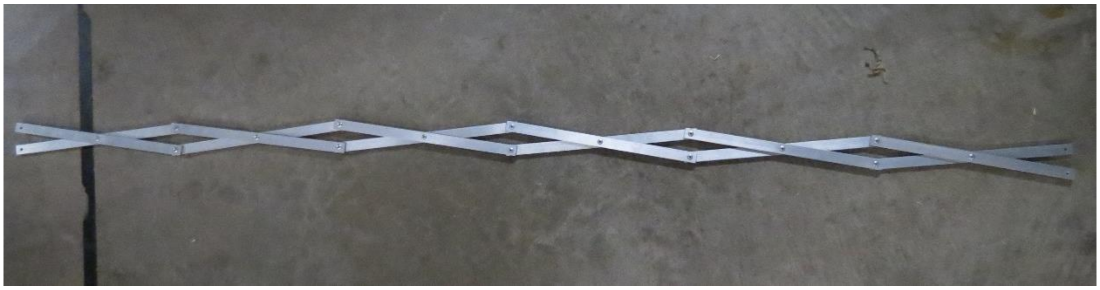
Figure 32 Kickstand Autonomous

```
// default values
bool goal = false;
bool kickstand = true;
bool zoneside = false;
bool useRamp = false;
bool somethin = false;
int delayTime = 0;
int test = 0;

void setupMenu()
{
    // you must have 4 or more lines or else there could be weirdness
    menuLength = 4;
    // how many lines (array index starts at 0)
    menuParameter parameters[4]; //same number as one above

    parameters[0].name = "Goal:";
    parameters[0].var = &goal;
    parameters[0].type = 'b';
    parameters[0].trueDisp = "kick";
    parameters[0].falseDisp = "goal";

    //parameters[1].name = "Kickstand:";
    //parameters[1].var = &kickstand;
    //parameters[1].type = 'b';
    //parameters[1].trueDisp = "yes";
    //parameters[1].falseDisp = "no";

    //parameters[2].name = "Zone Side:";
    //parameters[2].var = &zoneside;
    //parameters[2].type = 'b';
    //parameters[2].trueDisp = "right";
    //parameters[2].falseDisp = "left";


    parameters[1].name = "Delay: ";
    parameters[1].var = &delayTime;
    parameters[1].type = 'i';
    parameters[1].min = 0;
    parameters[1].max = 15;

    parameters[2].name = "Testing: ";
    parameters[2].var = &test;
    parameters[2].type = 'i';
    parameters[2].min = 0;
    parameters[2].max = 30;

    parameters[3].name = "rampOverride: ";
    parameters[3].var = &somethin;
    parameters[3].type = 'b';
    parameters[3].trueDisp = "yus";
    parameters[3].falseDisp = "non";

    menu = &parameters;
}
```

Figure 33 Edited Menu Selector Parameters

DATE:	START TIME:	STOP TIME
November 11, 2014	2:00	6:00

R & D Robot	
TASKS	**REFLECTIONS**
Lighten Scissor Lift and Reduce Its Length Adam	Each section of our original scissor lift was 16 inches long, and had a 16-inch travel distance for max extension. Even at its most compact configuration, the scissor lift stood well over 20 inches tall. In order to reduce its height, length and weight we switched from large aluminum L-brackets to just plain aluminum bars, each measuring 9 inches in length. Shortening the length of pieces by 7 inches took a lot of our height away, so we had to go from a 3-stage lift to a 6-stage lift. Even though there were more stages, the final product was faster and lighter than the previous lift. Also, it was only 4 inches tall in its collapsed configuration, but could still extend up to 50 inches at its fullest extension. The travel distance for a full extension had also been reduced from 16 inches down to just 9.



Scissor Lift

DATE:	START TIME:	STOP TIME
November 13, 2014	6:15	9:00

TASKS	REFLECTIONS
Driving with Gamma Hannah	Thomas and I drove with Gamma because they needed driving practice and to find out who they would have as their drivers. I found some issues with the 80/20 we have on the bottom of the robot to keep us from pushing the tubes when we take them up the ramp. The issue is when our robot jumps up on a ball or over the lip. The 80/20 gets on the base of the tube and we are unable to get off. I ran out of time to fix it this meeting.

DATE:	START TIME:	STOP TIME
November 17, 2014	6:15	9:00

TASKS	REFLECTIONS
Team Cheer Lala	We now have an awesome cheer for our next competition! It is a 2-part musical cheer! The 2 parts are the bass line and the melody. Usually the boys will sing the bass and the girls will sing the melody. This is a great cheer because it is the Star Wars main theme and it is easy for everyone to join in on. We are also thinking about using the Imperial March as another cheer so we can have a fun variety of battle cries. So now we have taught the other teams how to sing with us!

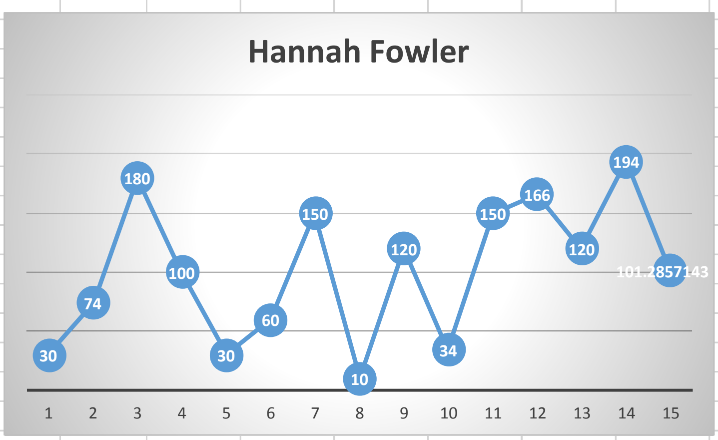
R & D Robot	
TASKS	**REFLECTIONS**
Machining second scissor lift Adam	We wanted to make our next side to the scissor lift, and this time we did not want any slop at all. Our original problem was that the holes were not drilled perfectly due to the edges being slightly different on each piece of the lift. So this time we took all 12 pieces and milled their edges near perfection. Now all we have to do is redo the jig for our holes and we should be all set for finishing the lift.

4250 LIGHTSABERS **4250**

DATE:	START TIME:	STOP TIME
November 20, 2014	6:15	9:00

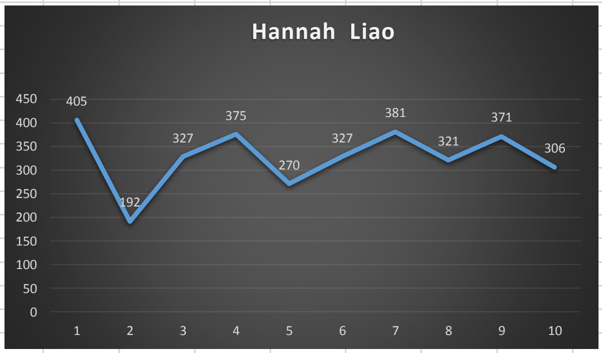
TASKS	REFLECTIONS
Driving & Hand Hannah	I had already started making a hand to pick up 2 big balls on the 17th. I did not have much more to do so I finished it up and tested it on the robot. Today I also invited Thomas, Hannah (from Gamma), and Caleb (from Gamma) over to drive. Caleb was unable to make it to the meeting. I set up a spreadsheet to track our matches and get the average score out of 10 matches. Thomas accidentally broke the new hand when he was driving. I had not yet drilled holes into the cuts I had made to fold the hand and I think the stress is what caused it to break. I made a new hand and Thomas and I finished driving.

11/19/2014	Hannah	H RG	M RG	S RG	Off Groun	The Big P	Total
Match 1		0	20	0	60	-50	30
Match 2		0	34	0	90	-50	74
Match 3		0	60	0	120	0	180
Match 4		0	60	0	90	-50	100
Match 5	Disconec	0	0	0	30	0	30
Match 6		0	0	0	60	0	60
Match 7		0	60	0	90	0	150
Match 8		0	60	0	0	-50	10
Match 9		0	60	0	60	0	120
Match 10		0	34	0	0	0	34
		0	30	0	120	0	150
		0	46	0	120	0	166
		0	0	0	120	0	120
		0	74	0	120	0	194
							101.2857

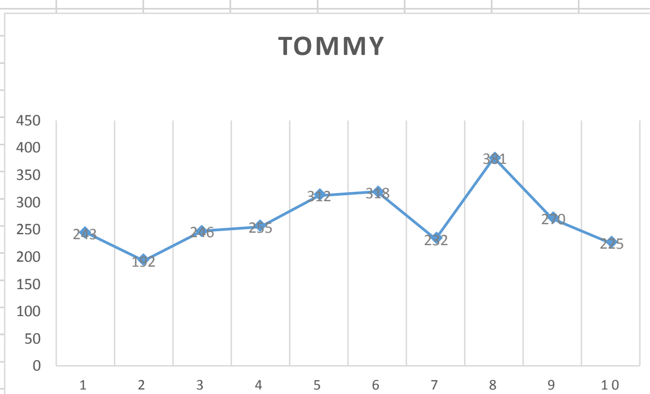


4250 LIGHTSABERS **4250**

Hannah I.	H RG	M RG	S RG	Off Groun	Total
	261	24	0	120	405
LC @ 1	162	0	0	30	192
	207	0	0	120	327
	255	0	0	120	375
Hand swit	150	0	0	120	270
	207	0	0	120	327
	261	0	0	120	381
	261	0	0	60	321
	261	20	0	90	371
	246	0	0	60	306
					327.5

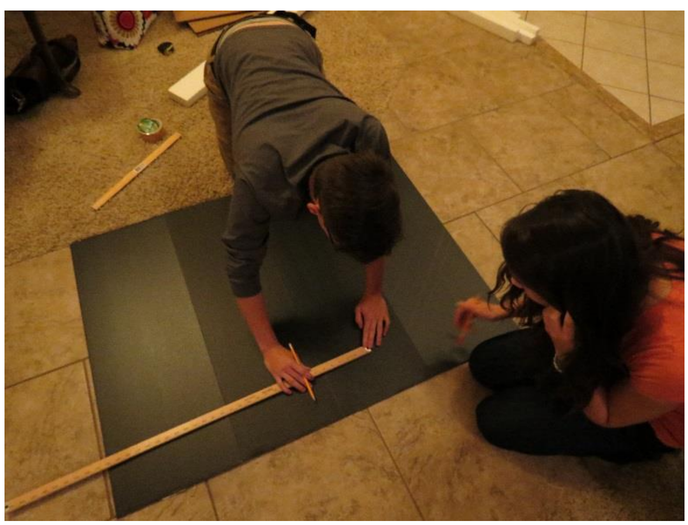


Tommy	H RG	M RG	S RG	Off Groun	The Big P	Total
	183	0	0	60	0	243
	72	0	0	120	0	192
Borked Ha	126	0	0	120	0	246
	165	0	0	90	0	255
	192	0	0	120	0	312
	198	0	0	120	0	318
	222	0	0	60	-50	232
	261	0	0	120	0	381
	240	0	0	30	0	270
	165	0	0	60	0	225
						267.4



Repairing Hand

TASKS	REFLECTIONS
Team Numbers Lala	To add to our cheering and fun costumes, Elliot and I came up with the idea to make numbers! These numbers are going to be gold and black and will have a pole to rest upon so we can easily wave them in the air! Hopefully these will raise our team spirit levels and get us noticed in the crowd at FTC® events!



Team Numbers

 4250

TASKS	REFLECTIONS
Programming Biv	I started with just watching Hannah and Thomas run autonomous and teleop. The autonomous would score consistently on one side but when switched to the other undershot or overshot on the drive toward the goal. Thomas figured out that due to our slightly inaccurate field he was positioning the robot wrong in the beginning and then accounted for that and offset the position on that certain side. It ran perfectly after his fix. We will have to pay close attention to how the field is set up at this next qualifier and test run autonomous a couple of times to figure out the correct position. Later Mr. Liao asked for an autonomous that would stop after the step that grabs the goal just in case the normal autonomous was consistently missing it could be switched to the new autonomous that skips the last steps so that the driver doesn't have to go all the way back to the goals. In the code, I changed one of the menu parameters to a Boolean with a variable named 'park' with its default value set to true. Then switched over to the parking zone and ramp autonomous programs and set an if statement around the final steps that checks if 'park' is true. However with the change of the parameter the NXT froze. Somehow it did not like the Boolean I had added, so I switched it back to an integer and changed the if statements in the autonomous to check if 'park' was equal to zero. Then it cooperated and ran properly.

```
parameters[2].name = "SkipParking ";
parameters[2].var = &park;
parameters[2].type = 'i';
parameters[2].min = 0;
parameters[2].max = 30;
```

Figure 34 Skip Parking Menu Parameter

```
void parkingZoneAuto()
{
  driveInchesSmooth(5, 100);
  turnDegreesGyro(-7);
  driveInchesSmooth(62,100);
  turnDegreesGyro(-15);
  driveInchesSmooth(25,33);
  wait1Msec(1000);
  servo[claw] = 255;
  setGrabber(True);
  wait1Msec(3000);
  driveInchesSmooth(-.5,25);
  setGrabber(True);
  wait1Msec(1000);
  if(park == 0)
    {
  driveInchesSmooth(-25,50);
  turnDegreesGyro(30);
  driveInchesSmooth(-80,100);
  turnDegreesGyro(-80);
  driveInchesSmooth(-10,100);
};
};
```

Figure 35 New Parking Zone Autonomous

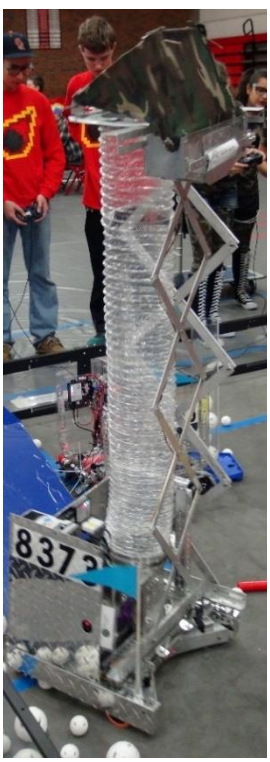
```
void oneGoalAuto()
{
  driveInchesSmooth(39, 35);


  int sensor = SensorRaw[sonar];
  nxtDisplayBigTextLine(3,"%i",sensor);


  int inZone;

  if(sensor >= 95 && sensor <= 110){
    inZone = 1;
    PlaySound(soundFastUpwardTones);
    } else if(sensor == 255 || sensor == -1) {
    inZone = 2;
    PlaySound(soundFastUpwardTones);
    wait1Msec(15);
    PlaySound(soundFastUpwardTones);
    } else if( sensor >= 117 && sensor <= 123) {
    inZone = 3;
    PlaySound(soundFastUpwardTones);
    wait1Msec(15);
    PlaySound(soundFastUpwardTones);
    wait1Msec(15);
    PlaySound(soundFastUpwardTones);
    } else {
    PlaySound(soundLowBuzz);
    inZone = 1;
  };

 wait1Msec(1000);
 driveInchesSmooth(6,100);
 turnDegreesGyro(35);
 driveInchesSmooth(22,100);
 turnDegreesGyro(-65);
 driveInchesSmooth(21,33);
 wait1Msec(1000);
 servo[claw] = 255;
 setGrabber(True);
 wait1Msec(3000);
 driveInchesSmooth(-.5,25);
 setGrabber(True);
 wait1Msec(1000);
 if(park == 0)
 {
 driveInchesSmooth(-25,50);
 turnDegreesGyro(30);
 driveInchesSmooth(-80,100);
 turnDegreesGyro(-80);
 driveInchesSmooth(-10,100);
;
```

Figure 36 New Ramp Autonomous

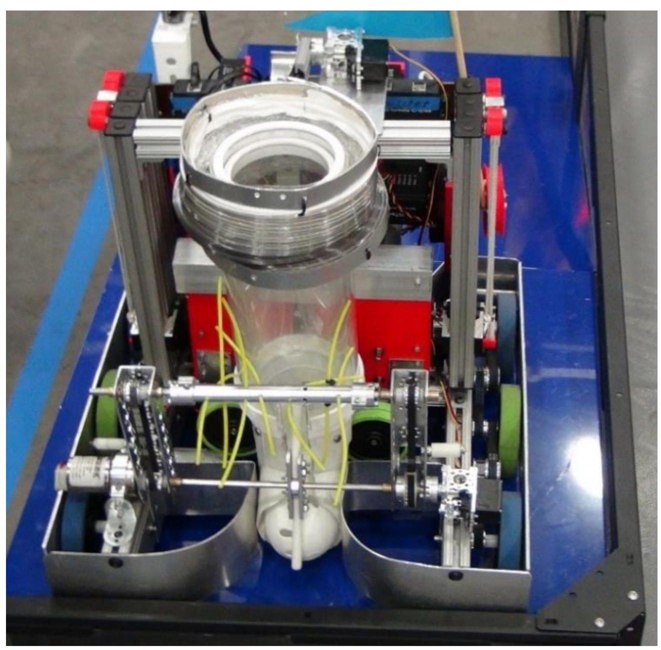
4250 LIGHTSABERS **4250**

DATE:	START TIME:	STOP TIME
November 22, 2014 Tulsa Qualifier	8:00 a.m.	5:00 p.m.

R & D Robot	
TASKS	**REFLECTIONS**
Tech Hogs and Diva Bots Adam	At the Bishop Kelly qualifier, I saw two robots that had figured out ways to do continuous scoring systems similar to our R and D robot. The tech hogs had a very similar design, except instead of a ball popper, they used flywheels to launch their balls. While this design is much simpler and easier to construct, it can only score one ball size and lacks power. Even though they did not have scissor lifts as their lift mechanism, they still used telescoping tubes as their guide. As for their "U-Tube" at the top, they used a servo that pulled out plastic dryer ducting. The diva bots used a ball popper, but theirs was ripped out of a toy, meaning it lacked power and had difficulty firing the smaller balls. As for their lift, they used two scissor lifts, but instead of having them parallel, they were perpendicular, lending them stability.

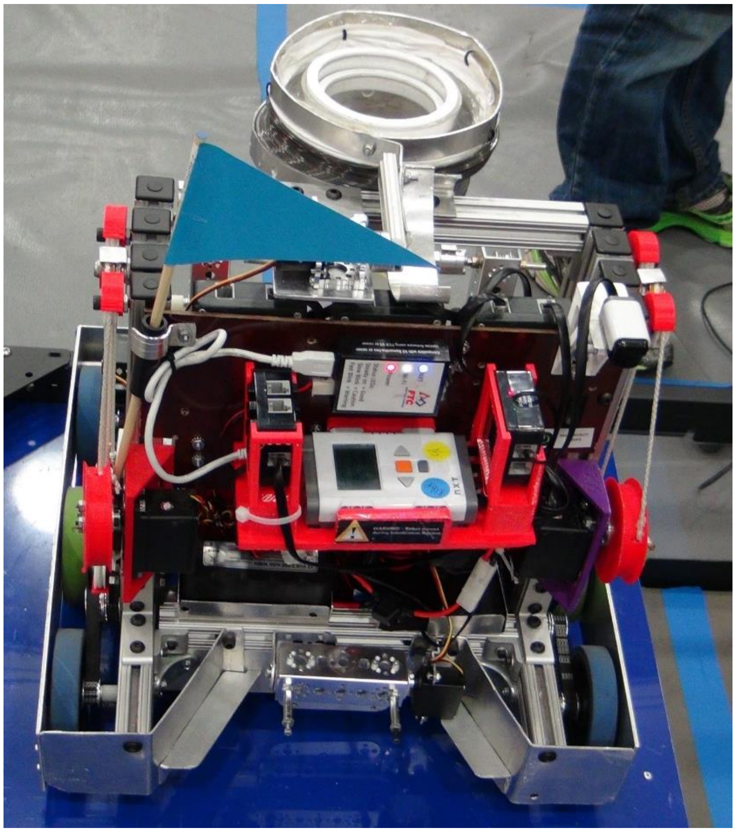


Diva Robot

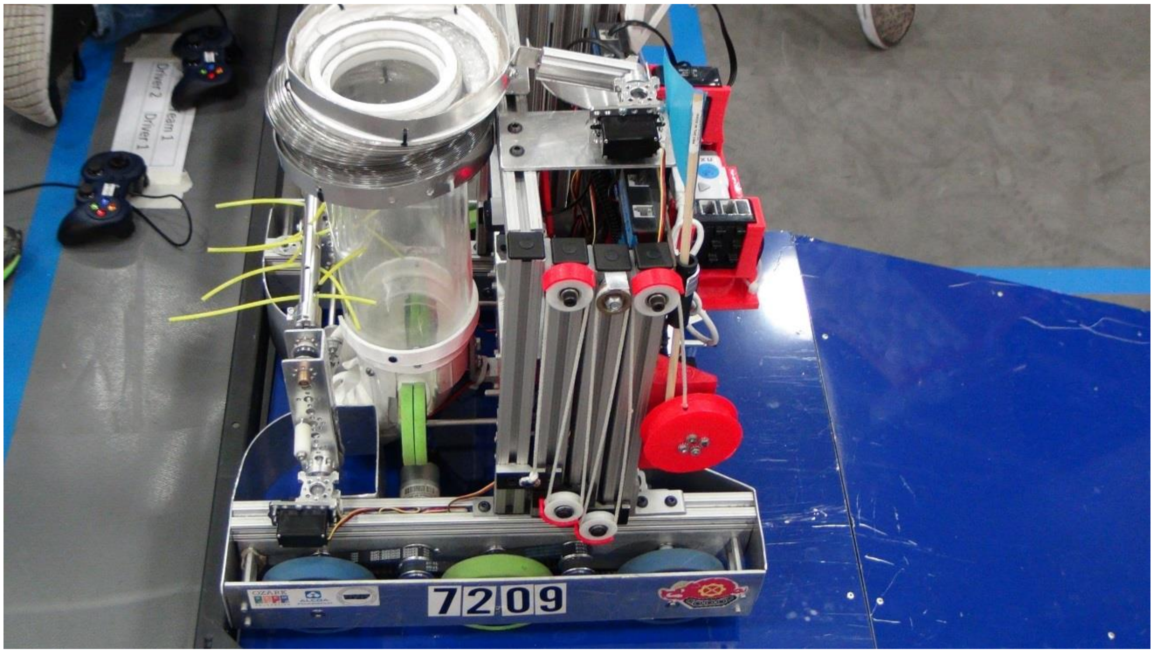


Tech Hog Robot

4250 4250



Tech Hog Robot



Tech Hog Robot

TASKS	REFLECTIONS
Fix programming errors in the Gamma bot then scout alliance partners. Josiah	The day before competition we found that we had made mistakes in two of our programs. So, at competition we looked over the code to find the errors. Mentors Brian Frost, Xavier Zwirtz, and David Murphy helped Noah and I fix those problems and upload to the robot. Scouting helps us to see what competition will be like. We want to know what to expect so we can cooperate better with our alliance partner's robot. Our alliance partners are scouted using a specific scout system. It uses the six basic things a robot needs to do in this competition. The questions are 'what does it do in autonomous,' 'can it move goals to the parking zone,' 'can it mate with the goals,' 'can it score & in what goal,' 'can it score in the center goal,' and 'can it move onto the platform.' The results showed us that competition is starting to do more tasks, such as moving goals onto the platform. Comparing ourselves with the competition, we have a lot to prepare for state.

TASKS	REFLECTIONS
Driving the Gamma robot in competition. Hannah	Driving was a lot of fun. I thought I was going to be nervous but it was actually exciting. In the Finals we divided up tasks, Alpha would attach to the tall goal, fill it up as much as possible and then head up the ramp after Gamma had moved the short goal up and dropped a few balls into the medium goal and driven goal and robot onto the ramp. I loved having Alpha as an alliance partner! They would finish what they said they would do, and it was awesome driving with experienced drivers like Thomas and Hannah! We got the high score for the day with 465 points in our final match. Gamma lost two of the qualifying matches and the Alpha-Gamma alliance lost one of their final matches. Gamma received the Judges award and second place in Inspire. And Alpha got the Think award and something else. In the Qualifying Rounds, Gamma was third and Alpha was first.

Driving in the Finals

4250 LIGHTSABERS **4250**

DATE:	START TIME:	STOP TIME
November 24, 2014	6:15	9:00

TASKS	REFLECTIONS
Team Future Hannah	At the beginning of the season, we all decided our goal for the year was to reach the semifinals at Worlds and be a world-class team. We recently began finalizing the design for the R&D bot (see picture). Jacob was able to CAD this general idea for the robot. Once we had this rough idea, we immediately saw that it would take all of our FTC® teams working on the robot and giving it our best efforts to complete the task. It became apparent to us, that it would be nearly impossible for us to use our strongest FTC® members for the FRC® team because we need all that experience to be able to successfully build and design the robot. It also became obvious that without the help of Coach Vince (our most experienced mentor) we would never successfully build this robot. This created a huge problem. Without the most experienced team members on FTC® we would be hard pressed to make the robot well. To solve these issues, we decided to merge all of the FTC® team members together into one workforce. In other words, we will take the members from each separate FTC® team and combine all the members together. We will all build the R&D robot together. To accomplish this we broke up the tasks by systems that need to be completed. We then put Elliott, Hannah, and Adam in charge of a group of 2-4 younger students. The goal is to teach and work with the younger students so we can bring them up to the level of the most experienced members. This allows our older students to become teachers and learn more about leading, while teaching our younger students solid principles. This is a very solid system because of our 1 to 1 ratio of mentor to student. Our students all get to work together and learn from each other while working with mentors at every meeting and with every project. Adam and Hannah were tasked with building the separate systems with the remaining students. The younger students will float between working with each group leader.

Adam and Hannah were tasked with building the separate systems with the remaining students. The younger students will float between working with each group leader.

Elliott (who is familiar with FRC®) was placed as the leader of the FRC® group. Elliott's task is to teach Jacob, Quinnlan, and Olivia (with help from Mentor Matthew) about the FRC® robot.

We realized this year that we have everything going for us this season. Our 1 to 1 ratio of mentors to students is the perfect amount. As students, we have guidance and experience everywhere to help us reach our goal. We have more experience this year than ever before and a good robot idea for the game. We have everything going for us and we intend to make the most of it to reach our goal of the semifinals and a world-class team.

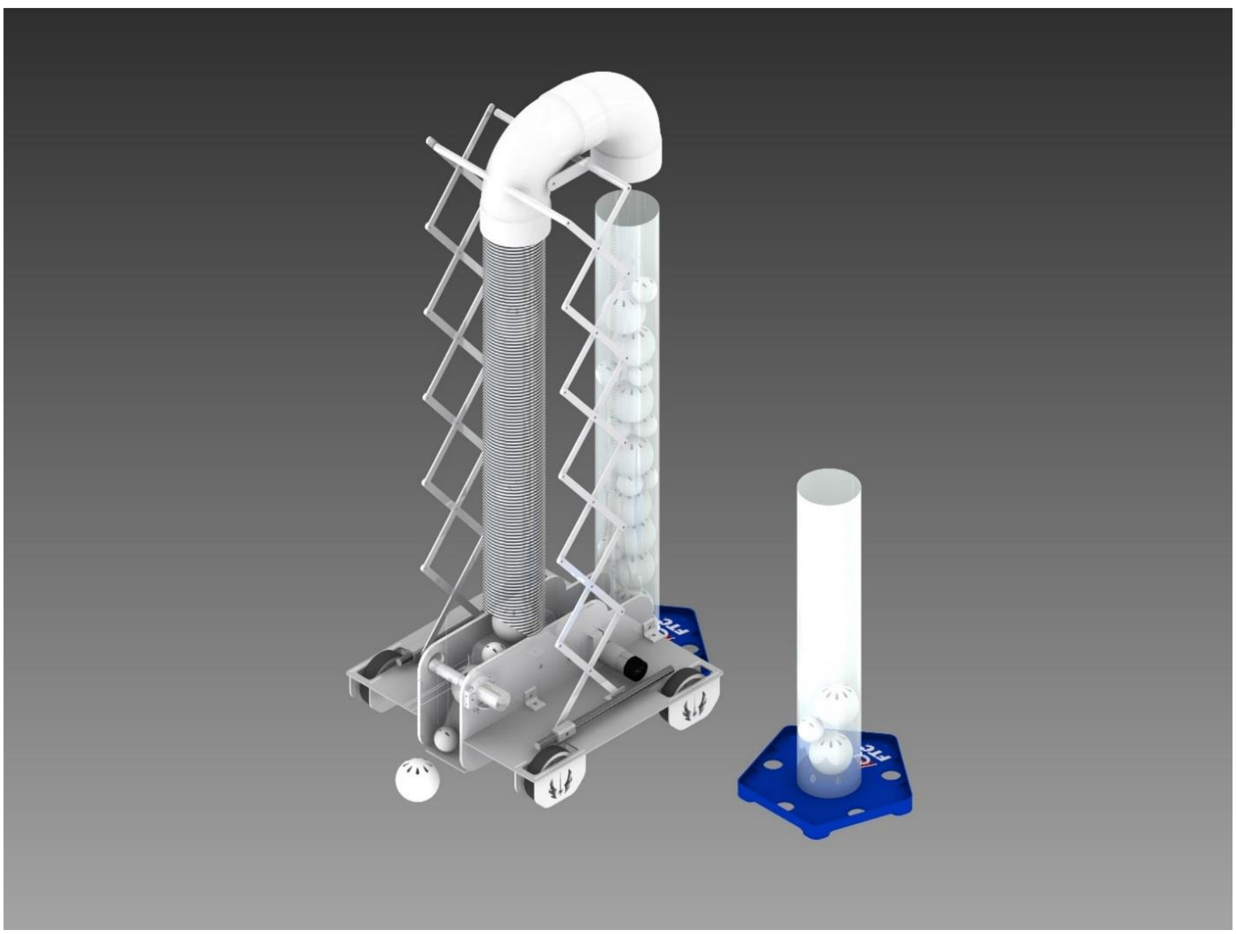
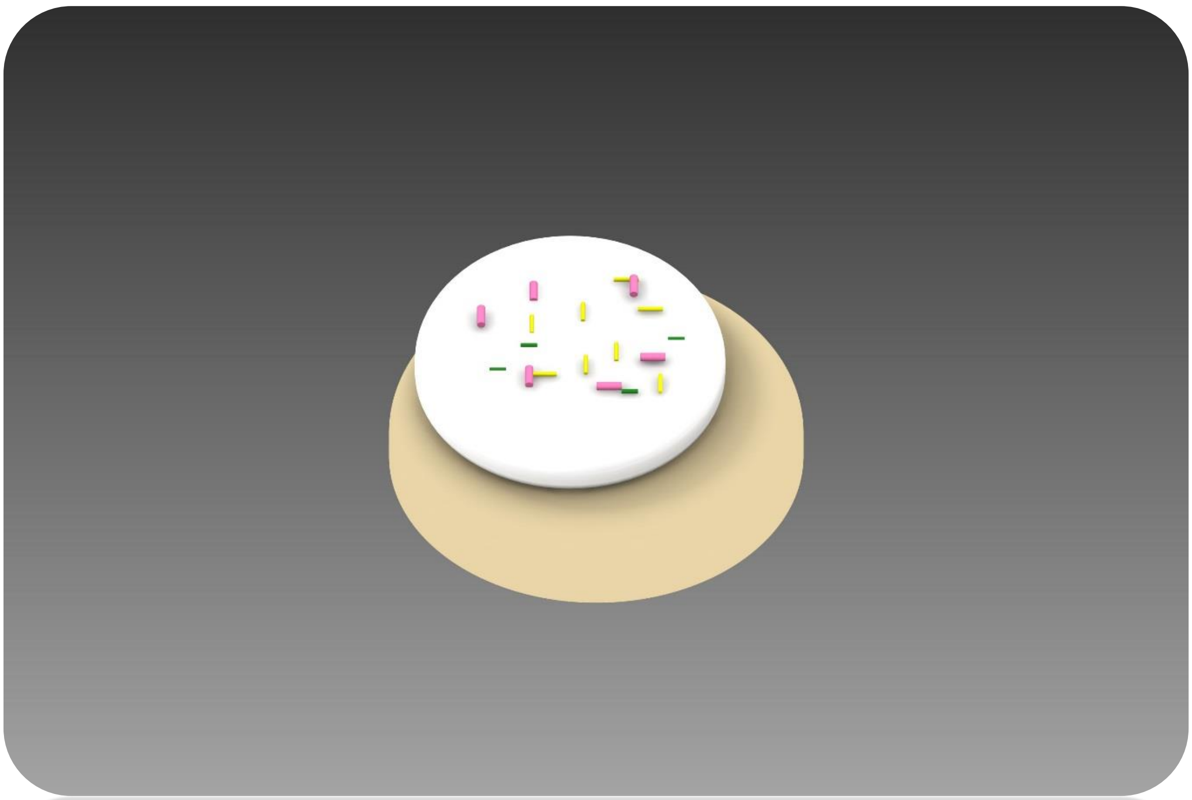


Figure 37 CAD/General Idea for R&D Bot

DATE:	START TIME:	STOP TIME
November 27, 2014	3:00	5:00

TASKS	REFLECTIONS
CAD the Robot Jacob	In the spirit of Thanksgiving, I recently CADed a generic sugar cookie.



DATE:	START TIME:	STOP TIME
November 30, 2014	6:47	9:18

TASKS	REFLECTIONS
CAD Robot Jacob	Coach Vince got an online CAD sharing program in which we can upload our CAD files to the cloud. Teammates and mentors can download, view, and comment on CAD drawings. We will be working on CAD a lot more so we can start building this robot. CAD is essential to building this robot so we can see how each system will fit into the robot.
	Previously the robot I was CADing was more of just the concept bot and we were just trying to see how everything loosely fits together, but now we are trying to refine the design more so we can get to building.

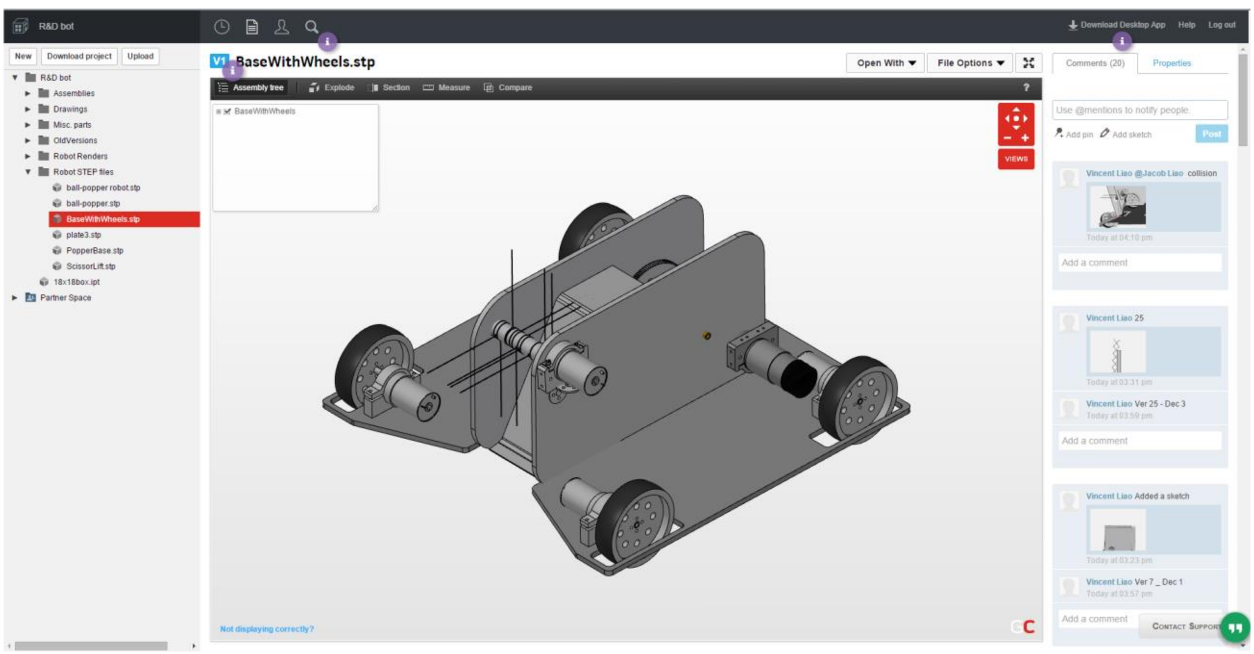


Figure 38 Screenshot from GrabCAD (the online CAD sharing site)

Figure 39 CAD/Concept Bot

DATE:	START TIME:	STOP TIME
December 1, 2014	6:15	9:00

TASKS	REFLECTIONS
CAD robot Jacob	Additions: - Made the popper plates to the 18" height limit - Added release bolt for popper - Shortened the ramp - Rotated some of the motor mounts - Added ball for reference - Lowered popper mechanism to 2.25 of the base plate

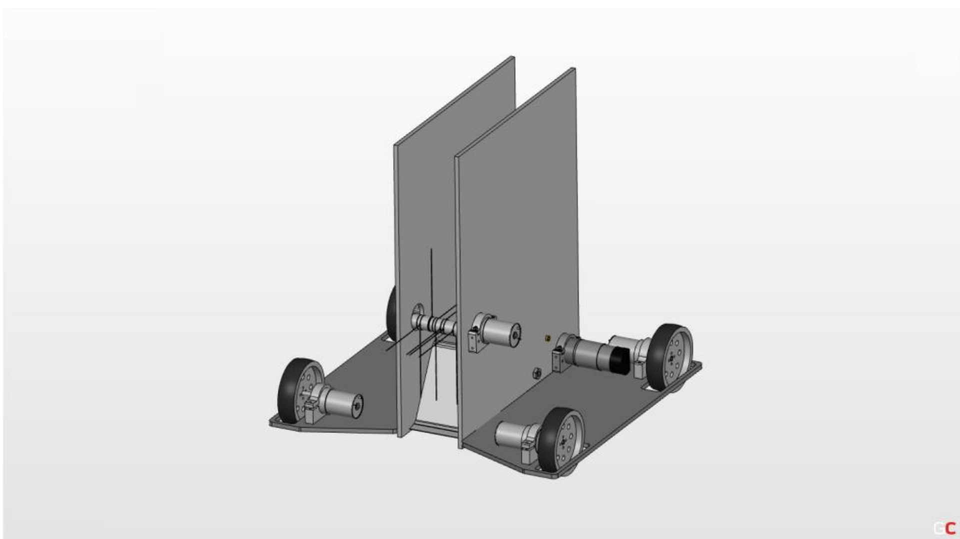


Figure 40 CAD/Plates and Popper

TASKS	REFLECTIONS
Wood Base Hannah Liao	Today my group had Hannah Fowler and Josiah Murphy in it. I was tasked with working with them to make a wooden base from the CAD Jacob had been making. Jacob gave us a printout of the measurements and I walked Hannah F. and Josiah through marking measurements on the wood for our cuts. After the measurements were marked, we cut out the base and the holes for the wheels. I

	taught them how to use a Dremel and a belt sander. We completed our task by the end of the night.

Mentoring New Build Team Members

TASKS	REFLECTIONS
Vertical Guide Adam	Tonight Caleb and I set out to increase the scissor lift's stability. We knew that if we linked each section of the scissor lift to the section opposite it then we would gain substantial stability. We measured the distance between each section and it was 3 ¾ in. between them. We took some plywood and cut 5 3 ¾ in. pieces out of it and then used a pair of vice grips to test the idea. It was a resounding success; with only one brace placed at the very top of the lift, we gained a lot of stability. For the final design, we want to use ¼ in. aluminum instead of the wood and weld it to each section. Now that we could

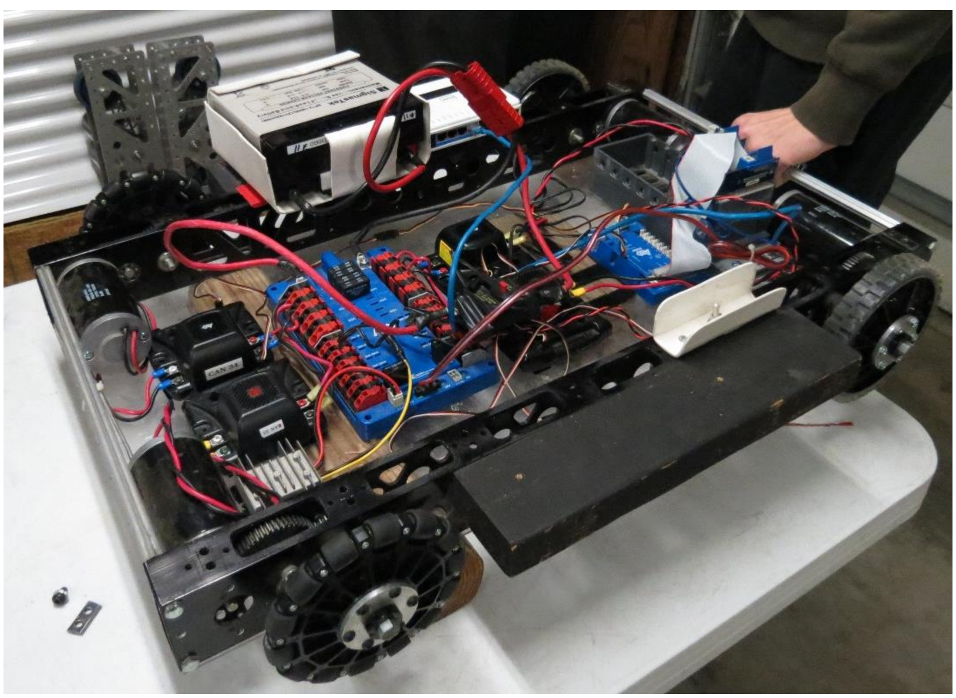
	stabilize our lift, we started to discuss different ways to guide the ball. The consensus was to use a series of telescoping tubes for the guide. We went with this design because if we could get the tubes to nest inside of each other properly then we could gain stability from the guide itself. In order to get each tube to nest in the next we heated one up and plugged each end with FTC® 4 in. diameter wheels and slowly rotated the tube while heating it. Once the tube was malleable, we slowly pulled one end away from the drill, stretching the tube slightly while also decreasing its circumference. While crude, this allowed us to begin playing around with the telescoping mechanism.

TASKS	REFLECTIONS
Coded for the new design Julian	Tonight the design team was using the space in the garage for the field, so we discussed what our plans were for the robot. We decided that the highest scoring/reliable way to score was to drive down the ramp, square up on the ball container, raise the lift and score in the tallest goal, turn and knock the rod over, scoring 90 points. We are also using the gyro to detect the position of the ball container and have coded it to score in every position.

Discussion of New Autonomous Plan

TASKS	REFLECTIONS
Spirit and Inspire Lala	From here forward, we are going to try to add to our team spirit by having a photo booth, more costumes, masks, and possibly some display boards. Updating the website is a priority as well as coming up with new cheers. Also, I am going to make a new zero for our numbers and finish the gold edging so our numbers will look complete and professional. We also talked a lot about new responsibilities and deadlines to help organize our goals in becoming an Inspire Team.

TASKS	REFLECTIONS
Introducing FRC Jason-Elliott	Quinnlan and I had re-built a basic FRC® robot base for Matthew and Olivia. They were trying to get it to work and were having some trouble. Matthew and I had to trouble shoot for a while. At first, we thought it was hardware, then software, then hardware again. In the end, we discovered it was a result of faulty wiring. I had wired the Jaguars into the wrong ports. After wiring them correctly, the robot responded as it was supposed to.



FRC Base

DATE:	START TIME:	STOP TIME
December 2, 2014	12:57	7:44

TASKS	REFLECTIONS
CAD Robot Jacob	Additions: - Added scissor lifts and tube for vertical guidance system - Added base flaps to keep kickstand from interfering with wheels - Made locking tabs on base and popper plates for more strength - Rotated wheel motors so bottom of the base is 1" off the ground

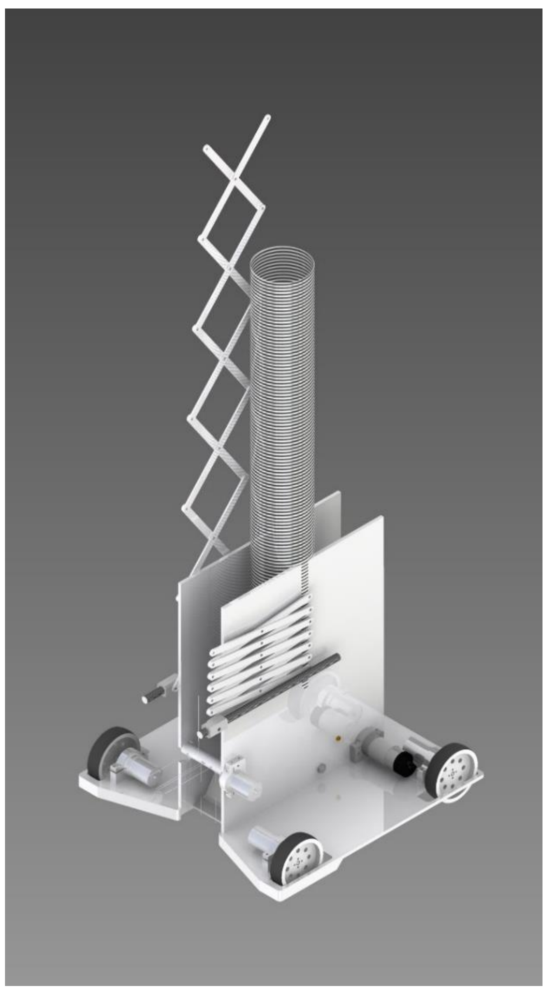


Figure 41 CAD/Lifts and Base

DATE:	START TIME:	STOP TIME
December 3, 2014	1:28	10:59

TASKS	REFLECTIONS
CAD Robot Jacob	Additions: - Shortened the popper plate height to 10" and extended the length forward so we can attach lead screws to the top of the plates - Attached chain, sprockets, and motors to the lead screws powering the scissor lifts - Aligned scissor lifts with center of tube - Moved forward and lowered the sweeper for better ball contact - Extended base flaps so it covers the sides of the front wheels

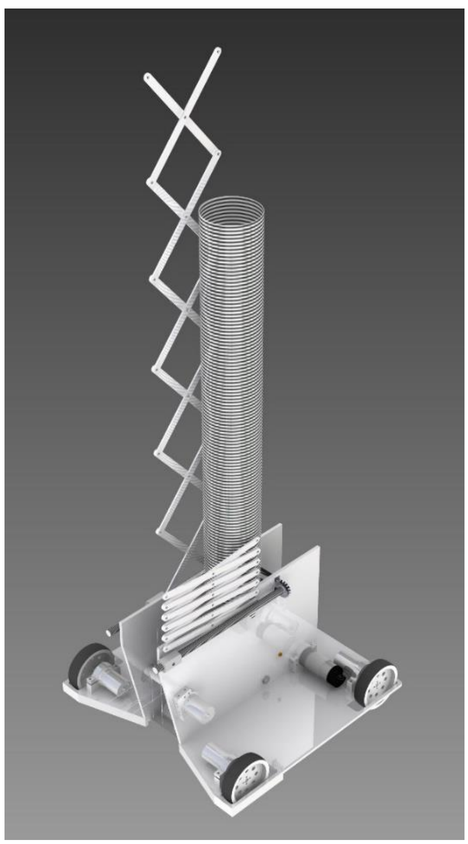


Figure 42 CAD/Robot with Shortened and Extended Popper Plates

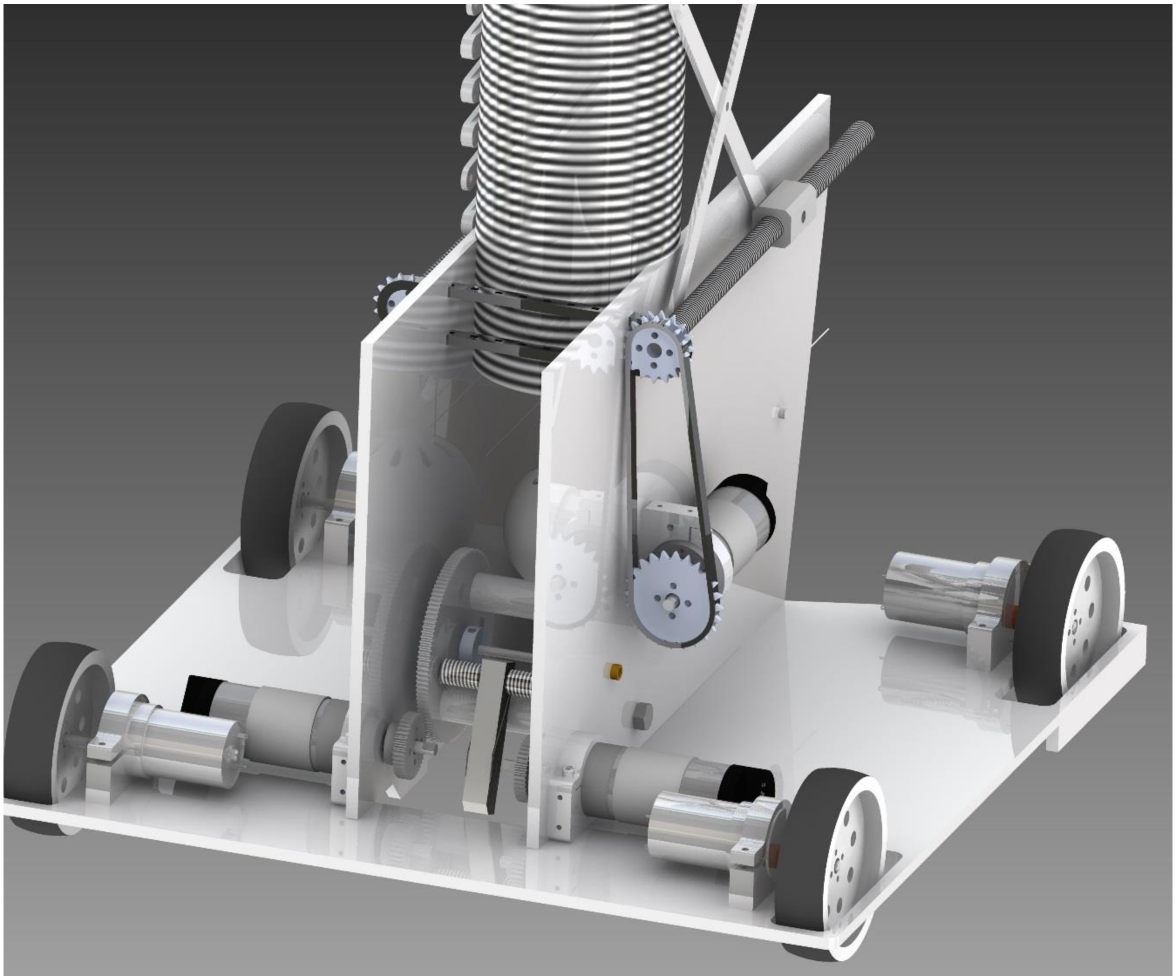


Figure 43 CAD/View of Chain System that Powers the Scissor Lifts

DATE:	START TIME:	STOP TIME
December 4, 2014	6:30	9:15

TASKS	REFLECTIONS
Work on sonar for autonomous Julian and Lucien Zwirtz	Tonight we worked on getting the robot to read the goal position during autonomous. We had it drive to a set position, where the sonar could see the goal, and then it would read the position. Upon determining the position the robot would execute code accordingly, for instance if the sensor read 105 it would see that value as position 1 and react accordingly. We were unable to finish it tonight, due to lack of time, so we will have to return at the next meeting and work on it.

TASKS	REFLECTIONS
Website design and content updates Thomas Lewis	Joel and I were given the task of updating our website with updated graphics and information. After looking through the files, we were able to find the color location in the style.css sheet and I opened that up in Notepad++ and began to change any location where the old colors appeared, and replaced them with our new colors. Because I was doing CSS, Joel went to the content locations and removed and added pages based on what coach Vince and Rebecca wanted to make it look more professional. Joel also edited the slider on the homepage to have appropriate information. The final thing I messed around with was I added the new logo that Hannah Liao created, and added a favicon to the website to make it look a little cleaner.

TASKS	REFLECTIONS
Prototype a way to stabilize the scissor lift and refine the telescoping tube Caleb Smith	We needed to make a way to stabilize the scissor lift so we cut a few pieces of wood that we could put in between the two scissor lifts to help make it stable. This worked pretty well but we did not put them on the robot permanently because we wanted to put the telescoping tube on first. The telescoping tube wasn't moving smoothly so we decided to try a different tape that had less friction on the inside of the tube and it has worked better.

TASKS	REFLECTIONS
Cutting the Plates Hannah Liao	We worked on cutting out the popper plates out of the same wood as the base using CAD printouts made by Jacob. We also finished mounting the wheels from last meeting. We cut the holes needed for the popping mechanism and for the motors.

DATE:	START TIME:	STOP TIME
December 5, 2014	4:15	7:18

TASKS	REFLECTIONS
CAD Robot Jacob	Additions: - Extended the tube so it`s 48" tall - Extended tube down toward the ball popper - Shortened the popper plates so they fit in the 18" limit - Made the ramp have a ball holder so it`s in the right position for launch - Replaced sprocket on motor to a 24 tooth sprocket

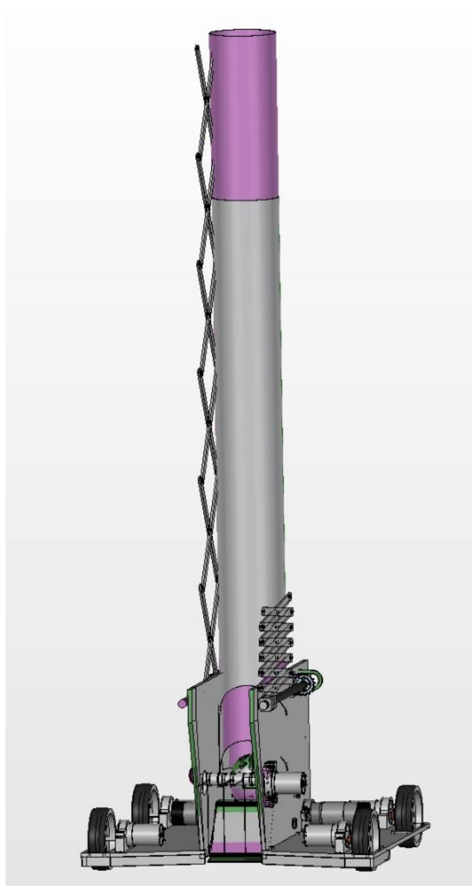


Figure 44 CAD/Tube and Intake

(Changes in Purple)

DATE:	START TIME:	STOP TIME
December 8, 2014	6:30	9:30

TASKS	REFLECTIONS
CAD Jacob	Additions: - Raised ramp and ball holder for maximum striking position - Cut slit in tube so the popper bat can pass through - Moved release bar so it launches the ball vertically - Rotated motor mount for sweeper

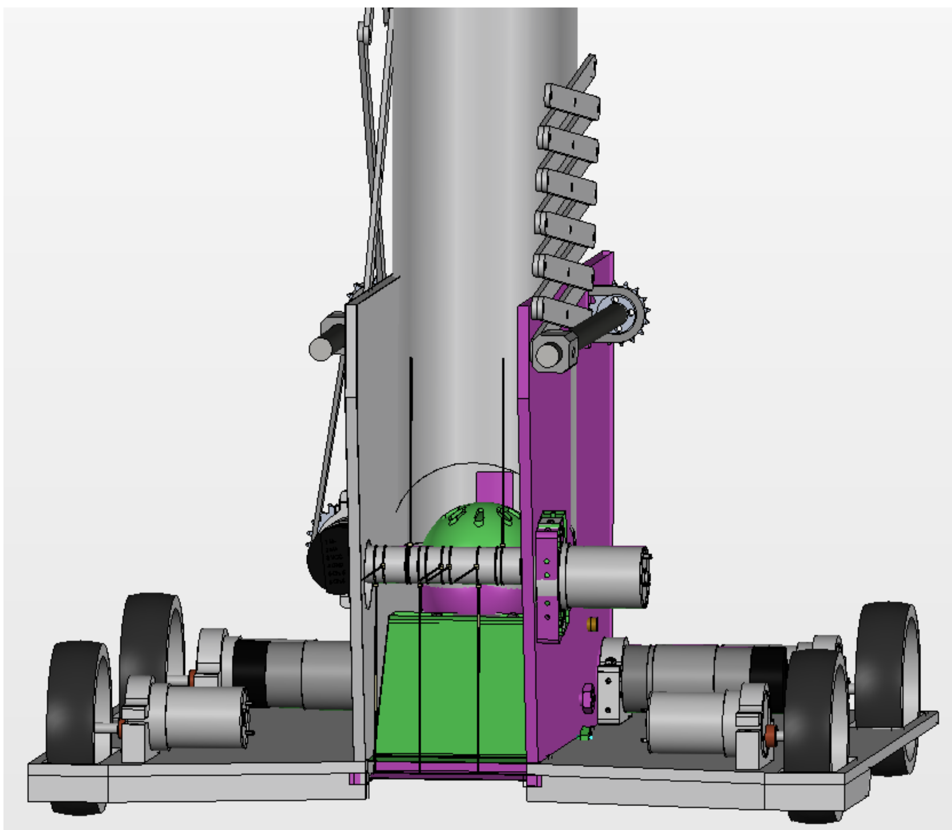
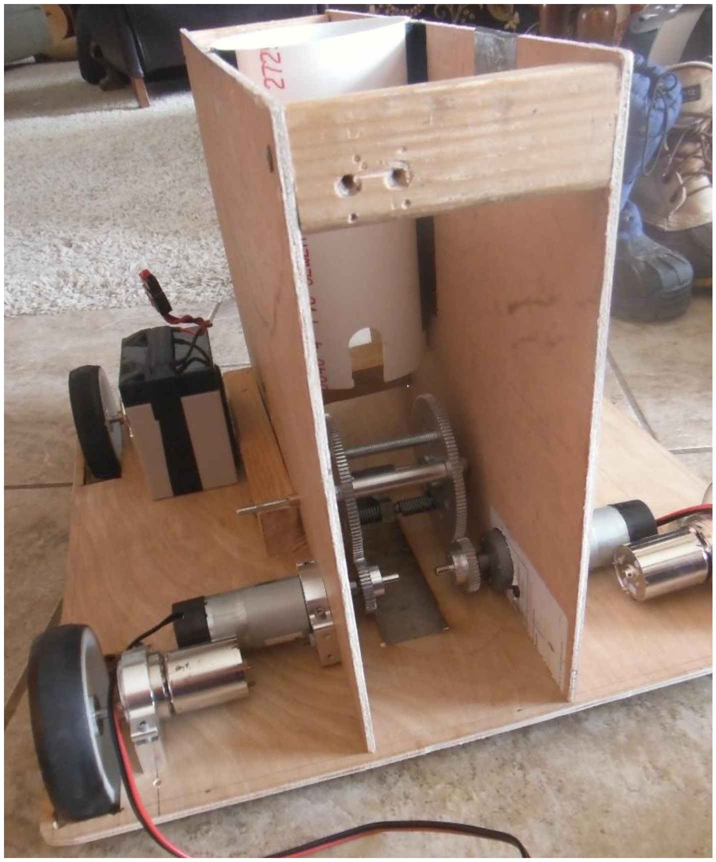


Figure 45 CAD/Popper and Intake

(Changes in purple [Previous version] and green [changed])

TASKS	REFLECTIONS
Wooden Base Hannah Liao	Today I worked with Hannah F. and Josiah to attach the side plates to the robot. We were able to mount the popping mechanism and fire it a few times through the tube guide Adam and his team are

	working on. Shooting the ball through the tube showed us how important it will be for the spot the ball sits on to be consistent. We will work on making and attaching to the robot the sweeper, ball holder and ball intake at the next meeting.



Side Plates

TASKS	REFLECTIONS
Website Design Joel	Joel and Thomas continued working on the graphical bugs on the LIGHTSABERS website. They managed to finish the sponsors list and fix the home pages slideshow stuttering problem.

TASKS	REFLECTIONS
Work on Autonomous Lucien, Julian	Julian and Lucien worked on getting the robot to see the position of the goal during autonomous. The values that the sonar sensor would sometimes vary if it was not the right position so we are working on getting it into the right place. We were eventually able to get it to read the position of the goal accurately.

DATE:	START TIME:	STOP TIME
December 11, 2014	6:30	9:00

TASKS	REFLECTIONS
CAD robot Jacob	Additions: • Ball holder to keep ball in the perfect spot for launch • Rear base flaps to keep the kickstand from getting in the wheels • 18"x18" block to see if parts are out of the 18"x18" limit • High rolling goal for reference • Extended left scissor lift to 18" height limit

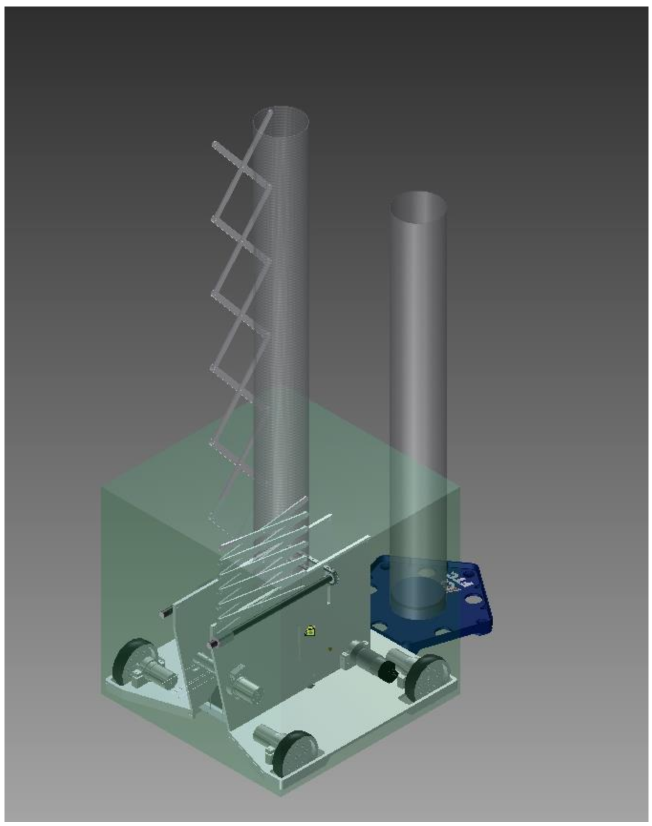


Figure 46 CAD/Ball Holder and Base and 18x18 Sizing

TASKS	REFLECTIONS
Ball Holder and Intake Ramp Hannah F	Coach Vince and Hannah started making a holder for the balls out of moldable plastic (first picture). We ran into issues that started taking a while so we made a different holder design and created it (second picture). We started with pvc pipe and cut, heated and molded it to

	make an opening where the balls could come in at the base but closed at the bottom so the balls could not fall out. We also had to cut a channel at the bottom so the hammer could hit the balls through the opening. Josiah started making a ramp for the balls out of pvc to guide the balls into the launcher. But we did not have enough time so we arranged another meeting Saturday or Friday to finish that.

Moldable Plastic Ball Holder

2nd Design For Holder

4250

TASKS	REFLECTIONS
Wiring and Horizontal Scoring tube Caleb Smith	We needed to have a working ball holder to test the scoring tube, so while Hannah's team worked on the ball holder we worked on the wiring for the wheels. When we had a working ball holder we started to work on the scoring tube and after trying a few things we decided to try using a deflector at the top of the telescoping tube to deflect the balls into a horizontal tube that is slightly angled downward with one end closed off and a hole in the side of the tube at the same end so the balls would hit the closed off end and fall down through the hole into the rolling goal. We have not gotten to mount the horizontal tube yet because we ran out of time.

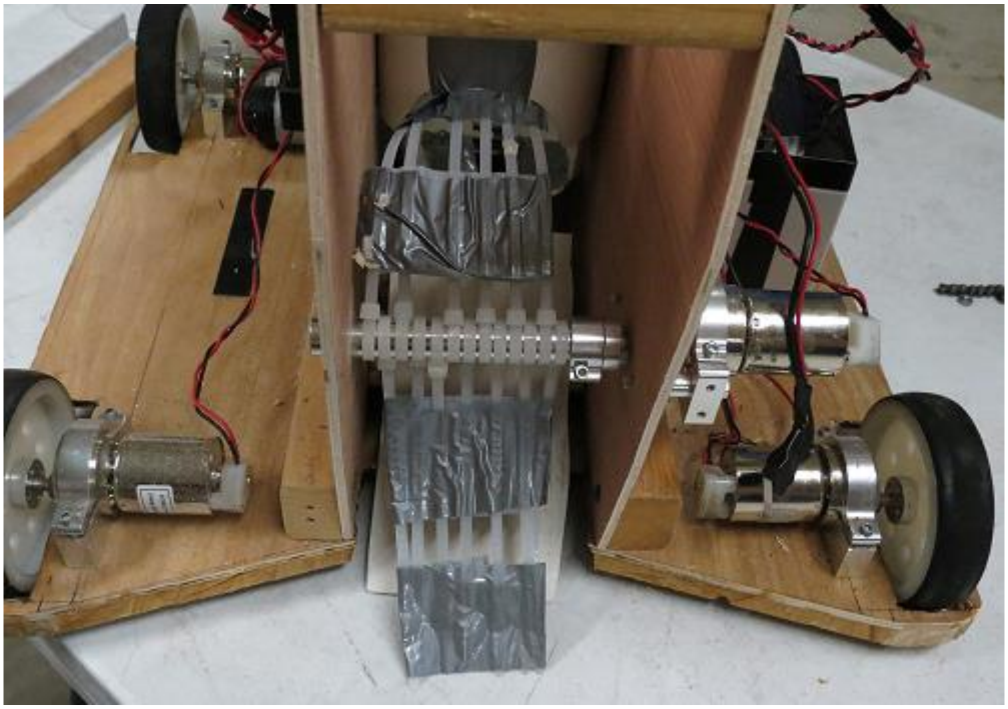
TASKS	REFLECTIONS
Team Spirit: Making Team Numbers and Star Wars masks for costumes Lala	This evening we decided to complete the numbers that we use for cheering at competition events. They are made out of black cardboard, Styrofoam, gold duct tape, and gorilla glue. We used the Styrofoam as spacers between the two sides of the numbers to give them a 3D effect. We hope this will help our team stand out and motivate our team members to support our team and others. Also, we are adding more masks to our costumes so we can become more memorable visually! We already have a Darth Maul and a Togruta mask so we are going to make 5-6 more masks for other kids who are enthusiastic and want to take part in team spirit. However, the white masks that we originally used will not fit all of the kids so to fix this problem we have been browsing the internet to find other sizes to accommodate different people’s faces.

4250

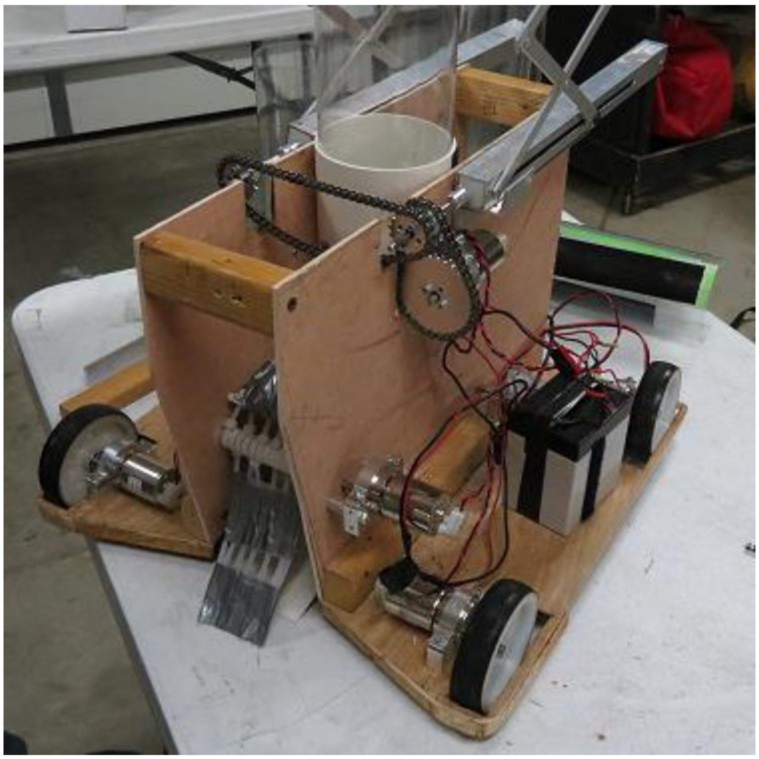
DATE:	START TIME:	STOP TIME
December 12, 2014	2:00	5:30

TASKS	REFLECTIONS
Mounting and Driving Scissor Lifts Adam	We wanted to mount the scissor lifts so we could test our motor set-up and see if just one dc motor would be adequate. We started by taking some 9-inch pieces of aluminum L bracket and mounting them to each side of the popper plate. We then rested the scissor lifts on top and used Velcro to attach them to the popper plates and L brackets. Once we had them mounted, we extended the drive axles of the lifts out about 3 more inches to clear the ball guide and then mounted our sprockets. Now that everything was in place, we measured out the appropriate amount of chain and looped the two sprockets together along with the drive sprocket. When we powered the motor, the entire mechanism immediately bound up. Since chain generates force by pulling, the entire frame of the wooden bot tried to collapse on itself since we had not supported the end of the axles or the popper plates. We plan to add two L brackets to support the loose end of our axles and a support directly between where the chain is crushing the frame.

TASKS	REFLECTIONS
Completing The Base Josiah	Jacob and I finished the ramp while Hannah L. and F. worked on getting the Ball Compartment and Sweeper made. The Ramp was made using a sheet of pvc with a heat gun bent to the right angle. The Ball Chamber was made using pvc also, cut and bent to the right shape. It has a hole for the ball to enter and exit and also a slot for the bat. We sanded the opening with a dremel to get it to the right size. The Sweeper was made using zipties mounted on an axle. Jacob also wired the robot while I helped finish the Ball Compartment and Sweeper.



Ball Compartment and Sweeper



Ramp

DATE:	START TIME:	STOP TIME
December 15, 2014	6:30	9:00

TASKS	REFLECTIONS
CAD the robot Jacob	Additions: - Extended popper plates so it`s flush with the back of the base plate - Made popper plates 4" apart - Changed ramp for better sweeping results - Added center goal for reference - Added middle goal for reference - Moved ball holder higher for better launch position - Made the tube separate pieces so they can telescope - Made holes for the popper motor mounts to add stability

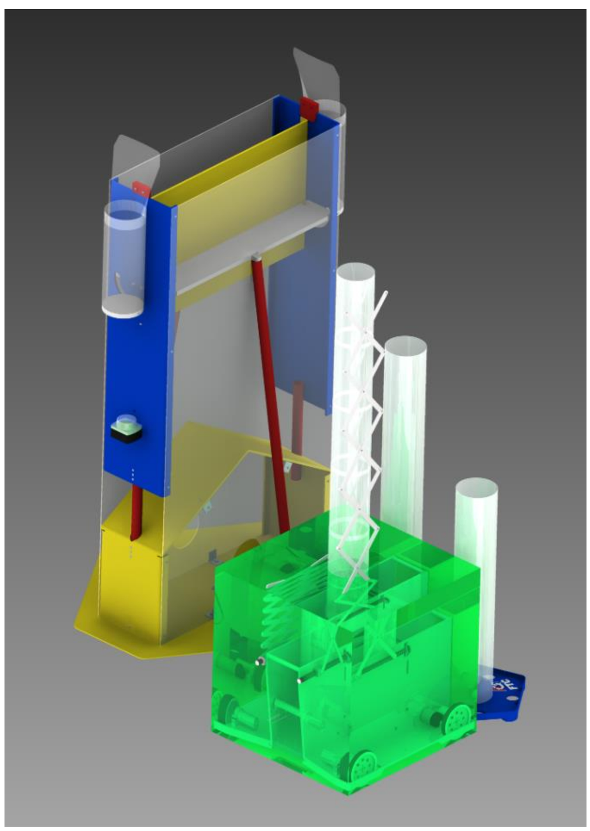


Figure 47 CAD/Popper, Ramp, and Tube

TASKS	REFLECTIONS
Continue to Work on Autonomous Julian, Lucien	Julian and I continued to mess with the autonomous. We had to switch the side of the sonar sensor; because of this, the robot now has to drive down the ramp backwards. We switched the sensor so that when the robot gets off the ramp, in order for the sonar to 'look' at the dispenser and tell the value, it had to turn around, which made for more faulty code

TASKS	REFLECTIONS
Wire the popper bot Jacob	The robot needed to be wired and drivable, so I wired up another motor controller and the NXT. After I wired the robot we tested it by driving it up and down the ramp and tried to pick up and launch balls.

DATE:	START TIME:	STOP TIME:
December 16, 2014	4:30	5:00

TASKS	REFLECTIONS
CAD the robot Jacob	Additions: - Moved scissor lifts to position where it is optimal for lifting the telescoping tubes.

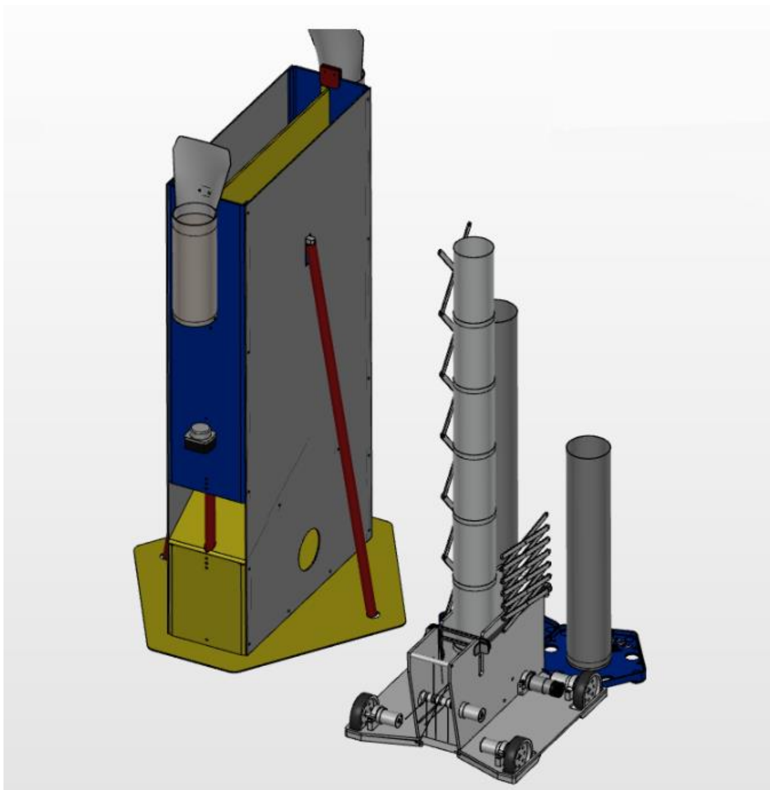


Figure 48 CAD/Move Lifts

TASKS	REFLECTIONS
Add base supports Jacob	The base on the robot was bending due to the weight of the popper plates, popper, misc. To solve this problem I worked with Coach Vince to cut strips of 1/4 sheet aluminum. I then attached the strips to the base by drilling holes in the strips and then used the screws for the motor mounts to attach them.

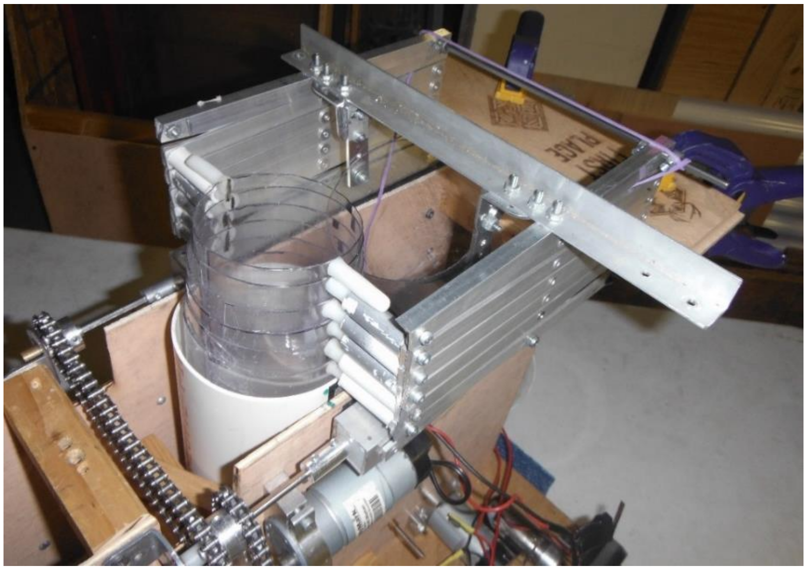
DATE:	START TIME:	STOP TIME
December 17, 2014	5:00	8:30

TASKS	REFLECTIONS
CAD the robot Jacob	Additions: - Moved lead screw assembly so they fit in 18" limit - Added L-brackets to hold lead screws - Made scissor lift capable of retracting and detracting - Extended left scissor lift - Made the tube that lets the balls roll into the rolling goal

Figure 49 CAD/Lead Screw, Brackets, Lifts, and Ball Guide

DATE:	START TIME:	STOP TIME:
January 6, 2015	4:00	10:00

TASKS	REFLECTIONS
Solving Friction Issues Adam	One of the last major problems in our lift system is that at the very beginning of our lift, it almost binds up as if there is too much strain on the motor. At first, I thought it was just that the load on the scissor lifts weighed too much, but that was not the case. We stacked up all the tubes and the horizontal guide on top of the lifts and they had no problem raising them, so then I started to think that it was there was too much friction in the tubes, and it was slowing the lift down. Since several of our tubes had been bound together with duct tape, it seemed reasonable that there would be a lot of friction present. So I remade the telescoping guide with packing tape instead, removing most of the friction. Once we linked it up to the scissor lifts, again we tested to see if it had solved the problem. Unfortunately, it had not. We started brainstorming for what could possibly be putting such a bind on the lift. Eventually we figured that since the most difficult part of the lift was getting the last few sections to extend that maybe they were what was binding. So now, we plan to try a few different methods for helping it along in the early lift stages, such as spring loading it.



Closed Scissor Lift

LIGHTSABERS

4250

Open Scissor Lift

 4250

TASKS	REFLECTIONS
To design the pit layout **Noah**	**As part of the spirit team, we want to make sure that our pit represents and explains our team fully. Our goal is to help others see what our team is about and be a visual representation of our team. Because of our goal, we have totally redesigned how we will use our pit. We plan on having large graphic boards showing all we do throughout this year. We also gave each student different roles on the spirt team.**

Pit layout

DATE:	START TIME:	STOP TIME:
January 13, 2015	6:30	7:30

TASKS	REFLECTIONS
CAD the robot Jacob	Additions: • Switched scissor lifts to vertical lifts so we have another lifting option just in case • Extended ball holder • Made telescoping tubes longer so we can use less tubes • Attached tubes to lift

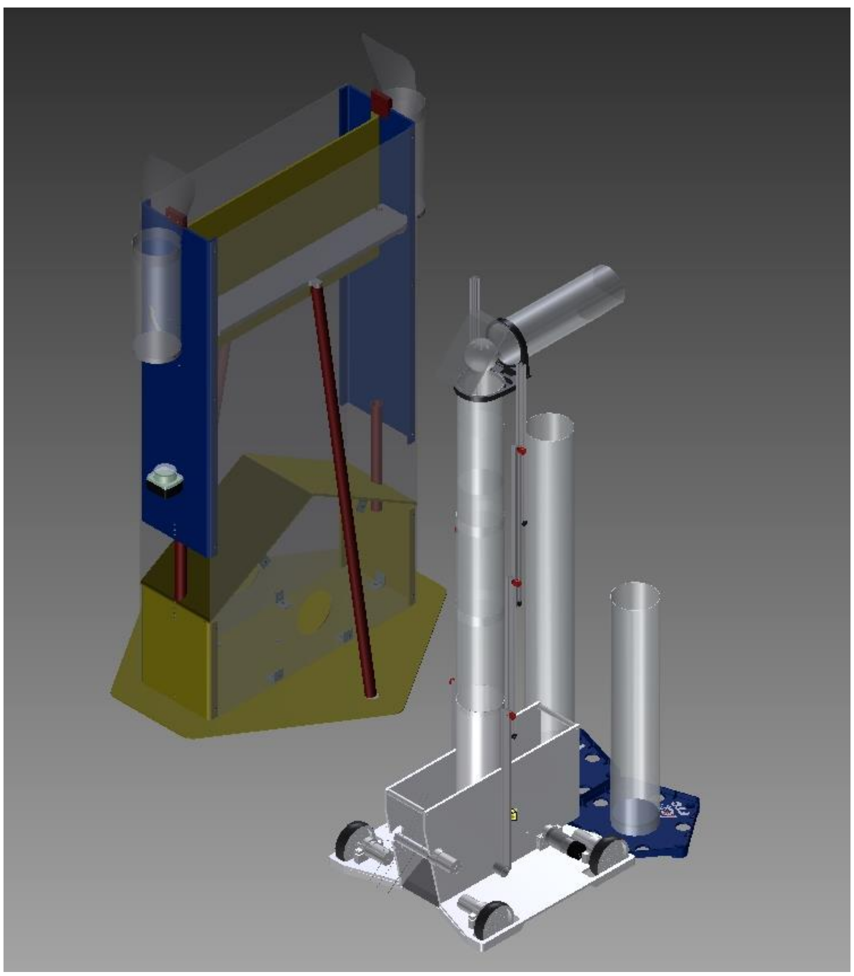


Figure 50 CAD/Vertical Lift, Ball Holder, and Fewer Tubes

4250 4250

DATE:	START TIME:	STOP TIME:
January 15, 2015	5:45	8:30

TASKS	REFLECTIONS
CAD the robot Jacob	Additions: - Shorten lead screw assembly - Turn scissor lifts inward
Turn down the end of the lead screw	While at Nathan`s shop CADing, I also got to turn down a lead screw for the scissor lift using the lathe. Adam and Nathan mentored me by showing me to slowly move the cutting device in and and do that until it`s about 1/4 inch thick.

CAD Meister

Turn Down Lead Screw

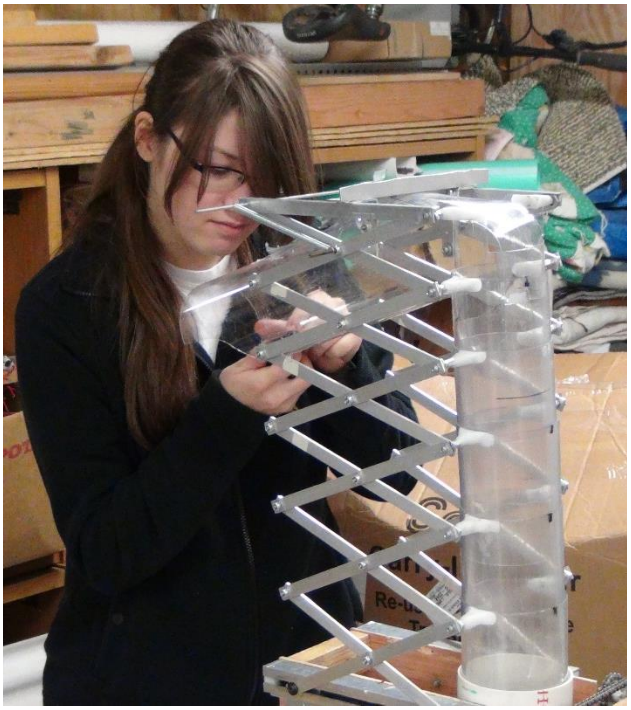
 4250

DATE:	START TIME:	STOP TIME:
January 17, 2015	9:00 a.m.	6:30 p.m.

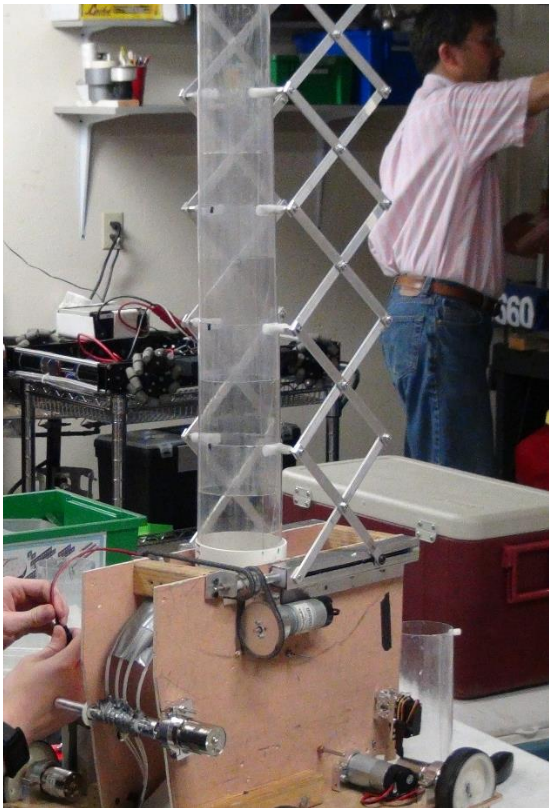
TASKS	REFLECTIONS
Build Hannah Liao	I worked on wiring the robot. I made a Y to link the front and back motors together. This made the wiring easier and neater because I had to deal with fewer wires. Biv did some programming so we could start testing what works and does not work. We discovered that the bat for the popper mechanism was hitting the metal beam we put on the underside of the base to strengthen it. We cut out a notch in the metal and it solved the problem.

TASKS	REFLECTIONS
Cleaning up the Popper Bot Adam	Now that we had proven all of the concepts on the popper bot, it was time to start getting it ready for competition. The first thing we looked at was the poles attaching the scissor lifts to our telescope. The original prototype was just a cylinder of shape lock stuck into a pvc tube that was hot glued onto the scissor lift. So in order to solidify them we got rid of the pvc tubes and hot glue and replaced them with FTC® spacers, as well as beefed up the shape lock connecting to the tubes. Next, we refined our 45-degree ball deflector. Instead of cutting up and using the telescope itself we took a small scrap of left-over tubing and used shape lock to glue it in to the telescope, and then mounted the other end to the horizontal tube bracket. The last issue we addressed was the top of the scissor lift popping off due to the force of the horizontal tube snapping into position, so we cut a small hole at the top of each side of the scissor lift and ran zip ties through them, ensuring that they would not fall out of the aluminum channel.

4250

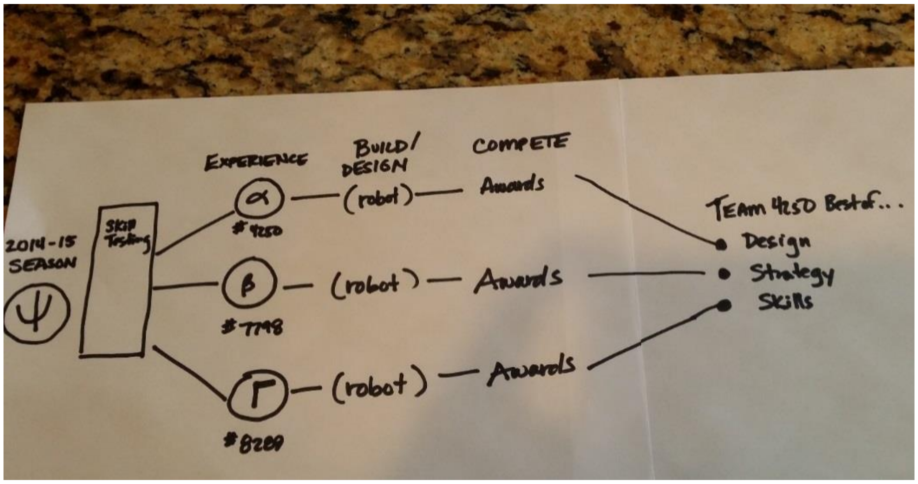


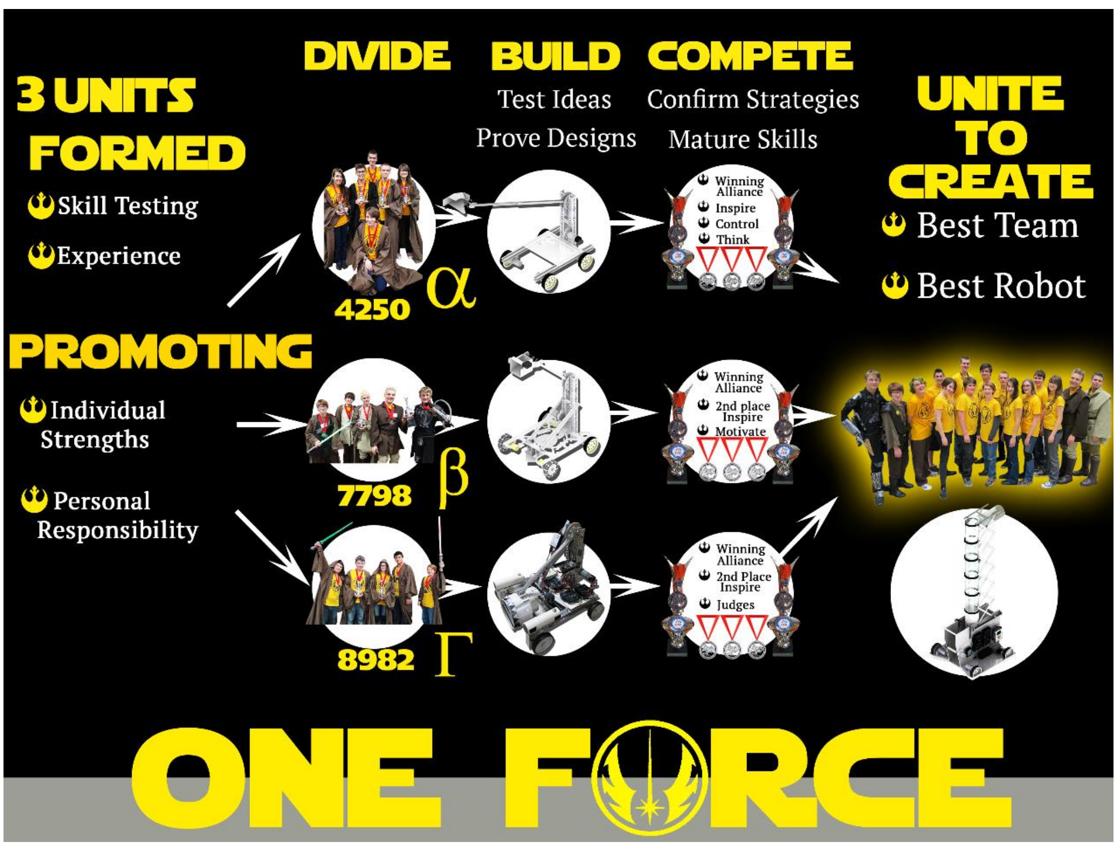
45-Degree Piece



Scissor Lift Connection Points

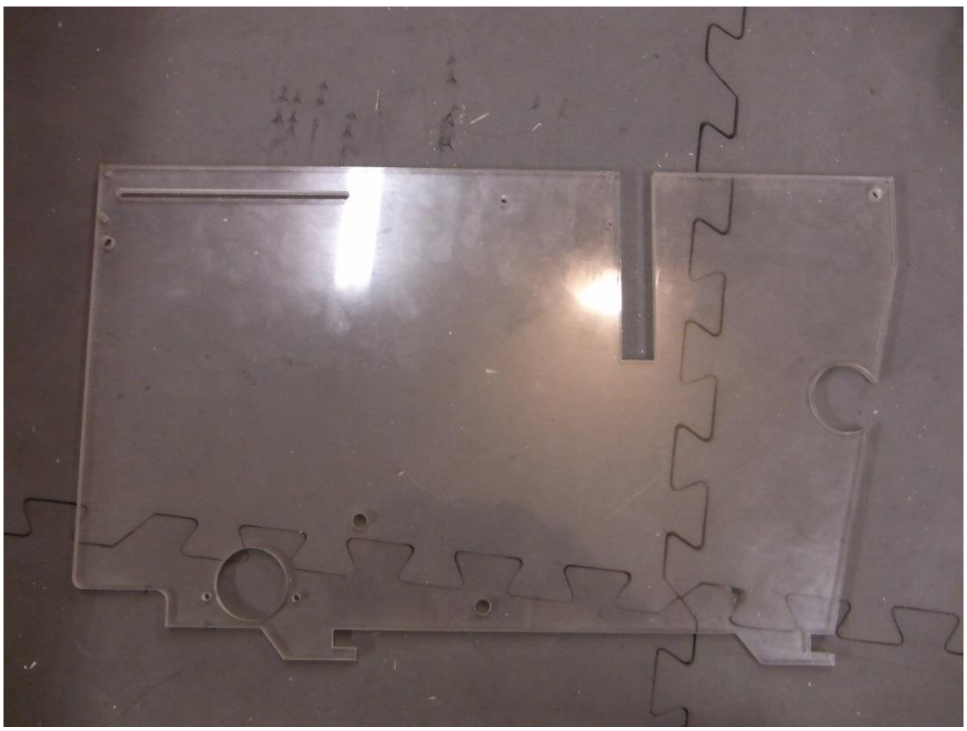
TASKS	REFLECTIONS
Presentation Boards Joel Fowler	Today I worked on the presentation boards in Photoshop. I rearranged and resized the CAD on the boards and got to start on the Outreach Board.





DATE:	START TIME:	STOP TIME:
January 19, 2015	4:15	9:00

TASKS	REFLECTIONS
Laser cut the popper base and sides Jacob	I went to Nathan`s shop and we got the base and sides for the popper bot laser cut out of acrylic. We did this by uploading the dxf. file to Dropbox and downloading it onto the laser cutter`s computer. we then set the starting point and cut.



Acrylic Side

TASKS	REFLECTIONS
Presentation Hannah	Intro -- Team Story (Boards brought in; members use them throughout the presentation to explain our information) We are team #4250, the Lightsabers! (Brandish a few lightsabers?) We would like to explain the journey of our team this year: Hannah L: At the beginning of the season, our team set a goal to field the best team and best robot possible to get further in competition than we ever have before. The Lightsabers have fielded an FTC team for 5 years and for the past 4 seasons, we have made it to worlds but not the semi-finals. A robot that performs well early, or even late, in the season does not necessarily win at Worlds. For example, we fielded a single team robot in 2013 for the "Ring it up" game but we finished worlds in 15th place. Quinnlan: Last year at Worlds we placed 8th in our division, and although we had great success, we were not selected for the semi-finals. Lala: Through these experiences, we have learned the caliber of teams and robots that can be successful at Worlds, so in an effort to become one of those teams, we have changed our approach. Joel: The Lightsabers have lofty goals this season so to explain it I designed this board using Photoshop. To build the best team, we actually split into 3 units and built 4 robots between us in the process. At the beginning of the year we had every student take the Gallup StrengthFinders Assessment and interest surveys to determine where everyone's strengths are, and which students would work well together. We ended up splitting everyone into 3 teams based on experience. Alpha was comprised of the most experienced people, Beta were the people who had some experience, and Gamma was the rookies. Each team built their own robot so that they will have the experience of designing a robot by themselves. Splitting up by experience kept the rookie members from being overshadowed by more experienced members. Even though we had

multiple teams, the more experienced members always mentored the less experienced members.

Noah: As you can see, all three teams built their own robot. All of which won their first qualifiers. We are now in the process of bringing all three teams back together to combine the best strategies, robot design and individual skills.

Throughout this season, we have also been working on a R&D robot that is being tested at today's qualifier. This multi-team approach has allowed us to build four robots within Lightsabers and enabled us to pick the best one for competition. The experience that each student received as a result of this approach was far beyond what would have occurred if all 16 students would have worked on a single robot.

Robot

Hannah L.: Today we are fielding 2 teams to test which robot is the best. We have a small part of our team driving another one of our robots. Also, we are getting our younger drivers competition drive time to sharpen their skills.

Personal Stories

Laurel: This new approach for the robotics program this year has impacted each of us personally so we would like to share some of our experiences with you.

Eli: I was a build member of the rookie team. I learned a lot during this season already. One of the problems we worked on was a mechanism to pick up balls. We brainstormed and ended up making four different prototype grabbers. We also had to make a funnel to dump the balls into the goal so we dedicated a whole meeting to design and prototype funnels. What I learned from this experience is that you need to brainstorm and design things before making them.

Caleb: I enjoy problem solving, and as a builder and driver, I have found that robotics offers many different problems to solve. For instance, building is not always as easy as bolting two pieces together. Instead, it often takes a lot of brainstorming and testing to make something work. The same goes for driving. It is not just pushing buttons on a controller. It takes practice and patience, but I think it is well worth it. I have really enjoyed robotics and all the challenges it gives me.

Olivia: My most memorable experience so far was when I problem-solved in RobotC for the first time on my own. For the past two seasons, I had been using LabView but Robot C is brand new to me. I have had online tutorials and a mentor help guide me through the ins and outs of the language. There has been a lot of non-stop learning while writing functions and logic and programming the gyro and sonar. It was only at a recent meeting that I diagnosed a problem in the code, considered and used the best-known solution and improved my conclusions through the steps of trial and error -- all without any need for outside assistance. It has been very fulfilling to realize how casually I had learned to walk through the process of problem solving in a newly acquired language.

Jacob: I enjoyed learning CAD and really progressed in my skills this year. Some of my new skills are learning how to water jet cut, laser cut, use a lathe, and work side by side with an engineer. One thing I did to help other teams this season is I used CAD to design a USB surge protector mount, and shared it online at Thingiverse. At Worlds last season I even received a “You Inspire Me Badge” from one of the judges for my CAD work.

Hannah F: I just love seeing our robot accomplish what it is supposed to do. And it gives me pride to see the parts that we made work. I have also helped one of the Lightsaber FLL teams “Gold Squadron” with building a jig to help line up their robot correctly. Josiah and I also had a club for our younger brothers and their friends where we taught them how to build and program a lego mindstorm robot. We made a game table that had tasks for their robot to do. They really enjoyed working with the robot, and had a lot of fun!

Josiah: Last October we took part in a Lightsabers FLL mini-meet, which helps the Lightsabers FLL teams prepare for competition. Most of us also volunteered at the FLL state championship. This is my first year in FTC after being in FLL for two years. I have taken part in building two robots this year, the first being the Gamma bot and the second being our new R&D bot, which is being tested for the first time today.

Quinnlan: I enjoy building. Whether it's costumes, props, or devices, so being able to build a robot that can move and complete tasks is really fun for me and seeing the robots perform at competitions is really exciting to watch. Also, seeing the different ideas from other teams plus meeting other teams from around the World.

Lucien: My most noteworthy robotics experience was going to the FTC world championship last year. I wholeheartedly enjoy the competition that FTC allows me to participate in. While at worlds I had the chance to meet and work with many great people that I would have otherwise never met. I had many long conversations with the judges about our robot and what our team was all about. One of the judges saw our over the top Jedi costumes and thought we should be in the First Tech Challenge promo video that was going to be shown nationally.

Scouting

Business Plan

Jason-Elliott: Our team had a combined budget of about $9000 this year. Fundraising and acquiring sponsorships were really important. One of the biggest supports to our budget came from developing new business partnerships. We had some existing partnerships but were able to gain even more this year such as Miracle Productions and OSSO.

Team Spirit

Laurel: Our goal is to build a world-class team. This year we are bringing the party to FIRST through fun masks, costumes, and cheering our loudest for our team and others!

Outreach

Hannah F: Our team has done a lot to connect with the community. We sent one representative from each of our Lightsabers teams to meet with our Lieutenant Governor Todd

Lamb and shared the message of FIRST with him. Sharing FIRST with others is important to us.

Hannah L: The Lightsabers are not only about the robot. We volunteered hours with Habitat for Humanity. We have also reached out to the different homeschool groups in our community to introduce them to FIRST and our Seamless Progression of Programs in which young students interested in robotics can join our Jr. FLL teams and move up to FLL, FTC, and eventually FRC. Through our outreach to thousands of families in home school groups, we have been able to create 5 new FLL teams, and a new FTC team adding up to our total of nine Lightsaber teams.

Jason-Elliott: Gracious Professionalism is important to demonstrate in all aspects of our team. We know that winning isn't all there is to FIRST. As a result, every year we come up with new ideas to try to help other teams as much as we can. For example, this year I created a Wiring Addendum to the Wiring Guide released by FIRST FTC. We have handed these out at every competition that we have attended. Also, at every competition we make sure to offer our assistance (and tools) to other teams when and where we are able.

Summary

Laurel: This season has been very exciting for us all because of our new ideas and goals. Splitting the team into 3 units has been very successful because the new kids got to experience building their own robot and the veteran members could focus on innovating and developing new ideas. As a result, our outreach, time management and cooperation as a team have greatly improved through the process.

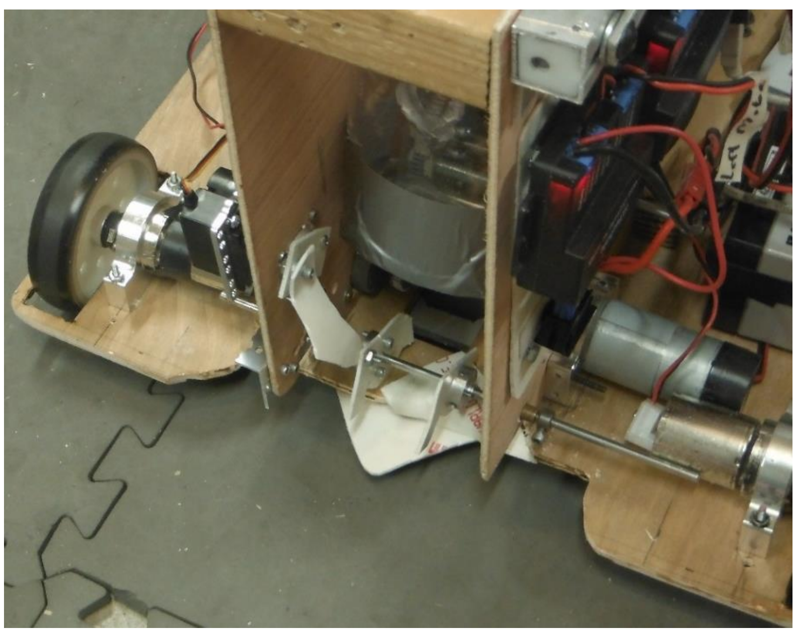
Closing

Hannah: We have so much more to tell you about our robot, our team, and our personal experiences. Please stop by our pit!

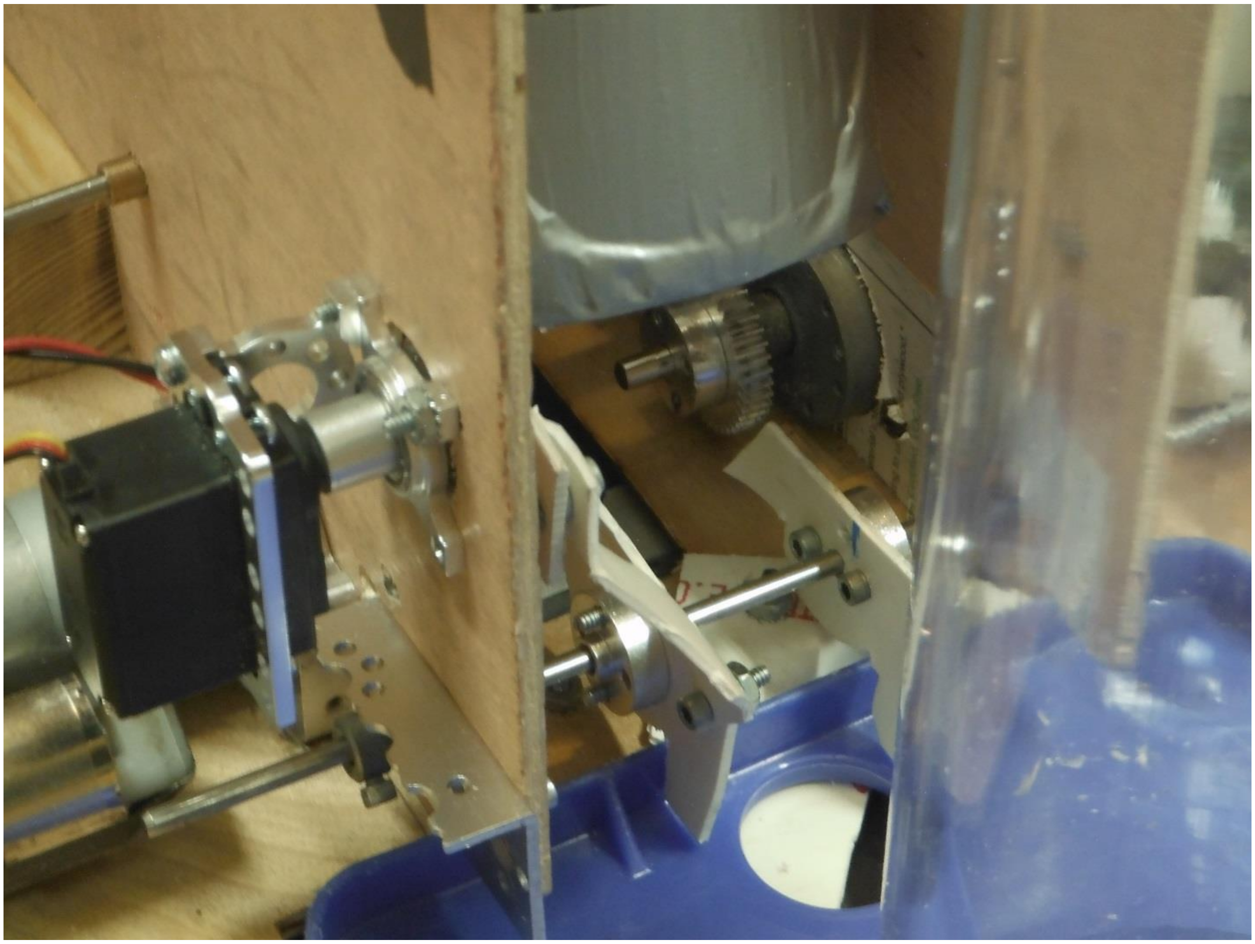
That's the end of our presentation! Do you have any questions?

DATE:	START TIME:	STOP TIME:
January 20, 2015	3:30	9:00

TASKS	REFLECTIONS
New Grabber Adam	Today we designed a new goal grabber and implemented it on the R and D robot. The new design was based off of the competition bots goal grabber to make the transition easier on the drivers. However, it had a slightly harsher angle one the prongs to allow it to carry the high goal up the ramp if necessary. First thing we did was dremel out the base to fit the flat side of the goal. Then we added a pvc triangle to make sure that the goal base will situate nicely without much driver input. The hard part though was the actual grabber itself. Due to all the experimentation, we had done on the R and D bot's frame there were several holes in inconvenient places, which made mounting the axle that the prongs would rotate on difficult. To circumvent this we attached a small piece of tetrix to the sturdy parts of the frame and positioned it so it would hold a brass bearing for the loose end of the axle. Once the axle was mounted, the last major hurdle was articulating it. The old method of using a thin wire had given us issues before, so we switched to a solid piece of pvc to make the prongs raise and lower. After a bit of programming the new grabber was ready for action.



Goal Grabber



Grabber Docking

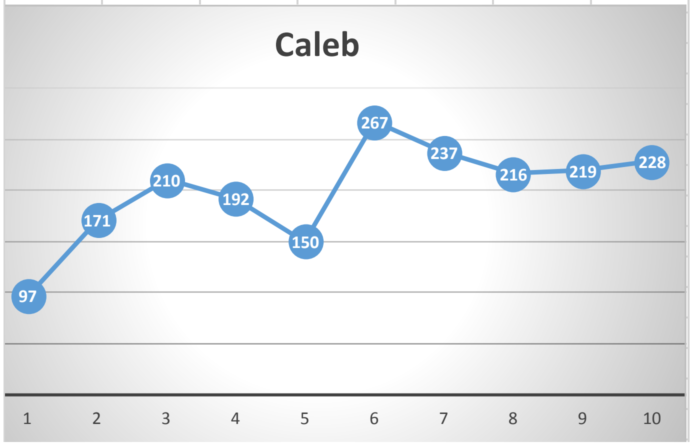
TASKS	REFLECTIONS
Drive Coaching Hannah Liao	I worked with Caleb and Hannah F. Driving the Hand robot.

TASKS	REFLECTIONS
Practice driving with Hannah L Hannah F	Caleb and I took turns driving matches while Hannah L kept track of our scores and averaged them when we had each driven ten matches. We improved a lot by the end of the meeting, but will meet again later in the week to keep improving our scores.

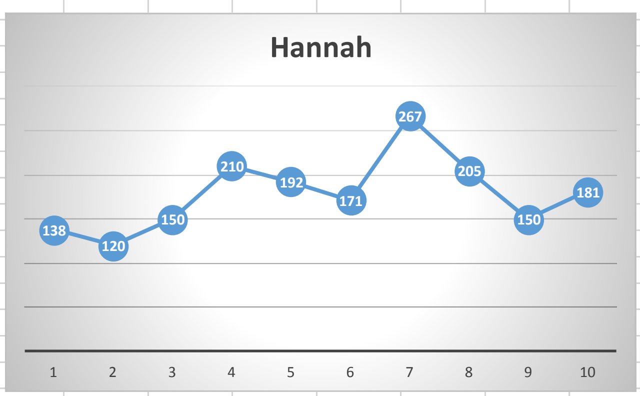
4250

4250

Caleb	H RG	M RG	S RG	Off Groun	The Big P	Total
	67			30		97
	51	0	0	120	0	171
	90	0	0	120	0	210
	72	0	0	120	0	192
	30	0	0	120	0	150
	147	0	0	120	0	267
	147	0	0	90	0	237
	126	0	0	90	0	216
	129	0	0	90	0	219
	108	0	0	120	0	228
						198.7

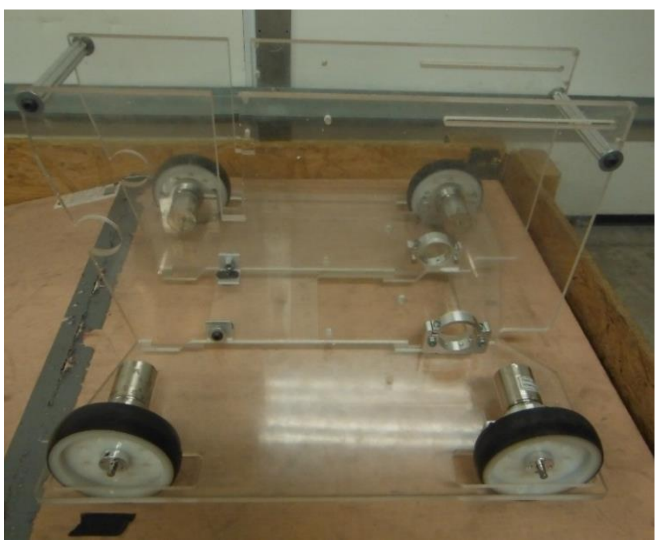


1/20/2015	Hannah	H RG	M RG	S RG	Off Groun	The Big P	Total
Match 1		108	0	0	30	0	138
Match 2		0	0	0	120	0	120
Match 3		30	0	0	120	0	150
Match 4		90	0	0	120	0	210
Match 5		72	0	0	120	0	192
Match 6		51	0	0	120	0	171
Match 7		147	0	0	120	0	267
Match 8		135	0	0	90	-20	205
Match 9		30	0	0	120	0	150
Match 10		111	0	0	90	-20	181
							178.4



Drive Practice

TASKS	REFLECTIONS
Put together laser cut acrylic base Jacob	We wanted to get the laser cut acrylic parts together so that's what we did. We did this by tapping any holes that needed threads and mounted the motor mounts, I then attached the motors and wheels and motor mounts on the side plates. After that we connected the side plates together and then attached them to the base with "L" brackets.



Acrylic base

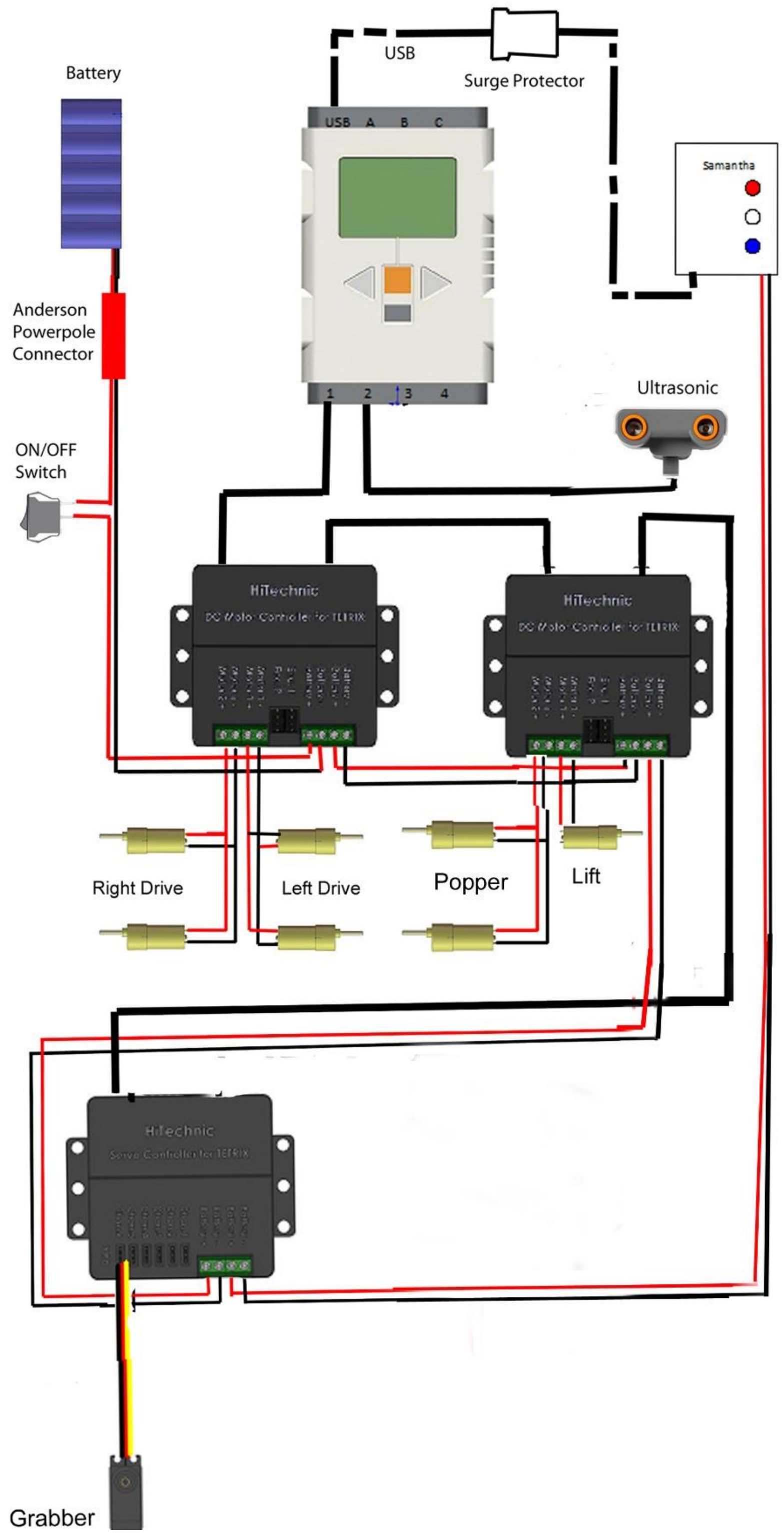


Figure 51 Electrical Schematic for Popper Bot

DATE:	START TIME:	STOP TIME:
January 21, 2015	6:30	10:00

TASKS	REFLECTIONS
Driving Hannah Liao	Hannah F. and Caleb came over again to practice driving the hand robot. I coached them during the matches and kept track of their scores.

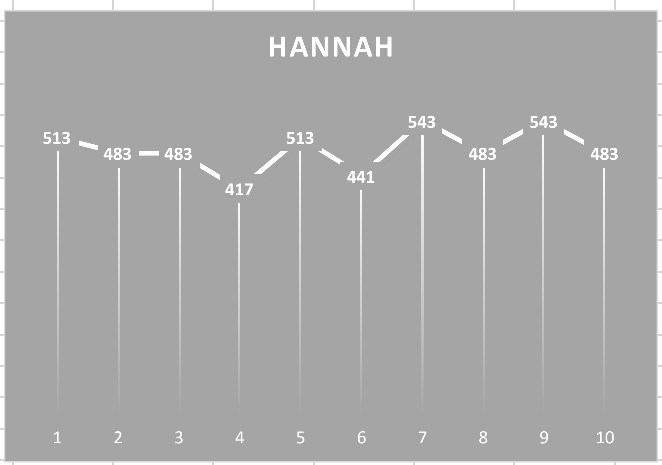
1/21/2015	Hannah	H RG	M RG	S RG	Off Groun	The Big P	Total
Match 1		66	0	0	90	-20	136
Match 2		114	0	0	90	0	204
Match 3		165	0	0	120	0	285
Match 4		126	0	0	60	0	186
Match 5		147	0	0	90	0	237
Match 6		108	0	0	90	0	198
Match 7							
Match 8							
Match 9							
Match 10							
							207.6667

1/21/2015	Caleb	H RG	M RG	S RG	Off Groun	The Big P	Total
Match 1		183	0	0	60	0	243
Match 2		147	0	0	120	0	267
Match 3		120	0	0	120	0	240
Match 4		129	0	0	60	0	189
Match 5		108	0	0	120	0	228
Match 6		0	0	0	0	-40	-40
Match 7		228	0	0	90	0	318
Match 8							
Match 9							
Match 10							
							206.4286

DATE:	START TIME:	STOP TIME:
January 22, 2015	2:30	9:00

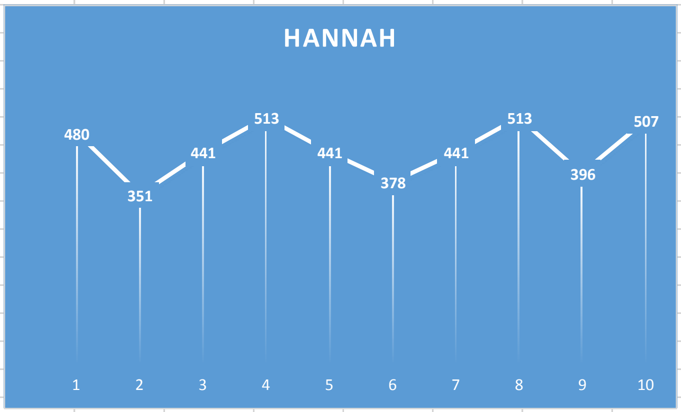
TASKS	REFLECTIONS
Presentation and Driving Hannah Liao	Before the meeting at about 2:30 I decided to drive the popper bot and see what score I could get. My goals were to 1) see what issues it has running multiple matches and 2) what my average was on that robot. I kept an excel spreadsheet record of my driving. I drove until 5:30 when I ate dinner, and then drove more matches until 6:30. I was able to drive 20 matches. I broke the 20 matches up into groups of 10. I did this because I made adjustments and did maintenance to the robot for the first 10 matches. For the remaining 10 matches I really put all my effort into the driving and focused. We spent the meeting working on the Gamma presentation. By the end of the night we were fairly ready.

1/21/2015	Hannah	H RG	M RG	S RG	Off Groun	CG	Total
Match 1		261	0	0	90	162	513
Match 2		261	0	0	90	132	483
Match 3		261	0	0	90	132	483
Match 4		261	0	0	90	66	417
Match 5		261	0	0	90	162	513
Match 6		261	0	0	90	90	441
Match 7		261	0	0	120	162	543
Match 8		261	0	0	90	132	483
Match 9		261	0	0	120	162	543
Match 10		261	0	0	90	132	483
							490.2



4250 **4250**

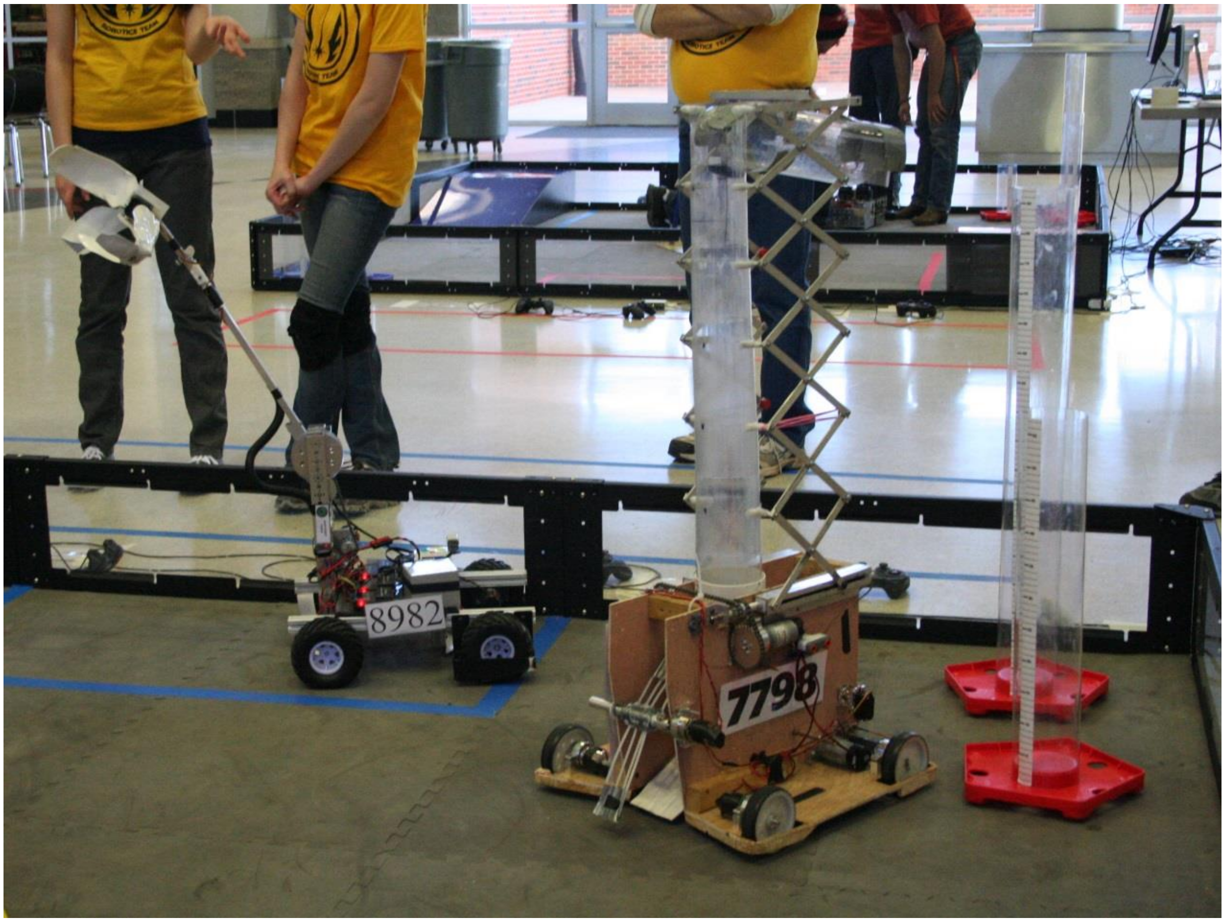
1/21/2015	Hannah	H RG	M RG	S RG	Off Groun	CG	Total
Match 1		258	0	0	60	162	480
Match 2		261	0	0	90	0	351
Match 3		261	0	0	90	90	441
Match 4		261	0	0	90	162	513
Match 5	axle	261	0	0	90	90	441
Match 6	motor scre	258	0	0	120	0	378
Match 7	lag	261	0	0	90	90	441
Match 8		261	0	0	90	162	513
Match 9	tube screv	261	0	0	90	45	396
Match 10		261	0	0	120	126	507
							446.1



 4250

DATE:	START TIME:	STOP TIME:
January 24, 2015 Mustang Qualifier	7:45 a.m.	6:00 p.m.

TASKS	REFLECTIONS
Test the R&D robot in a competition environment and combine the teams Thomas	At the beginning of the season we split into three teams based on our skill tests. The plan was to come together and create a robot based on all of our skills we had learned from being on the teams. Being in the finals stages of this we took our main team to test out our presentation and begin the combination of the teams. At the same time, Julian, Adam, and I were placed on a skeleton crew tasked with driving the new R&D bot in a competition state. The plan was to drive the R&D robot against our current high score robot, the Alpha Bot, and compare the scores and decide which we would take to state. During the competition, the R&D robot performed extremely well and, alongside team 6735, Medusa, we achieved the high score of the state with 521 points. Throughout the competition, we noticed a number of issues with the bot such as a small ball lodging itself in the popping mechanism thus causing damage to the ball and field. Four times, however, the R&D robot locked up and prevented us from driving it in the middle of the match. The first two times the issue occurred were in the qualifying matches where we still won the match, however the next two times were both in the final matches against our Alpha Bot. We have looked into it by looking at three different documents regarding solutions to the issue, but we are not sure what exactly happened to cause those issues. At the end of the day, the popper performed extremely well despite having the lockup issues, and it is most definitely a scoring improvement over the Alpha competition Bot. As the Skeleton Crew, we were awarded the Rockwell Collins Award and the Finalist Alliance Award. The main team was able to win the 3rd Place Inspire Award, the Think Award, the Control Award, and the Winning Alliance Award.



Mustang Qualifier

DATE:	START TIME:	STOP TIME:
January 26, 2015	6:30	9:00

TASKS	REFLECTIONS
Jason-Elliott Hendricks	This meeting was focused on discussing how the team was going to proceed from here. We decided that the best way to continue would be to forfeit our extra team slots at World Competition. Through this the team would go forward as one entity and team. We felt that we would be stronger if we were unified with one robot, one team and one force. A lot of our discussion was focused on how the popper bot performed at the Mustang qualifier and whether to proceed with it or not. The team decided that even though the competition bot was more reliable at the moment, it did not have the ability to compete at a higher level. The popper bot performed extremely well at the qualifier and gave us confidence that it was the route to proceed in. Despite its slight malfunctions, everyone agreed that they wanted the popper bot. We will go into the next competitions with it. After splitting the team into the three different sections, it was apparent that unifying the team once again would be very important. This factored into our decision to drop our extra slots at Oklahoma Regional. We will be stronger and better as a team through combining all of our strengths and experiences.

DATE:	START TIME:	STOP TIME:
January 27, 2015	6:30	9:00

TASKS	REFLECTIONS
CAD the robot Jacob	Additions: - NXT - Three motor controllers - One servo controller - Samantha - Battery - On-off switch - Tube clamps that attach to the scissor lift - Changed the cut-out for the rolling goal for better holding position - Balls in the horizontal tube for reference - Bars across the top of the scissor lift for support and holding the horizontal tube
Make the goal grabber	The acrylic base needed a goal grabber so with the help of Coach Vince, I designed and built one. We did this by putting an axle through the hole of a small piece of 8020, then keeping it in place with axle hubs. We then drew up sketches of the hooks that will grab onto the rolling goal's base, and cut them out of PVC. Looking at how the first hooks worked and using trial and error we refined the hooks quickly and attached the new hooks to the axle hubs that were holding the axle in place. After that we took an aluminum "L" bracket and cut a slot in it for the servo that drives the hooks. I then marked the holes to attach the servo on and drilled them. We then attached the 8020 to the base and put a rubber band on the hooks so we can hook onto the rolling goal easier.

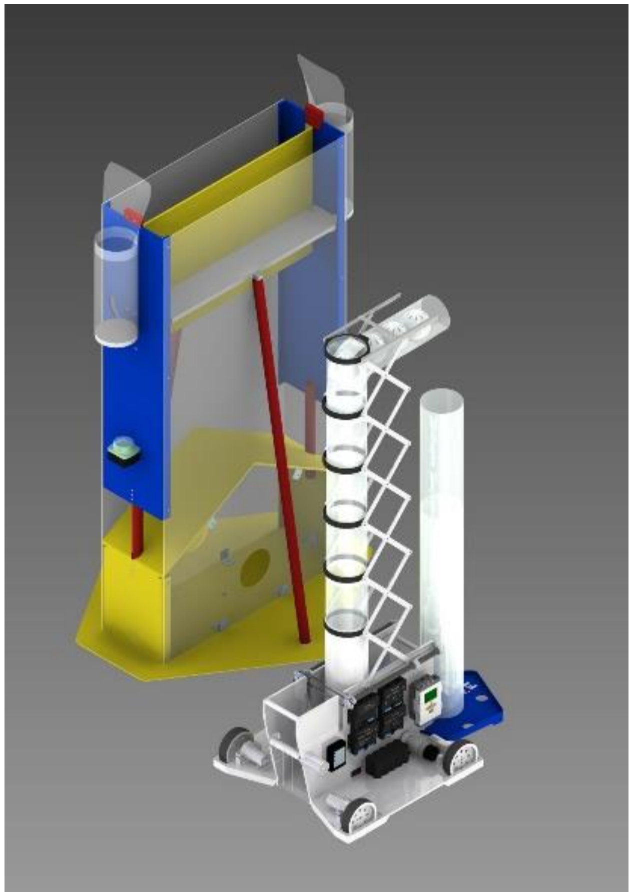
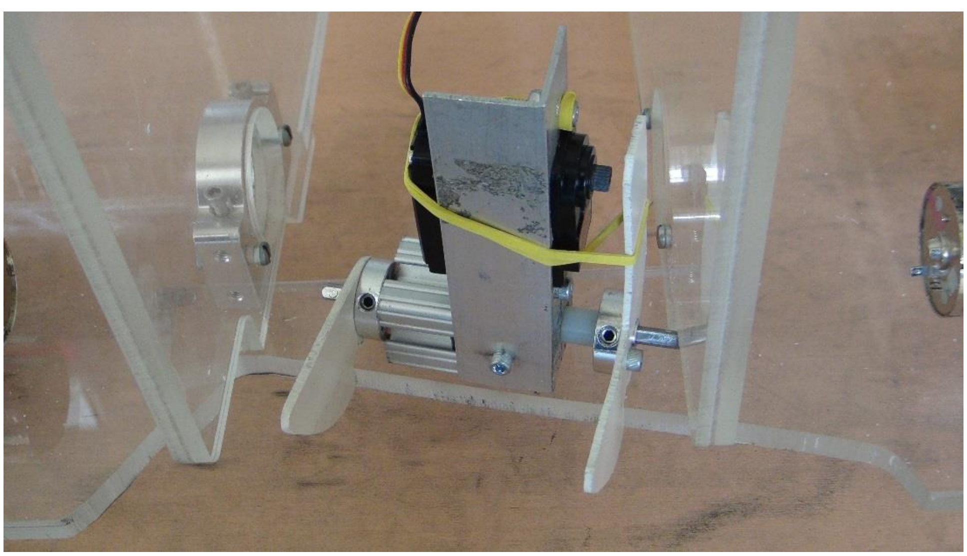


Figure 52 CAD of the Robot



Goal grabber, A.K.A. T.I.M.I. 2 (Truly Ingenius Mechanical Integration Mark 2)

TASKS	REFLECTIONS
Photoshop team photos	A member taught two of the rookies how to use photo shop to edit the team photos so we could put them on our board.

TASKS	REFLECTIONS
Design a board for regional competition	We decided to make a board that would tell everyone that you can take pictures with us and with our masks and another board with a team photos and our goals.

Photoshopping

Making New Board

TASKS	REFLECTIONS
Get the robot to knock down the bar in the center goal Julian	Tonight we worked on getting the robot to score in the tallest rolling goal. The robot was supposed to drive around the tallest goal, and punch it into the wall. We were unable to get it to score though, because the base needed alterations. The robot kept dragging on the wall, preventing it from scoring reliably.

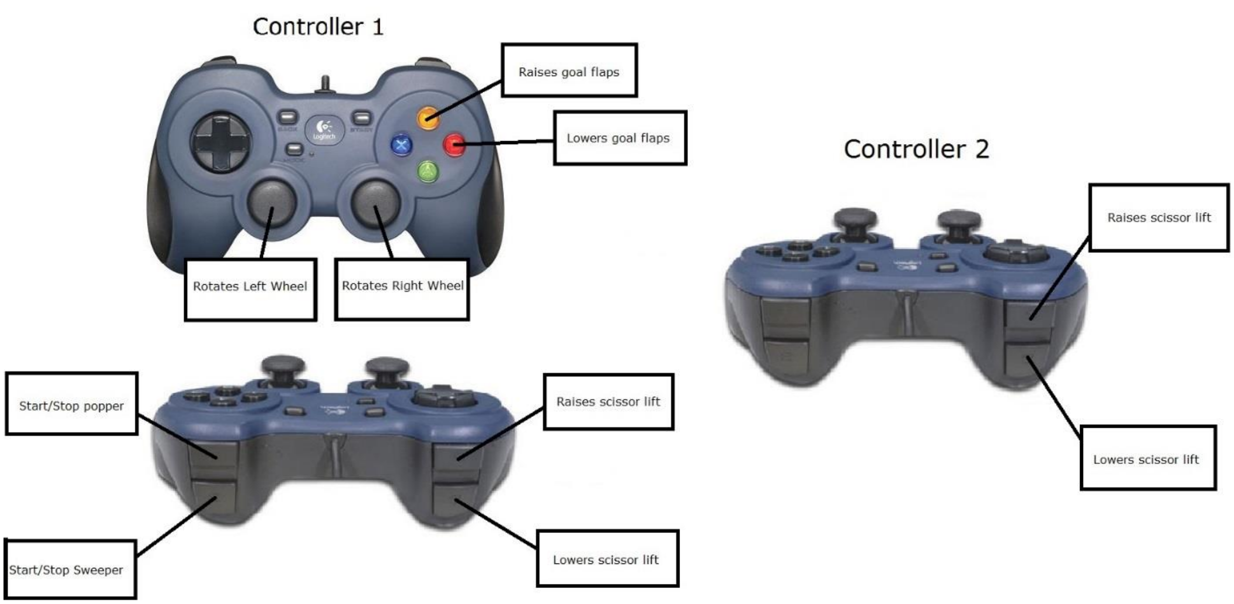


Figure 53 Programming Controller Schematic

Autonomous Code

```
#pragma config(Hubs,  S1, HTMotor,  HTMotor,  HTServo,  HTMotor)
#pragma config(Sensor, S2,     Sonar_Sensor,    sensorSONAR)
#pragma config(Sensor, S3,     Gyro_Sensor,     sensorI2CHiTechnicGyro)
#pragma config(Sensor, S4,     Color_Sensor,    sensorCOLORFULL)
#pragma config(Motor,  mtr_S1_C1_1,     LeftDrive_Motor, tmotorTetrix, openLoop, reversed)
#pragma config(Motor,  mtr_S1_C1_2,     RightDrive_Motor, tmotorTetrix, openLoop)
#pragma config(Motor,  mtr_S1_C2_1,     Popper_Motor,  tmotorTetrix, openLoop)
#pragma config(Motor,  mtr_S1_C2_2,     Scissor_Motor, tmotorTetrix, openLoop)
#pragma config(Motor,  mtr_S1_C4_1,     motorH,        tmotorTetrix, openLoop)
#pragma config(Motor,  mtr_S1_C4_2,     Sweeper_Motor, tmotorTetrix, openLoop)
#pragma config(Servo,  srvo_S1_C3_1,    LeftHand_Servo,       tServoStandard)
#pragma config(Servo,  srvo_S1_C3_2,    RightHand_Servo,      tServoStandard)
#pragma config(Servo,  srvo_S1_C3_3,    servo3,               tServoNone)
#pragma config(Servo,  srvo_S1_C3_4,    servo4,               tServoStandard)
#pragma config(Servo,  srvo_S1_C3_5,    Sweeper_Servo,        tServoContinuousRotation)
#pragma config(Servo,  srvo_S1_C3_6,    Grabber_Servo,        tServoStandard)
//*!!Code automatically generated by 'ROBOTC' configuration wizard               !!*//

// #include "MenuHelper.h"
#include "JoystickDriver.c"  //Include file to "handle" the Bluetooth messages.
#include "lib/Auto/AutoUtils.h"

//Sub Systems
#include "subsystems/Scissor.h"
#include "subsystems/Popper.h"
#include "subsystems/Grabber.h"
#include "subsystems/Sweeper.h"
#include "subsystems/Scoop.h"

void InitializeRobot()
{
  //defaults
  AutonomousFunctions_InitializeRobot();
  Scoop_Up();

}

void PrintColor() {
  string sColor;

  switch (SensorValue[Color_Sensor])
  {
  case 1: sColor = "Black"; break;
  case 2: sColor = "Blue"; break;
  case 3: sColor = "Green"; break;
  case 4: sColor = "Yellow"; break;
  case 5: sColor = "Red"; break;
  case 6: sColor = "White"; break;
  default: sColor = "???"; break;
  }
  nxtDisplayTextLine(6, sColor);
}

int GetGoalPosition(){
  int goalPosition = 0;
  int goalPosition1Count = 0;
  int goalPosition2Count = 0;
  int goalPosition3Count = 0;

  for(int i=0; i<500; i++)
  {
    nxtDisplayCenteredTextLine(1,"Current read %i", i);

    int sonarValue=SensorValue[Sonar_Sensor];
    if (sonarValue>100 &&sonarValue<112)
    {
      goalPosition1Count += 1; //Horizontal
      //PlaySound(soundException);
    }
```

```
    else if (sonarValue>120 && sonarValue<130)
    {
      goalPosition3Count += 1;//Virtical
      //PlaySound(soundException);
      //wait1Msec(1000);
      //PlaySound(soundException);
      //wait1Msec(1000);
      //PlaySound(soundException);
      //wait1Msec(1000);
    }
    else
    {
      goalPosition2Count += 1 ; //Angled
      //PlaySound(soundException);
      //wait1Msec(1000);
      //PlaySound(soundException);
    }
    wait1Msec(1);
  }

  if (goalPosition1Count > goalPosition2Count && goalPosition1Count > goalPosition3Count){
    goalPosition = 1;
  }
  else if(goalPosition2Count > goalPosition1Count && goalPosition2Count > goalPosition3Count){
    goalPosition = 2;
  }
  else if(goalPosition3Count > goalPosition1Count && goalPosition3Count > goalPosition2Count){
    goalPosition = 3;
  }
  else
  {
    goalPosition = 1;
  }


  int sonarValue=SensorValue[Sonar_Sensor];
  nxtDisplayTextLine(1,"sonar %i", sonarValue);
  nxtDisplayTextLine(2,"goal1 %i", goalPosition1Count);
  nxtDisplayTextLine(3,"goal2 %i", goalPosition2Count);
  nxtDisplayTextLine(4,"goal3 %i", goalPosition3Count);
  nxtDisplayTextLine(5,"goal  %i",goalPosition);

  return goalPosition;
}

task main()
{
  eraseDisplay();

  InitializeRobot();

  //while (true){   nxtDisplayTextLine(5,"goal  %i",SensorValue[Sonar_Sensor]);
  //}

  bDisplayDiagnostics = false;
  // StartTask(runMenu);

  //waitForStart();  //Wait for the beginning of autonomous phase.
  //When using TrunPiviotDegrees 90 is -90 is right
  // StopTask(runMenu);
  //eraseDisplay();
```

```
DriveInches(72,85);
wait1Msec(500);
TurnDegreesLeft(45);
DriveInches(30,20);
TurnDegreesLeft(81);
Scissor_Up();
wait1Msec(8500);
Scissor_Stop();
DriveInches(-46,80);
Grabber_MoveDown():
Sweeper_RunIn();
Popper_Enable(100);
wait1Msec(6000);
DriveInches(50,100);
Popper_Stop();
```

Figure 54 Code for Autonomous

Teleop Code

```
#pragma config(Hubs,  S1, HTMotor,  HTMotor,  HTServo,  HTMotor)
#pragma config(Sensor, S1,     ,               sensorI2CMuxController)
#pragma config(Sensor, S2,     Sonar_Sensor,   sensorSONAR)
#pragma config(Sensor, S3,     Gyro_Sensor,    sensorI2CHiTechnicGyro)
#pragma config(Sensor, S4,     Color_Sensor,   sensorCOLORFULL)
#pragma config(Motor,  mtr_S1_C1_1,     LeftDrive_Motor, tmotorTetrix, openLoop)
#pragma config(Motor,  mtr_S1_C1_2,     RightDrive_Motor, tmotorTetrix, openLoop)
#pragma config(Motor,  mtr_S1_C2_1,     Popper_Motor,  tmotorTetrix, openLoop)
#pragma config(Motor,  mtr_S1_C2_2,     Scissor_Motor, tmotorTetrix, openLoop)
#pragma config(Motor,  mtr_S1_C4_1,     motorH,        tmotorTetrix, openLoop)
#pragma config(Motor,  mtr_S1_C4_2,     Sweeper_Motor, tmotorTetrix, openLoop)
#pragma config(Servo,  srvo_S1_C3_1,    LeftHand_Servo,       tServoStandard)
#pragma config(Servo,  srvo_S1_C3_2,    RightHand_Servo,      tServoStandard)
#pragma config(Servo,  srvo_S1_C3_3,    servo3,               tServoNone)
#pragma config(Servo,  srvo_S1_C3_4,    servo4,               tServoStandard)
#pragma config(Servo,  srvo_S1_C3_5,    Sweeper_Servo,        tServoContinuousRotation)
#pragma config(Servo,  srvo_S1_C3_6,    Grabber_Servo,        tServoStandard)
//*!!Code automatically generated by 'ROBOTC' configuration wizard               !!*//

/*---------------------------------------------------------------------------------------------------------*\
|*                                                                                                         *|
|*                                          - 4250 Tele-Op -                                               *|
|*                                          ROBOTC on Tetrix                                               *|
|*                                                                                                         *|
|*  This program allows you to drive a robot via remote control using the Tank Drive or Arcade Drive      *|
|*  This program has a "deadband" that can be set to prevent the the robot from moving when the joysticks *|
|*  fail to return back to exact center.                                                                   *|
|*                                                                                                         *|

#include "JoystickDriver.c"
#include "lib/TeleOp/JoystickUtils.h"

//Sub Systems
#include "subsystems/Scissor.h"
#include "subsystems/Popper.h"
#include "subsystems/Grabber.h"
#include "subsystems/Sweeper.h"
#include "subsystems/Scoop.h"

void InitializeRobot()
{
  Scoop_Initialize();
  Grabber_Initialize();
}

void RunTankDrive()
{
  int deadband = 5;
  int YInput = -joystick.joy1_y1;
  int YInput2 = joystick.joy1_y2;

  if (abs(YInput) < deadband)
  {
    YInput = 0;
  }

  if (abs(YInput2) < deadband){
    YInput2 = 0;
  }

  //if either side has change of greater than 110 slow the change
  //used to combat voltage dropout due to quick speed changes
```

```
  if(abs(motor[LeftDrive_Motor] - YInput/1.27) > 110 || abs(motor[RightDrive_Motor] - YInput2/1.27) > 110)
  {
    //slow to current half speed
    motor[LeftDrive_Motor]  = motor[LeftDrive_Motor] / 2;
    motor[RightDrive_Motor] = motor[RightDrive_Motor] / 2;
    wait1Msec(10);
    //increase to half selected speed
    motor[LeftDrive_Motor]  = YInput/2.54;
    motor[RightDrive_Motor] = YInput2/2.54;
    wait1Msec(10);
  }

  motor[LeftDrive_Motor]  = YInput/1.27; //Divide the inputs to make them a range from 0 to 100
  motor[RightDrive_Motor] = YInput2/1.27;
}

void RunPopper()
{
  if ( toggleJoyBtn_RB.active ) //Arm up
  {
    Popper_Enable(100);

  }
  else
  {
    Popper_Stop();
  }
}

void RunSweeper()
{

  if(toggleJoyBtn_RT.active){
    Sweeper_RunIn();
     } else {
     Sweeper_Stop();
   }

}

void RunScissor()
{

   if(toggleJoyBtn_LT.pressed || toggleJoy2Btn_LT.pressed){
     Scissor_Down();
     } else if(toggleJoyBtn_LB.pressed || toggleJoy2Btn_LB.pressed){
     Scissor_Up();
     } else {
     Scissor_Stop();
   }
nxtDisplayTextLine(5,"povHat  %i",joystick.joy1_TopHat);
}

void RunGrabber(){
   if(toggleJoyBtn_Y.pressed)
   {
     Grabber_MoveUp();
   }
   else if (toggleJoyBtn_B.pressed)
   {
     Grabber_MoveDown();
   }
}
```

```
void Disable(){
Popper_Stop();
wait1Msec(50);
PlaySound(soundBeepBeep);
motor[LeftDrive_Motor] = 0;
motor[RightDrive_Motor] = 0;
Scissor_Stop();
}
//////////////////////////////
//                          //
//        Main task         //
//                          //
//////////////////////////////

task main()
{
  InitializeRobot();

  waitForStart();   // wait for start of tele-op phase
  JoystickUtils_Init();

  while (true)
  {
    // system Update Buttons and Joysticks
    getJoystickSettings(joystick);
    // custom joystick
    JoystickUtils_CheckAllToggles();

    if (!bDisconnected){
      RunTankDrive();
      RunPopper();

       RunSweeper();
       RunGrabber();
       RunScissor();
     }
     else {
       Disable();
     }
  }
}
```

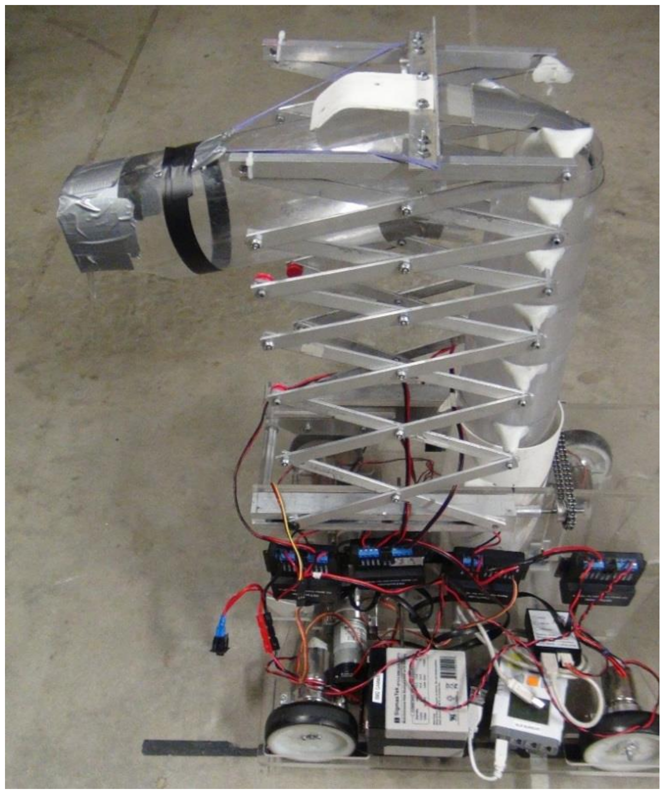
Figure 55 Code for Teleop

DATE:	START TIME:	STOP TIME:
January 28, 2015	5:00	9:00

TASKS	REFLECTIONS
Finish making the ball popper for the new plexiglass bot Josiah	Today Adam and I made the popper. First we made the popper supports. We made them using round metal rods that we used the lathe to cut the ends down to the right size. Then we drilled holes in the ends and tapped them. Afterwards, we made the two poodle bolts. We made them by using the lathe on long bolts to turn down some of the threads. Next, we had to make the second bat and file two of the holes on one of the gears to make it match the poodle bolts. Now all we had to do was assemble. We put the springs and bats onto the poodle bolts then finished assembling the popper. Now that it's done, we can assemble the new robot.

The Double Popper Mechanism

TASKS	REFLECTIONS
Assemble the Acrylic Robot Hannah F	We are updating the robot for Regional. The old robot (with wooden base and walls) made it difficult to see balls, so we are now using acrylic. First Hannah L, Coach Vince, Jacob, and I removed the components of the old robot, and then we transferred them to the new acrylic one.



New Acrylic Base

Assembling New Base

DATE:	START TIME:	STOP TIME:
January 31, 2015	9:00	4:00

TASKS	REFLECTIONS
CAD and render robot Jacob	I did all of the needed changes for now and rendered it.

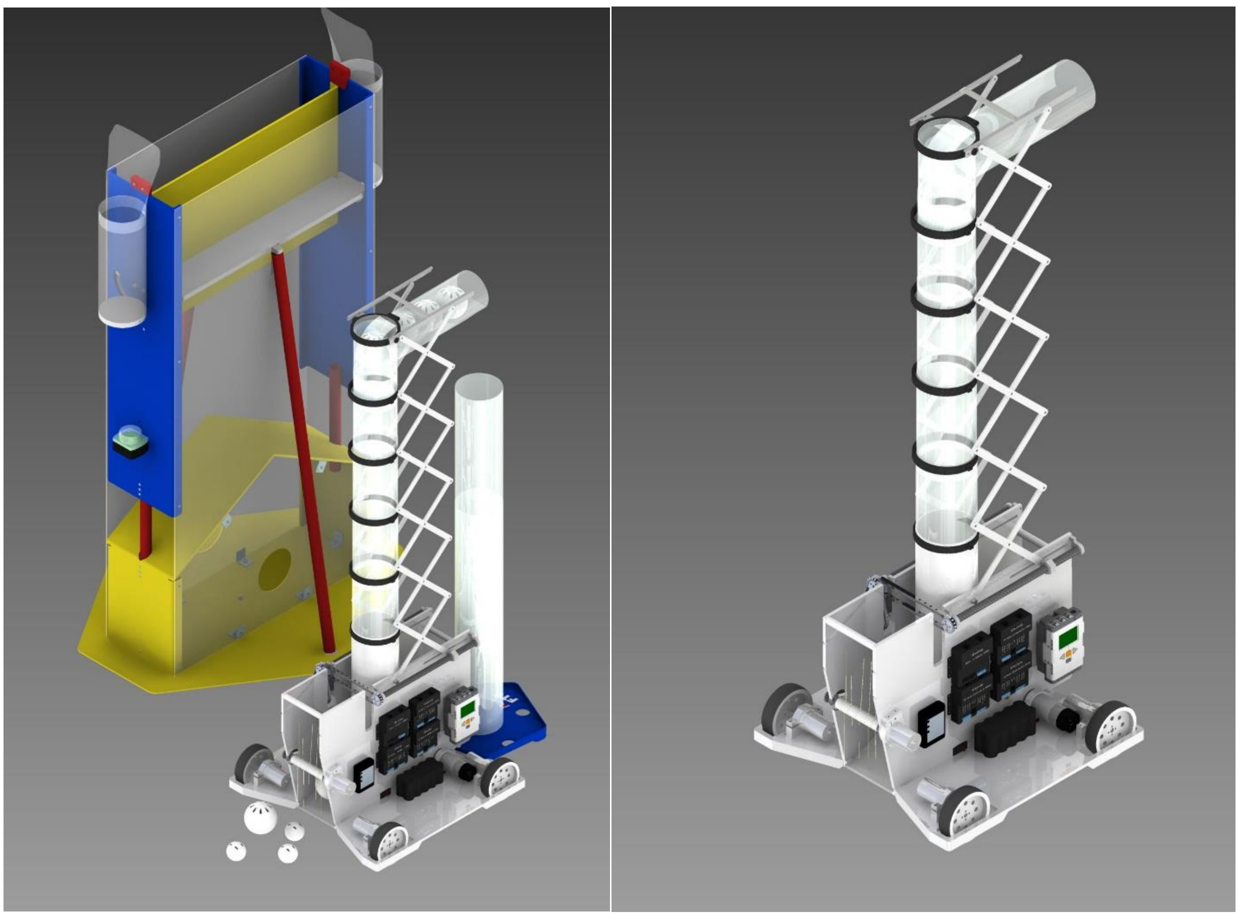


Figure 56 CAD/Popper Bot Render

4250

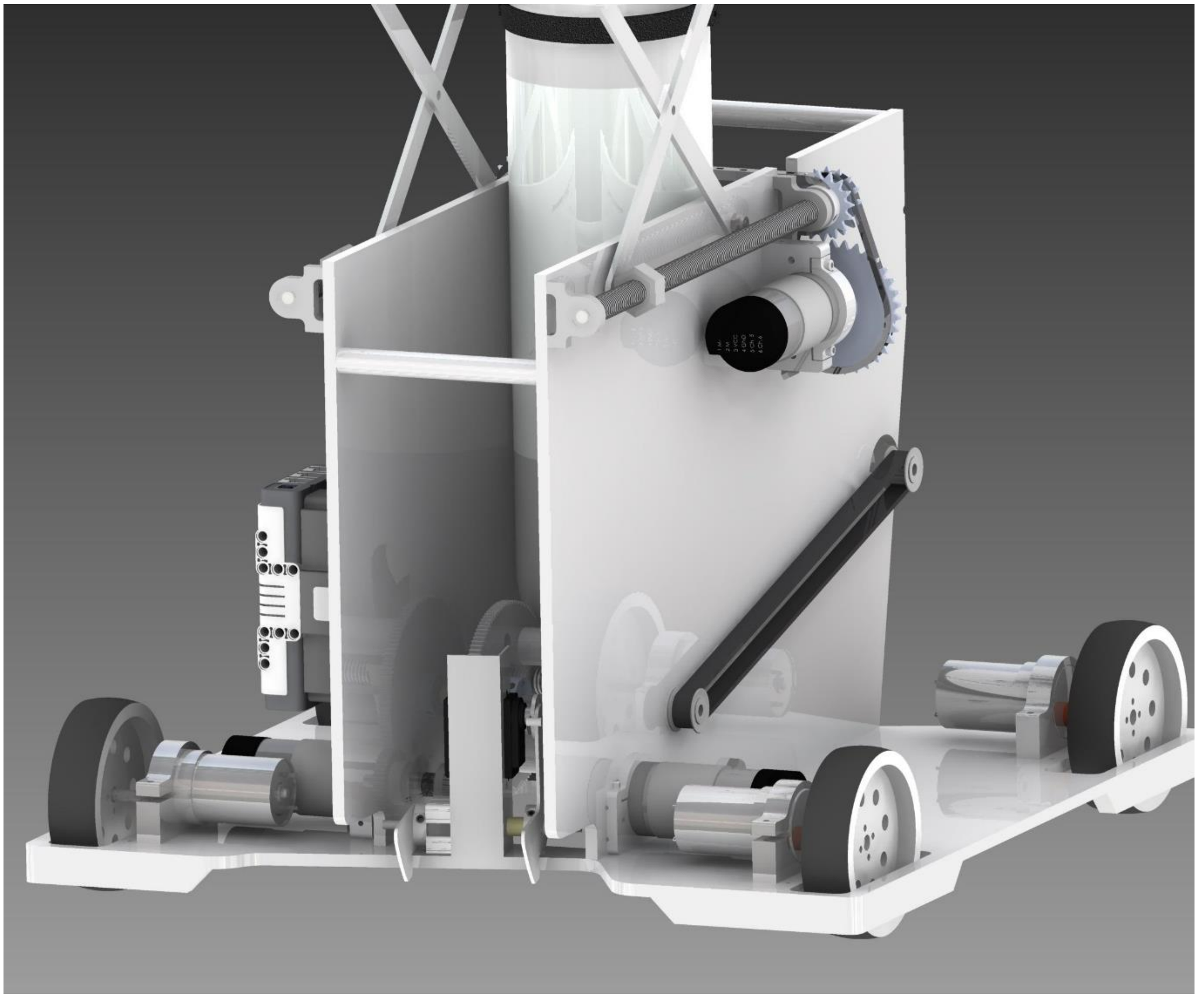
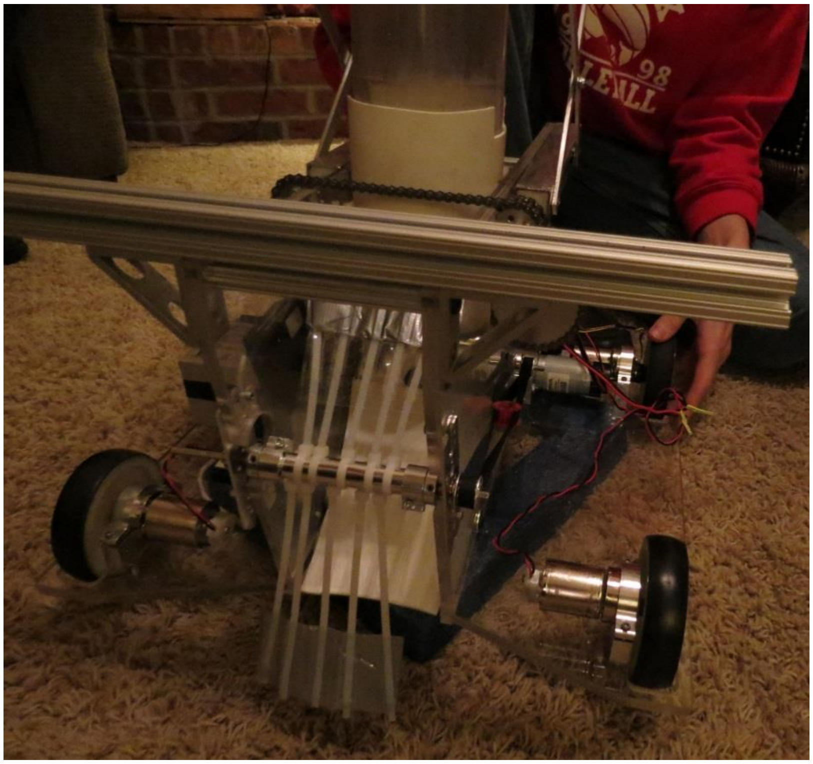


Figure 57 CAD/Popper Bot Base Render

TASKS	REFLECTIONS
Design new sweeper Adam	Once we had all of the popper bot's mechanisms attached to the new acrylic frame we started working on designing a better sweeper. At first we tried a piece of thin pvc, but it proved too rigid and would throw balls out of our intake. So next we tried to use a slightly refined version of the zip-tie sweeper. The zip-tie version worked great with single balls, but was unable to sweep in large groups. So we tried to get the best of both worlds by using a half zip-tie/half pvc sweeper. It worked to some extent, but the pvc was still too rigid. So we decided to try doing a full pvc sweeper, but with several cuts in it to weaken the pvc a bit.



Sweeper

TASKS	REFLECTIONS
Design the presentation boards Joel	Today Laurel and I designed the Team, Outreach, and Progression boards. I finished formatting the Progression board and prepared it for printing. Laurel started work on the Outreach board.

4250

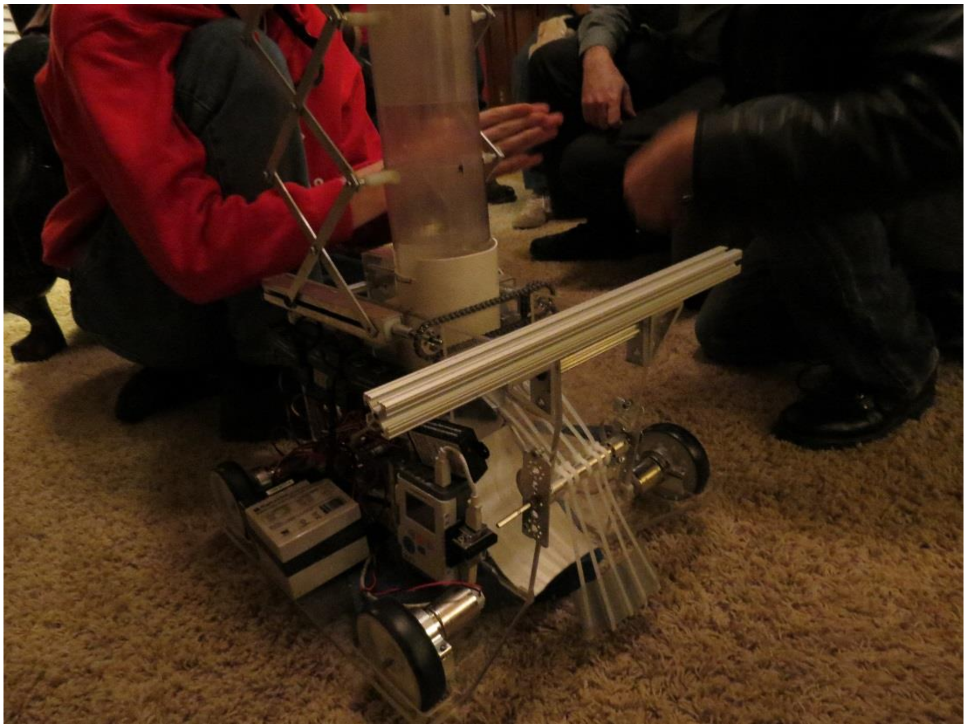
TASKS	REFLECTIONS
Design the candy awards and outreach award Lala	I got to make and design the candy awards! First, I searched for an origami take out box diagram online so I could make it to see how big it would be and if it could hold enough candy. After successfully cramming in a lot of candy into the newly stapled box, I went into photoshop to start customizing the outside to make it look like a star wars award with Yoda on the front. I also had the chance to help Joel make the Outreach presentation board. This involved lining up a lot of little people that symbolized mentors and students, to represent our growth through the years on the state of Oklahoma that we placed into the top left corner of the board and enlarged it to take up about a fourth of the board's space.

Origami Box for Team Awards

DATE:	START TIME:	STOP TIME:
February 2, 2015	6:30	9:00

TASKS	REFLECTIONS
Presentation Dress Rehearsal	Tonight we did a dress rehearsal for our presentation. We ran through the presentation twice, and decided it was satisfactory. Only small changes were made, because the competition was at the end of the week. We also worked on making 'force pops' which are small suckers, with little Jedi robes.
Acrylic Base	We will be taking our new acrylic base robot to the next competition.
Lucien	

Presentation Practice



New Acrylic Base

4250 4250

DATE:	START TIME:	STOP TIME:
Oklahoma Regional Championship February 6-7, 2015	2:00 February 6	6:00 February 7

TASKS	REFLECTIONS
Thomas	The competition went very well as it was the first time we were able to test out the acrylic base in a competition setting. Throughout the matches, my personal scores were around 320 points on average, and Julian's was around that same area, if not slightly higher. The team was able to walk away with Winning Alliance Captain, Rockwell Collins, and the Inspire Award, as well as a couple of others. Going to Super Regionals in San Antonio with us were Tech Hogs and Medusa, our picks for the finals, and Black Box.

TASKS	REFLECTIONS
Adam	The regional went well, but it pointed out a few glaring flaws in the robot. We need a much more consistent end game. We need to be able to pop 4 balls into our horizontal goal, and then raise it up and dump all 4 the moment the end game starts. Our goal grabber needs an overhaul. On multiple occasions, we lost match time due to the grabber releasing or not grabbing in the first place. Our sweeper actually did ok, still needs some minor tweaking, but overall it functioned as intended. Not everything was bad though, the robot

	didn't have a single break down the entire day, and we had no static issues whatsoever. Even though it wasn't at the level I was hoping for, the robot did perform consistently all day. There was one good thing I noticed though. When the drivers actually got into a large group of balls, and made sure not to knock them all away, the scoring rate went up tremendously, and it was fun to see how fast it could really score. Now we need to focus on being able to replicate situations like that. I think that with an instantaneous end game, better goal grabber and some minor tweaking we could start looking at filling up the medium rolling goal as well.

TASKS	REFLECTIONS
Biv	To start off, presentation went smoothly considering what happened. We'd prepared different team members to answer different questions, but nobody had anticipated that a judge would interrupt in the middle of the presentation with a vague, difficult question. Suddenly Eli had to find an answer on a subject that didn't easily pertain to his part of the presentation and wasn't explicitly reviewed beforehand. However rocky he may have sounded, he still made an effort to satisfy a facet of the judge's complex question. From there, other inquiries from the judges were handled well and the presentation continued until time ran out. I think the fact the judge interrupted and a rookie member stepped up to the plate without a script or preparation helped us far more than being able to finish our whole presentation. It was evidence that the students are involved in the team's goals and processes. As far as improvements go, it would probably be best to prepare for questions that are more spontaneous and have everyone know all the material in case they are called out to answer something they don't specialize in. The rest of the competition was rather easy going. I spent most of the time in the pit, being friendly to the other teams and offering Jedi pops and selfies whenever needed; and of course keeping a sharp eye out for judges. Sadly, there wasn't any time to discuss programming with them. Our team's story and the technical aspects of the popper bot filled up all the talking time. There's so much information, there's only room for the most important topics even in the pits. It must be hard for the judges to choose award winners with

	the small portions of info they can manage to get in the tiny window of time. For outreach outside of the pit, I walked around with Hannah and Eli handing out Jedi pops and the LIGHTSABERS wristbands. I took part in giving out the LIGHTSABERS awards to some of the teams. The awards are a very clever idea. Having a group of people all decked out in robes, masks, costumes and carrying a big flag to recognize and encourage others teams communicates a strong presence without arrogance and helps with outreach. The robot performance was completely consistent throughout all the matches. The scores weren't all that exciting, but there were moments when the popper bot's real potential shined. When there was a big cluster of balls, the double popper could send them up as fast as they came in. Half the high goal would be filled up in a matter of seconds. The sweeper just needs some improvement to increase the area of intake when balls are more scarce and spread out. Julian's autonomous impressed me throughout the day. It scored the ball 30% of the time and only missed when it was an inch off. The encoders are a much more reliable solution to turning than the finicky gyro. An autonomous that scores in the center goal and knocks the kickstand down doesn't seem too far off now.

TASKS	REFLECTIONS
Lala	The FTC Oklahoma Regional was super fun and went quite smoothly. All day Saturday, we were wandering the pits getting to know other teams, giving out the Jedi pops, presenting the teams with our mini awards, or cheering. Our team spirit was consistent with each match and proved to be a good way to give us a presence among the pits and the audience. I learned that cheering and over-all happiness at any competition pleases the judges more than I expected. We are now preparing for the Super Regional! We are creating an outreach board and I have to make one more mask for Julian!

TASKS	REFLECTIONS
Caleb	Regionals were the first time I got to try scouting and after I got the hang of it, I liked it. It's not my favorite thing to do at a competition but driving is hard to beat. The only thing I would change about scouting would be having another sheet of paper to cover the other

	slips that you are not filling out because I found myself starting to fill out the wrong one in the middle of a match.

TASKS	REFLECTIONS
Josiah	Scouting was different at Regionals than the qualifiers. This was due to the fact that there were about fifteen to twenty-five more robots competing. Also, there were specific robots we wanted to scout, not just our alliance partners. One particular robot I noticed, was consistent in the task they did and were a good candidate for an alliance partner in the finals. Although we did not pick them, the process helped us eventually pick the perfect teams for our alliance. At Super-Regionals, a change I think we should make is we need at least one more scout on the team and should scout more teams so we can be even more prepared for the finals.

TASKS	REFLECTIONS
Quinnlan	Jacob and I both wore Mandalorian armor so people would ask if they could take pictures with us. When our team was about to start a match we would run across the floor holding 4250.

TASKS	REFLECTIONS
Hannah F	I did some scouting and helped Olivia hand out Jedi pops and wristbands to other teams. I also helped give out our awards; that was fun and the teams really liked it.

TASKS	REFLECTIONS
Noah	I had a great time at regionals. I reached out to other teams and went out to the judges to ask if they would come to the pit so the team could explain our team. I learned even more with scouting and became a master at it.

TASKS	REFLECTIONS
Jacob	My favorite part of the Oklahoma Regional is that I got to wear my Mandalorian costume that I finished just the day before and loved taking pictures with people and connecting with other teams.

TASKS	REFLECTIONS
Elijah	My favorite part of regional was walking around, talking to other teams, learning about what they did through the season, and handing out our Jedi pops. I also loved cheering for our team and running with our flag.

TASKS	REFLECTIONS
Joel	Regionals was so much fun, and a massive success! I spent the weekend photographing the event, interviewing other teams, and telling judges all about our team!

TASKS	REFLECTIONS
Lucien	I really enjoy *FIRST* competitions. This years regional was very enjoyable, because our team was so large. I was not as pressed to do outreach or sit in the pit waiting for judges, due to our team size and was able to enjoy the competition more. I really enjoyed talking with other teams and seeing how their robot worked.

TASKS	REFLECTIONS
Julian	This competition was the first time our entire team pulled together into one team. We did extremely well in our presentation despite our low practice time. Our team went home undefeated from regionals, and I was even able to get the Oklahoma high score of 531.

TASKS	REFLECTIONS
Jason Hendricks	My tasks for this competition involved presentation, leading part of the team spirit, handing out our team spirit awards and pit duty. My

	favorite part of the day was either cheering for our team or handing out the awards. We have this really awesome cheer that I helped coordinate. When our team is announced before a match, we held up big signs of our team numbers and ran beside the field. It was difficult to get it all coordinated with the announcing at first but it got easier and more fun as the day went on. Before the competition, I worked with Laurel and we created some awards that we wanted to give to teams apart from the *FIRST* awards. Some of them were awards like "The Lando Calrissian Award" for the best team mascot! Handing those out was pretty awesome.

TASKS	REFLECTIONS
Hannah L.	The Regional was a lot of fun. Because of how many people we have on the team, it allowed each of us to really do our thing at the competition. Is previous years, I have always had to do several jobs. This year I could focus on driving. I know I had a lot of fun driving. As always, the competition was a blast. At the awards ceremonies I was nominated as a Dean's List Finalist I was really surprised and delighted! Going to Worlds as a Dean's List Finalist is something I am now looking forwards to.

4250

DATE:	START TIME:	STOP TIME:
February 9, 2015	6:30	9:00

TASKS	REFLECTIONS
Debriefing Regional Adam	The robot didn't have any major malfunctions, but it still needed improvement to the goal grabber and end game scoring method. When the robot would get into a large group of balls the scoring rate went up phenomenally. Now that I have seen what it can do, we just need to make it consistent.

TASKS	REFLECTIONS
Biv	This regional was successful and greatly contrasted previous regionals I'd been to. Rather than being a driver or a scouter, I got to stay at the pit to talk to judges and in turn got time to become more acquainted with other team members and the outreach process. The difficult presentation helped greatly with future scripts and speech presentation. The robot was beautiful and consistent, never breaking down. Hopefully things will go even smoother at Super Regional with the robot improvements and presentation tweaks.

TASKS	REFLECTIONS
Outreach Board Lala	Our design for this board has changed a lot from the beginning design that we had hoped would work. The first design idea was to have a big picture of Oklahoma in the top left corner. This would have little jedis on it to signify our growth from year to year. We couldn't fit all of our outreach categories around the Oklahoma so we were forced to temporarily store the state until further use. Now with a lot more space to work with, we began placing our information in groups and organizing it so it would look appealing on to board.

DATE:	START TIME:	STOP TIME:
February 10, 2015	9:00	11:00

TASKS	REFLECTIONS
Capitol day Hannah Liao	We took the Alpha FTC bot, the popper bot, and the FRC robot from last season to the capitol. We handed out slips of paper with the information people who wanted to join the teams would need to know, such as the Coach's email, the age groups of the levels if *FIRST,* and the type of experience one can get from each level. We answered any questions people had and demonstrated the robot. We would pass out balls from this year's game and have the kids feed the balls to the robots. We also shot the ball out of the FRC bot and had them catch it. Overall it was a lot of fun.

4250 **4250**

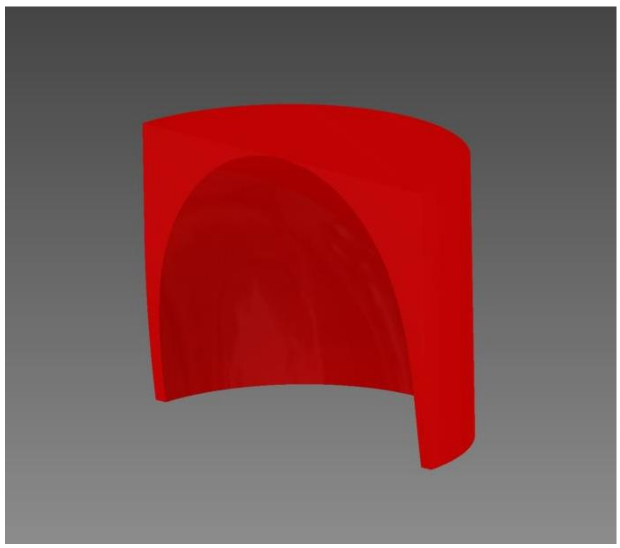
DATE:	START TIME:	STOP TIME:
February 13, 2015	6:30	9:00

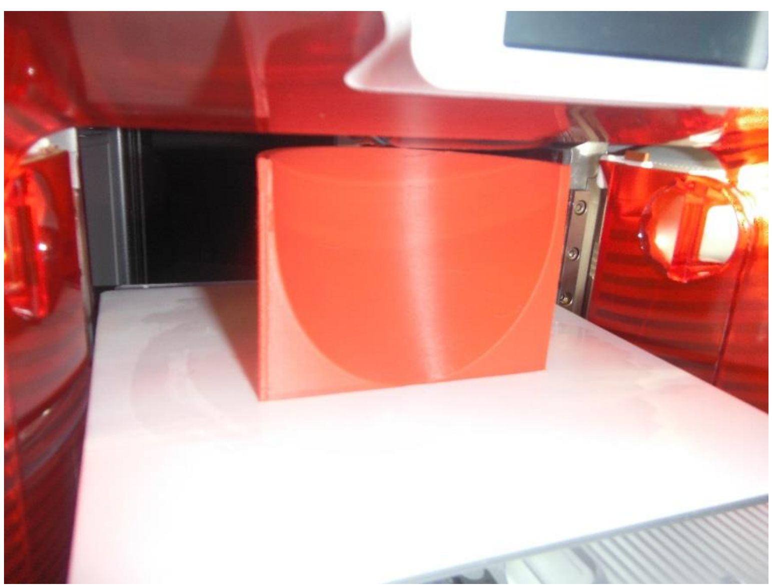
TASKS	REFLECTIONS
Display Boards Joel	Today I completed the work in Photoshop on the Team and One Force boards. This allows us to display our team's progress throughout the year in our presentation, and in our pit. I had some issues scaling the image resolution, but I solved it by turning the resolution up to 300 dpi. Lala and I also continued work on Outreach, and Robot.

TASKS	REFLECTIONS
Driving Thomas	I was given the field for the week to be able to practice and attempt to get my average up. Julian and Hannah Fowler came to my house on Saturday to drive as well. Throughout the few days that I had the robot, I was able to get my average up from 351 to 371, and Julian's went from 320 to 329. This was Hannah Fowler's first time to drive the popper bot and achieved an average of 242 in six matches. In total, I ran 17 matches, not including anywhere something went wrong. On Saturday, Hannah Fowler broke the goal grabber by accident due to the odd angle it required, and we put some duct tape on it to hold it for a time until I took the robot back to the Liao's. Overall, the driving practice was great as the three of us were able to test our skills and improve upon them, and point out any issues with the robot.

DATE:	START TIME:	STOP TIME:
February 16, 2015	6:30	9:00

TASKS	REFLECTIONS
CAD and 3D print the new 45 degree angle Jacob	I CADed and 3D printed a new 45 degree angle to make the balls that fly up the tube go down the horizontal tube.





CAD and 3D Print

TASKS	REFLECTIONS
Strength Assessments,Team Build Exercise Quinnlan	Tonight we briefly went over our STRENGTHSFINDER assessments. We talked about how each member needs to take ownership and know his or her part on the team. After that, we had a team build exercise. For this we split into teams of 4; 3 were blindfolded and the 1 who wasn't had to instruct the other 3 to finish a puzzle. Then we had ICE CREAM from the prior week.

DATE:	START TIME:	STOP TIME:
February 19, 2015	6:30	9:00

TASKS	REFLECTIONS
Presentation Goal Grabber Popper Broken Driving Hannah Liao	We started out with a meeting about what the team needs to work on before Super Regional. We all agreed the presentation needed to be made shorter, and fewer people talk. We also discussed the Goal Grabber. In some of the matches we've played in competition and in practice, we have lost the goal. Because of this, there has been some conflict about what is causing the robot to become disconnected form the goal. The Goal Grabber, the angle for the goal on the robot, and driver error are all reasons why it could be losing the goal. Since we don't have real data telling us why this happens, we have started recording our practice matches so we can review. We have also started doing this so the drivers can review matches and improve. After the meeting, I drove some matches with the robot, and was unable to get nearly as high of a score as I was. After inspecting the robot we discovered the popper springs were broken. We fixed the popper, and I drove a few matches to see if it worked. The robot performance was much better, and I was able to score 513 on my 2nd match. I didn't drive anymore than 2 matches after we fixed the popper because it was getting late. I sent out an email to all the drivers inviting them over tomorrow from 12:30 till 3:30.

TASKS	REFLECTIONS
Driving **Thomas** **Hannah F.** **Julian**	**The following are driving scores for Feb. 12, 13, 14, and 18.**

DATE	DRIVER	HIGH	MED	LOW	CENTER	BALL POINTS	ROBOT OFF	GOALS OFF	GOALS PARKED	TOTAL	DAILY AVG	ISSUES
2/12/2015	Thomas	87	0	0	8	309	No	0	1	319		
2/12/2015	Thomas	86	0	0	0	258	No	2	1	328		
2/12/2015	Thomas	87	0	0	15	351	No	2	1	421		
2/12/2015	Thomas	87	0	0	0	261	No	3	0	351	355	
2/13/2015	Thomas	75	0	0	8	273	No	2	1	343		
2/13/2015	Thomas	81	0	0	0	243	No	2	1	313		
2/13/2015	Thomas	87	0	0	8	309	No	3	0	399		
2/13/2015	Thomas	76	0	0	8	276	No	2	1	346	350	
2/14/2015	Thomas	86	0	0	8	306	No	2	1	376		
2/14/2015	Thomas	87	0	0	0	261	No	3	0	351		
2/14/2015	Thomas	81	0	0	8	291	No	3	0	381		
2/14/2015	Thomas	63	0	0	5	219	No	2	0	279		
2/14/2015	Thomas	87	0	0	14	345	No	2	1	415		
2/14/2015	Thomas	87	0	0	8	309	No	3	0	399		
2/14/2015	Thomas	87	0	0	8	309	No	3	0	399	371	
2/18/2015	Thomas	56	0	0	0	168	No	2	1	238		
2/18/2015	Thomas	87	0	0	0	261	No	2	1	331	285	

DATE	DRIVER	HIGH	MED	LOW	CENTER	BALL POINTS	ROBOT OFF	GOALS OFF	GOALS PARKED	TOTAL	NIGHT AVG	ISSUES
2/14/2015	Hannah F	80	0	0	8	288	No	0	1	298		
2/14/2015	Hannah F	76	0	0	0	228	No	2	1	298		
2/14/2015	Hannah F	48	0	0	0	144	Yes	3	0	264		
2/14/2015	Hannah F	63	0	0	8	237	No	2	0	297		
2/14/2015	Hannah F	9	0	0	11	93	No	1	0	123		
2/14/2015	Hannah F	37	0	0	0	111	No	2	0	171	242	

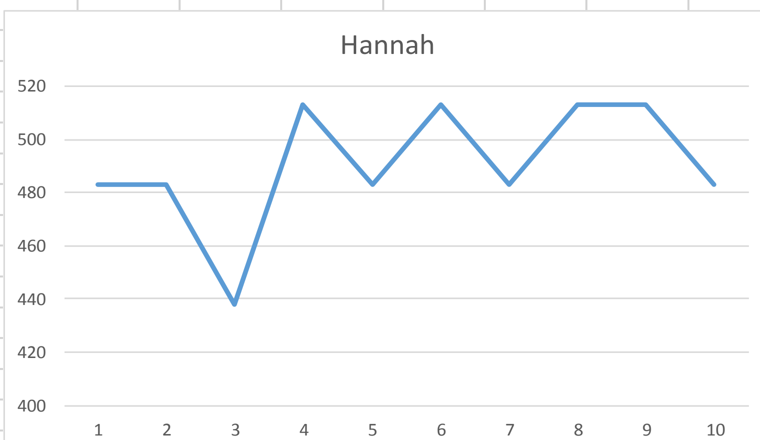
DATE	DRIVER	HIGH	MED	LOW	CENTER	BALL POINTS	ROBOT OFF	GOALS OFF	GOALS PARKED	TOTAL	DAILY AVG	ISSUES
2/14/2015	Julian	82	0	0	8	294	No	1	0	324		
2/14/2015	Julian	53	0	0	8	207	No	3	0	297		
2/14/2015	Julian	63	0	0	21	315	Yes	1	0	375	332	

4250 | 4250

DATE:	START TIME:	STOP TIME:
February 20, 2015	12:30pm	3:30pm

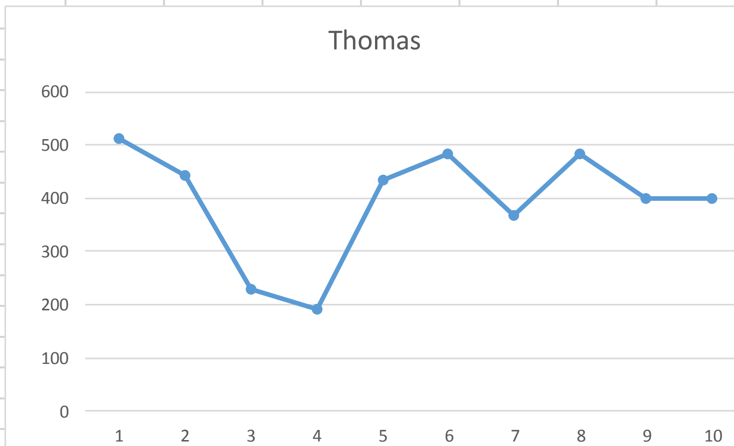
TASKS	REFLECTIONS
Driving Thomas	Caleb, Hannah Liao, and myself, got together today to get in driving practice with the popper bot to achieve a higher score. Each of us ran ten matches to get a higher average and to find any issues in driving strategy or in the robot before Super Regional. After the ten matches, Caleb's average was 330, mine was 394, and Hannah's was 491. This was Caleb's first time driving that I have recorded on the popper bot, and my average jumped up from the previous average of 371.

2/20/2015	Hannah	H RG	M RG	S RG	Center Go	Off Groun	The Big P	Total
Match 1		261	0	0	132	90	0	483
Match 2		261	0	0	132	90	0	483
Match 3		258	0	0	90	90	0	438
Match 4		261	0	0	162	90	0	513
Match 5		261	0	0	132	90	0	483
Match 6		261	0	0	162	90	0	513
Match 7		261	0	0	132	90	0	483
Match 8		261	0	0	162	90	0	513
Match 9		261	0	0	162	90	0	513
Match 10		261	0	0	132	90	0	483
								490.5

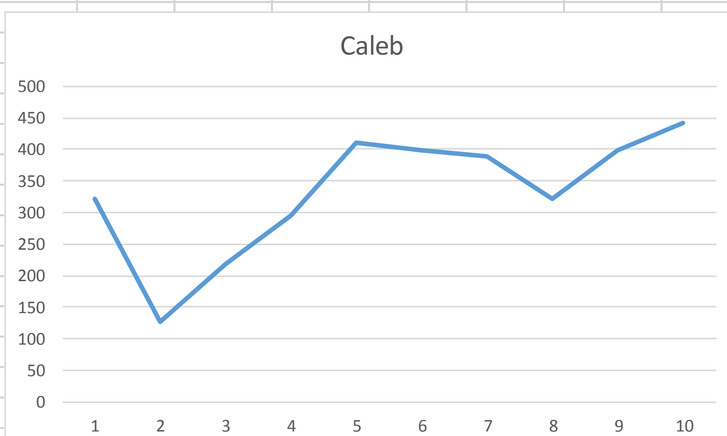


4250 **4250**

2/20/2015	Thomas	H RG	M RG	S RG	Center Go	Off Groun	The Big P	Total
Match 1		261			162	90		513
Match 2	touching t	261	0	0	132	90	-40	443
Match 3	knocked o	258	0	0	0	60	-90	228
Match 4		0	0	0	132	60	0	192
Match 5	knoked ov	261	0	0	132	90	-50	433
Match 6		261	0	0	162	60	0	483
Match 7		261	0	0	48	60	0	369
Match 8		261	0	0	132	90	0	483
Match 9		261	0	0	48	90	0	399
Match 10		261	0	0	48	90	0	399
								394.2

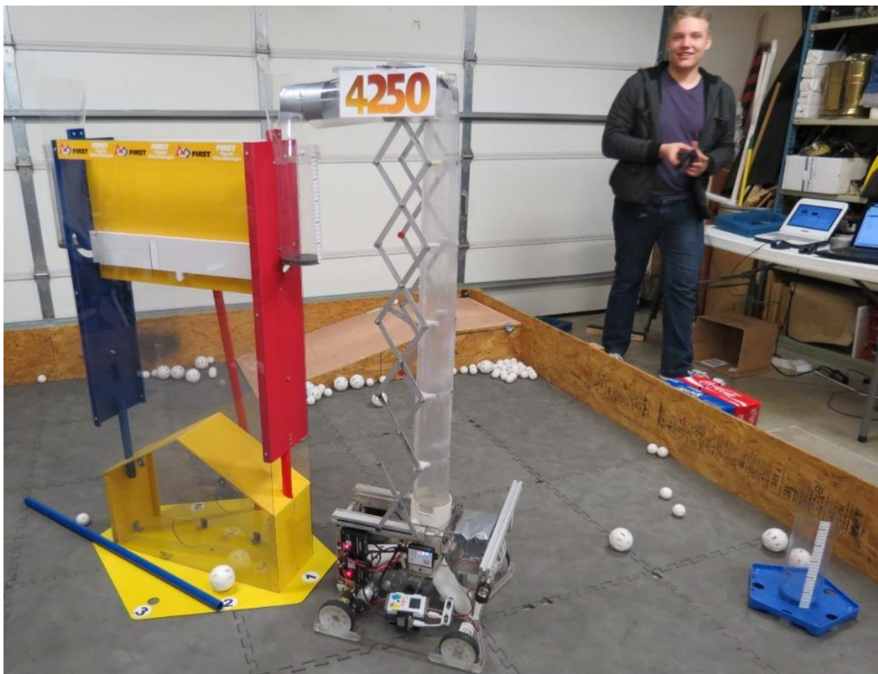


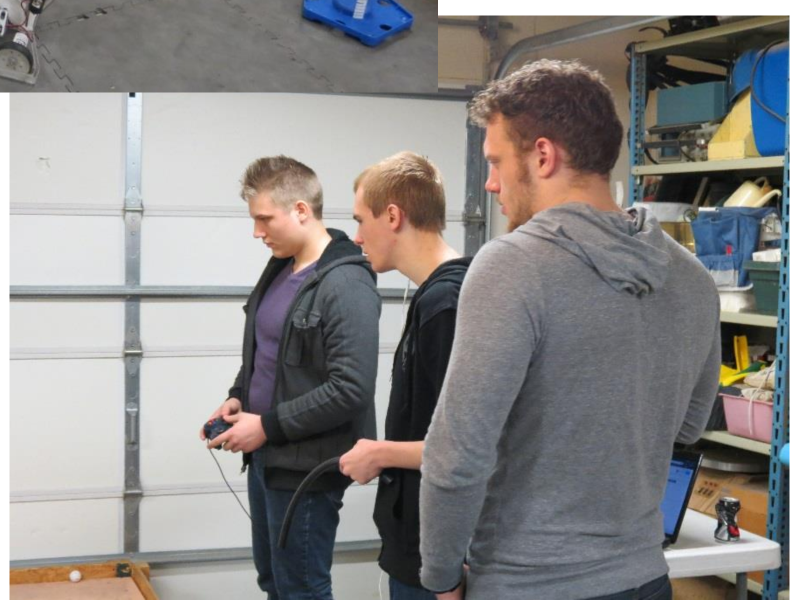
2/20/2015	Caleb	H RG	M RG	S RG	Center Go	Off Groun	The Big P	Total
Match 1		261			0	60	0	321
Match 2		126	0	0	0	0	0	126
Match 3		171	0	0	48	0	0	219
Match 4		204	0	0	90	0	0	294
Match 5		261	0	0	90	60	0	411
Match 6		261	0	0	48	90	0	399
Match 7		240	0	0	90	60	0	390
Match 8		261	0	0	0	60	0	321
Match 9		261	0	0	48	90	0	399
Match 10		261	0	0	90	90	0	441
								332.1



DATE:	START TIME:	STOP TIME:
February 21, 2015	9:00am	2:00pm

TASKS	REFLECTIONS
Driving Julian	Today we started driving at about nine a clock. We had Jacob, Julian, Hannah. F, Hannah.L, and Caleb driving. With the improved popper mechanism and extended drive time, we are all able to score above 471 consistently. Our goal is 543, but we're not quite there yet.





4250 **LIGHTSABERS** 4250

DATE:	START TIME:	STOP TIME:
February 22, 2015	9:00 (from day before)	2:00

TASKS	REFLECTIONS
Driving Hannah Liao	Yesterday I came up with a new strategy that allows you to get 657 points. I take the 90cm tube and fill it up, then push it and the 30cm onto the ramp. I then take the medium goal to the parking zone and score as much as I can before 40 seconds. After 40 seconds I gather 4 balls and after we pass 30 seconds, score in the center goal. If there is time left over, I try to fill up the medium goal more, and take it and the robot to the ramp Today I started driving with that strategy. It took a few matches to get warmed up and to get used to this harder way of driving. I was able to get 657 several times. Since we added Adam and Jacob's new tube that holds 4 big balls it has made scoring in the center goal so much easier and much less time consuming, allowing me to score in the medium goal.

4250 **4250**

DATE:	START TIME:	STOP TIME:
February 26, 2015	5:30	9:00

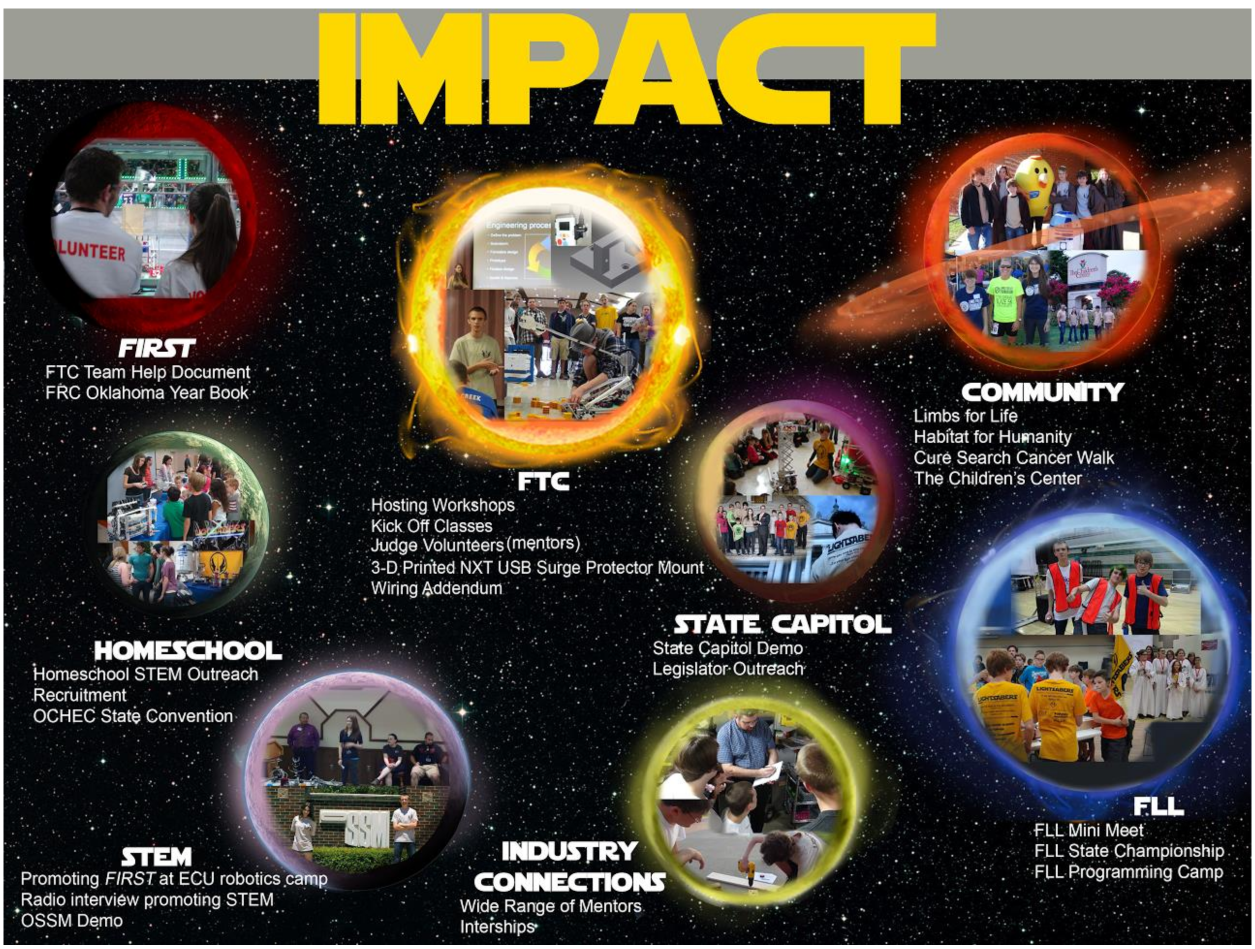
TASKS	REFLECTIONS

Presentation-Robot Hannah	Adam and I were tasked with doing the robot part of the presentation. We came up with an outline and decided who would say what. Here is our outline:
	
	• Sweeper – Adam Our sweeper intakes both large and small balls and places them into our ball chamber
	• Popper – Adam The popper then rotates around and loads one of its bats against this bolt, the popper then launches the ball into our telescope
	  o Continuous score our robot is designed to score the balls so quickly that we never are holding more than 5.
	• 3d Printed angle - Hannah
	  o Redirects the balls
	• Endgame chamber - Hannah
	  o Foldy thingy - hold 3 balls
	• Goal grabber - Hannah
	  o Angle – consistent orientation
	
	• Pro Strat
	  o Grab goal and kickstand– Hannah
	    ▪ In auto
	  o Fill 90 – Adam Once telescope starts we grab the 90 cm goal and fill it.
	  o Small and tall on ramp – Adam once it has been filled we push it and the small goal up on the ramp
	▪ Medium if time if time permits then we start filling the medium goal as well
	• Parking zone at the 40 second mark we leave the goal in the parking zone.
	  o INSTA CENTA – Hannah - get ready to score center goal at 35 sec
	    ▪ Finish Medium scoring
	    ▪ Parking zone or ramp

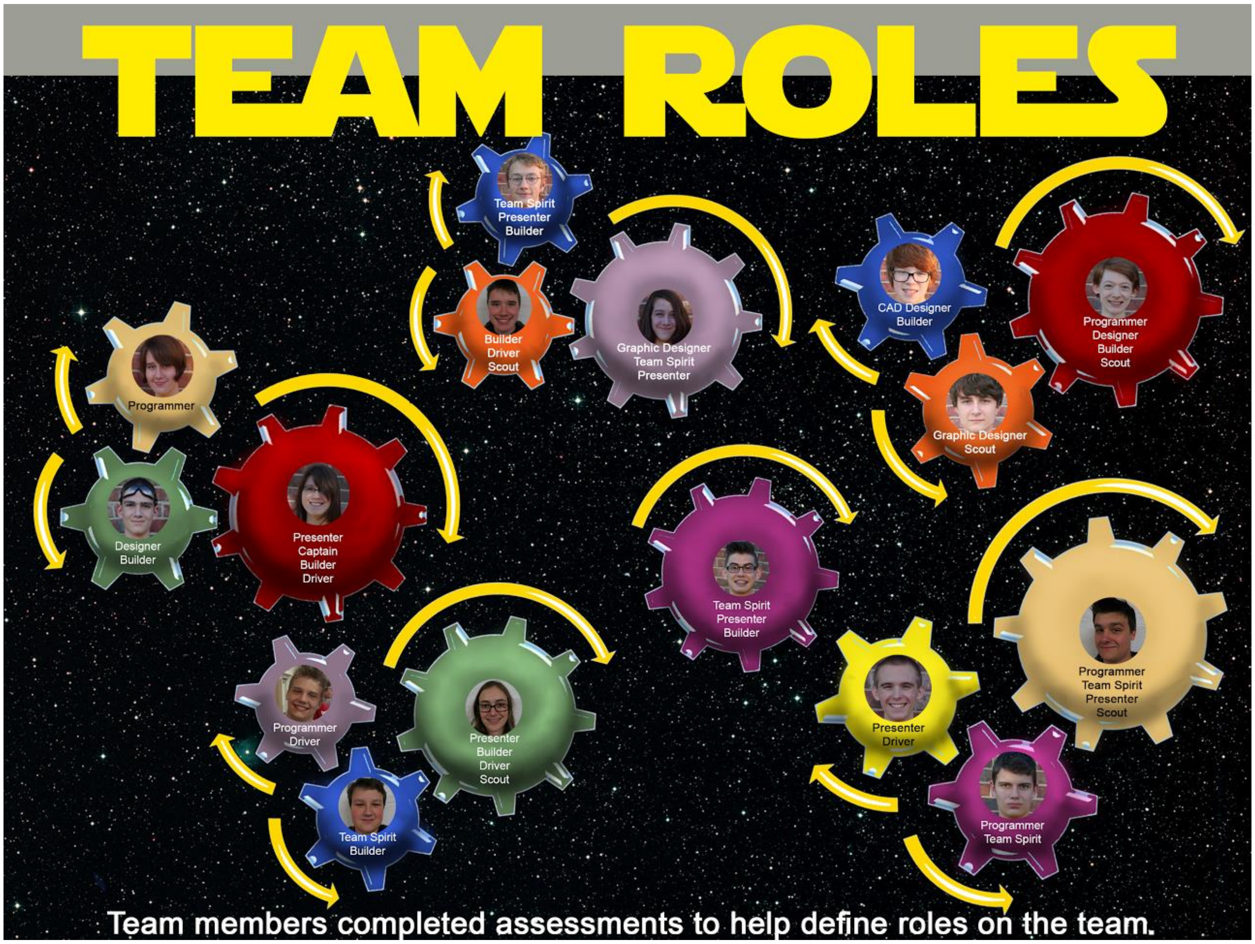
4250 LIGHTSABERS 4250

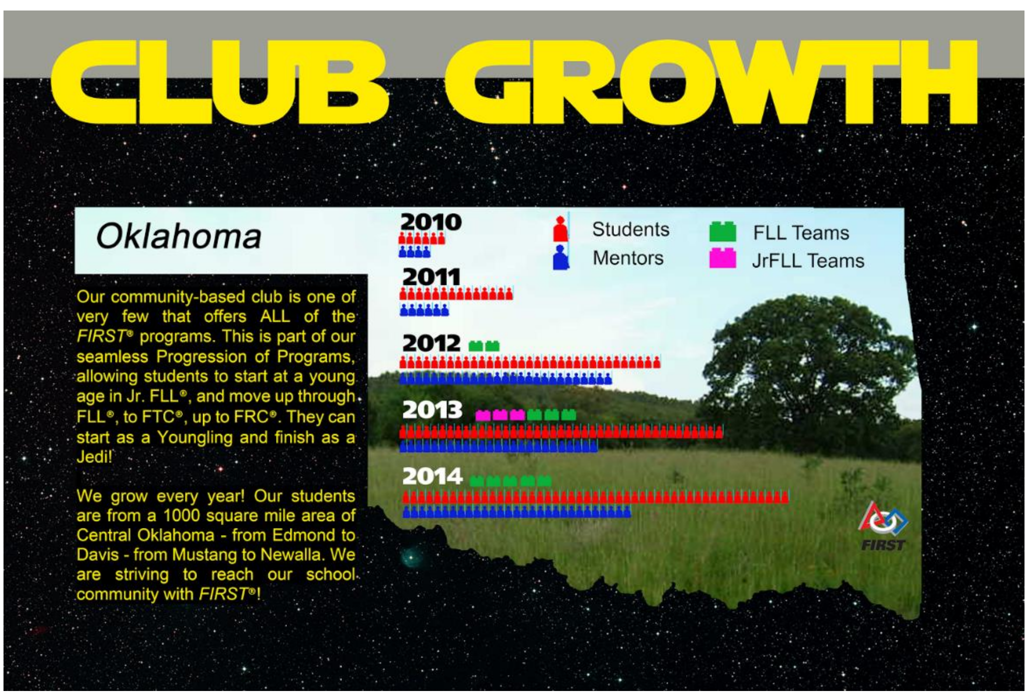
DATE:	START TIME:	STOP TIME:
March 2, 2015	6:30	9:00

TASKS	REFLECTIONS
Boards Lala	We needed boards to communicate our teams planning and growth for the season. To design these boards we organized our information on each board into these categories: Impact, Team Roles, and Club growth. Starting to put these boards together we wanted to keep our LIGHTSABERS theme and started experimenting with different ideas for the lay out. Using Photoshop Elements 13 was fun and I learned a lot of handy tricks from my teammate Joel Fowler.



4250 LIGHTSABERS 4250





4250 LIGHTSABERS 4250

DATE:	START TIME:	STOP TIME:
March 5, 2015	6:30	9:00

TASKS	REFLECTIONS
Presentation Hannah Liao	Presentation for Super-Regional Blue text are items to bring Olivia: [Notebook & Control Award] Hannah: [Hand trifold to judges] We are team 4250, the Lightsabers.We have a 5 min presentation that is divided into 3 sections - Robot, Team, and Impact. We will pause for questions after each section if that is OK. Adam: Early on… Our sweeper intakes both large and small balls why and places them into our ball chamber. The popper then rotates around and loads one of its bats against this bolt, the popper what makes it an exceptional manipulator then launches the ball into our telescope. why scissor lift and telescope vs something else Continuous score our robot is designed to score the balls so quickly that we never are holding more than 5. Hannah: 3d Printed angle Redirects the balls - CAD - "In fact, we CADed our complete robot which facilitated the laser cutting of our base. We have a handout to show how much we did with CAD." Jacob: *[displaying CAD]* Horizontal tube - hold 3 balls · to quickly score balls in 120mm goal.Goal grabber - Angle – consistent orientation Caleb: *[DEMO Robot with balls and goals]* Strategy - In auto - score ball goal and kickstand Adam: Once telescope starts we grab the 90 cm goal and fill it ALL THE WAY UP. Once it has been filled we push it and the small goal up on the ramp. If time permits then we start filling the medium goal as well. At the 40 second mark we leave the goal in the parking zone. Hannah: - get ready to score center goal at 35 sec. Finish Medium scoring. Parking zone or ramp.We ran stats on multiple parts of our

process. We studied our Autonomous program scoring after running it XXX times. We found that it was XX% accurate. We tuned it and began to score XX% higher. We also studied our TeleOp scoring to see our weaknesses and better develop our skills.
[hand out score sheets]
Do you have any questions about the Robot before we continue on to our presentation about the TEAM?

Team - Laurel & Elliott[right side of room]
Lucien: Roles board [left]
Q: One Force board [right behind L&E]

E: We would like to continue our presentation talking about our team.
E: We had a different approach this year in the way we developed/setup the team. We did this in three stages: Individual Assessment testing, splitting into Multiple teams, and merging back again.

L: Individual assessment testing allowed us to place members where they best fit. 4 assessments testing through Gallup strengthsfinder and O*net Interest profiling. From there, we placed them on one of the three Lightsaber teams, Alpha, Beta, Gamma. This process realized the highest potential of each student and team to develop our best FTC World team.
Josiah: [Assessment Notebook]

E: Dividing the team was not a permanent setup (reword?). We merged as one team at the Oklahoma Regional, every member now comfortable and developed in their roles. We are now a stronger, better team with every individual offering strong contribution to the team.

L: For example, one of my team roles is Spirit [refer to board] Also we want to bring the party to FIRST through hand crafted masks, costumes, and cheering our loudest for our team and others. As an example of what we are doing to encourage other teams we have designed and are giving away mini awards for things like best costume or coolest robot. We have a few to share with you as a thank you for volunteering your time.
Noah: [pass out favors]

L: Do you have any questions about the Robot before we continue on to our presentation about the TEAM'S IMPACT?

Impact - Hannah F & Thomas[left side of room]
Julian: Impact board [right]
Joel: Growth board [left behind H&T]
[Wiring doc on cart]
Thomas: If you have no more questions, we're going to talk about our Team's Impact.

Hannah F: The LIGHTSABERS recognize that impact is important to the success of our team. In order for our team to succeed, we actively seek out new members and engineering mentors. To complete this, we have visited a number of events to spread FIRST and STEM throughout our community.

Thomas: For example, our team has visited the OCHEC Homeschool Convention and a number of homeschool co-ops. In addition, we have demonstrated our robot at the Capitol and presented our Lieutenant Governor Todd Lamb with one of our awards. We also presented at the Oklahoma School of Science and Mathematics and helped with Habitat for Humanity.

Hannah: Thanks to the outreach we did, we have been able to create five new FLL teams and four of us have moved up from FLL to FTC this year alone. To assist those FLL teams, we have hosted an FLL Mini Meet for those teams, and volunteered at the FLL State Championship.

Thomas: We also seek out mentors and opportunities in engineering and have a variety of mentors from various areas in engineering, as well as a number of us have interned with Oklahoma Robotics.

Hannah: The Lightsabers plan on being a force in FTC for years to come. In order to fund our team, each student had the responsibility to secure sponsors. Aside from student dues, the largest portion of our budget came from developing new business partnerships.
[Sponsor board on cart]

	Thomas: That’s the end of our presentation, do you have any questions on our section or any other questions for our team? Hannah L. [when leaving] Please come by our pit, we have so much more to share with you.

4250 LIGHTSABERS 4250

DATE:	START TIME:	STOP TIME:
March 11-13, 2015 Super-Regional San Antonio	5:00 Wednesday	6:00 Friday

San Antonio Super-Regional

TASKS	REFLECTIONS
Driving Team's Experience and Award Ceremonies **Hannah Liao**	The first day we set up the pit and practiced the presentation before giving our presentation to the judges. I think the presentation went well. After that, Biv and I got the robot inspected. The next day I arrived before most people to the pits. I drove the robot around to make sure everything worked. I couldn't play practice matches because the practice fields didn't have any balls. Then I went back to the team pit and checked the robot thoroughly. Not long after I started going over the robot, everyone else from the team arrived. I tried to drive on the practice fields they had with Julian and Thomas but the Wi-Fi was inconsistent and laggy. Thomas was sick that day so Julian and I drove the matches. The first day went well, and we only lost 1 match. Over all, it was a fun day. The 2nd day Thomas was feeling better so Thomas and I drove the matches. We lost our last match of the day and placed 4th in our division. In the alliance selections, we were 1st pick by the 3rd ranked

	team, the Technowarriors. We were excited to be in the Semi Finals, however, we didn't make it past the Semi Finals. I believe we made several mistakes that caused us to lose the Semi Finals. I think our first mistake was playing a different strategy than we had been all day. In the Semi Finals, we were running our defensive auto. The issue with this is it takes us away from the goal, and by the time we get over to it there are no more balls and our drivers are not very practiced in that strategy. The other issue with us playing our defense auto is that it is a strategy to play only if you are the weaker robot, and by our scouting, we were the stronger robot. The final issue to me was a lack of leadership. The alliance felt very thrown together to me, and there was hardly any communication between the alliance captain team and their picks. Sadly, I think these things caused us to lose and that things could have gone very differently. At the end of the day, this shows me again the importance of us picking instead of being picked, for us to do what we know we can do, and how critical it is that you don't lose a single match. At the awards ceremonies we were surprised and delighted to get the Think Award! This gave us a ticket to worlds. We were thrilled. Overall, it was a blast to compete in the San Antonio Super Regional again this year.

TASKS	REFLECTIONS
Robot Assessment Adam	On the first day of the regional, our horizontal tube was having trouble fully extending. Luckily, all we had to do was tweak the servo's arm positioning and make the locking hole slightly larger. Once that was out of the way, we were ready for the qualification matches. The robot performed well in the first match, with no major problems to speak of. We still ended up losing the match though, mainly due to a communication error. As we played a few more matches, I realized that our autonomous was going to need some work done on it. On one of our later matches, we only managed to score three balls in the 90 cm rolling goal the entire match. This was due to it taking nearly a minute for the goal grabber to latch. So our goal grabber definitely needs some work as well. An interesting thing about all the matches involving decent robots is that all the large balls have already been scored by the 1-minute mark, and since most

robots are designed to only pick up the large balls, their scoring rate drops drastically once the large balls are gone. Our robot however, can still score the small balls. Granted we are not very efficient, but I hope to capitalize on this advantage with a better sweeper design in the future. We did not compete during the first semifinal match, but our alliance still won it. The next match took a turn for the worse though. We wasted an enormous amount of time trying to latch on to the goal, and when we finally did, it was too late, and so we lost that match. On our final match, the cascade had already occurred when we made it over to the rolling goals, so there were balls everywhere. Normally, this would not be a problem, but since our grabber relies on shoving the goal into the wall to get a good latch, we ended up shoving the goal on top of several small balls in the corner. Once the goal was on top of the balls our grabber could no longer attach, so we ended up spending most of the rest of the match just trying to latch onto the goal. So our first priority is to fix the goal grabber, update autonomous, and maybe even change the sweeper and speed up the popper.

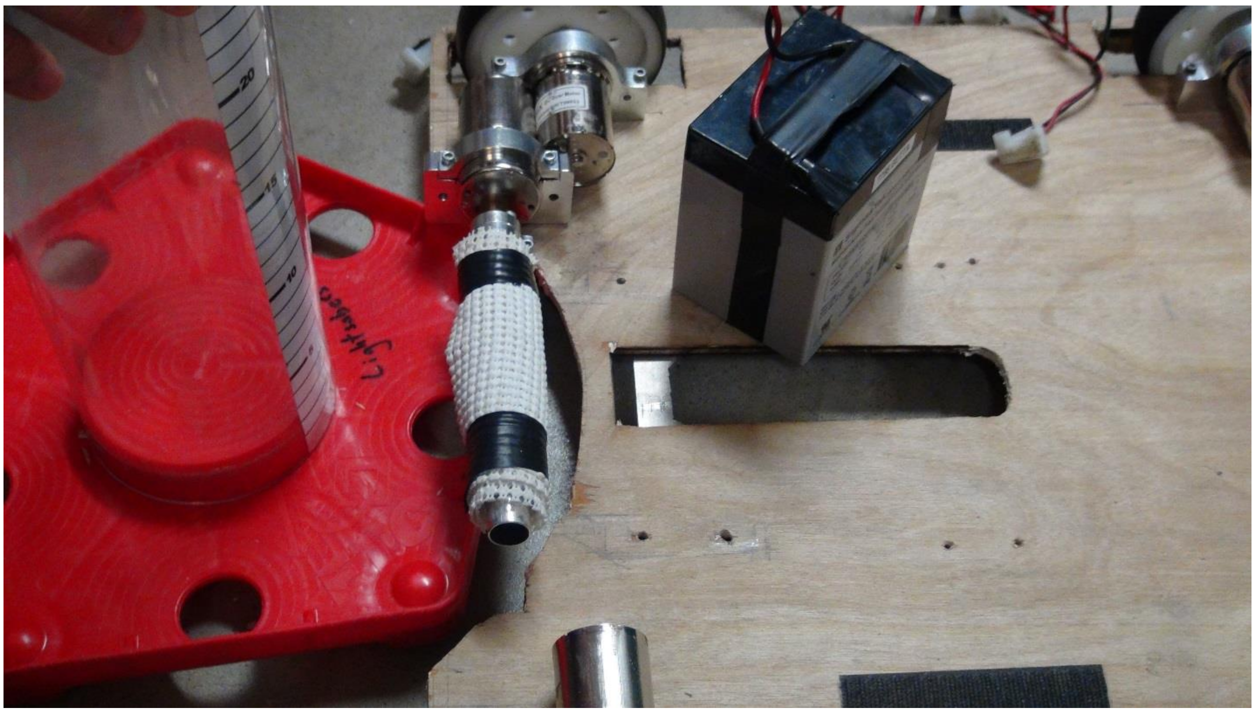
DATE:	START TIME:	STOP TIME:
March 24, 2015	6:30	9:00

TASKS	REFLECTIONS
Biv Programming	At Super-Regional, the autonomous was having problems with accuracy, so Matthew, Xavier and I decided on using the sonar to be able to detect the position of the highest rolling goal. We started by running the sonar reader program and seeing the different values it returns when the goal is at varying distances. In the code, once the robot is approximately in front of the high rolling goal the robot turns left for one second and then right until the sonar detects the goal within a minimum and maximum distance. A “while true” loop is used for the sonar scanning and breaks once the current sonar read value makes it within a certain threshold. Also, we added a bit of time for the motors to keep moving after it sees the goal since the sonar catches the edge of the goal and the robot would move to the goal before it was centered on it. However, we encountered a problem with the sonar seeing the wall rather than the goal. We tilted the sonar at an upwards angle, tweaked the sonar thresholds and then tested it. The only time it still sees the wall now is in odd situations when the goal is not there or is too far off. Though the sonar is not completely accurate, it gets the robot in the ballpark. With the improved goal grabber, autonomous should not be a problem.

```
int LastSonarRead = SensorValue[Sonar_Sensor];
int MaxDistance = 40;
int MinDistance = 15;
int LoopCount = 0;
int GrabThreshold = 12;
int CurrentSonarRead = 0;

clearTimer(T1);
//use sonar to center with goal
while(true) {
  CurrentSonarRead = SensorValue[Sonar_Sensor];
  //int SonarDifference = abs(CurrentSonarRead - LastSonarRead);
  if(time1[T1] < 1000) {
    motor[LeftDrive_Motor]= -20;
    motor[RightDrive_Motor] = 20;
    }else {
    motor[LeftDrive_Motor]= 20;
    motor[RightDrive_Motor] = -20;
  };

  if(CurrentSonarRead < MaxDistance && CurrentSonarRead > MinDistance) {
    //if(SonarDifference > SonarThreshold) {
    PLaySound(soundDownwardTones);
    if(LoopCount > 20) {
      wait1Msec(500);
    }
    else {
      PlaySound(soundException);
    };
    motor[LeftDrive_Motor] = 0;
    motor[RightDrive_Motor] = 0;
    break;
    //  };
  };

   LastSonarRead = CurrentSonarRead;
   nxtDisplayBigTextLine(3,"%i",CurrentSonarRead);
   wait1Msec(10);
   LoopCount++;

 };



 // Backup to 90cm goal
 Grabber_MoveDown();
 DriveInches(-46,80);
 Scissor_Down();
 wait1Msec(500);
 Scissor_Stop();
 Plug_Open();

 // Pop ball
 Sweeper_RunIn();
 Popper_Enable();
 wait1Msec(3000);
 Popper_Stop();
 Sweeper_Stop();

 // Forward to see if goal is latched
 DriveInches(6,80);

 wait1Msec(1000);
```

Figure 58 Two Goal Auto with Sonar

TASKS	REFLECTIONS
Prototyping New Goal Grabber Adam	We saw a robot with a very convenient goal grabber at Super-Regionals built by team 4211. It was a padded roller that could intake the goal from any angle. We decided to use a similar design. We started by making a semi-circle cut out from our wooden robot's base. We prototyped a roller using a wooden rod and some shelf liner padding. As long as enough pressure was applied to the roller, then it had no problems intaking the goal. Now all we had to do was actually attach it and power it.



New Goal Grabber Prototype

4250

DATE:	START TIME:	STOP TIME:
March 31, 2015	6:30	9:15

TASKS	REFLECTIONS
Biv Programming	Our goal this meeting was to add a parking goal section to autonomous. We wanted to have the robot take the goal back to the parking zone if the goal was securely grabbed. Before the field was set up I wrote a rough draft of the code that after running into the goal and popping the ball, it checks to see if the current sonar read is below a specified threshold to see if we have grabbed the goal. If it is below, it goes ahead and scores the goal in the parking zone, if not it ends autonomous so that we don't head all the way back to the parking zone with no goal. Matt and I set up the field and ran the sonar reader program to determine the grab threshold in the code. When we ran autonomous it detected if we had the goal very consistently, but sometimes if we had only partially grabbed the goal it would still count it as being fully grabbed. That can be a problem if the goal happens to come off while the robot is heading to the parking zone and the robot continues getting farther from the goal. So Matt had the idea of adding another drive-inches function that uses the sonar to constantly check if the goal is still grabbed during driving. The function has a Boolean that's set to true while the goal is grabbed and false if it's not and returns the value of the boolean. When calling the function, you just ask if that Boolean is true and the drive inches will run while it's true. Now our autonomous drives down from the ramp, scores in the medium goal, drives toward the high goal, scans for the high goal's position and then scores in the high goal. If the goal is grabbed it then takes it back to the parking zone.

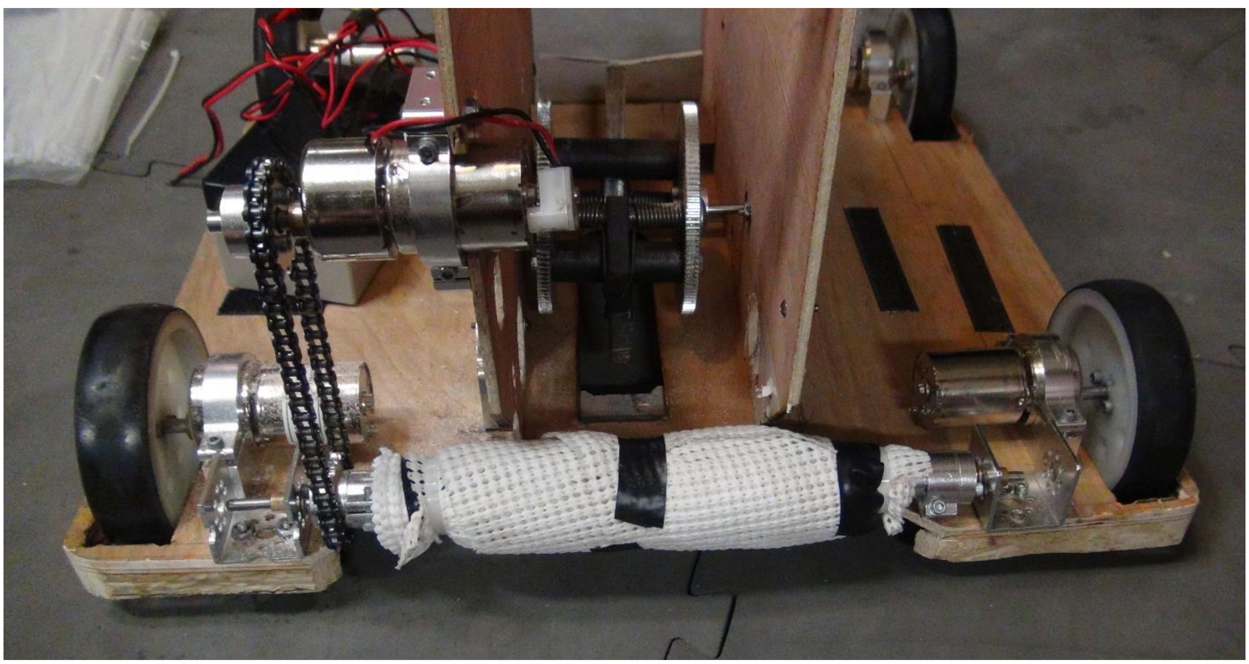
```
  CurrentSonarRead = SensorValue[Sonar_Sensor];

  //If goal is grabbed head to parking zone
  if(CurrentSonarRead < GrabThreshold) {
    DriveInchesSonar(30,75,GrabThreshold);
    TurnDegreesLeft(65);
    if(DriveInchesSonar(90,100,GrabThreshold)== true) {
    TurnDegreesRight(-100);
    DriveInchesSonar(-10,100,GrabThreshold);
};
  }
  else {
    DriveInches(-11,80);

    wait1Msec(1000);

    CurrentSonarRead = SensorValue[Sonar_Sensor];

    if(CurrentSonarRead < GrabThreshold) {
      DriveInchesSonar(37,75,GrabThreshold);
      TurnDegreesLeft(55);
      if( DriveInchesSonar(90,100,GrabThreshold)== true) {
        TurnDegreesRight(-100);
        DriveInchesSonar(-10,100,GrabThreshold);
      };
    }
  };
}
```

Figure 59 Parking Zone Section of Autonomous

```
int DriveInchesSonar(int Inches, int Power, int SonarThreshold){

  ResetDriveEncoders();

  int iTicks = GetTicks(abs(Inches));
  bool GoalGrabbed = true;

  if(Inches < 0){
    Power = -Power;
  }
  while(abs(nMotorEncoder[LeftDrive_Motor]) < iTicks && SensorValue[Sonar_Sensor] < SonarThreshold)
  {

    //nxtDisplayCenteredBigTextLine(3, "%d",nMotorEncoder[LeftDrive_Motor]  );

    motor[LeftDrive_Motor] = Power;
    motor[RightDrive_Motor] = Power;
  }
  int iTicksDriven = nMotorEncoder[LeftDrive_Motor];
  motor[LeftDrive_Motor] = 0;
  motor[RightDrive_Motor] = 0;
  if(SensorValue[Sonar_Sensor] >= SonarThreshold) {
    GoalGrabbed = false;
    DriveInches(4, -Power);
  };

  ResetDriveEncoders();

  return GoalGrabbed;
}
```

Figure 60 DriveInchesSonar Function

TASKS	REFLECTIONS
Finishing Goal Grabber Prototype Adam	We made a much sturdier roller using some aluminum tubing. We then attached an FTC axle in each end and mounted it to the wooden base with a few tetrix pieces. Now we just had to figure out how to drive it. We decided to use some chain and a couple of sprockets. We attached one sprocket to the roller one to the end of the motor axle. We wanted to mount the motor into the popper plate, but if we did, it could not reach all the way out to the sprocket. So we decided to clamp down on the body of the motor. This would allow us to mount the motor on the popper plate and still reach the sprocket. However, the motor's body did not fit the motor mounting correctly. We used a thin piece of PVC to fix this issue. By the end of the night, we had the prototype working. It could grab the goal from almost any orientation. It even pulled the goal in correctly from just grabbing a corner. Now we just have to implement it on the real robot.



Goal Grabber Prototype

DATE:	START TIME:	STOP TIME:
April 1, 2015	1:00	2:00

TASKS	REFLECTIONS
CAD the new roller goal grabber Jacob	I CADed the roller goal grabber we`ve been working on.

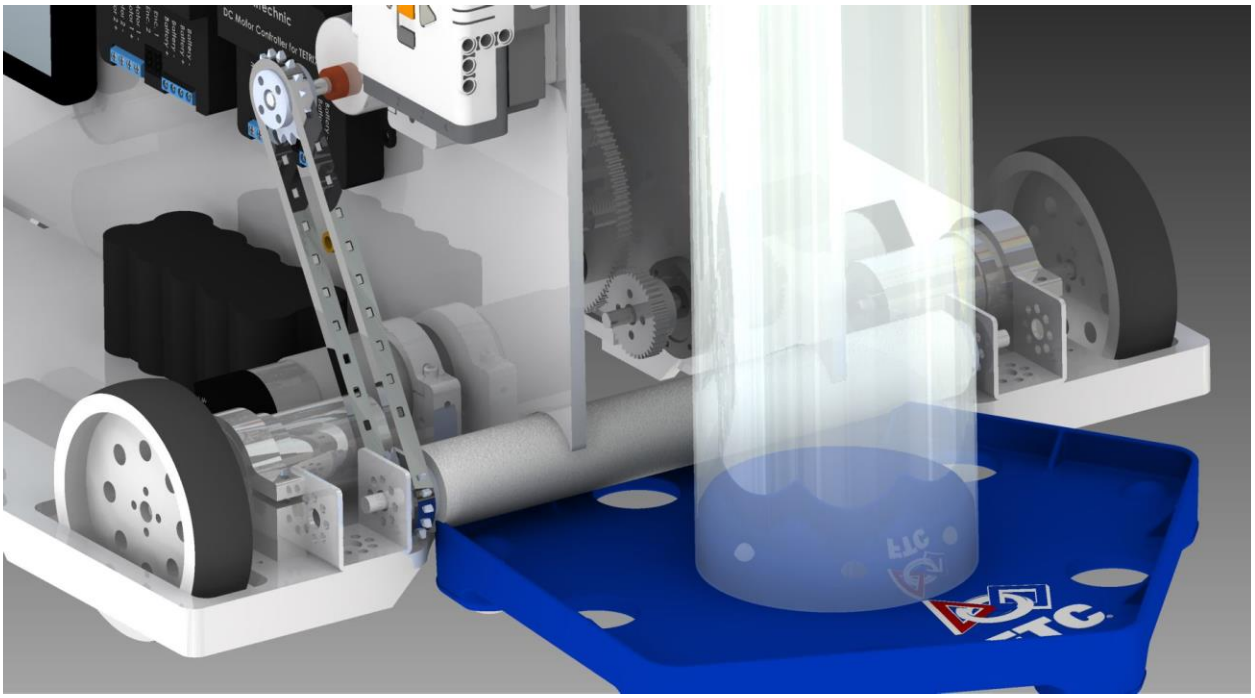


Figure 61 CAD/Roller Goal Grabber

TASKS	REFLECTIONS
R&D Robot Biv	Today we continued our relentless work on finishing up the robot before the competition. To address this year's underwater game, "UnderwaterGame," we all agreed we needed to design a robot that could dive deep enough to score the weighted pool toys and float high enough to score in the floaty goal. First we looked into aquatic animals like the snake. Jacob calculated the sine wave that it would take to emulate a snake's swimming pattern on a robot, but it turns out the science was impossible. In Light of the Lightsabers design principles we decided to keep to a more reachable, practical amphibious frame, choosing the eloquent crocodile as the basis for

our design. It is heavy enough to cut through the initial surface tension of placing it into the water and it overcomes water buoyancy that would normally keep it from reaching the bottom. The overpowering size of the crocodile robot allows its limbs to manipulate the weighted pool toys and its head to peek out of the water to score them in the floaty goal. As for the electronics and the hazard of H2O we had Quinlann wave his magic wand to put a water-coated protection over all the wires and controllers and due to a lack of underwater crimpers we had Julian use his enormous jaw strength to crimp down the wires. Since we were having trouble with the crocodile's small arms grabbing the game elements we employed Adam and Jacob's latest Faze Techonology® that simply makes the ball travel from anywhere on the field into the crocodile's mouth. Matt and I were having trouble addressing the water element in code, so we downloaded all 689(As of April 4th) One Piece episodes onto the robot's cRIO and that eliminated all errors in our code. Lala and Joel took our scissor lift design to a whole new level and made it reach up into the heavens with a giant television screen to broadcast the entirety of the Lightsaber's community outreach straight from the Liao's abode. This solves the problem of the conflict between our lazy lifestyles and actually going out to communicate with our state. Below are the finalized designs of our robot.

R&D Bot April Fools!!!!!

4250 4250

DATE:	START TIME:	STOP TIME:
April 2, 2015	6:30	9:00

TASKS	REFLECTIONS
Programming Biv	With the two goal autonomous finished, Matt, Julian, and I decided to spend the meeting working to finish up the center goal autonomous. Mr. Liao suggested that we use the sonar or IR to detect if it's in position three and score in the Center goal and knock down the kickstand and if it's in position one or two just program it to knock down the kickstand and move towards the rolling goals. After some trial and error, we figured out that the IR in a certain position could detect all three positions. We started with coding the path for position three first. I made it drive forward while running a task that lifts the scissor up to center goal height. Then there was code from a previous autonomous prototype that scores the ball, drives backward and knocks down the kickstand. It worked surprisingly well! With the extra time to get to work, Matt thought we should also make it head to the rolling goals, use the sonar to detect the highest rolling goal just like in the two goal auto and score the second autonomous ball. After figuring out the correct angle to turn and copy pasting the sonar code from the two ball autonomous and modifying it a bit we ran it a couple times. In all reasonable situations, it lined up properly and got close enough to the goal for the improved goal grabber to pull in and score. Everything seemed super awesome and perfect until Mr. Liao asked us to time the autonomous. It went 7 seconds over the time limit. I shortened a few delays and added a task that runs the goal down to the 90cm height while knocking down the kickstand. However, when it runs that task and the drivetrain together, all the turns are off due to battery usage. We tried constantly switching out the batteries and tweaking turns, but it never ran consistently. All the autonomous was thrown off. We reverted to the commit closest to the 90cm task addition since I forget to commit before it. The night ended with fixing that problem and accepting we may just have to come close to the goals without scoring. Next time we will have to work on adding the other paths to it.

```
void Autonomous_InitializeRobot(){
  ResetDriveEncoders();
  Plug_Close();
  Grabber_MoveDown();
  eraseDisplay();
}

task main()
{
  Autonomous_InitializeRobot();

  //waitForStart();  //Wait for the beginning of autonomous phase.
  // ****From Parking Zone to Center Goal score & Kickstand****
  // Detect IR

  int CenterGoalPosition = 3;

    StartTask(ScissorAutoUp);

     CenterGoalPosition = HTIRS2readACDir(IR_Sensor);

    if (CenterGoalPosition == 6 || CenterGoalPosition == 7){
    // **Drive to Center goal position #3**
    DriveInches(-28,20);
    while(!Scissor_Finish) {};
    DriveInches(-5,20);
    wait1Msec(500);
    Plug_Open();
    wait1Msec(2000);
  DriveInches(10,20);


  // Kickstand
  // Kickstand
  TurnDegreesRight(53);
  DriveInches(-22,20);
  wait1Msec(500);
  TurnDegreesLeft(40);
  DriveInches(-33,50);


  //Drive towards rolling goals
  startTask(Scissor90);
```

```
DriveInches(20,100);
TurnDegreesRight(60);
DriveInches(-69,100);

//Scan for high rolling goal
  int MaxDistance = 40;
int MinDistance = 15;
int LoopCount = 0;
int GrabThreshold = 12;
int CurrentSonarRead = 0;


//use sonar to center with goal
while(true) {
  CurrentSonarRead = SensorValue[Sonar_Sensor];
  //int SonarDifference = abs(CurrentSonarRead - LastSonarRead);
    motor[LeftDrive_Motor]= 20;
    motor[RightDrive_Motor] = -20;

  if(CurrentSonarRead < MaxDistance && CurrentSonarRead > MinDistance) {
    //if(SonarDifference > SonarThreshold) {
    PLaySound(soundDownwardTones);
    if(LoopCount > 20) {
      wait1Msec(500);
    }
    else {
      PlaySound(soundException);
    };
    motor[LeftDrive_Motor] = 0;
    motor[RightDrive_Motor] = 0;
    break;
    //  };
  };
  nxtDisplayBigTextLine(3,"%i",CurrentSonarRead);
  wait1Msec(10);

  LoopCount++;

};


// Backup to 90cm goal
Grabber_MoveDown();
DriveInches(-46,80);
Scissor_Down();
wait1Msec(500);
Scissor_Stop();
Plug_Open();

// Pop ball
Sweeper_RunIn();
Popper_Enable();
wait1Msec(3000);
Popper_Stop();
Sweeper_Stop();

// Forward to see if goal is latched
DriveInches(6,80);

wait1Msec(1000);

}
else
{
  // **Drive to Center goal position #1**

}

// Score ball

}
```

Figure 62 Two Goal Auto

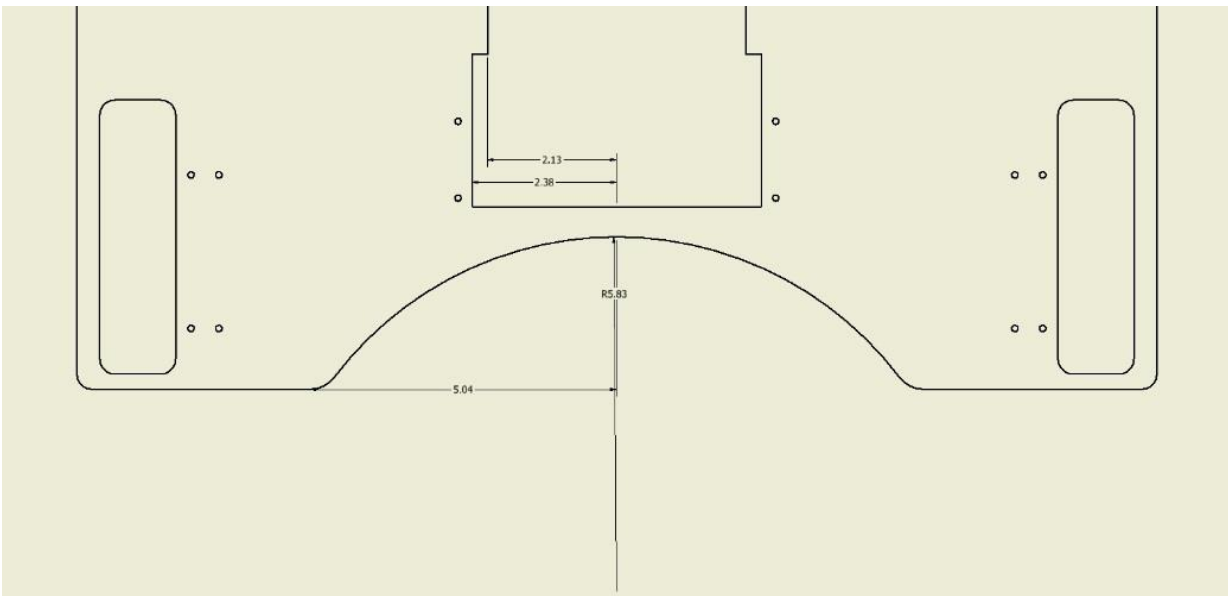
TASKS	REFLECTIONS
Spirit Prep for Worlds Lala	Tonight, Thomas, Quinnlan, Josiah, Caleb, and I worked on replenishing and repairing our spirit props! In the beginning, Thomas and I repaired the 4250 numbers by adding foam where they were bending while Quinnlan and the others began working on cutting robes for the jedi pops. After completing the numbers, Thomas and I helped with the jedi pop robes and designed a new Lightsabers tag to tie around the lollipop's necks.

TASKS	REFLECTIONS
Elliott	At this meeting, Joel and I spent time making our new pit design. Our old pit, we found at the Super Regional, did not meet our needs as well as we wanted it. We spent a good time debating on the different designs we thought up and finally decided on one. Joel and I decided to mock one out in person at the next meeting. Several of us also played a fun game! We all ate different flavored jelly beans (ranging from toothpaste to vomit) to see who could last the longest. That was pretty fun (but mostly disgusting) and I managed to last till the end.

Team-Building Game

DATE:	START TIME:	STOP TIME:
April 6, 2015	6:30	9:00

TASKS	REFLECTIONS
Cut circle out of the base for the goaler roller Jacob	We needed to cut the circle out of the base for the new goaler roller Jacob printed out a drawing from the CAD with dimensions for a template



New Cut in Base

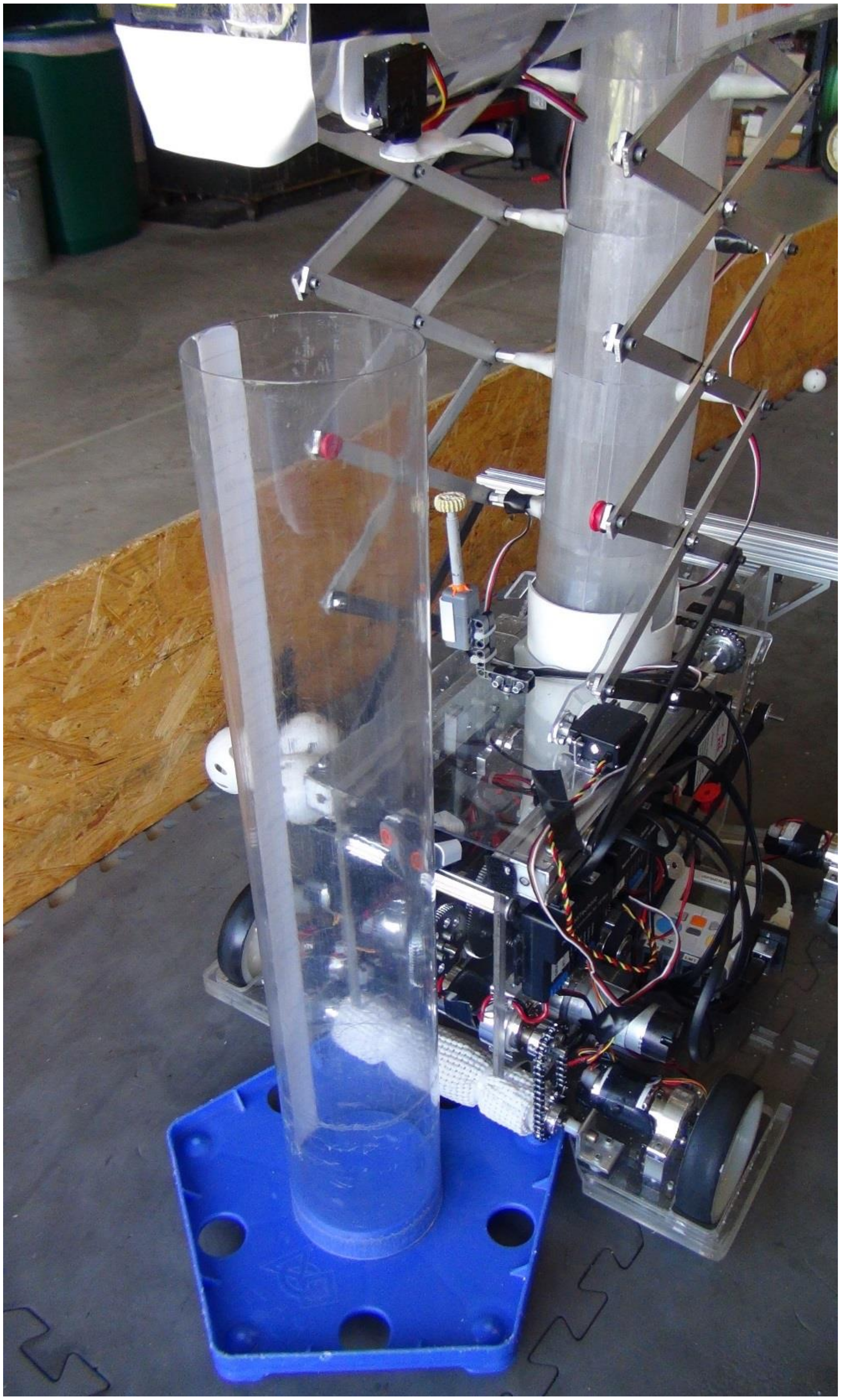
TASKS	REFLECTIONS
Rebuilding robot Hannah	Since we made the changes to the base yesterday, today we started putting everything back together. One of the first things we did was add 2 more 80/20 angles to hold the base together since we moved the motor mounts that we had been using to hold the base. For some reason, we had a lot of trouble drilling the holes. After we finished securing the base, we put the sweeper back on the side plates with the sprocket that would allow us to run it by a belt. We then reinstalled the popper and put a sprocket on the axel. Then we attached the sweeper and the popper using a belt. It was smooth sailing from then on.

	By the end of the night, we had rebuilt the popper, sweeper, top of the robot, linear slides for the scissor lift, ramp to the chamber, and the chamber. I plan on finishing the rest of the robot (wiring, roller goaler, scissor lifts, and tubes) tomorrow. It's a lot to do but we have to start driving practice again as we are running out of time.

4250 **LIGHTSABERS** 4250

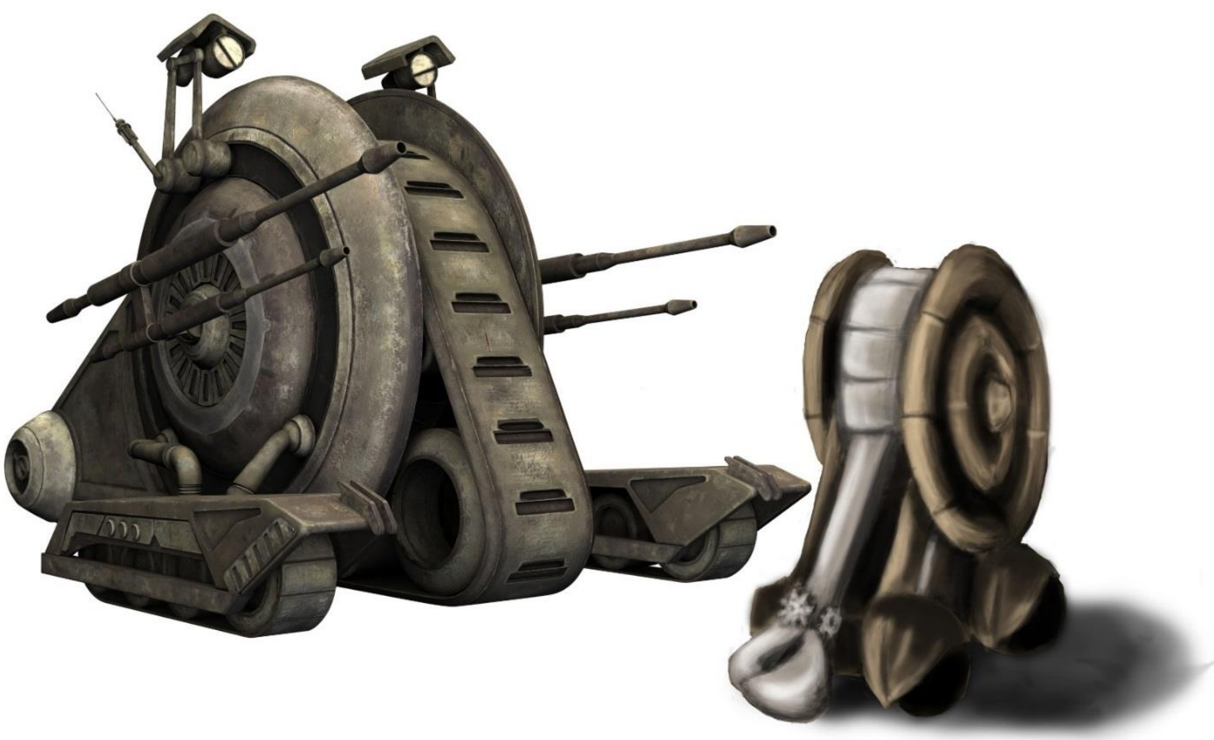
DATE:	START TIME:	STOP TIME:
April 9, 2015	6:30	8:45

TASKS	REFLECTIONS
Make roller goaler Jacob	We made the roller goaler by taking aluminum tubing and adding end caps to it so we could attach axle hubs and axles. We then mounted "L" brackets with holes in them for the axles to go through. On the right end cap, we also added a small sprocket and chained it to the motor we mounted. To get the tube to grip onto the goal we hot glued some non-slip rubber fabric to the tube and wrapped it around multiple times.
Mount IR and ultrasonic sensor	The programmers needed the ultrasonic sensor mounted so I attached it by adding LEGOs to it and zip tying the LEGOs to the support bar on the back of the robot. The programmers also need an IR sensor attached so I used one of the screws for the scissor lift to hold it on by putting the screw in one of the holes on the sensor to hold it on.
Modify sweeper	The sweeper was not up-to-par and we saw that surgical tubing worked well so using Windex, we slid the surgical tubing over one of the zip-ties and looped it over to the opposite zip-tie and repeated with the others.



Roller Goaler

DESIGN



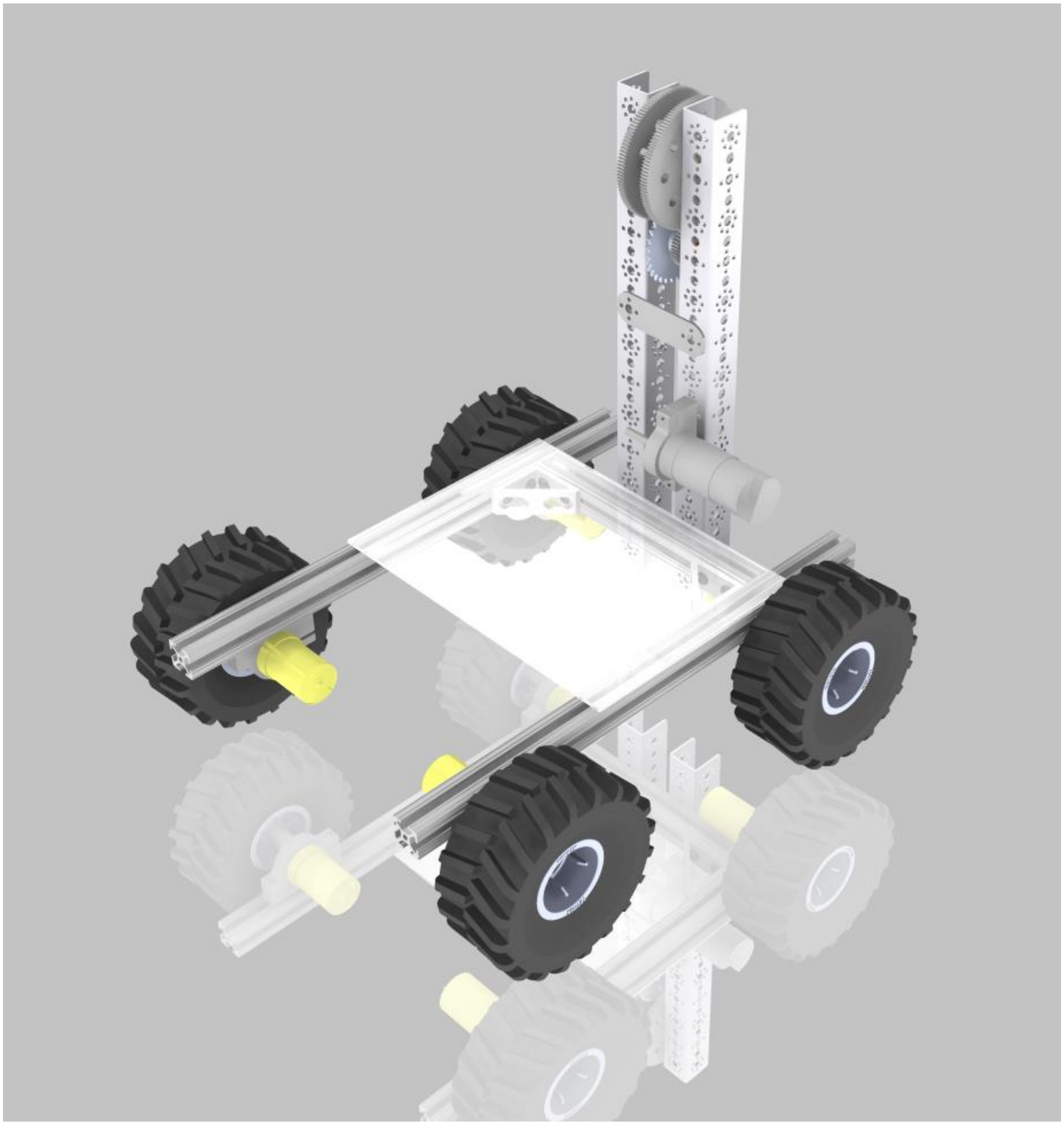
Sketches

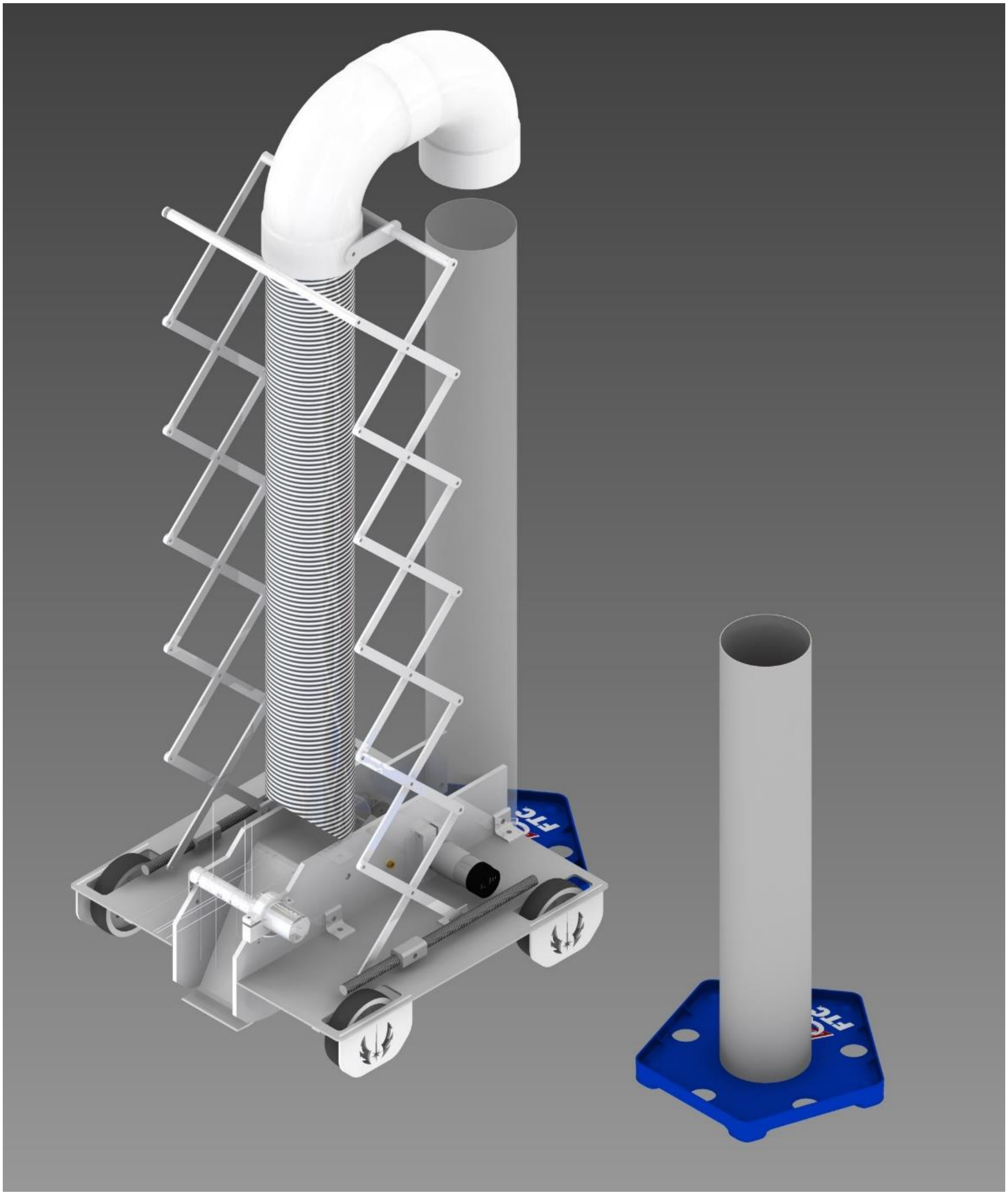
PAGES 2 THROUGH 17 CONTAINED

HAND SKETCHES

IN ORIGINAL NOTEBOOK

CAD

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LIGHTSABERS

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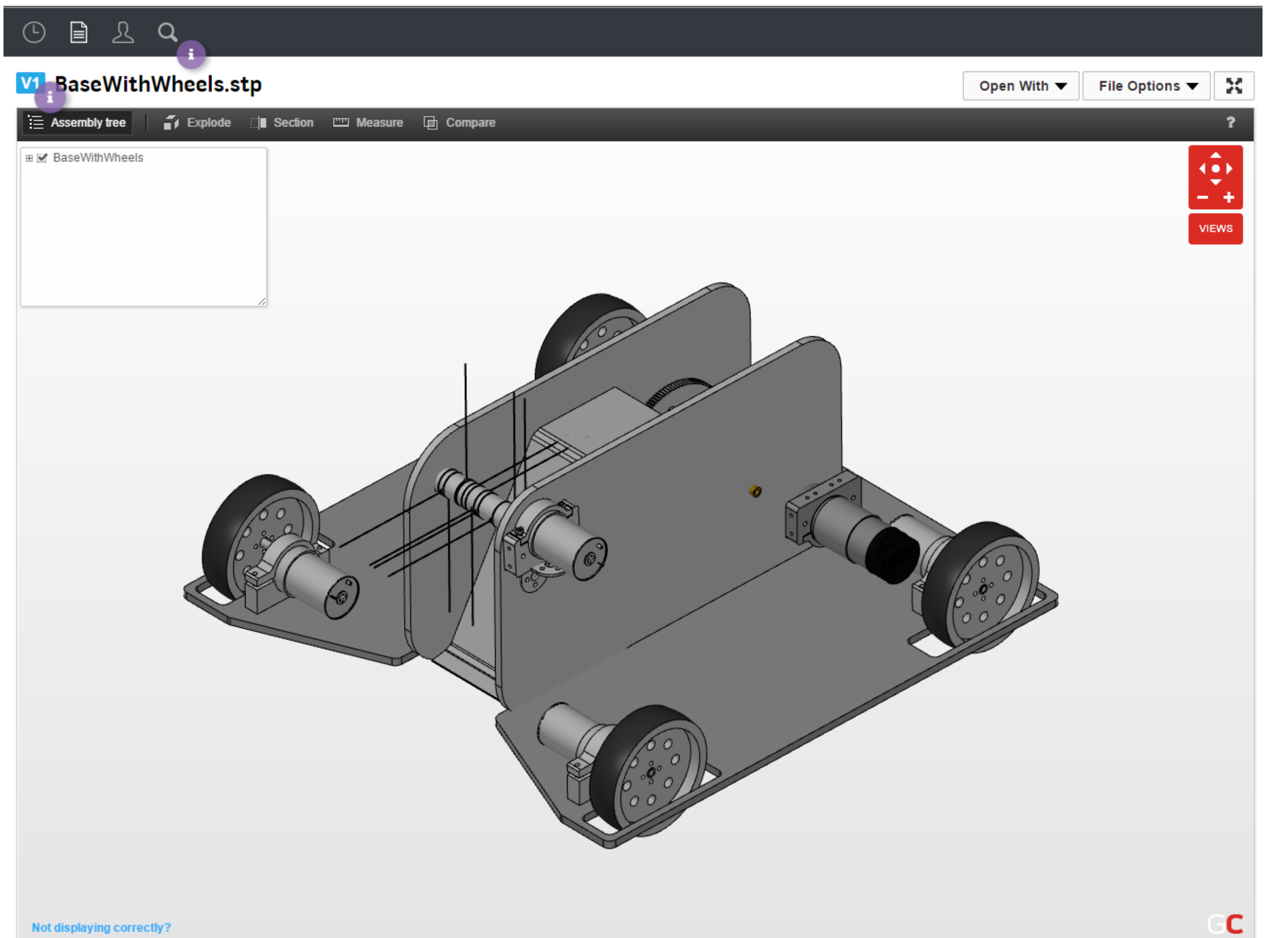
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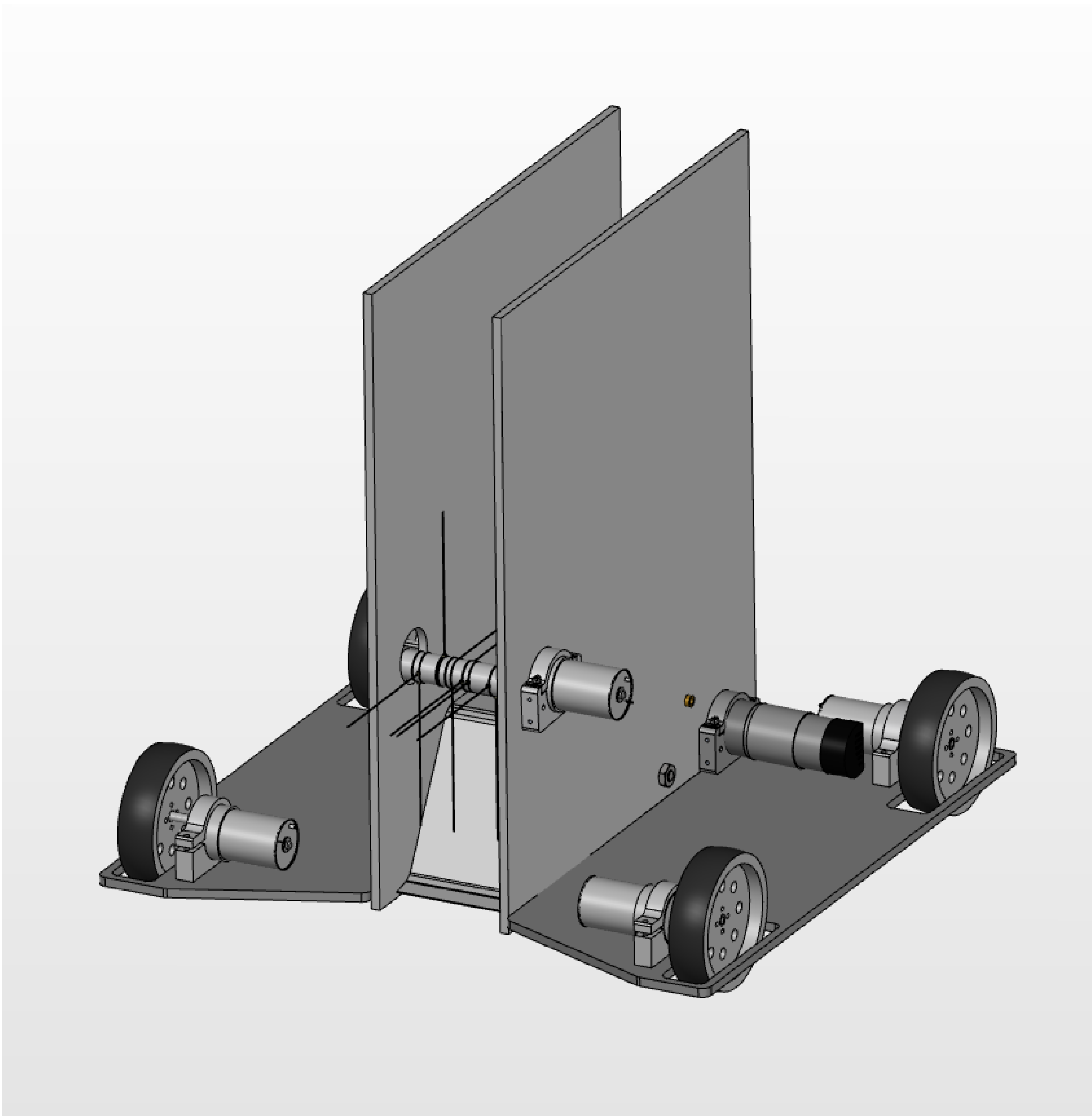

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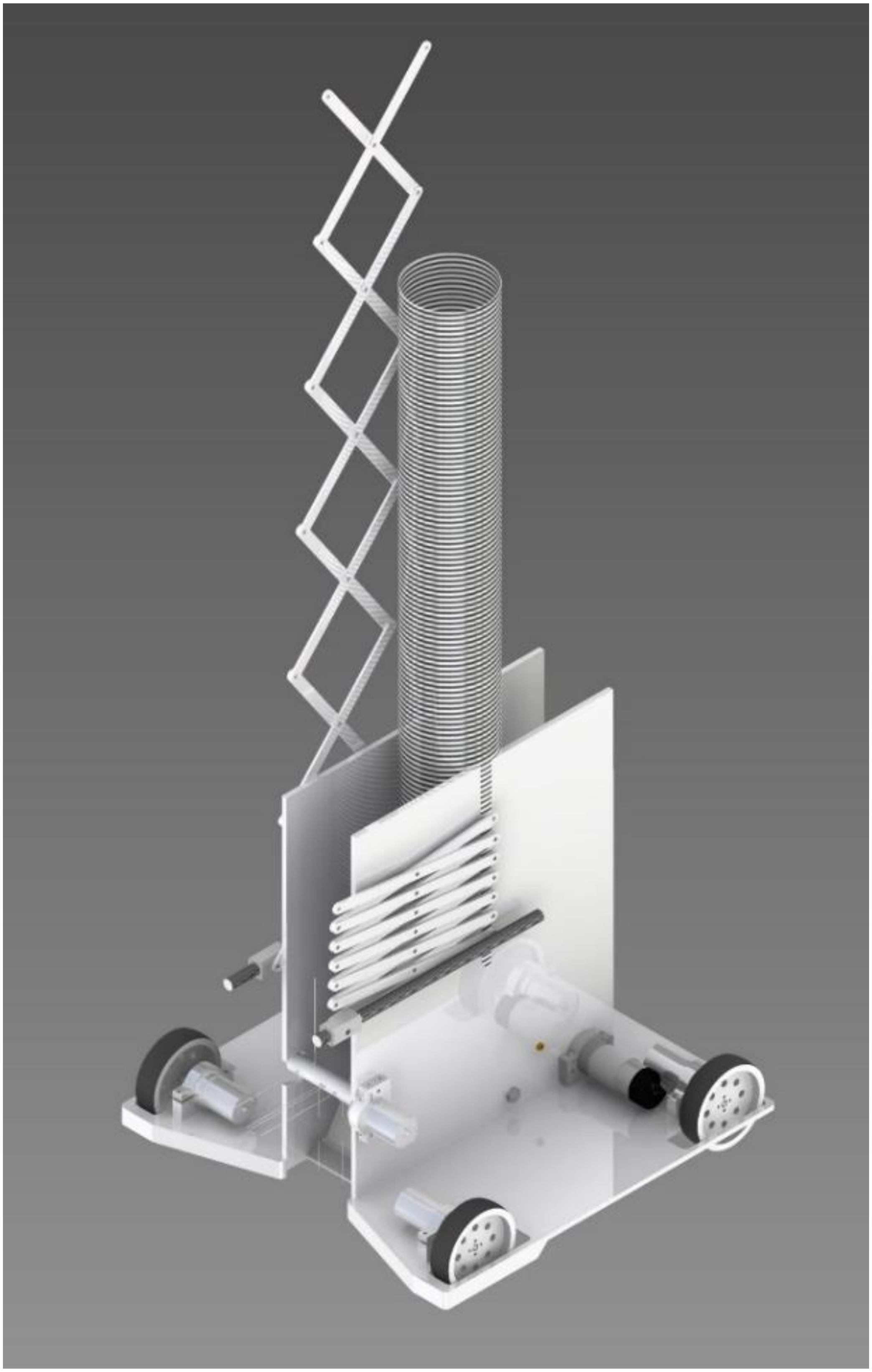

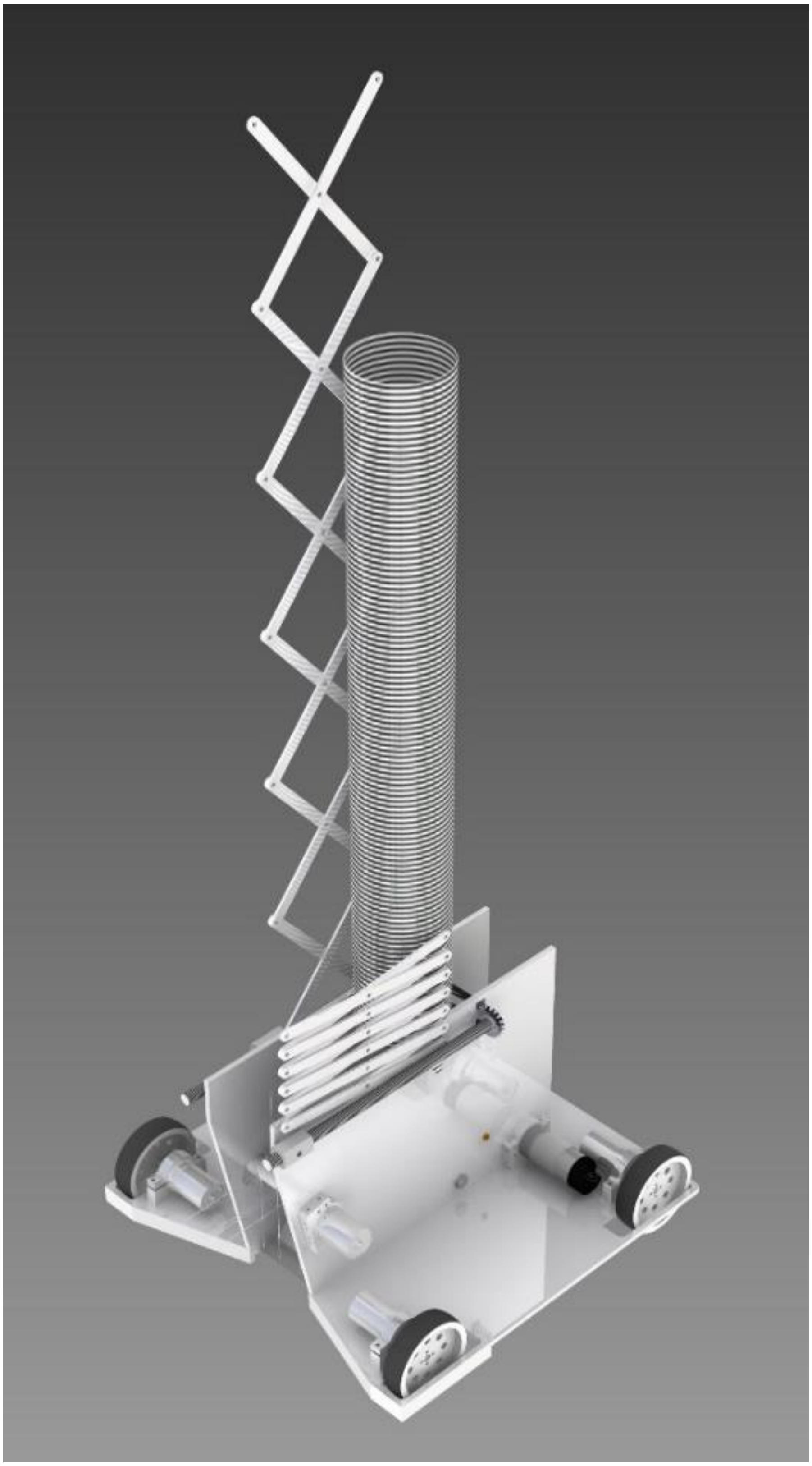

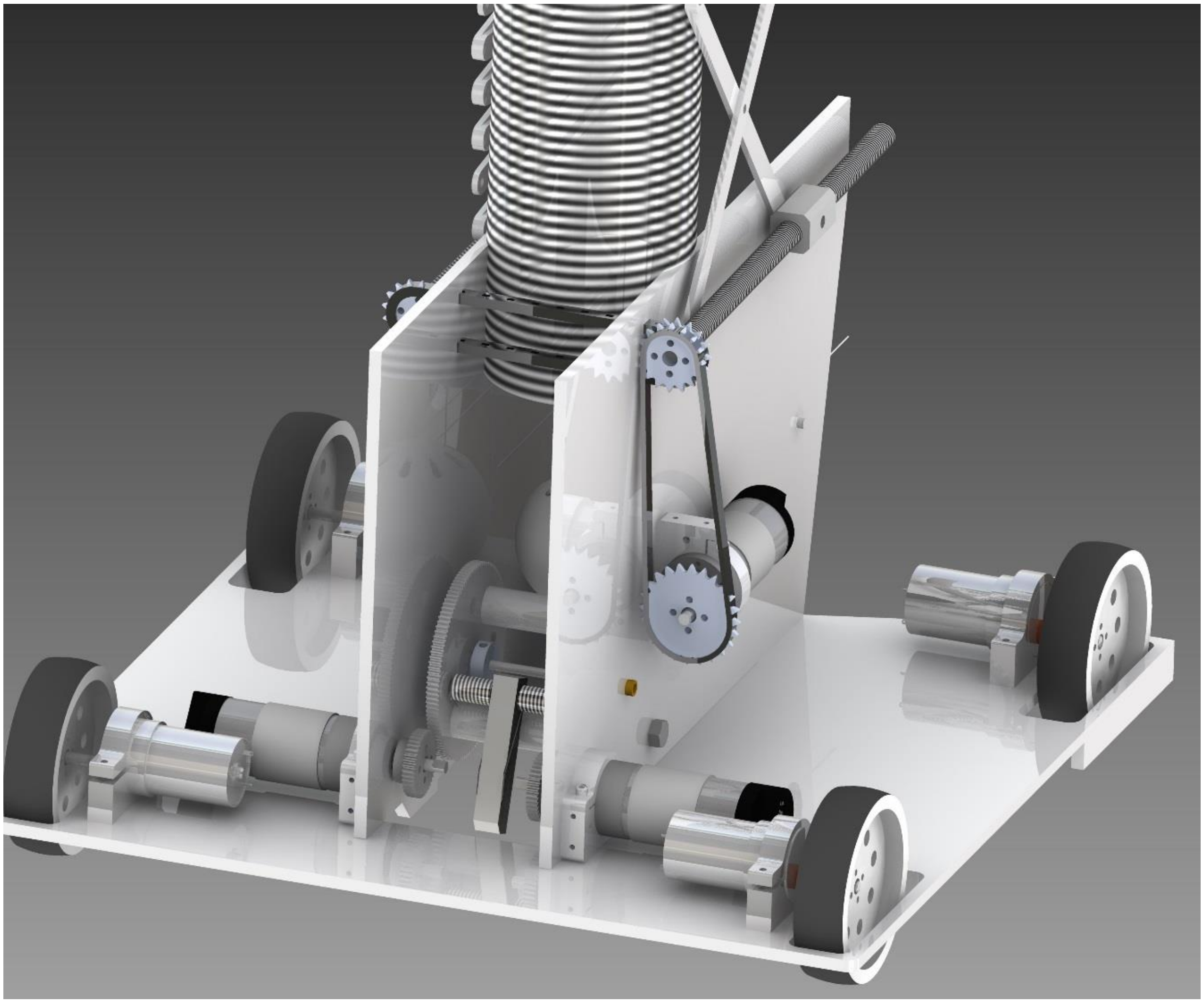

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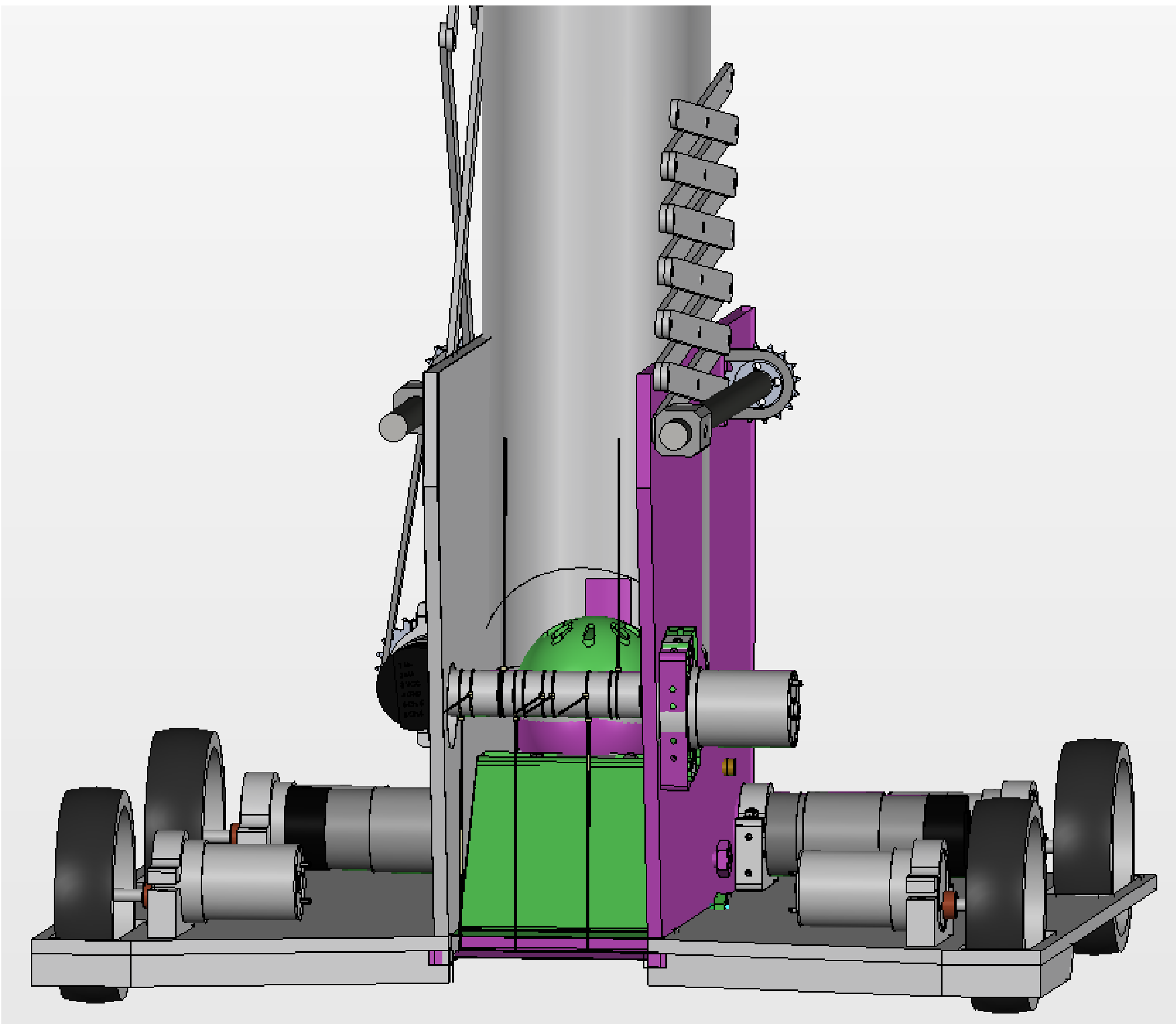

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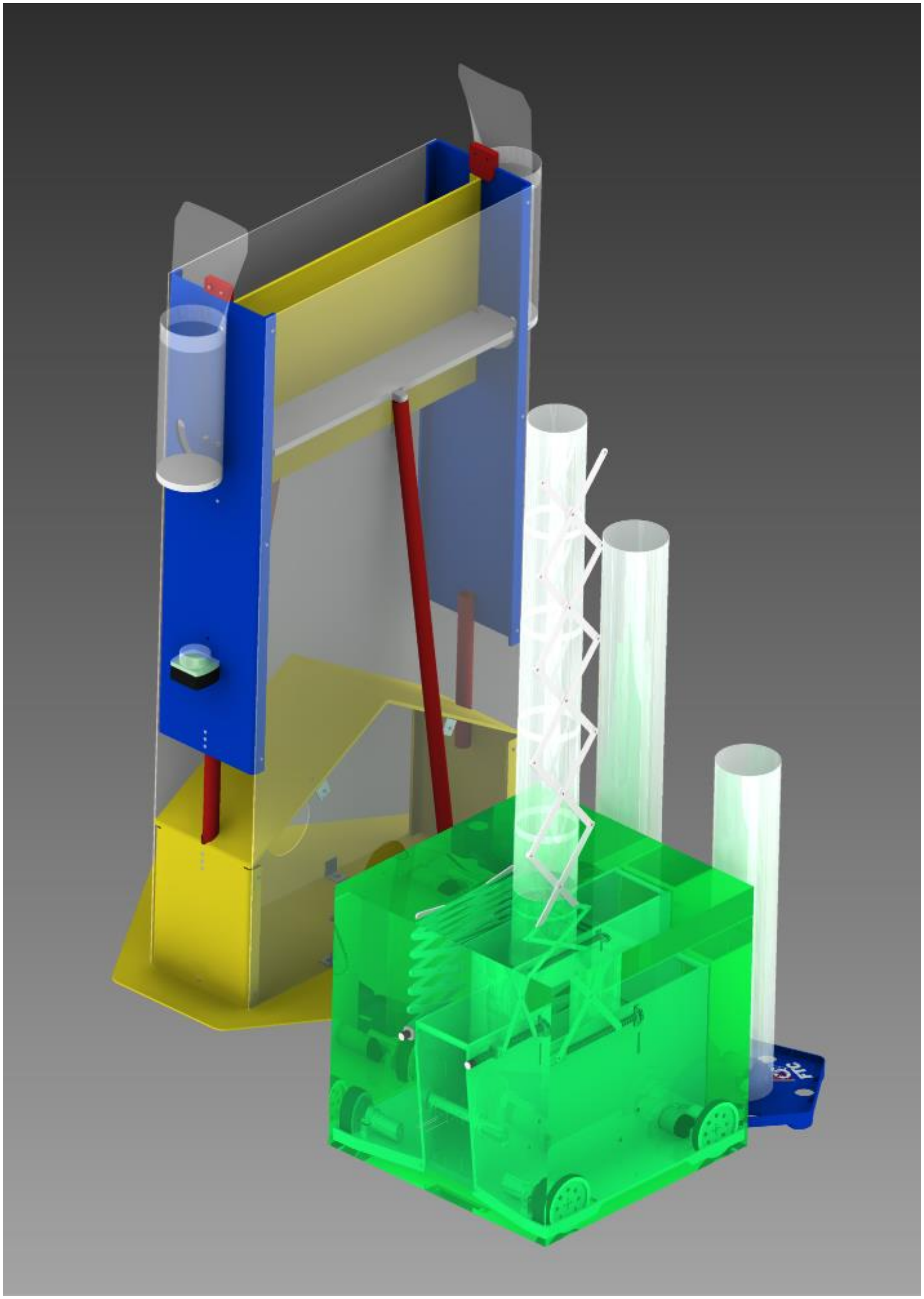

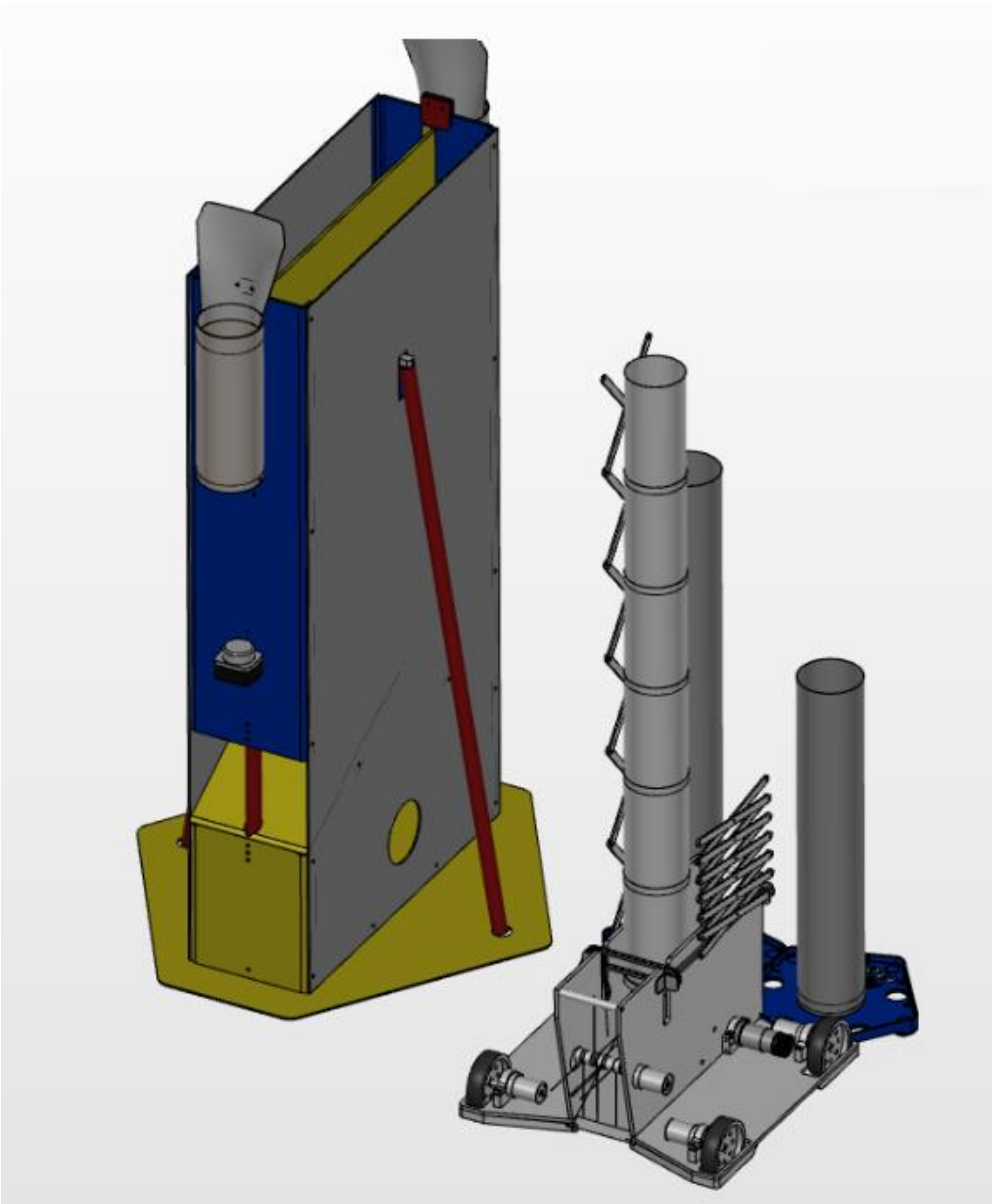

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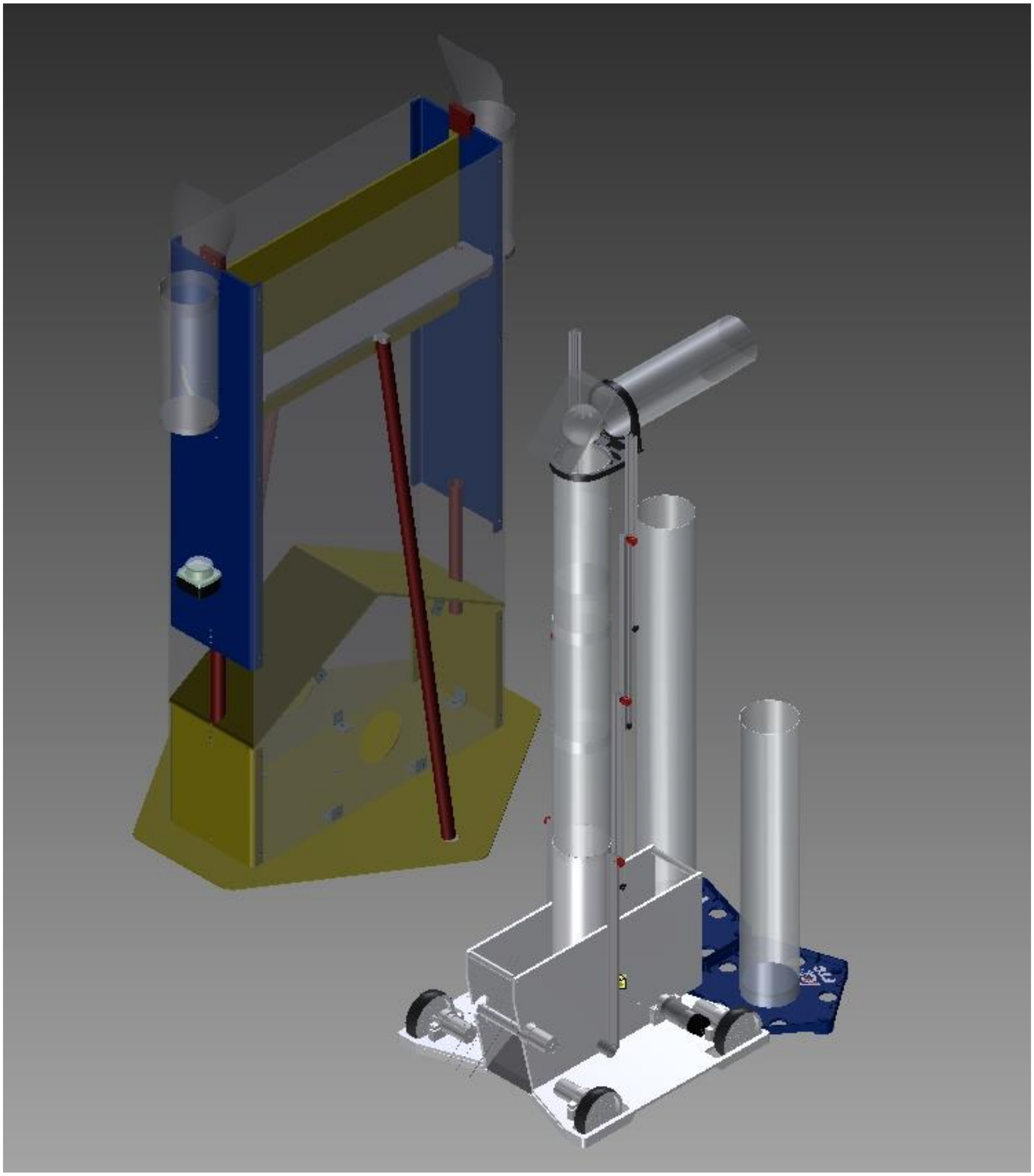

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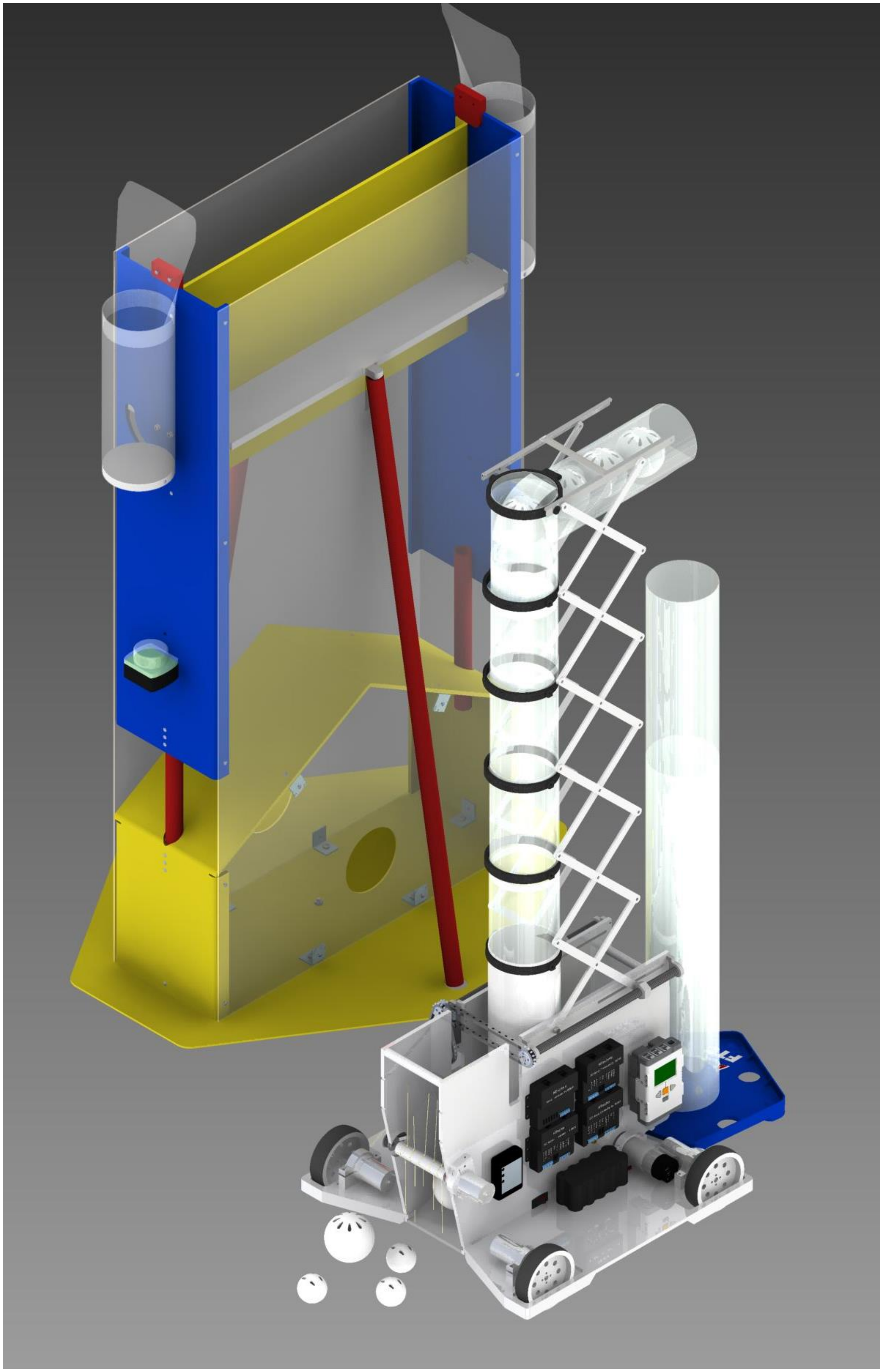

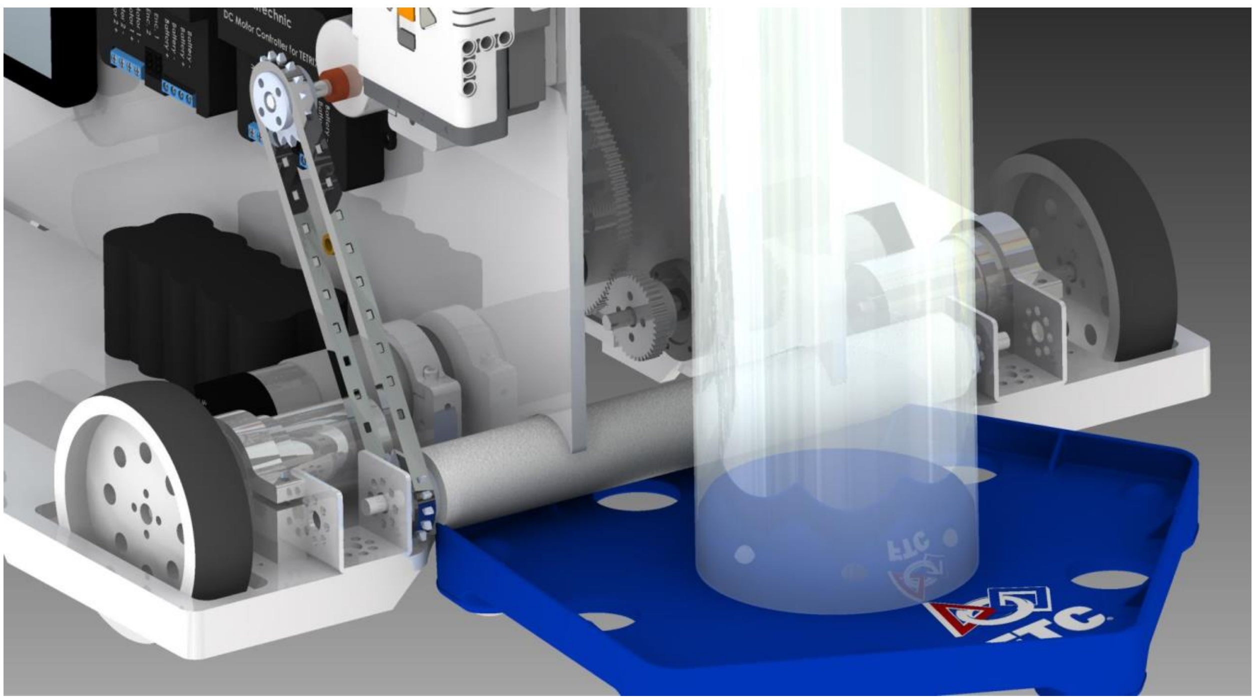

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BOM

FTC Robot Bill of Materials

Team Number:	**4250**
Part Description	**Game Rule / Forum Reference**
QTY 3 AndyMark Motor	Game Manual Pt 1: <R09.b>
QTY 2 FTC Cascade Effect Goal Tubes	Game Manual Pt 1: <R04.a>
QTY 2 1/4" Aluminum Channel	Game Manual Pt 1: <R04.a>
QTY 2 1/2" Aluminum Bars	Game Manual Pt 1: <R04.a>
QTY 2 1" Aluminum Square Tubing	Game Manual Pt 1: <R04.a>
QTY 20 1/8" Aluminum Bar	Game Manual Pt 1: <R04.a>
QTY 4 1/8" Steel Bar	Game Manual Pt 1: <R04.a>
QTY 2 1/2" Steel Rod	Game Manual Pt 1: <R04.a>
QTY 1 3/8" Steel Bar	Game Manual Pt 1: <R04.a>
QTY 4 Torsion Springs	Game Manual Pt 1: <R04.b>
QTY 3 4" PVC Tubing	Game Manual Pt 1 <R04.a>
QTY 1 HiTechic HS-40 Servo	Game Manual Pt 1 : <R04.c>
QTY 2 1/2" All-Thread	Game Manual Pt 1 : <R04.b>
QTY 16 Shape Lock	Game Manual Pt 1 <R04.a>
QTY 1 Lexan	Game Manual Pt 1 <R04.a>
QTY 7 Acrylic	Game Manual Pt 1 <R04.a>
QTY 1 Custom 3D Printed Ball Deflector	Game Manual Pt 1 <R07>
QTY 1 10 Tooth Pulley	Game Manual Pt 1 <R04.b>
QTY 1 17" 80-20 Aluminum Bar	Game Manual Pt 1 <R04.b>
QTY 4 Aluminum Triangle Support	Game Manual Pt 1 <R04.b>
QTY 1 Anderson PowerPole Power Distribution	Game Manual Pt 1: <R10.c>
QTY 6 Anderson PowerPole Connector	Game Manual Pt 1: <R10.c>
QTY 1 USB Surge Protector	Game Manual Pt 1: <R08.c>
QTY 1 Non-Slip Pad	Game Manual Pt 1: <R04.b>
QTY 1 Surgical Tubing	Game Manual Pt 1 <R04.b>

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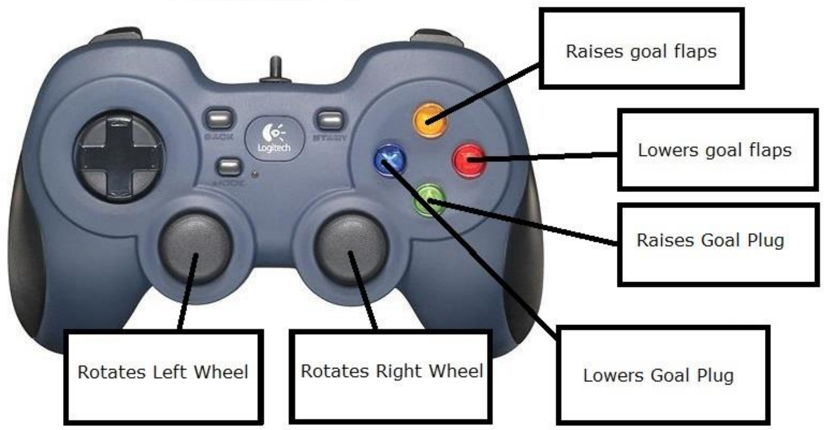
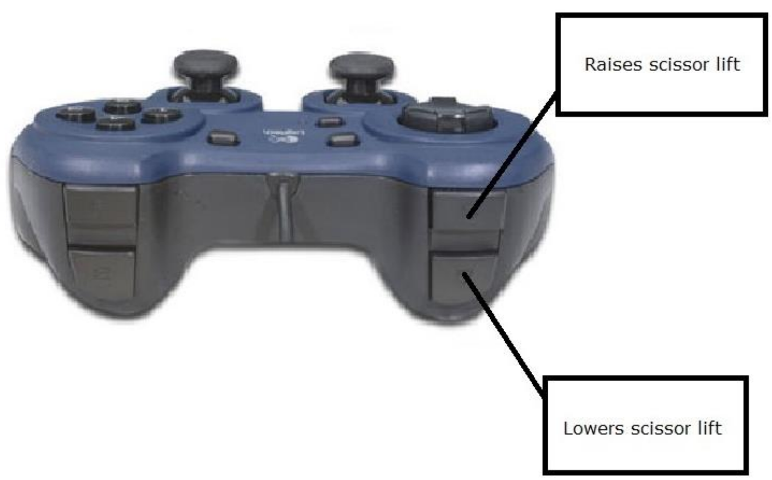
PROGRAMMING

Controller Schematic

Controller 1



Controller 2



Autonomous Code

Two Goal Autonomous

```
task main(){

  Autonomous_InitializeRobot();
  //waitForStart is in Autonomous_InitializeRobot function.

  StartTask(Scissor_Up_to_60);

  // ****From Ramp to 60cm & 90cm Goal score****
  // Forward to 60cm goal
  DriveInches(72,50);
  wait1Msec(500);
  TurnDegreesLeft(45);
  DriveInches(30,20);
  TurnDegreesLeft(57);

  // Backup to goal
  DriveInches(-30,50);
  Plug_Open();
  wait1Msec(2500);
  Grabber_Out();


  // Drive to 90cm goal and pop up small ball
  DriveInches(13,20);  //10
  Grabber_Stop();
  Plug_Close();
  //StartTask(HighGoalPop);
  Popper_Enable();
  wait1Msec(2000);
  Popper_Stop();
  TurnDegreesLeft(53); //75

  // Raise scissor to 90cm goal height
  Scissor_Up();

   wait1Msec(3500);
   Scissor_Stop();
//   StopTask(HighGoalPop);

   // Drive forward to ready for scanning
   DriveInches(-8,40);

   int LastSonarRead = SensorValue[Sonar_Sensor];
   int MaxDistance = 40;
   int MinDistance = 15;
   int LoopCount = 0;
   int GrabThreshold = 26;
   int CurrentSonarRead = 0;

   ClearTimer(T1);
   //use sonar to align with goal
   while(true) {
     CurrentSonarRead = SensorValue[Sonar_Sensor];
     //int SonarDifference = abs(CurrentSonarRead - LastSonarRead);
     if(time1[T1] < 1000) {
       motor[LeftDrive_Motor]= -20;
       motor[RightDrive_Motor] = 20;
       }else {
       motor[LeftDrive_Motor]= 20;
       motor[RightDrive_Motor] = -20;
     };

     if(CurrentSonarRead < MaxDistance && CurrentSonarRead > MinDistance) {
       //if(SonarDifference > SonarThreshold) {
       PlaySound(soundDownwardTones);
       if(LoopCount > 20) {
         wait1Msec(500);
       }
```

```
      else {
        PlaySound(soundException);
      };
      motor[LeftDrive_Motor] = 0;
      motor[RightDrive_Motor] = 0;
      break;
    }
    LastSonarRead = CurrentSonarRead;
    nxtDisplayBigTextLine(3,"%i",CurrentSonarRead);
    wait1Msec(10);
    LoopCount++;
  }

  // Backup to 90cm goal
  DriveInches(-46,80);
  Grabber_In();
  Scissor_Down();
  wait1Msec(500);
  Grabber_Stop();
  Scissor_Stop();
Plug_Open();

  // Forward to see if goal is latched
  DriveInches(6,80);
  StopTask(Scissor_Up_to_60);

  CurrentSonarRead = SensorValue[Sonar_Sensor];

  //If goal is grabbed head to parking zone
  if(CurrentSonarRead < GrabThreshold) {
    DriveInchesSonar(30,75,GrabThreshold);
    TurnDegreesLeftSonar(65,GrabThreshold);
    DriveInchesSonar(90,100,GrabThreshold);
    TurnDegreesRightSonar(-100,GrabThreshold);
    DriveInchesSonar(-10,100,GrabThreshold);

  }
  else
  {  //Try to get goal again
    //DriveInches(-11,80);
    //DriveInches(4,80);
    //wait1Msec(1000);

    //CurrentSonarRead = SensorValue[Sonar_Sensor];

    //if(CurrentSonarRead < GrabThreshold) {
    //  DriveInchesSonar(37,75,GrabThreshold);
    //  TurnDegreesLeftSonar(55,GrabThreshold);
    //  DriveInchesSonar(90,100,GrabThreshold);
    //    TurnDegreesRightSonar(-100,GrabThreshold);
    //    DriveInchesSonar(-10,100,GrabThreshold, false);
    //}
  }
}
```

Center Goal Autonomous

```
task main(){

  Autonomous_InitializeRobot();
  //waitForStart is in Autonomous_InitializeRobot function.

  // ****From Parking Zone to Center Goal score & Kickstand****
  int IR_Zone = 0;

  StartTask(Scissor_Up_to_120);

  // Detect IR
  IR_Zone = HTIRS2readACDir(IR_Sensor);

  if (IR_Zone == 5){
    // **Drive to score in Center goal position #3**
    while(!Scissor_Finish) {};
    DriveInches(-36,20);
    wait1Msec(500);
    Plug_Open();
    wait1Msec(2000);
    DriveInches(10,20);
    StopTask(Scissor_Up_to_120);
    StartTask(Scissor_Down90);

    // Kickstand
    TurnDegreesRight(53); //45
    DriveInches(-22,20);  //-18
    wait1Msec(500);
    TurnDegreesLeft(40);  //45
    DriveInches(-33,50);  //30

    //Drive towards rolling goals
    DriveInches(20,100);
    TurnDegreesRight(60);

  DriveInches(-69,100);
  StopTask(Scissor_Down90);

  //Scan for 90cm goal
  int MaxDistance = 40;
  int MinDistance = 15;
  int LoopCount = 0;
  int GrabThreshold = 12;
  int CurrentSonarRead = 0;

  //use sonar to align with goal
  while(true) {
    CurrentSonarRead = SensorValue[Sonar_Sensor];
    //int SonarDifference = abs(CurrentSonarRead - LastSonarRead);
    motor[LeftDrive_Motor]= 20;
    motor[RightDrive_Motor] = -20;

    if(CurrentSonarRead < MaxDistance && CurrentSonarRead > MinDistance) {
      //if(SonarDifference > SonarThreshold) {
      PlaySound(soundDownwardTones);
      if(LoopCount > 20) {
        wait1Msec(500);
      }
      else {
        PlaySound(soundException);
      }
      motor[LeftDrive_Motor] = 0;
      motor[RightDrive_Motor] = 0;
      break;
    }
/      nxtDisplayBigTextLine(3,"%i",CurrentSonarRead);
/      wait1Msec(10);
```

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```
      LoopCount++;
    }

    // Backup to 90cm goal
    Grabber_In();
    DriveInches(-46,80);
    Scissor_Down();
    wait1Msec(500);
    Grabber_Stop();
    Scissor_Stop();
    Plug_Open();

    // Score 2nd ball in 90cm
    Popper_Enable();
    wait1Msec(2000);
    Popper_Stop();

    // Forward to see if goal is latched
    DriveInches(6,80);
  }
  else  // Ignore Center goal positions #1 & #2 and quickly do Kickstand
  {
    // ****Kickstand****
    DriveInches(-5,75);
    TurnDegreesRight(15);
    DriveInches(-35,75);
    TurnDegreesRight(25);
    DriveInches(30,75);

    // Drive to goals
    DriveInches(-10,75);
    TurnDegreesLeft(20);
    DriveInches(-12,75);
    TurnDegreesLeft(20);
  }
```

Kickstand Autonomous

```
void Autonomous_InitializeRobot(){
  ResetDriveEncoders();
  Plug_Close();
  Grabber_MoveDown();
  eraseDisplay();
}

task main()
{
  Autonomous_InitializeRobot();

  // ****Kickstand****
  DriveInches(72,75);
  wait1Msec(500);
  TurnDegreesLeft(90);
  DriveInches(30,75);
}
```

Teleop Code

```
void TeleOp_InitializeRobot(){
  Plug_Open();
  Tube_Retract();
}

void RunTankDrive(){
  int deadband = 7;
  int YInput = joystick.joy1_y1;
  int YInput2 = joystick.joy1_y2;

  if (abs(YInput) < deadband)
  {
    YInput = 0;
  }
  if (abs(YInput2) < deadband)
  {
    YInput2 = 0;
  }

  //if either side has change of greater than 110 slow the change
  //used to combat voltage dropout due to quick speed changes
  if(abs(motor[LeftDrive_Motor] - YInput/1.27) > 110 || abs(motor[RightDrive_Motor] - YInput2/1.27) > 110)
  {
    //slow to current half speed
    motor[LeftDrive_Motor]  = motor[LeftDrive_Motor] / 2;
    motor[RightDrive_Motor] = motor[RightDrive_Motor] / 2;
    wait1Msec(10);
    //increase to half selected speed
    motor[LeftDrive_Motor]  = YInput/2.54;
    motor[RightDrive_Motor] = YInput2/2.54;
    wait1Msec(10);
  }
  motor[LeftDrive_Motor]  = YInput/1.27; //Divide the inputs to make them a range from 0 to 100
  motor[RightDrive_Motor] = YInput2/1.27;

}

void RunPopper(){
  if ( toggleJoyBtn_RB.active ) //Arm up
  {
    Popper_Enable();
  } else {
    Popper_Stop();
  }
}

void RunGrabber(){
  if(toggleJoyBtn_RT.pressed)
  {
    Grabber_In();
  }
  else if (toggleJoyBtn_RightStickButton.pressed)
  {
    Grabber_Out();
  }
  else
  {
    Grabber_Stop();
  }
}
```

```
void RunScissor(){
  if((toggleJoyBtn_LT.pressed || toggleJoy2Btn_LT.pressed)&&(SensorValue(Scissor_Dn_Limit)==0))
  {
    Scissor_Down();
  }
  else if(toggleJoyBtn_LB.pressed || toggleJoy2Btn_LB.pressed)
  {
    Scissor_Up();
  } else {
    Scissor_Stop();
  }
  nxtDisplayTextLine(5,"povHat  %i",joystick.joy1_TopHat);
}

/*
void RunGrabber(){
  if(toggleJoyBtn_Y.pressed)
  {
    Grabber_MoveUp();
    Plug_Close();  // plug horz tube after letting go of goal
  }
  else if (toggleJoyBtn_B.pressed)
  {
    Grabber_MoveDown();
  }
}
*/

void RunPlug(){
  if(toggleJoyBtn_X.pressed)
  {
    Plug_Open();
  }
  else if (toggleJoyBtn_A.pressed)

  {
    Plug_Close();
  }
}

void Disable(){
  Popper_Stop();
  wait1Msec(50);
  PlaySound(soundBeepBeep);
  motor[LeftDrive_Motor] = 0;
  motor[RightDrive_Motor] = 0;
  Scissor_Stop();
}

//////////////////////////////
//                        //
//        Main task       //
//                        //
//////////////////////////////

task main(){

  TeleOp_InitializeRobot();

  waitForStart();   // wait for start of tele-op phase
  JoystickUtils_Init();

  while (true){
    // system Update Buttons and Joysticks
    getJoystickSettings(joystick);
    // custom joystick
    JoystickUtils_CheckAllToggles();

    if (!bDisconnected){   // NO loss of connection for 3 sec.
      RunTankDrive();

      RunPopper();
//      RunSweeper();
      RunGrabber();
      RunScissor();
      RunPlug();
    }
    else {
      Disable();
    }
  }
}
```

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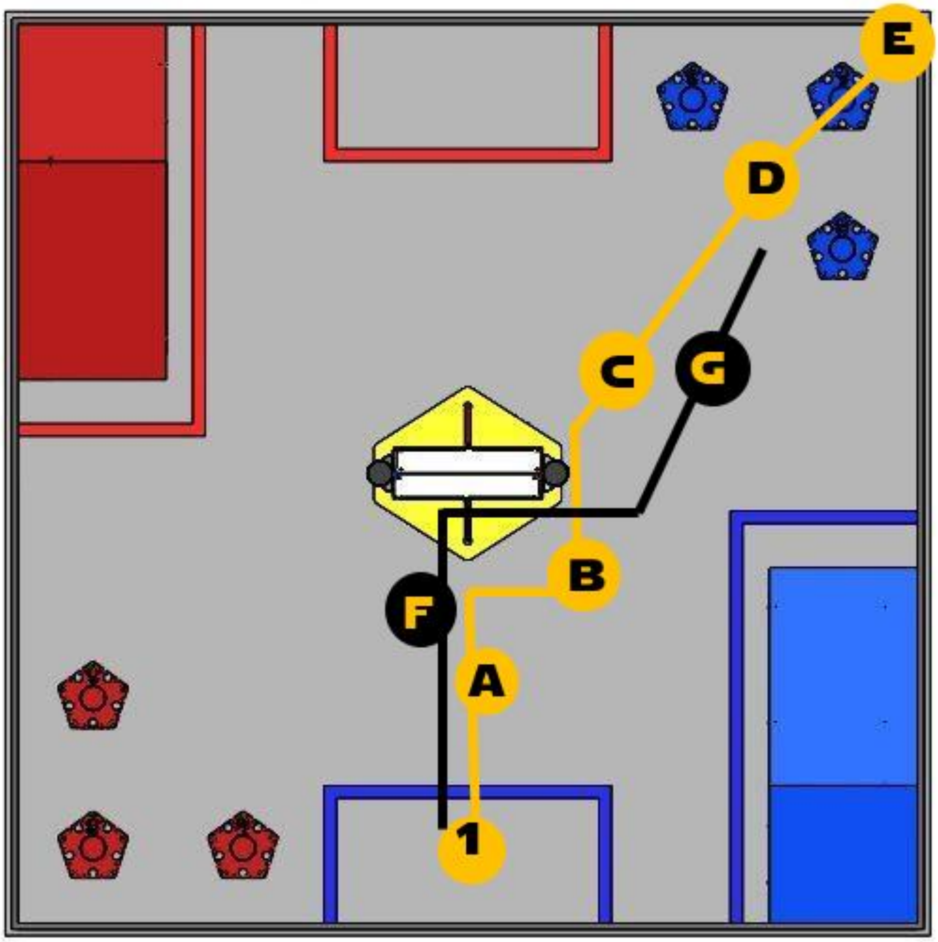
Autonomous Options

Center Goal



1. Place robot in the middle of the parking zone facing the center goal. Use IR sensor to identify center goal position.
   If the Center Goal is in position 3 (Gold):
      A. Raise scissor lift to 120cm height, drive backward to the center goal and score the large ball.
      B. Move scissor lift to 90cm height while driving and turning to knock down kickstand.
      C. Turn right and drive towards the highest rolling goal.
      D. Turn left for one second then turn right while using the sonar to scan for high rolling goal.
      E. Once the goal has been detected drive forward into the high rolling goal while running the goal grabber inwards. Open servo plug to drop the small ball into the goal.
   If the Center Goal is in any other position (Black):
      F. Drive backward, turn left and drive forward again to knock down kickstand.
      G. Drive to get close to rolling goals.

All driving and turning is handled with encoders.

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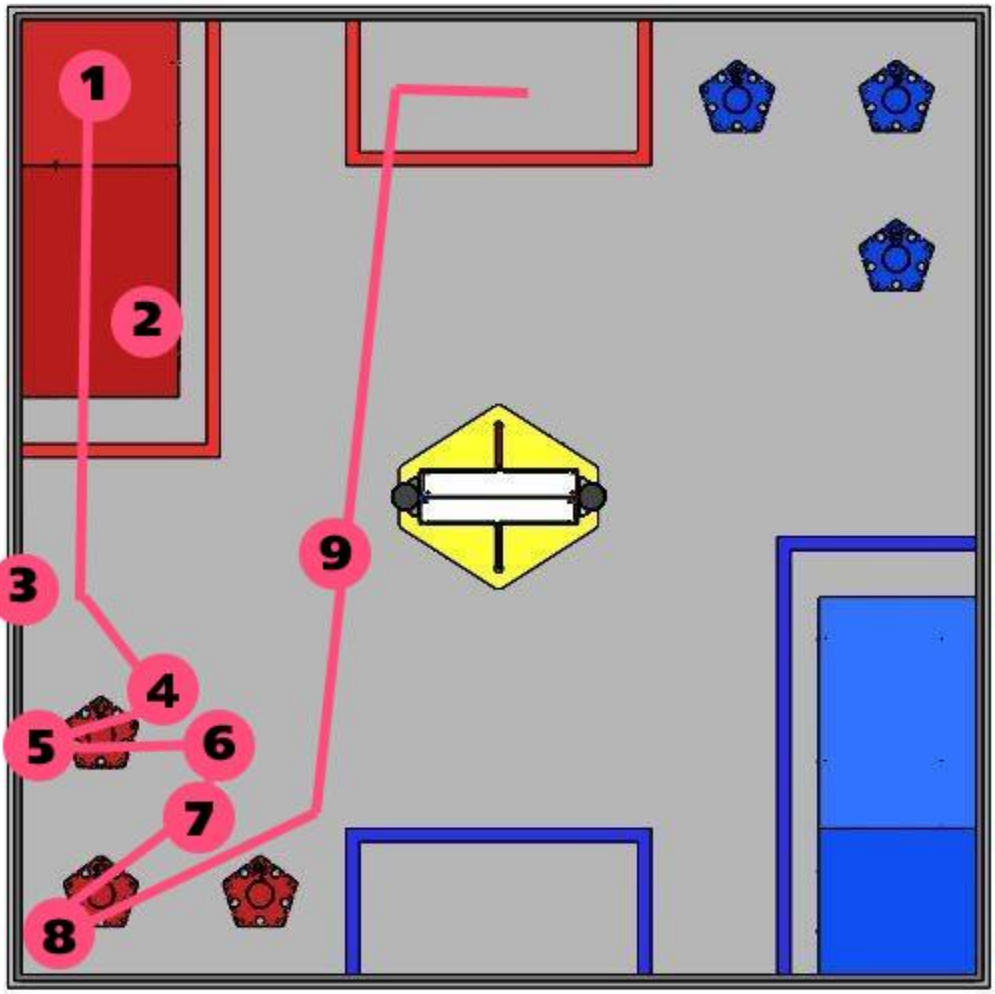
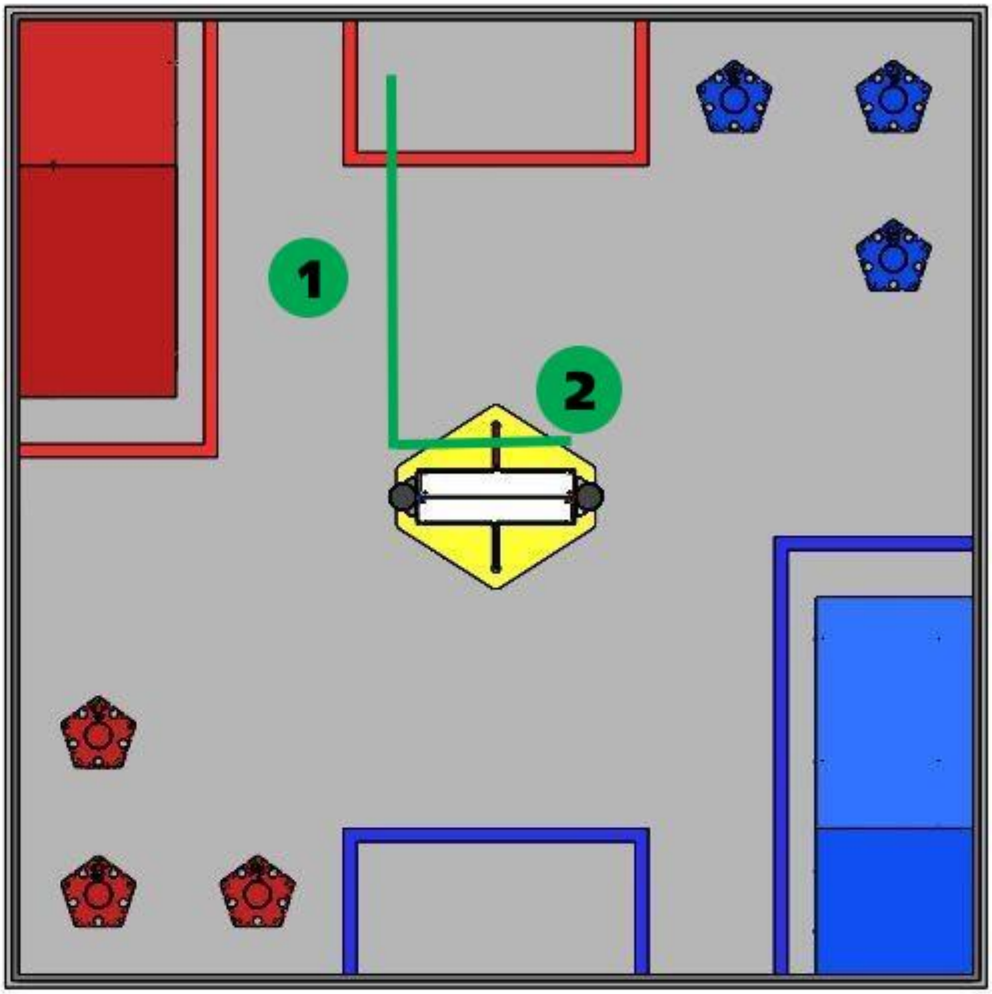
Two Goal Autonomous



1. Align robot with free edge of ramp facing forward.
2. Drive forward off of ramp.
3. Turn left and drive forward.
4. Turn left again so that the goal grabber faces the medium goal.
5. Drive backwards into the medium goal and open up the horizontal tube plug servo to drop large ball into goal.
6. Drive forward while goal grabber spins outward to release rolling goal then turn right and run the popper to pop small ball up into horizontal tube.
7. Drive forward and turn left to face the high rolling goal then use the sonar to scan for high rolling goal.
8. Once the goal has been detected drive forward into the high rolling goal while running the goal grabber inward. Open servo plug to drop the small ball into the goal.
9. Drive forward, turn left and drive into parking zone.

All driving and turning is handled with encoders.
If the sonar should detect that the grabber has been lost on the drive to the parking zone, end autonomous.

Kickstand Autonomous



1. Drive forward and turn left using encoders.

2. Drive forward and knock down kickstand.

Alliance Partner Strategies

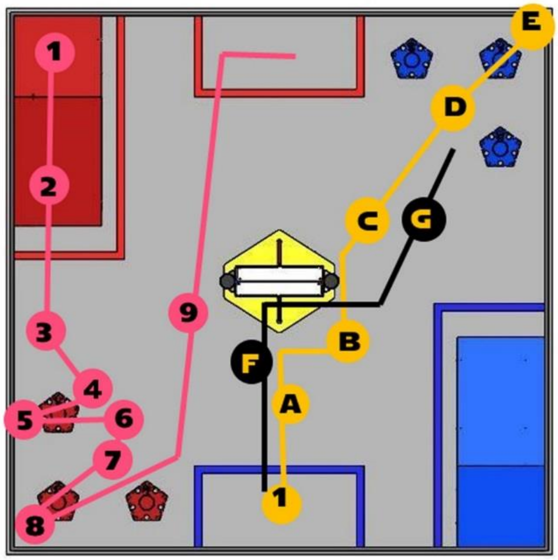
Our main autonomous starts at the ramp, drives to the medium rolling goal, and scores a ball. Then it drives to the high goal, scores the second ball and if the rolling goal is grabbed, drags it back to the parking zone. Turning and driving forward uses encoders. In teleop, we grab onto the low rolling goal and push it up onto the ramp. Then, we latch onto the high rolling goal, fill it, and push it up onto the ramp. Next, we fill the medium goal and push it up on the ramp. We then fill the center goal and drive onto the ramp. In matches, we modify the above strategy based upon our alliance partner's ability and work together to achieve the highest score. For example, if our alliance partner can fill the medium goal, put it on the ramp with the small goal and park the robot on the ramp; we will be filling the high goal, center goal, and finally parking on the ramp.

Control Award Content Sheet

Control Award Content Sheet

****Please turn in this sheet during your Judge Interview along with your Engineering Notebook****

Team # 4250	Team Name: LIGHTSABERS



Autonomous:

Two Goal (Pink)

1. Align robot with free edge of ramp facing forward.
2. Drive forward off of ramp
3. Turn left and drive forward.
4. Turn left again so that the goal grabber faces the medium goal
5. Drive backwards into the medium goal and open up the horizontal tube plug servo to drop large ball into goal
6. Drive forward while goal grabber spins outwards to release rolling goal then turn right and run the popper to pop small ball up into horizontal tube
7. Drive forward and turn left to face the high rolling goal then use the sonar to scan for high rolling goal
8. Once the goal has been detected drive forward into the high rolling goal while running the goal grabber inwards. Open servo plug to drop the small ball into the goal.
9. Drive forward, turn left and drive into parking zone.

All driving and turning is handled with encoders.
If the sonar should detect that the grabber has been lost on the drive to the parking zone, end autonomous.

Center Goal (Gold and Black)

1. Place robot in the middle of the parking zone facing the center goal. Use IR sensor to identify centergoal position

If the Center Goal is in position 3 (Gold):

A. Raise scissor lift to 120cm height, drive backward to the center goal and score the large ball
B. Move scissor lift to 90cm height while driving and turning to knock down kickstand
C. Turn right and drive towards the highest rolling goal
D. Turn left for one second then turn right while using the sonar to scan for high rolling goal
E. Once the goal has been detected drive forward into the high rolling goal while running the goal grabber inwards. Open servo plug to drop the small ball into the goal.

If the Center Goal is in any other position (Black):

F. Drive backward, turn left and drive forward again to knock down kickstand
G. Drive to get close to rolling goals.

All driving and turning is handled with encoders.

Driver Controlled:

- **Map joystick controls to driver's preference.**
- **Use limit switch to prevent scissor lift from going down too far.**

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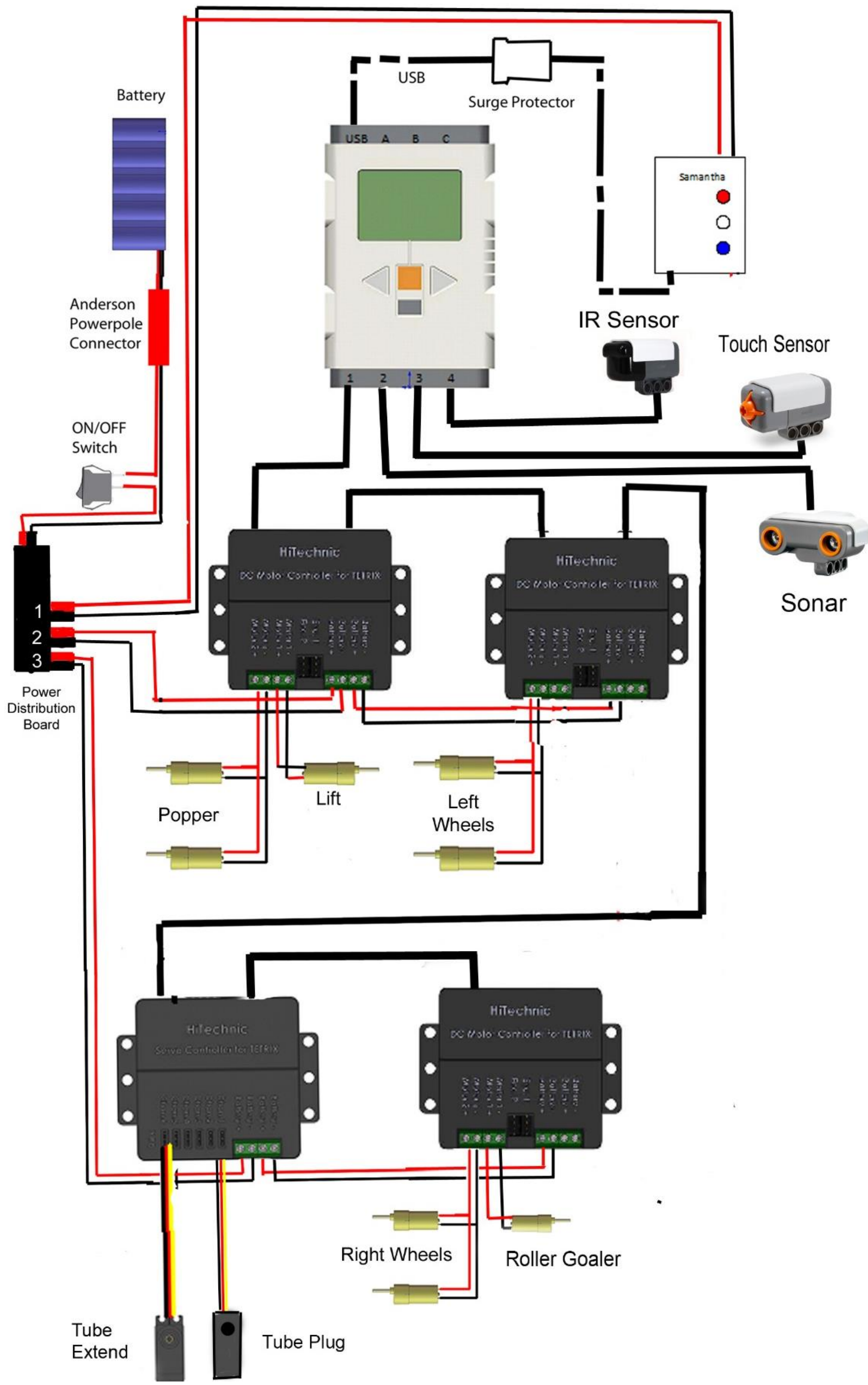
ELECTRICAL

LIGHTSABERS

Schematic



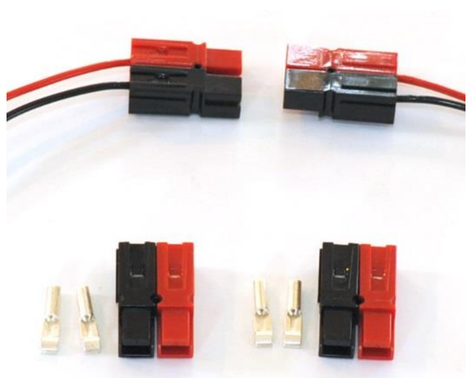
Electrical System Design

USB Surge Protector

We added a surge protector between the USB port on the NXT and the Samantha Module. In previous years, we have had static electricity lock up our NXT. We believe the surge protector will help minimize the effect of the static electricity. We also routed the power paths and data paths separately as much as possible to minimize signal interference.

Anderson Powerpole Connectors

The standard connectors on the Tetrix batteries become weak and faulty over time. When the batteries get bumped they can come loose from the robot's power connector causing the robot to lose power and restart. To remedy this we changed our connectors to Anderson Powerpole connectors. They have a better connection and do not become weaker over time.



We are using an Anderson Power distribution block rated @ 45A to provide low-loss voltage. This is to be sure every sub-system is getting full power from the battery.

LIGHTSABERS 2014-15 Wiring Addendum

2014-2015

FTC® WIRING

ADDENDUM

SUPPORTING: FTC® ROBOT WIRING GUIDE & ADDRESSING NXT LOCKUPS

http://www.usfirst.org/sites/default/files/uploadedFiles/Robotics_Programs/FTC/Team_Resources/FTC_Robot_Wiring_Guide.pdf

http://www.usfirst.org/sites/default/files/uploadedImages/Robotics_Programs/FTC/FTC_Documents_and_Updates/Addressing_NXT_Lockups.pdf

Battery Beak (Battery Tester)

Purchase at: http://www.andymark.com/product-p/am-0995.htm

The Beak works on both Lead Acid and NIMH batteries used in FRC®, FTC®, and VEX®!

This is a battery load tester, capable of delivering an 18 amp load and measuring these battery qualities:

- **Internal resistance**
- **State of charge (SOC)**
- **Can determine the overall health of the battery**

Anderson Powerpole Connectors

Purchase at: http://www.powerwerx.com/anderson-powerpoles/powerpole-sets/30-amp-red-black-anderson-powerpole-sets.html

30 Amp Unassembled Red/Black Anderson Powerpoles

Recommended for use with 12-14 gauge wire. Unassembled sets can be assembled in any configuration. An included slotted roll pin prevents the housings from sliding apart

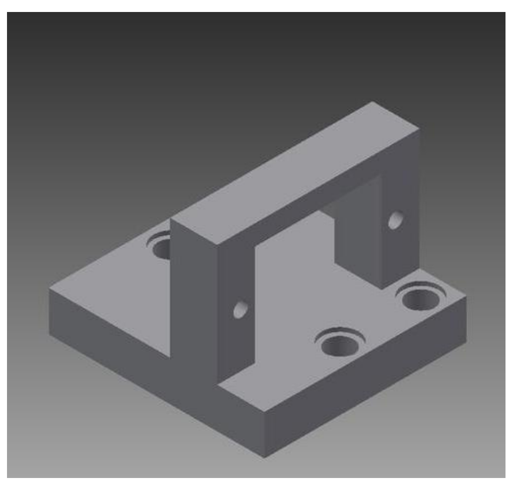
L-Com USB Surge Protector

Purchase at: http://www.l-com.com/usb-usb-surge-protector-ecf-style-panel-mountable-type-a-type-b

The L-com AL-ECF504-AB USB surge suppressor is a commercial quality device designed to protect a Computer's sensitive USB ports from surges and spikes from attached devices. To ensure USB 2.0 speeds, the device uses ultra-low capacitance diodes to protect the data lines. In addition, a protection device clamps the power lines to safe levels. This surge suppressor is ideal for protecting a PC from WiFi client adapters and surveillance cameras used with long USB extender cables.

Lightsaber Robotics - 3D Printed L-Com Mount

Download at: http://www.thingiverse.com/thing:507574



6” USB Type A Male to Type B Male

Purchase at: http://www.pchcables.com/6inusb20tyma1.html

This is the most common type of USB cable. Usually used to connect your PC to a Printer, Scanner, Multi-Function Printer, some USB hubs and other devices, also simply called "USB A to B" cables.

18” USB Type A Male to Type B Male

Purchase at: http://www.pchcables.com/18inusb20tym.html

This is the most common type of USB cable. Usually used to connect your PC to a Printer, Scanner, Multi-Function Printer, some USB hubs and other devices, also simply called "USB A to B" cables.

3D Printed Samantha Mount

Download at: http://www.andymark.com/product-p/am-sambracket.htm

This bracket securely holds the Samantha Module with the use of cable ties. More importantly, this case with use of cable ties keeps the cables attached to the Samantha Module. Below are links to the layout print, and print files for making this part in your facility.

Good Luck from the LIGHTSABERS!

***Email us @ vince@LIGHTSABERrobotics.org if you would like an electronic version of this document.**

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ENGINEERING CALCULATIONS

Gear Ratios

Sprocket ratio: $8 \div 16 = .5$

Gear ratio: $40 \div 120 = .33$

Total ratio $= .5 \cdot .33 = .165$

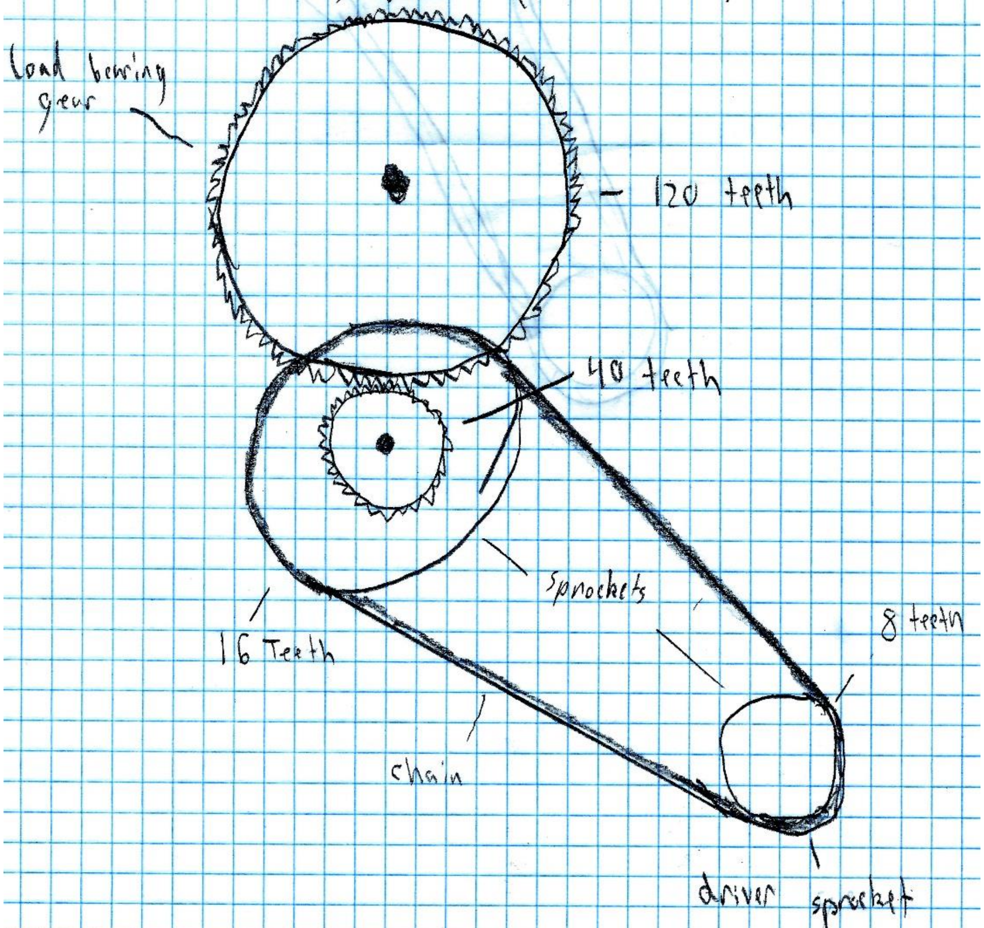
Motor RPM = 160

Final load bearing gear RPM $= 160 \cdot .165 = 26.4$

Motor Torque: 350 oz/in

Torque ratio: 6

Load bearing gear torque: 2100 oz/in

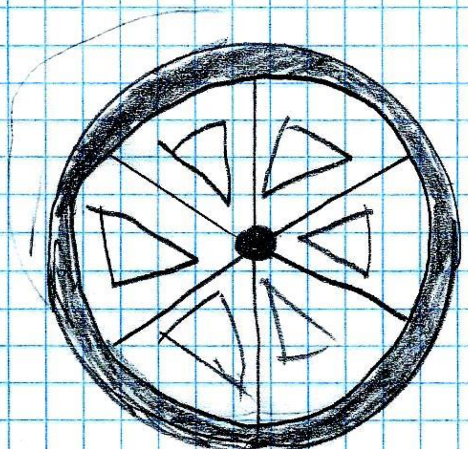


Wheel Radius

Competition bot Monster truck wheel

diameter: 5 inches

Circumference: $5 \cdot 3.14 \approx 15.7$ inches



Optimal Motor RPM = 160

1 rotation = 15.7 inches of travel

Travel rate = $160 \cdot 15.7 =$ 2512 in per minute

$\frac{2512}{60} = 42$ in/sec

$\frac{2512}{12} = 209$ ft/min

$\frac{209}{5280} = .04$ miles/Min

$\frac{.04 \text{ mile}}{1 \text{ minute}} \cdot \frac{60 \text{ minute}}{1 \text{ hour}} = 2.4$ mph

Scissor Lift Chain Length Calculation

The following is a formula for calculating the roller chain length:

Z + Y = Q (Chain length in inches)

Where Z = Sprocket DriveR No. of Teeth + Sprocket DriverN No. of Teeth x Chain pitch (in inches)

Then divide by 2 .

Z= 16 + 16 x .25 = 8

8 / 2= 4

Z =4

And Y = 2 x Shaft's Center distance (in inches)

Y = 2 x 5.75 = 11.5

Y =11.5

4 + 11.5 = Q

Q = 15.5 inches

Popper Motor Load

Popper requires 5.9 lbs of force to load. 5.9 lbs converted to ounce inches is 1132.8 oz inches.

Our motor's stall torque = 350 ounce inches. Since our drive gear = 40 teeth and our driven gear = 120 teeth we have a gear ratio of 3.

This means that one motor can provide 3 x 350 ounce inches of torque, or 1050 ounce inches.

This is just barely below the amount of force the popper requires to load. This is why we run the popper with 2 motors. 2 motors can provide 700 ounces inches of force, which, when multiplied with our gear ratio, means the two motors can handle a load of 2100 ounce inches, which is well above our requirements, allowing the popper to run smoothly when powered by two motors.

Popper Launch Rate

Motor RPMs = 160

160 Revolutions per minute / 60 secs per min = 2.67 revolutions per second.

Our gear ratio = 3 since Drive gear= 40 teeth and driven gear = 120 teeth

2.67 RPS / 3 =.89 RPS

0.89 x 2 (due to 2 popper bats) = 1.78 pops per second

Convert 1.78 pops per second to second per pop

1.78 PPS x (1 sec / 1.78 pops) = 0.56 secs between pops.

We used a slow motion camera to time our actual pop rate. Our real rate was 0.625 secs between pops. The difference is due the actual load on the popper slowing down its firing speed.

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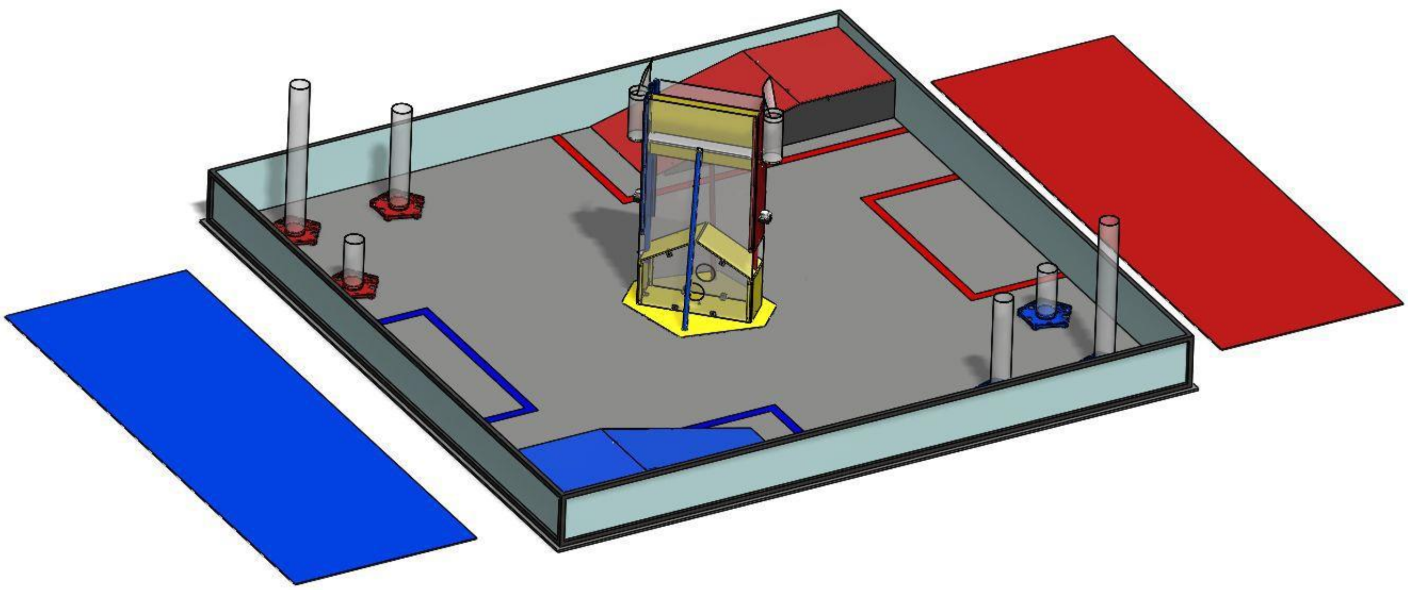
STRATEGY AND SCOUTING



The 2014 LIGHTSABERS Scouting Program

Our motivating factor for incorporating a scouting program is the future vocational benefits for our students. The processes of an effectual scouting program inculcate into their F.I.R.S.T. experiences, analytical abilities, and diagnostic skills for real world applications when they enter the work force. Our desire is to provide an exciting environment in which to teach our students to learn quickly and accurately how to strategically and tactically assess any given vocational situation or circumstance in order to rapidly resolve the problem. We want them to learn how to strip away the peripherals, eliminate the obvious, and thereby be able to reduce the dilemma to its core functions and constituent parts.

Our present scouting system was developed by one of our mentors, Wayne Hendricks, who has coaching experience from Little League baseball to high school athletics. Another of our mentors, Michael Lewis, is currently coaching middle and high school football. Drawing from their backgrounds of evaluating and judging athletes during competitive sports, our program is constantly evolving into a unique analysis tool for our students to utilize in their learning and mastering of the skills for interpreting the data they acquire during their scouting of robotic teams during matches.

Applying the belief that Drivers and robots emulate and imitate the basic dynamics of human athletic activity, the scouting program is retrofitted for the F.I.R.S.T. robotics environment.

Lightsaber Systematic Scouting Processes:

Scouting Principles – These are a collection of the five basic principles that cover particular topics that teach scouts how to compile data onto a worksheet for reporting to the Drive Coach and Drivers.

Fundamental Intrinsics – These are for teaching the scouts the intricacies concerning the minutiae of inherent and incidental robotic movements such as forward, backward, angle, diagonal, up, down, vertical, horizontal, lateral, etc., and how they relate to one another.

Offensive/Defensive Methodology – These are concepts that help the scouts to understand how robots actually and realistically interact with each other on the playing field.

Observation Skills – These are a combination of the philosophical and practical aspects of visual surveillance that help scouts learn how to analyze what they are observing.

Passion & Spirit – These are efforts to encourage and stimulate the scouts towards acquiring a conviction of the necessity of the scouting process, how much it benefits the team, and promoting how much fun it can be. This is to assist them to eventually take over the program and execute it as their own.

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Team Concepts – These are designed to re-enforce the values of the inter-dependence of one-on-one relationships and how they are a direct link to the building of a strong team identity and unity that results from a personal view that every part is invaluable to the whole.

Strategy & Tactics – These are viewpoints of contingencies and exigencies that relate to the team's preparations for match play and then the disruptive events that occur during the match that interfere with match preplans and pre-game specific goals.

"Do or Do Not! There Is No Try!" – Master Yoda

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Scouting Legend

TEAM | MATCH | TIME | : | Auto | TeleOp | End | PT | Pk | K | K | AUTO | H | M | L | Comments: | A | PARK | E | H | M | L | H | M | L | MATE | H | M | L | PUSH | SCORE | H | M | L | FULL | CENTER | A | E | PLAT | H | M | L | NEXT MATCH

TEAM | MATCH | TIME | : | Auto | TeleOp | End | PT | Pk | K | K | AUTO | H | M | L | Comments: | A | PARK | E | H | M | L | H | M | L | MATE | H | M | L | PUSH | SCORE | H | M | L | FULL | CENTER | A | E | PLAT | H | M | L | NEXT MATCH

TEAM | MATCH | TIME | : | Auto | TeleOp | End | PT | Pk | K | K | AUTO | H | M | L | Comments: | A | PARK | E | H | M | L | H | M | L | MATE | H | M | L | PUSH | SCORE | H | M | L | FULL | CENTER | A | E | PLAT | H | M | L | NEXT MATCH

TEAM | MATCH | TIME | : | Auto | TeleOp | End | PT | Pk | K | K | AUTO | H | M | L | Comments: | A | PARK | E | H | M | L | H | M | L | MATE | H | M | L | PUSH | SCORE | H | M | L | FULL | CENTER | A | E | PLAT | H | M | L | NEXT MATCH

TEAM | MATCH | TIME | : | Auto | TeleOp | End | PT | Pk | K | K | AUTO | H | M | L | Comments: | A | PARK | E | H | M | L | H | M | L | MATE | H | M | L | PUSH | SCORE | H | M | L | FULL | CENTER | A | E | PLAT | H | M | L | NEXT MATCH

Legend Instructions/Breaking Down the Game

SCOUTING LEGEND & INSTRUCTIONS

TEAM	MATCH	TIME
		:
Auto	TeleOp	End

	AUTO		
PT			H
Pk			M
K			L
K	Comments:		

A	PARK		E
H			H
M			M
L			L

MATE		PUSH
	H	
	M	
	L	

SCORE			FULL
	H	H	
	M	M	
	L	L	

CENTER	
	A
	E

PLAT	
	H
	M
	L

NEXT
MATCH

AUTO	Autonomous:	the robot moves off the platform and/or out of the parking zone
MATE	Mate:	the robot mates & secures tube(s) in a stationary position
PUSH	Push/Guide:	the robot is in continuous control of the tube movement
SCORE	Score:	the robot deposits balls into the rolling goal(s)
FULL	Tube Fill:	the robot fills up the tube(s) with balls
CENTER	Center Goal:	the robot deposits ball(s) into the center goal in autonomous and/or the end game
PARK	Parking Zone:	the robot leaves tube(s) in the parking zone and/or rests in the parking zone
PLAT	Platform:	the robot leaves tube(s) on the platform and/or rests on the platform
FLOOR	Floor:	the robot lifts tube(s) off the floor

FOUL POINTS This is the total amount of foul points gained by the opponent alliance team

Movement: Record each time segment the robot is in actual movement

An Unmarked Box:	the robot cannot do this
A Marked Box:	the robot does this
A Marked Letter Box:	the robot does this

NOTES:

Our scouting system is **Task Critical & Performance Based**.

"Do or Do Not. There is no try!" - Yoda. The robot either does the task or does not do the task.

We have eliminated the elements of "can" or "attempt" or "try" or "nearly" or "potential," etc., in the scout process.

We make the distinction between what the potential of a robot is compared to what the robot actually does in competition.

Scouting analysis is the critique from the introduction of the balls into the playing field eventuating in ball manipulation into the scoring goals.

The scout will focus on one robot only during a single match to the exclusion all other activity on & off the field.

The scouting of Alliance partners always takes priority. (Particularly true, should the number of personnel be limited for the scouting process.)

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Systematic Scouting Processes

SYSTEMATIC SCOUT PROCESSES:

SCOUTING PRINCIPLES			**FUNDAMENTAL INTRINSICS**					
#1	Worksheets	1	TRAVEL	Robot movement relative to the field				
	Tier 1 - 2 - 3	2	TRANSPORT	Carry the tubes about the field				
		3	TRANSFER	Deposit balls into tubes & move tubes to platform or parking zone				
#2	Strategy	4	TRAFFIC	Robot maneuvering around & past the obstacles				
	Tactics	5	TRAVERSE	Robot movement back & forth over the whole field				
		6	TRACKING	Robot positioning & re-positioning to specific places				
#3	Overview							
	Siteview		**OFFENSIVE/DEFENSIVE METHODOLOGY**			**OBSERVATION**		**PASSION**
#4	Simplicity	1	Playing Field Perspective		1	Task Critical	1	Belief
	Duplicity	2	Schemes & Zones		2	Performance Based	2	Sobriety
		3	Teaming & Twining		3	Reality Centered	3	Enthusiasm
#5	Compilation	4	Strict Analysis		4	Cause & Effect	4	Work Ethic
	Analysis	5	Game Flow		5	Intangibles	5	FUN

Team Concept: Cooperate - Collaborate - Instigate

Defensive Strategy: It is not about the prevention of scoring but about containment tactics.

Offensive Strategy: It is not about scoring, in & of itself, but creating opportunities for scoring.

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