6417

TheBluCru

Velocity Vortex

2016-2017

Engineering Notebook

Summary Page

This season, the Blu Cru is made up of 10 members (see Meet the Cru on pages 8-10) from all across Montgomery County, Maryland. We have worked extensively on designing, building, programming, and reaching out to the community to spread the spirit of FIRST during the 2016-2017 FTC Season. Some of the outreach activities in which we participated in that we particularly enjoyed this season were the Robert Frost Middle School STEM Night, Johns Hopkins Frontiers in Science, Summer Robotics camps, and the USA Science and Engineering Festival (documented on pages 40,52,48,44). We thoroughly enjoyed connecting with the kids, parents, and other teams in the community with our robot, which allowed us to experience first-hand the community-focused philosophy upon which FIRST was founded. The feedback we received allowed us to grow as a team, both technically and personally, throughout the season.

Our engineering design process began immediately following the release of the FTC kickoff. We spent, and are continuing to spend, a large majority of time planning, drawing, and CAD-ing our designs out this season (see our brainstorming session on page 58). This multifaceted effort culminated in our development of two distinct and functional launcher systems for our robot: a wheel launcher and a flicker launcher (see page 96 for our robot's evolution). We experimented with a number of permutations and combinations in order to try and maximize our scoring potential. In the end, we went with our flicker launcher solution, and designed a conveyor belt system to aid by lifting the balls into the launcher. Given that many ideas work in theory but not in practice, we decided that it was necessary for us to test our designs extensively. Thus, the testing phases of our engineering process took up the majority of our season so far, and were able to quickly resolve any issues we found. And finally, with our autonomous code, our plans for the season were to score with the beacons and to launch the balls. We believe that this will maximize our scores, and allow us to help our alliance win.

At the competitions in which we participate, we hope to exercise the fruits of our labors this season, and continue to have a good experience competing. We hope to continuously improve our robot and ourselves, and to be a positive influence to all the people with whom we interact. We are hoping for a successful competition season, and to strengthen our team both for current members and in anticipation of future members in the years to come. So far this season we have attended one qualifier (Sidwell Day 2), where we won 1st place Control, 3rd place Motivate, 3rd place Connect, 3rd place Think, 3rd place Inspire. The Cru was also given the opportunity to advance States at this qualifier; we are looking forward to representing our community at States this year!!

TABLE OF CONTENTS

Team Mission Statement

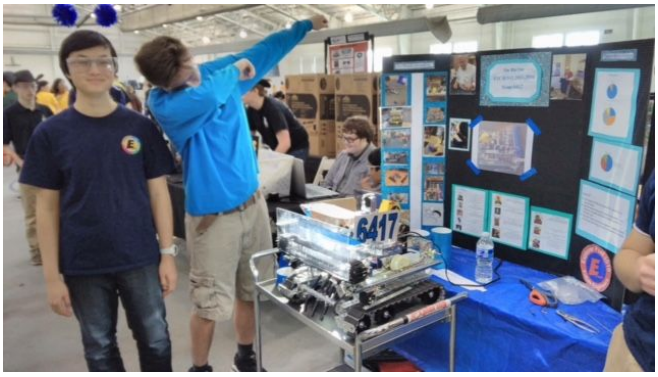
By involving the community in our efforts to succeed in FTC, we will inspire our peers, friends, families, and communities this season with our passion and dedication to FTC. Along the way, we will embody and exhibit the FIRST spirit of gracious professionalism. Together, we will face our fears, build our bot, and hopefully conquer the competition. All we have to do is try.

THANK YOU FIRST !

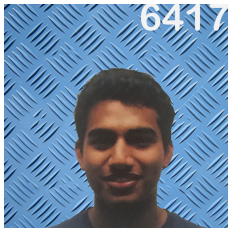
Dear FIRST,

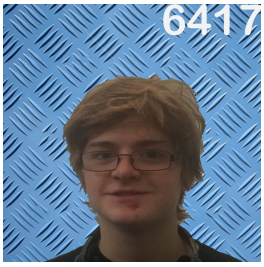
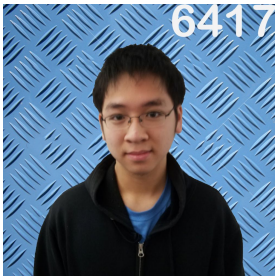
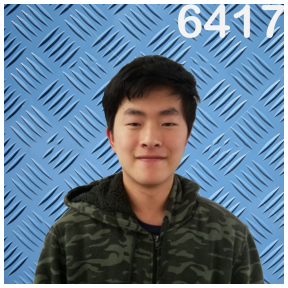
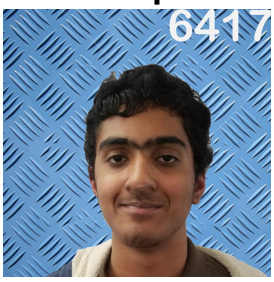
We'd like to thank you for creating and organizing the FIRST Tech Challenge. Those who say that robotics isn't a sport obviously have not seen a FTC competition in action. We love FTC because of the way it makes us think, and the way it makes us feel. FTC combines our love for robotics with the excitement of competition. For most of us, this program is our creative outlet, and an escape from the demanding school environment. During the season we are able to channel our passion for innovation, and push the limits of design. The Cru may start off the season as just teammates, but by the end we are family (robot included). FIRST makes all of this possible for us. WE LOVE FIRST & FTC!!!

Sincerely,
The Blu Cru 6417

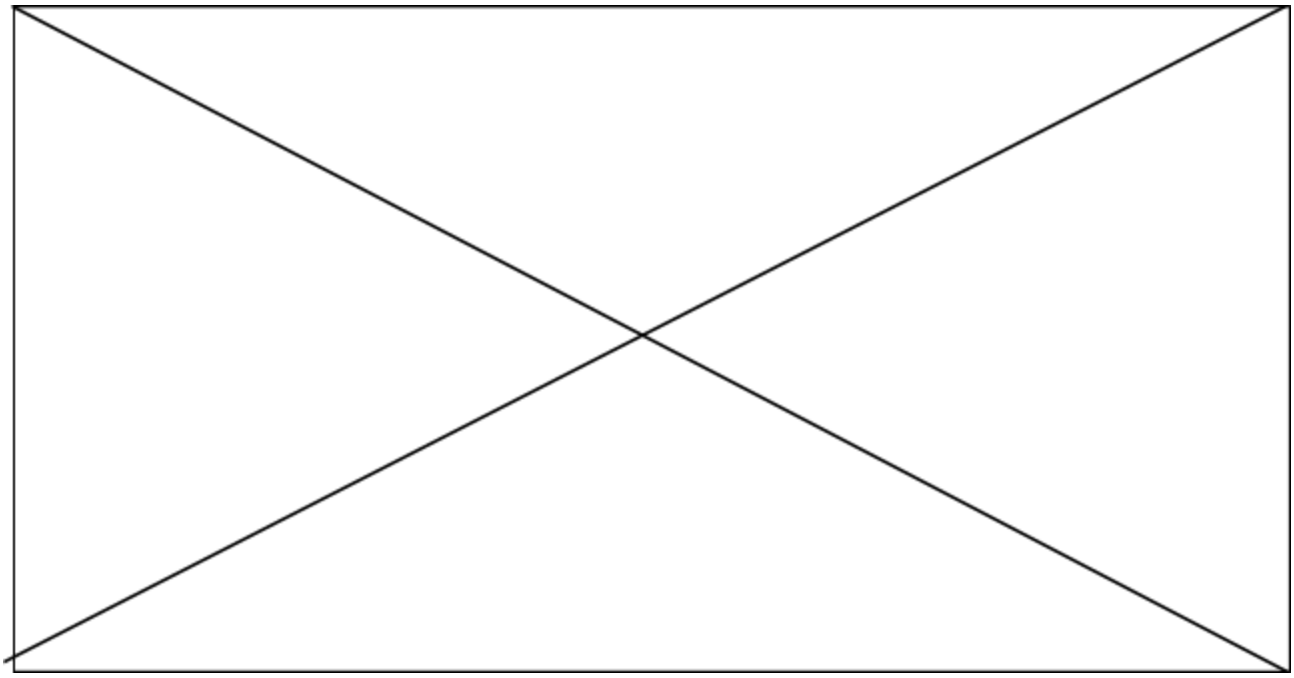


Meet The Cru

Members : 10	About
Ragini Balachandran 	**School:** Thomas S. Wootton High School **Age:** 16 **Interests:** Robotics, Soccer, Reading **Joined FTC:** I wanted to use my building skills to work on a team project in my community. Chair of FTC team
Avanish Yendluri 	**School:** Poolesville High School **Age:** 16 **Interests:** Robotics, Football, Basketball **Joined FTC:** I wanted to use my engineering skills from school to work on a robotics project.
Gunvir Lubana 	**School:** Richard Montgomery High School **Age:**14 **Interests:** Basketball, Swimming, Reading, Videogames, Engineering, and Robotics **Joined FTC:** I had an interest in engineering that I wanted to pursue and to increase my experience.
Ben Ganelin 	**School:** Thomas S. Wootton High School **Age:** 14 **Interests:** Robotics, Fencing, Video games, Engineering **Joined FTC:** I wanted to join FTC to gain experience in robotics and hopefully find people like me.

Connor Gregory 	**School:** Richard Montgomery High School **Age:** 15 **Interests:** Video Games, Mechanical Engineering **Joined FTC:** I wanted to find a more friendly FTC team.
Austin Long 	**School:** Thomas S. Wootton High School **Age:** 16 **Interests:** Coding, Video Games **Joined FTC:** I wanted to apply my coding skills to a real-life challenge that needed to be solved.
Moses Kang 	**School:** Thomas S. Wootton High School **Age:** 16 **Interests:** Reading, Soccer, Video Games **Joined FTC:** I love building and programming, and robotics is a perfect way to have the interdisciplinary engineering experience.
Rohit Harapanhalli 	**School:** Montgomery Blair High School **Age:** 15 **Interests:** Video Games, Engineering, Coding **Joined FTC:** I joined FTC because I wanted to apply various engineering skills and robotics skills, as well as learn more about robots.

Eric Rong 	**School:** Wheaton High School **Age:** 17 **Interests:** Hobby Drones, Cars, Writing **Joined FTC:** I wanted to be involved in an integrative experience encompassing the implementation of technology, social skills, and clear communication.
Upneet Singh 	**School:** Clarksburg High School **Age:** 16 **Interests:** Website Development, Rocketry, Cricket **Joined FTC:** I was interested in the hands-on experience that practical experience with robotics brings.



Meet the Mentor: Bob Ekman

This page is dedicated to our mentor Robert (Bob) Ekman, without whose support we would not be here.

When a team member asked,"Why do you do all of this?"
Bob responded, "Because someone has to inspire the next generation of engineers."

Not only does our mentor go out of his way to support us with the comical gear we request him to wear, but he also makes a lot of sacrifices for us and for the community. Along with running our organization, the Explorer Post 1010 (which consists of 5 robotics teams, 1 UAS4STEM team and 3 rocketry teams), he spends a great deal of time inspiring the youth of our community through science and technology through his presidency of the Rockville Science Center.

He does all this altruistically without seeking any reward. However, the true reward comes from those who benefit from his efforts: He sees and inspires the future engineers and scientists at work.

Unlike other mentors, Bob has an approach that facilitates greater growth of the team members; rather than directly telling the team what to do, he takes a step back and advises us, allowing us to design using our own collaborative methods. He advises us not only when we ask him, but whenever he finds it necessary, which is one of the things we most appreciate about him. The approach facilitates active thinking and independence, which work to develop critical skills essential for life. We feel, as a result of this approach, that we have both been able to grow as a team, as well as make the most of this experience. We can apply these invaluable skills later on as we pursue other engineering projects throughout our schooling and our careers.

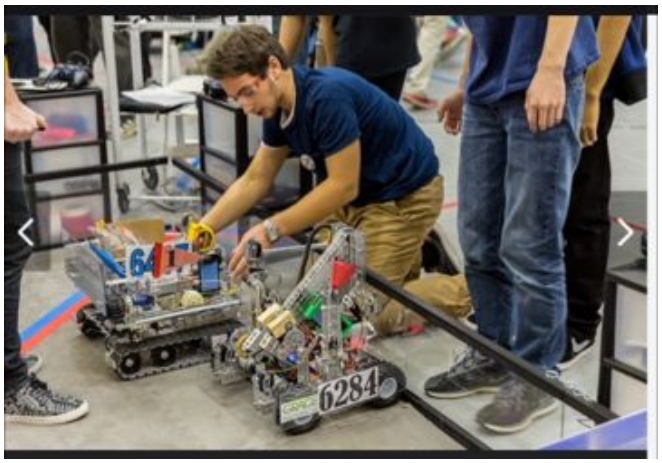
Meet the Mentor: Silvia Vidaurre

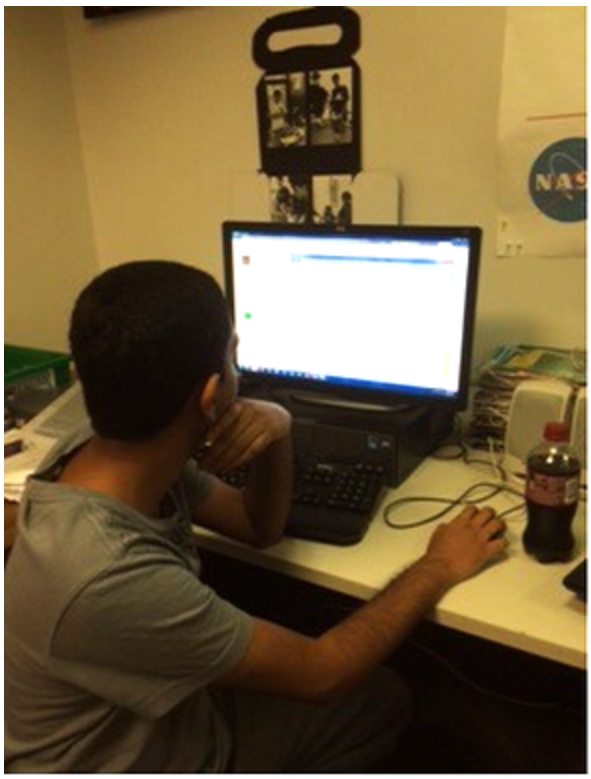
Our mentor, Silvia, an FRC alum, has played a Crucial role in our team by assisting us greatly as we build and develop our robot. She has constantly ensured that we are productive at every meeting, and makes sure that we are moving in the right direction. Silvia takes time out of her busy day so that she can teach and support our team as we work through the task of developing our robot. She has spent lots of time developing our team, furthering our knowledge in electrical and mechanical engineering, and preparing us for competition and for life. Silvia is currently an employee of Lockheed Martin.

Whenever we reach an obstacle, Silvia is there to help us. Whenever we are confused about which course to take to overcome a challenge, Silvia facilitates discussion as we share our opinions and helps us make the best decisions for our team. She always helps our team expand our critical thinking abilities, facilitating our growth by allowing us to solve our own problems rather than simply giving us the answer.

Silvia always provides her invaluable input when our team is working, which ensures that we effectively complete our tasks on a daily basis. Her perspicacious teaching has instilled a hard work ethic and has promoted active thinking in all of us, both of which have helped in the productivity of our team. Each and every team member will be able to effectively apply all the knowledge she taught us during this project to various engineering and even non-engineering projects in the future. Her mentorship and teaching have served a pivotal role in the development of our robot, and has strengthened the relationships between all our team members.

Business & Sustainability Section





Section Overview

1.0 Introduction

1.1 Who are we?

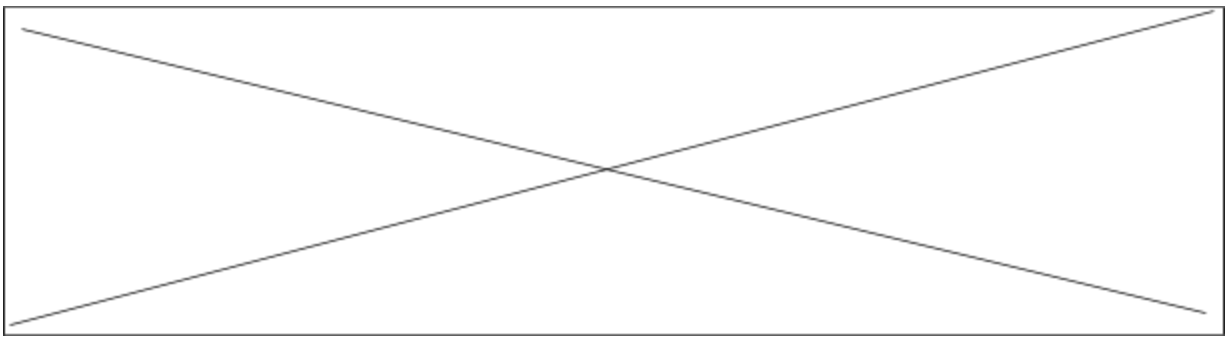
We are FTC (FIRST Tech Challenge) Team 6417 : The Blu Cru. The prominent Blue featured in the Explorer Post 1010 & Johns Hopkins Logos is a large reason for our team name. The color we wear honors and represents the organizations that extend their support to us. The Cru exhibits our team spirit through our capes, color coordinated outfits (tutus included), and our commanding chants.

We, as a FIRST team, strongly value the core principles set by the organization. Because of this, we make an effort to exemplify gracious professionalism at all events and meetings. We want to make a positive, lasting impact not only on FIRST, but on the community as a whole.

Our FTC team was started by the Explorer Post 1010 organization. Explorer Post 1010 has an exciting program of technical and fun activities for high school students interested in engineering. The Post is engaged in several engineering and research projects, such as the Team America Rocketry Challenge, FIRST Tech Challenge, Botball Educational Robotics Competition, and the UAS4STEM Drone Competition. The members get opportunities to develop both leadership and teamwork skills. The Post enrolls about 30 teens every fall and runs the program through the next summer, with most members being involved for three or four years. Since 1997, when our Post was founded, over 350 teens have participated, with some coming back after college to be mentors.

- The Blu Cru made its debut in FTC in the 2012 -13 season
- The Cru advanced to states in almost all of its past seasons
- Last season, when our alliance won, we qualified for states at Montgomery Bullis 1
- At states we made it to division finals, but just missed a chance at Super Regionals

Each of our team members has experience in other STEM related competitions, such as Science Olympiad, Mathletes, FLL, USA4STEM, Science Bowl, and Botball. Our passion for FTC originates from our heavy involvement in the STEM community in our schools.

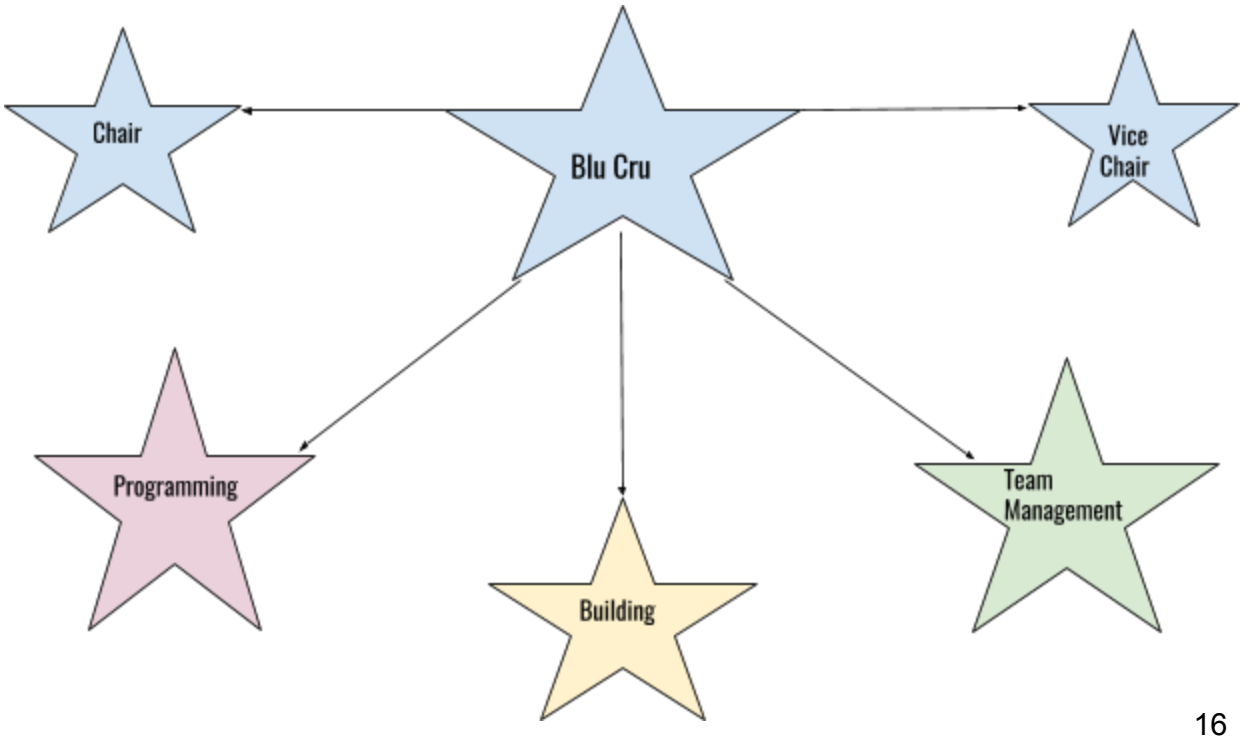


2.0 Team Organization

2.1 Leadership & Structure

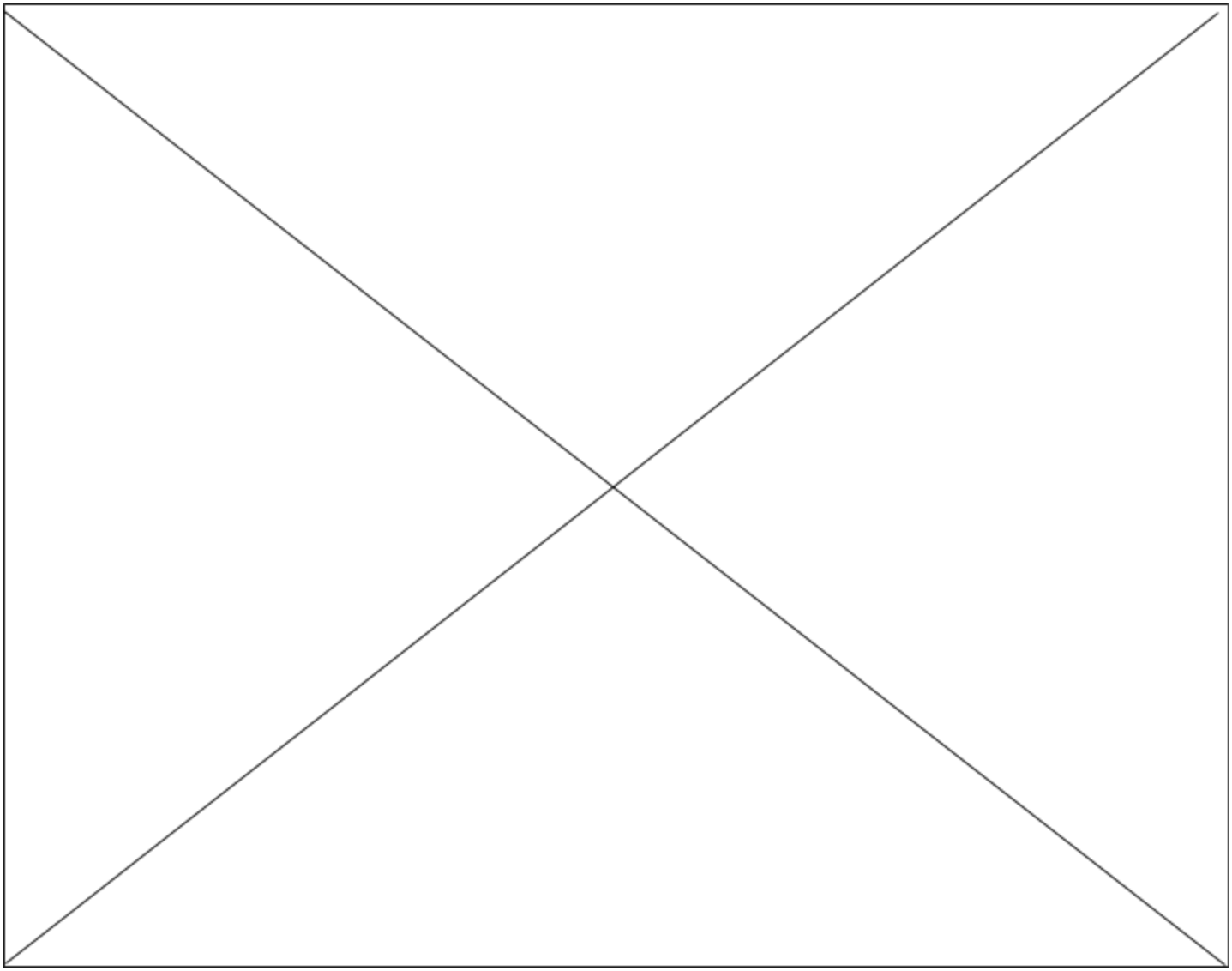
To keep our team running efficiently every season, we elect a chair, vice chair,and communications officer among the Cru to oversee all sub crews, activities, and events. The jobs require a large amount of dedication and organization, so our mentors nominate the candidates to ensure that the team goes into the season with good leadership. Members of the Cru then vote on the members to fill the positions. The election of the of chairs takes place two weeks after the FTC kickoff.

During the season we divide into sub crews to increase efficiency. Our main sub groups are each focused on programming, building, and team management. The builders effectively design & build the robot. The programmer' s program the robot's teleop & autonomous modes. Team management is responsible for deciding which competitions to attend, how to manage finances, and how to communicate with the community. However, we also come together as a team to make important, group-scale decisions, like when we decide on autonomous strategy and group objectives. This season we've also decided that documentation should be done by the whole team not just individuals, because we believe that if everyone is involved, it will keep everyone informed of group activities and achievements. Google Docs is an invaluable tool we use, with its collaborative features.



2.2 Business Meetings

Every month the Cru has a meeting to discuss our business agenda for the season. This meeting is headed by the team management sub crew, and is attended by all team members and mentors. During the meetings, we update team finance spreadsheets, and approve big purchases like team shirts and accessories. We also discuss our fundraising opportunities and our sponsors. These meetings will teach our members to not only be technically skilled in robotics, but to also learn how to be business savvy. Throughout the season we will update our business section to include the results and decisions from the meetings.



3.0 Goals

3.1 General

- Be gracious and professional at all competitions and events
- Spread the spirit of FIRST to everyone in the community
- Inspire the next generation of FIRST
- Improve time management skills
- Be cooperative

3.2 Outreach

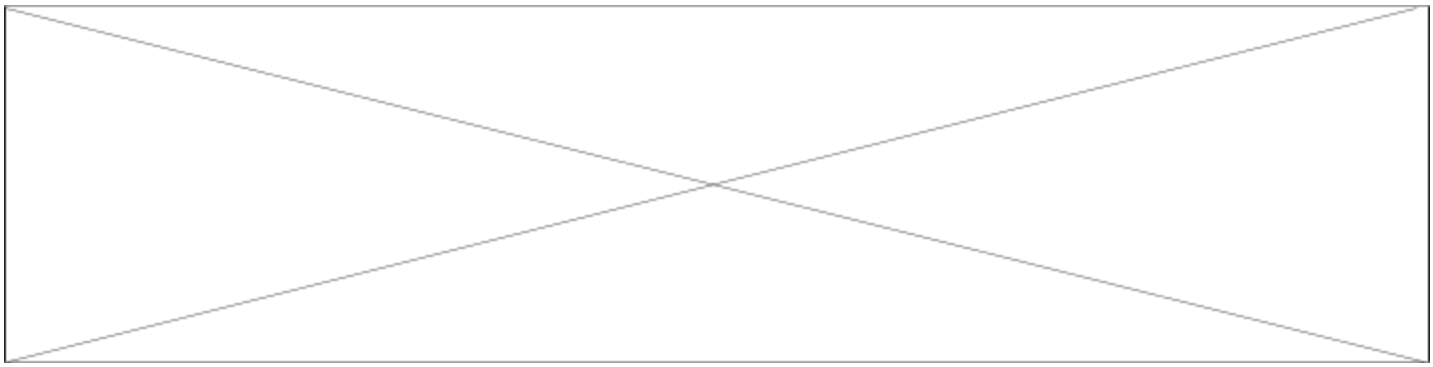
- Look for more ways to get involved in the immediate community
- Use social media effectively
- Attend at least one national level outreach event
- Get more team members to attend events
- Attend over sixteen outreach events this season

3.3 Technical

- Use CAD software (SketchUp/Autodesk CAD 360)
- Improve structure of robots
- Create robust designs
- Incorporate more sensors
- Improve autonomous programming
- Document the design process and its details extensively in notebook

3.4 Competition

- Score consistently
- Compete fiercely, but assist others when we can
- Improve presentation skills
- Create a competition checklist
- Efficient scouting spreadsheets
- Work our way up to competing at a national FIRST championship
- NEVER GIVE UP



4.0 Team Relationships

4.1 Community

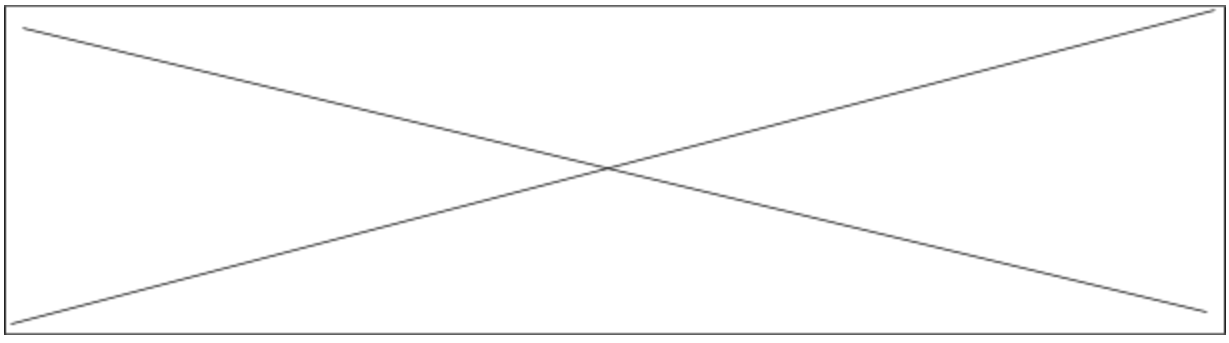
Members of the Blu Cru come from a variety of schools in Montgomery County, and because of this our team has strong ties to elementary, middle, and high schools in our area. Our outreach is primarily focused on reaching out to the youth in the community because we want to inspire the next generation of FIRST, and future STEM workers and leaders. Over the seasons, we have also become heavily involved with the local libraries. At the libraries, we host different events, including robot demonstrations and NXT robotics tutorials for elementary and middle schoolers.

During our season we received a lot of support from the parents, teachers, and students in the community. The Cru appreciates the community's continued support so we decided to focus most of our outreach efforts on the immediate community. We want to give back to the same people who have given so much to us.

4.2 FIRST Teams

The Cru communicates frequently with other teams during the season. During the season we set up numerous scrimmages with teams such as Mechanical Paradox, Watkins Mill HS Robotics, Gaithersburg HS Robotics, and RMaggedon. Occasionally, we even visit the USRA Stem Action Center to catch up with other teams. The Cru has numerous social networking accounts, including Facebook and Twitter, to catch up with other teams.

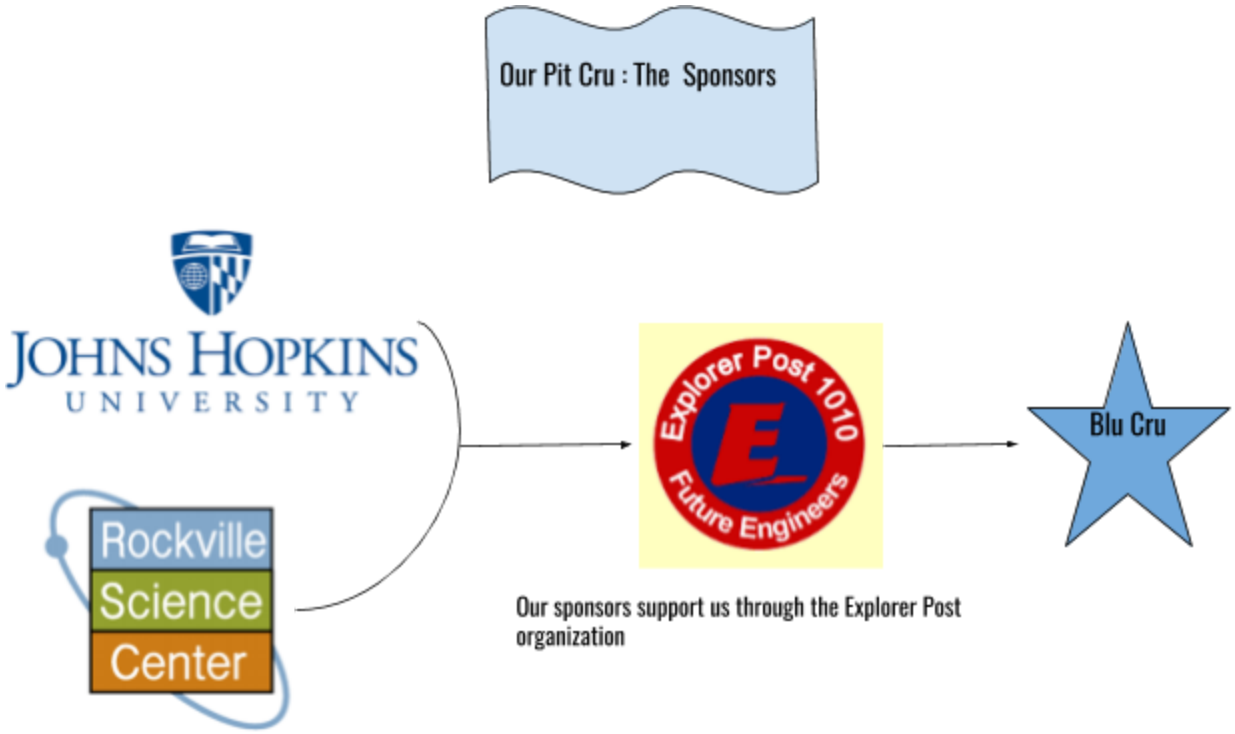
Additionally the Cru volunteers at FLL competitions, and assists local teams. This season, we hope to attend and volunteer at multiple FLL competitions and kickoffs. We also will be assisting a few local FLL teams through our mentor, Bob Ekman. The Cru really focuses on providing a good foundation in educational robotics for all FLL participants in our area. We hope that they will all follow our footsteps and take the next step into FTC or FRC in the future.



4.3 Our Pit Cru: Sponsors

We recently lost our sponsorship from Lockheed Martin. Lockheed used to provide the team with a rent-free workspace, but recently their offices in the area moved to a new location. Because of this, they were no longer able to support the Cru. This left the Cru particularly vulnerable going into the new season. Luckily, with help from our mentors, parents, and community we were able to get through it.

This season we are happy to announce that we are now being sponsored financially by the Rockville Science Center and by local donors/alumni. Moreover, Johns Hopkins University is sponsoring us with space in their Shady Grove campus. We are hoping to acCrue more sponsors and donations as the season progresses, and we wear their logos and brands proudly on our shirts. We represent our sponsors at their outreach events during the year, such as the Rockville Science Center at Rockville Science Day by wearing the center's uniform while we help put on the event. We will have several JHU events to attend later in the season, too.



We are expecting to receive a generous grants from ViaSat & IBM at the beginning of the season.

5.0 Sustainability Plans

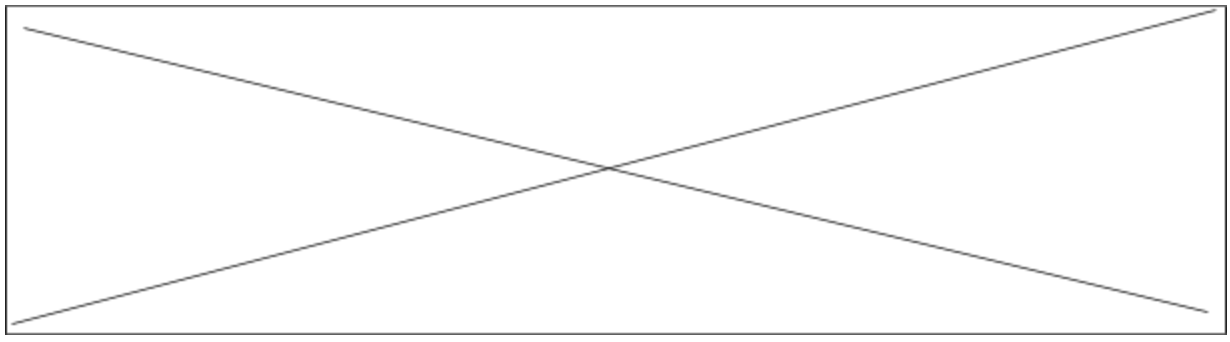
This section outlines our team's efforts to ensure the growth & stability during all FTC seasons. The Cru's members work collectively to execute each of these outlined steps.

This is Blu Cru's fourth season since its inception. We are under the parent umbrella of Explorer Post 1010 . Our team raises all funds through volunteer grants, direct sponsors, fundraising events and team dues. Every season we save parts of incoming funds for the next season. The amount of money saved for the next season is determined by our expenses, and team goals.

Our team is dedicated to building long term relationships with our sponsors by actively engaging them through the season. We will attend multiple outreach events hosted by sponsors to showcase our progress. We attract students from various schools in the MCPS area. The team usually has 2-4 new students every year to ensure that we can extend our legacy over the seasons. Our senior members usually transfer their knowledge and tips to the new members in training sessions. In addition, our team mentors are a mix of alumni and community volunteers. This allows us to ensure continuity from year to year.

5.1 Alumni Involvement

The Alumni of the Explorer Post 1010 program are vital to our team program because they make sure that everyone on the team has the proper knowledge required to participate in FTC. Before each season the alumni offer training sessions to new and current members on the team. They also advise the team on how to improve their competition and game strategies. During the competitions they also act as an additional layer of support and spirit for the Cru.



5.2 Team Risk & Opportunity Analysis

We have outlined the following concerns that might impact our current goals and strategies:

Risk 1- Advancing to Super Regionals and eventually a national championship

Factors that may hinder our goal:

- Technical errors in code (controllable)
- Other teams and robots (uncontrollable)
- Issues with static
- Robot's features like servos and motors having issues (controllable)

How we can address this :

- Create more checks for issues-(procedural checks)
- Use more static prevention techniques
- Increase teamwork and communication skills

Risk 2- Only One FTC team this season instead of usual 2 (old 9406)

Factors That may play into this risk

- May be harder to advance this season with only one team representing Explorer Post 1010

How will we address this

- Focus more resources on this one team
- More technical and individual training

Our Team has identified the following opportunities that we plan to take full advantage of:

Opportunity 1 - New workshop space

Benefits

- This will allow us to build in safer/organized environment
- Give us new technology to build and assemble parts

Opportunity 2 -More mentors

Benefits

- More training insight and help for the Cru
- More individual attention for members

Opportunity 3- More outreach opportunities with JHU & Rockville Science Center

Benefits

- Expands our platform to represent FIRST in the community
- Show sponsors & community our progress
- Reach our goal of 17 outreach events

5.3 Plans of action

Preseason Plan of Action to ensure growth & stability

(established 7/10/16)

Task	Actions taken	Responsibility	Planned completion
ReCruit & Train New members	1. Host 2 Open Houses a. 1st on 9/7/16 b. 2nd on 9/10/16 2. Have multiple coding, building, and designing workshops	Mentors & Seniors on the team	October 2016
Raise Team Funds for team registration costs, parts, and travel fees.	1. Send thank you notes to sponsors 2. Apply for more financial grants 3. Actively seek sponsors at outreach events 4. Host fundraiser events a. Laser tag in December b. Post 1010 picnic c. Car Washes	All team members participate Supervised by Mentors and alumni	Mid January 2017
Develop team leadership and more specialized roles	1. Hold Co-Captain elections 2. Identify strengths of each individual 3. Find methods of training for each individual to develop skills	Lead by senior members of team	November 2016
More OUTREACH	1. Use social media to communicate with community 2. Attend local and national events	EVERYBODY	Ongoing

6.0 Finances

The Cru is very fiscally responsible with the funds we are presented with. All donated funds are placed into a bank account managed by our mentor Bob Ekman. Although we don't have direct access to the funds, we do make a large majority of financial decisions as a group.

6.1 Income

Projected income ---------- Established (8/1/16)

Source	Amount
Member dues	$1000
Fundraisers/Community Donations	$100-500
Sponsors	$2000
Grants	$500
Total	**Approximate Goal:** $ 3,600

Fundraiser Opportunities * Actual Fundraiser dates, and details will be added as season progresses*

Fundraiser Breakdown	Projected income from each	Notes
Laser tag all nighter	$200	If Package deal is bought
Post 1010 picnic/ field day	$50- 100	For Alumni and community
Car washes/bake sales	$70	Produce products with our own resources

Travel

In the previous seasons we have not advanced past states, so our travel expenses have been covered by our team parents. The Cru tends to carpool to every competition and event, because of this travel expense remain relatively low.

6.2 Expenses

Projected Expenses (Rough Budget)
(actual budget/ amount of money spent will be updated as season progresses)

Category	Amount	Notes
Registration	$600	*required to compete
Building Expenses	$1000 (includes new field kit)	We are trying to reuse majority of parts and tools to save
Team wear	$200	If this exceeds budget amount we will individually pay the remainder to keep ON budget.
Competition expenses	$200	Addresses printing/posters/banners/ candy
Outreach/ activities	$100	We usually do not pay for spaces , but this just in case we need to buy something for these events
Total	$2100	Most likely will increase

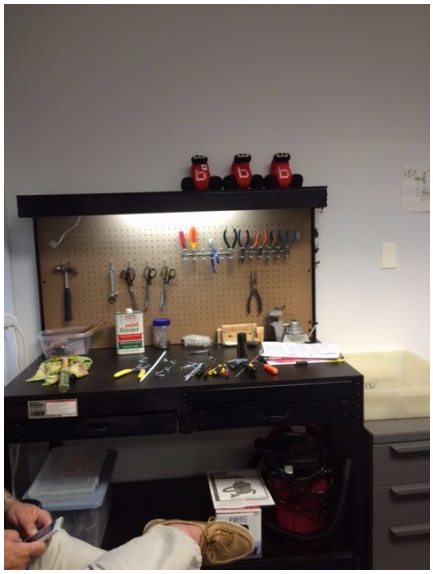
Staying on Budget

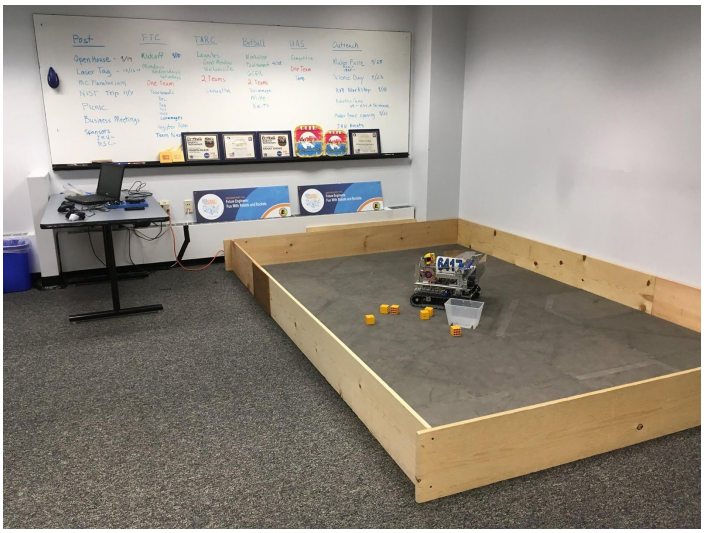
The Cru's main priority this season is to ensure that we have enough funds to build a good robot, while saving enough for future seasons and emergency expenses; it is for this reason that it is important to stay within our budget. Our business meetings, excel spreadsheets, and economic awareness will allow us to stay within our budget. Moreover, we will reuse the majority of parts from last season to stay on budget. However, if our income is greater than expected, then we may increase our budget accordingly.

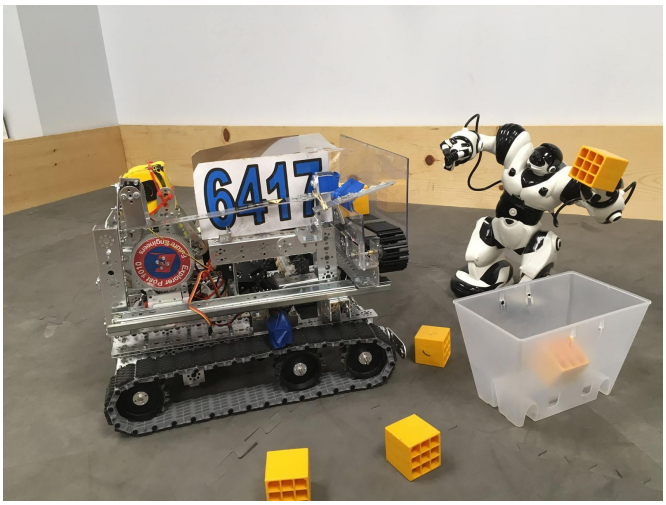
Workspace

We are extremely grateful for Johns Hopkins, which has offered its facilities to us rent free; their support saves our team a large amount of funds for this season.

Preseason Tour of our Workspace







Top Row : The Cru's workbench equipped with all our tools

Middle Row: Our programming and driving stations

Bottom Row: Our robot from last season has a little fun at its retirem

Cost Analysis

Item	Purpose	Quantity	Cost
NeveRest 40 Gearbox, No Motor (am-3106)	Use for spares	2	$25
Stealth Wheel	Use for launchers or drive train	2	$12 + (6 shipping)
TETRIX® MAX Axle Spacers for drive train construction		1	$1.9
TETRIX® MAX Axle Spacers for laucher construction		1	$.9
TETRIX® MAX Flat Bar for structural support		4	$39
TETRIX® MAX Motor Shaft Hub		1	$5.9
TETRIX® MAX Axle Hub		1	$6.9
TETRIX® MAX Axle Set Collar		1	$1.9
TETRIX® MAX 4 mm Bronze Bushing for axles		1	$13
TETRIX® MAX Motor/Axle Shaft Coupler		1	$4.9
TETRIX® MAX Flat		2	$19
TETRIX® MAX Inside C Connector		6	$29
TETRIX® MAX Chain with Links		1	$13
		TOTAL	$174.09

7.0 Team Resources & Contact Info

7.1 FIRST links

FIRST resource library
http://www.firstinspires.org/resource-library/ftc/team-management-resources
FIRST Maryland
https://firstinmaryland.org/

7.2 Software/Sites Used

CAD
http://www.sketchup.com/
http://www.ptc.com/cad
http://www.autodesk.com/products/inventor/overview

Google Docs/Drive
https://www.google.com/docs/about/
Excel
https://office.live.com/start/Excel.aspx
Finance Tips
http://managementhelp.org/businessfinance/

7.3 Team Links

Twitter
https://twitter.com/post1010
Team site
http://www.post1010.org/
Facebook
https://www.facebook.com/pages/Explorer-Post-1010/118262374919489

7.4 Contact Us @

Team Email
explorerpost1010@gmail.com
Mentor Bob Ekman Email
bob.ekman@att.net

8.0 Business Meetings/Developments

Business Meeting #1

Date : August 3, 2016 (preseason)
Attendance: Austin, Ragini , Eric, Rohit (Returning Members)
Goals: Outline direction we want team to take, and how we will address budget and new members

Tasks	Reflection
Discuss Fundraising	We decided that we will stick with Laser Tag and the Picnic as our main fundraising opportunities . We will also have several minor fundraising opportunities with bake sales.
Come up with a team agreement (contract)	We've had many members in the past who show up at the beginning, and then disappear later in the season. To make sure we have a dedicated team for the season we want an agreement. We outlined several things we had issues with, such as attendance, active participation, competitions, and outreach. We then asked Ragini to write the contract because she appeared to have a good understanding of what the team wants for the team. Structure may actually push us to be better during the season. We may be able to focus more time on the important things now.
Set a date for open the open house / discuss agenda for first real season meeting	Most likely the date will be September 14th. We have proposed this date because it will give everyone time to prepare for the season, and adjust to the school life. At this meeting we plan to introduce team history, and the competition to the new team members.

Recorded By: Austin Long

The page below shows the final team agreement for the season

6417 TheBluCru

FTC 2016-17 Season Agreement

OVERVIEW

FTC is a competitive robotics program, which encourages innovative thinking in high school students. Our team, Blu Cru #6417, is entering its 4th season of competition. The season lasts from September to March; this may be shortened or extended based on how well we do. This is agreement outlines the team expectations and requirements for the season.

MEETINGS

1. We have meetings 2-3 times a week (Mondays(Sometimes), Wednesdays, Saturdays)
2. Members are required to attend at least 1 meeting per week, and must actively participate
3. There is one required business meeting for the team each month
4. There will be 4 excused absences during the entire season

COMPETITIONS

1. Competitions are required events (dates/info will be sent out during season)
2. Members must pay Team dues and register to be on team before competitions
3. If you cannot attend certain events and competitions notify mentors & team

OUTREACH & ENGINEERING NOTEBOOK

1. The team members must attend at least 2 outreach event during the season
2. All team members must contribute to engineering notebook

_____ _____

Parent Signature Student Signature

Explorer Post 1010 Open House

Date : September 14,2016

Duration: 6-9 PM

Cru Attendance: Ragini, Austin, Moses, , Eric, Rohit

Goals: To reCruit new members, ensure the future of the team, and show the community how we are doing this season.

Tasks	Reflection
Deliver FTC presentation	The Cru compiled powerpoint presentations and explained the processes and commitment involved in FTC. At the end of the presentation we played the game video, and encouraged the students to try and brainstorm ideas for the game. Parents and students seemed to positively respond to the presentation.
Hand out team interest sheets and registration forms	To ensure that we have accurately accounted for the students interested in the team, we ask that they fill out Explorer Post 1010 forms so we can get to know them , and contact them as needed.
Talk to the parents and students individually	Most of the parents and students seemed to have questions about the team and the organization, so we assigned one team member to talk to each family. This opportunity allowed to get to know possible reCruits and explain FTC in more detail. Many parents were worried about the time FTC demands, but we reassured them the schedule we've provided would not be too strenuous; since many past team members had been able to handle it.

Recorded by	Ragini Balachandran

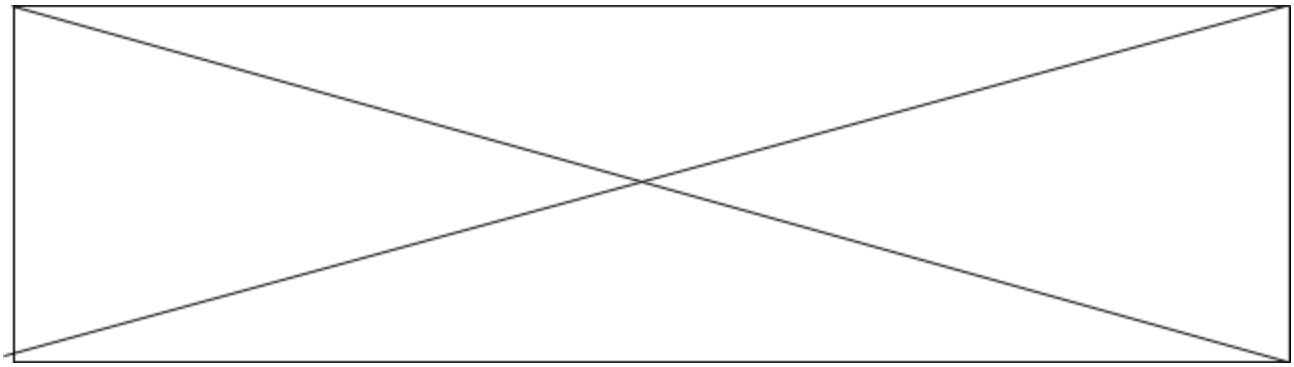
Explorer Post 1010 Business Meeting 2:

Date: September 17, 2016
Duration: 11-2 PM
Cru Attendance: Ragini, Austin, Rohit

Goals- To go over the rules for the game, develop a preliminary strategy, and send out team forms.

Tasks	Reflection
Go over the rules for Velocity Vortex with old members	By going over the rule manual, we were all able to understand the scoring system, and figure out how to score the most points.
Develop a preliminary strategy	We all gathered and discussed a preliminary idea for how to score points on the field. We also decided to try out a six-wheeled chassis. By doing this, we have a skeleton to build off of.
Send out team forms	We want to ensure that everyone who is on the Cru is committed to it. The forms are so we know that everyone is committed to FTC in the Post.

Recorded By:	Rohit Harapanahalli



Explorer Post 1010 Business Meeting 3:

Date: September 21, 2016

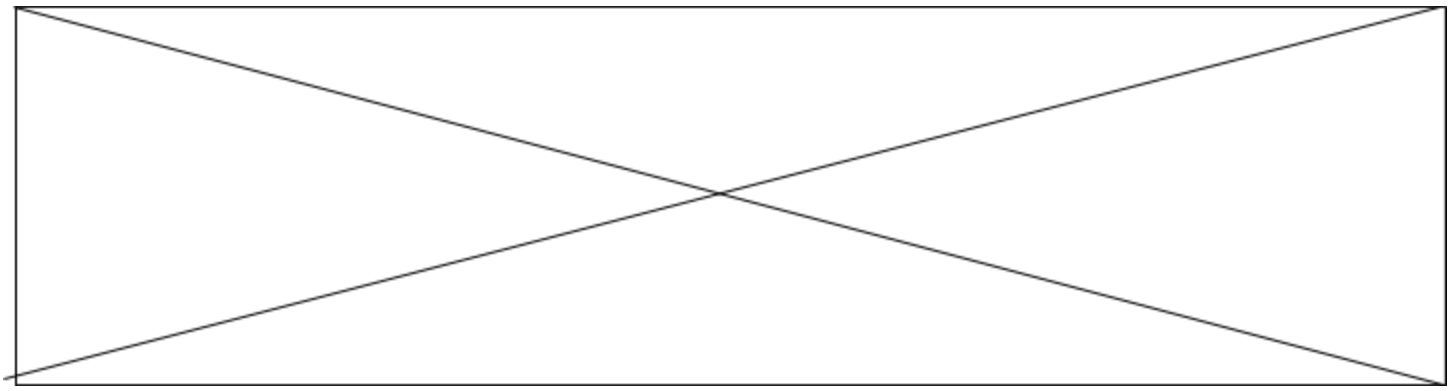
Duration: 6-9 PM

Cru Attendance: Ragini, Austin, Rohit, Ben, Avanish, Gunvir

Goals- To introduce new members to the Post

Tasks	Reflection
Introduce new members and general intro of the Post to new members	We introduced all our members, mentors, and alumni to each other and went over general rules and information about the Post. We also showcased each of our projects (Robotics, Rocketry, and Drones) and allowed members to choose which one they wanted to work on.
Present FTC powerpoint to parents and new members	Powerpoint went well, and was meant to show our team's progress. We had a couple new members sign up to be on FTC and we introduced them onto the team and discussed the game and our strategy.

Recorded By: Austin Long



Explorer Post 1010 Business Meeting 4:

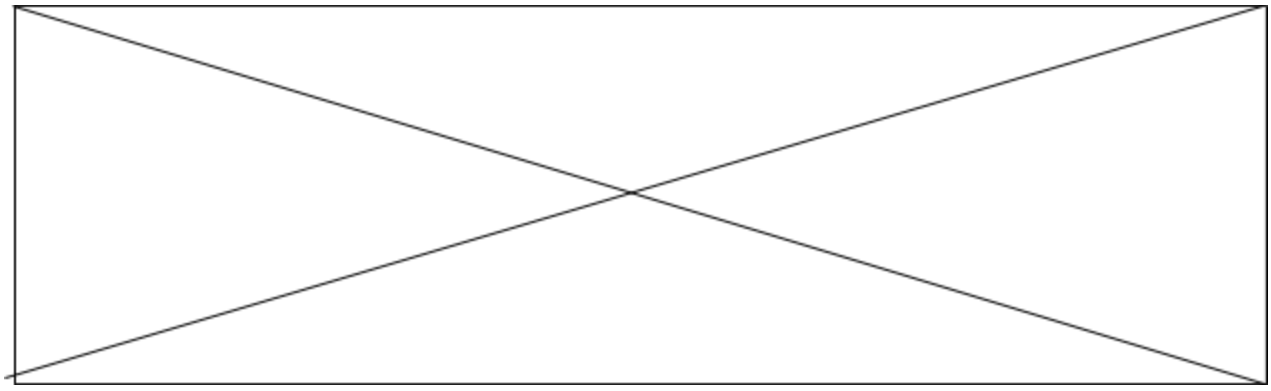
Date: September 28, 2016

Duration: 6-9 PM

Cru Attendance: Ragini, Austin, Rohit, Ben, Avanish, Gunvir

Goals- To brainstorm ways to score points in autonomous, and tele-op.

Tasks	Reflection
Discuss strategy for scoring points in autonomous	We discussed the various ways we could score points during autonomous. We eventually realized that it would be best if we could park on the vortex, as well as the ramps at the corners as we could be more versatile this way. We decided to work on both tasks.
Develop a strategy for scoring points during driver control.	We knew that throwing balls into the vortex would earn us maximum points. However, we were conflicted on how we should shoot the balls. The ideas ranged from a catapult system to a pulley system to a dual wheel launcher. We decided on the pulley system, as it would be the most reliable. Various sketches were developed on how to design the scoring system on our robot.
Recorded by: Rohit H.	Reviewed by: Austin Long



Explorer Post 1010 Business Meeting 5:

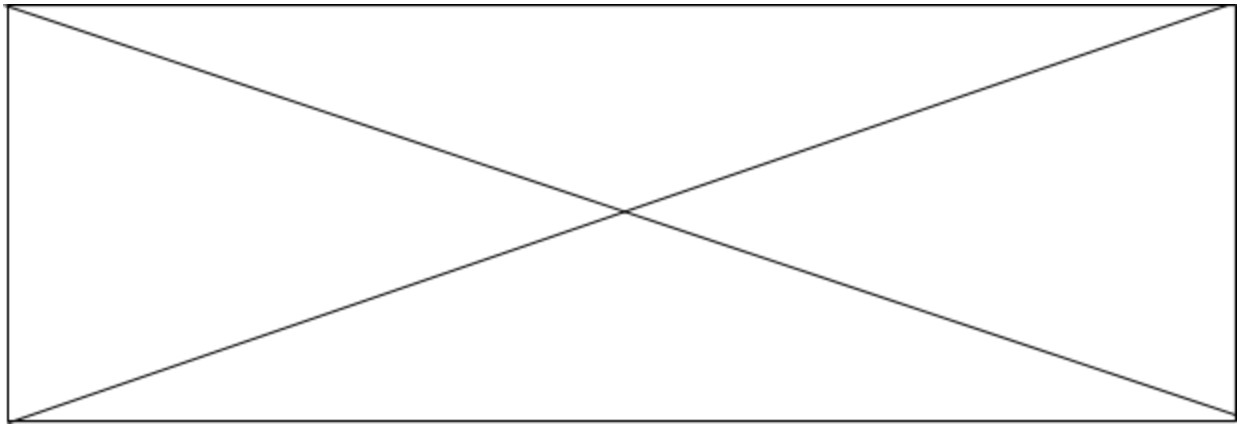
Date: October 12th, 2016

Duration: 6-9 PM

Attendance: Ragini, Austin, Connor, Gunvir, Avanish

Goals : Discuss Attendance, Qualifiers, and Active Participation

Tasks	Reflection
Review Group Attendance/ Active Participation	Over the last few meetings we have had some issues with attendance and participation in the last few meetings and we made it clear that in order to win we would need to put in more effort. This message was well received by our team.
Qualifier Overview	We updated our team on the qualifiers we had gotten this year: • Sidwell Day 2 December 11th • Bullis Day 2 Jan 20 th
Good News : **GRANT !!!!**	We received a $1000 grant from Lockheed Martin. We will use this money to purchase additional parts and supplies.
Recorded By :	Ragini Balachandran



Explorer Post 1010 Business Meeting 6:

Date: November 16, 2016

Duration: 6-9 PM

Attendance: Moses, Austin, Connor, Gunvir, Avanish

Goals : Discuss Qualifiers, and go over priorities list

tasks	reflection

Informed group of incoming events	• We have an incoming scrimmage and build session with RM and poolesville FTC teams on NOV 26th
	• We have our first qualifiers nearing as well
	• We made sure teammates knew how they could contribute and what they should do in advance
	  ○ Register for stims
	  ○ Focus on learning team rules more extensively
	  ○ Turn in T Shirt sizes

Went our team priorities and what needs to get done before competitions	• We need to finalize which method of shooting we will be going with
	  ○ The flicker method
	  ○ The wheel method
	• Autonomous will also become a priority in the next few days
	• Ordering t shirts will also be done ASAP
	• We decided that designs for the ball capturing system will be a latter priority
	• We think shooting may be more beneficial

Recorded by	Austin Long

Explorer Post 1010 Business Meeting 7:

Date: January 18th , 2016

Duration: 6-9 PM

Attendance: Moses, Austin, Connor, Gunvir, Avanish, Ragini,

Goals : Discuss Qualifiers, and go over priorities list

Tasks	Reflection
Go over revised schedule	Because our final qualifier was canceled and there will be no rescheduled. Our next competition will be States on Feb 12th. Our next fundraiser will be Saturday January 21st. Until those dates we will continue working on our robot and focusing on outreach.
Revisit expectations for the season	• We decided that outreach should be playing a larger role considering we we have finished the majority of our bot • We will be adding more features and improving what is currently on the robot as well. • Another thing we would like to do is have more scrimmages with other teams this season.
Recorded by: Ragini Balachandran	Reviewed by: Austin Long

BLU CRU OUTREACH SECTION

The Blu Cru has always emphasized the importance of community outreach. We feel that by reaching out and giving people the opportunity to see robotics in action, we'll be able to inspire more people to pursue STEM-related activities, including FTC and FLL. Furthermore, we believe that with good outreach, we'll garner additional interest for the development of new technology as a whole. Through outreach we have gained the support of the community, as well as the addition of new members to the Blu Cru. Many of our team members were inspired to join our team because of past outreach events, so we feel it is in the spirit of FIRST to give back, the same way our alumni graciously did. As such, community outreach has become a central aspect of what we do.

OVERVIEW OF OUR EVENTS & PROJECTS

- ➢Robert Frost Stem Night
- ➢Aspen Hill Library Outreach
- ➢USA Science & Engineering Festival (2 days)
- ➢Botball Regional Tournament Setup
- ➢Rockville Science Day
- ➢College & Career Preparation Expo
- ➢MCPS TV Interview
- ➢Cub Scouts
- ➢Gibbs Elementary School Stem Night
- ➢Hometown Holidays (2 days)
- ➢Summer Robotics Camps (8/8/16-8/19/16)
- ➢Explorer Post 1010 Open House
- ➢Robotics Demonstrations in Our High Schools
- ➢Gaithersburg HS Robotics & Watkins Mill Robotics
- ➢First Lego League Qualifiers (2 days)
- ➢Johns Hopkins Frontiers in Science
- ➢Scrimmage and Build Session @ the Library
- ➢NIST visit
- ➢Senior Center Presentation
- ➢Our Biggest Platform : Social Media

Robert Frost Stem Night

Location : Robert Frost Middle School, Rockville MD
Duration of Event : 3 hours

For the past three years, our team has been attending the annual stem night to raise awareness for robotics in the community, and demonstrate our progress during the season. Throughout the night we allowed students to drive, and test our robot's functions. We received a lot of positive feedback from the parents, students, and teachers ! The Cru also gave out information regarding summer robotics programs, future outreach events, and science programs in the Rockville Science Center.

One of the reasons we prioritize school events so much is to connect with the next generation of FTC programmers, and builders. Middle and elementary schoolers are not only the future FIRST participants, but future engineers, doctors, and astronauts. We hope with our demonstrations we are inspiring them just enough to start them on this journey.

College & Career Preparation Expo

Location : Bioscience Education Center at Montgomery College's Germantown Campus
Duration of Event: 5 Hrs
The event had over 1,000 attendees

At this event the Cru demonstrated our robot for a large number of spectators, while distributing information about what we do as an FTC team. We also allowed the spectators at this event to drive our robot, and see potentially how many points they could score in a real competition as a driver. Many people at the event were made aware of opportunities out there for them in FTC, and STEM competitions. We felt like we accomplished our goal of raising awareness, and entertaining our audience.

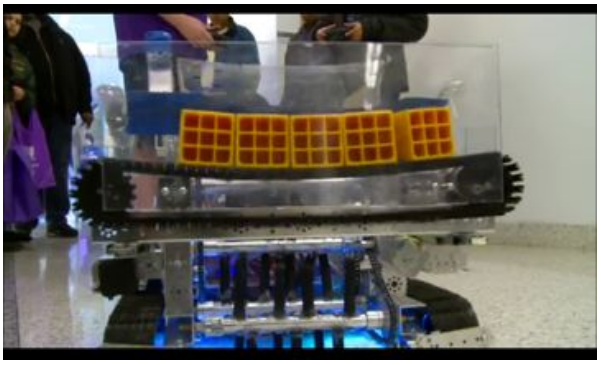
MCPS TV Interview

Blu Cru member, Ragini Balachandran was interviewed on Saturday, April 9th 2016 by David Frey from Montgomery County Public School TV.
MCPS TV is broadcasted for the thousands of students in the county.

During the interview Ragini answered questions about how kids could get involved in Robotics through their schools and community resources. She also advocated for more girl involvement in STEM programs,like FTC. Following her interview she showcased our robot's talents for the camera and the people at the event.

Later that week, we saw our Cru member and bot make a cameo in a MCPS TV episode! We all agree that our robot is definitely the star of our team.

Below are a few pictures from the interview



Aspen Hill Library Outreach

Location: 4407 Aspen Hill Rd, Rockville, MD 20853
Duration of Event: 3hrs
Basement of Aspen Hill

Some of our team members volunteer at local libraries in special after school, and weekend programs for local kids. They managed to set up a special day, where the Cru could come in and demonstrate for the kids. We allowed the participants to try to drive and collect debris on our makeshift field. The Cru oversaw mini competitions for them, and spoke to them about what they could do when they were older. The younger children really seemed to enjoy driving the bot, and proved that they were natural drivers. The Cru also enjoyed cookies with the kids after the demo.

Right: The kids navigate our robot through the makeshift field
Bottom left: Aspen Hill Library

USA Science & Engineering Festival

Location: Washington D.C.

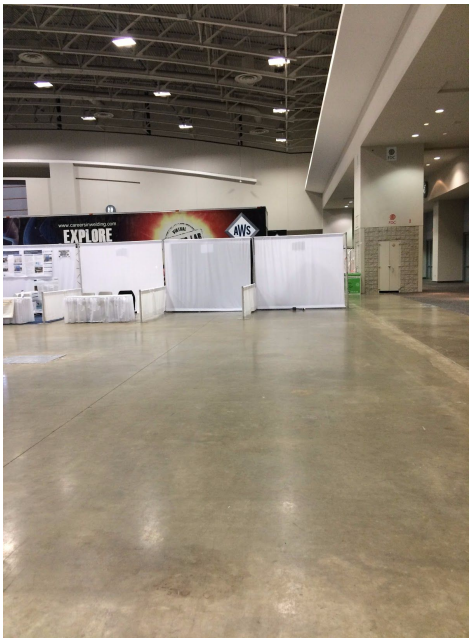
Duration of Event: 16 hours over two days

Thousands of people attended this huge event

The Explorer Post 1010 organization has been attending the event since it's inception in 2010.

The Science and Engineering Festival hosted hundreds of exhibits, including our own. Our booth was located on the first floor near the stage, and the Nasa exhibit. We also had members assisting the Gaithersburg HS booth on the second floor. On both days of the event we drove our bot for hundreds of people, and allowed some of them to drive as well. The Cru set up our booth with information about FTC, Rockville Science Center, and our team as a whole. We also played our competition feed on a laptop, to give a sense of what a competition is like. Our team also brought 3D printers and drones for people to observe along with our robot. At the event, we attempted to circulate between both floors to give everyone a view of our robot. Our robot made it down the escalator safely multiple times, thanks to our skilled drivers. The Cru thoroughly enjoyed seeing other exhibits,and learning about new experiments and companies out there. We hope our audiences enjoyed the event just as much as we did.

Above a picture of our event space, and demonstration for a group of people at the event.



Botball Regional Tournament

Location: Rockville High School
Duration of event: 6 hrs

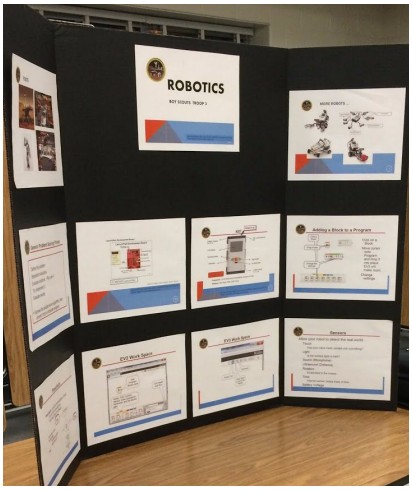
Our Explorer Post 1010 organization also supports multiple botball robotics team, in addition to our FTC organization. Our FTC team helped run, setup, and organize events of the competition.During the setup we helped construct the game boards, and set up seating. The Cru also provided schedules and directions at the event. At the event we also supported our fellow explorer post members.

Rockville Science Day

Location: Montgomery College, 51 Mannakee St, Rockville, MD 20850
Duration of Event: 5 Hours

The Rockville Science Day has been a tradition for our FTC team, because our involvement with Rockville Science Center. Our Cru drove our robot around the event, and raised awareness for robotics in the community. We met with a lot of kids and parents in the community, explained the functions of our robot, and how what we've learned can be applied later in the future. The Cru also set mini courses for people to try to get through with our robot. Overall, the team had a lot of fun with entertaining the attendees, and connecting with kids at the event. This year was the biggest Science Day to date, and was largely successful because of the efforts of our mentor Bob Ekman.

Cub Scouts



Total Hours Spent at meetings : 16 (as of 11/30/16)
Meetings Attended : 4

We periodically brought our robots to local Cub Scout meetings and allowed the children to drive the robots. It was our intent for the kids to learn more and become more passionate about robotics, and they had a lot of fun driving our bots around and seeing how they worked. At some of these meetings we helped teach boy scouts the basics of NXT and mindstorms building. Together we created posters that diagramed the processes we went through to get our mindstorms working. We plan to continue attending meetings throughout the season.

Gibbs Elementary School Stem Night

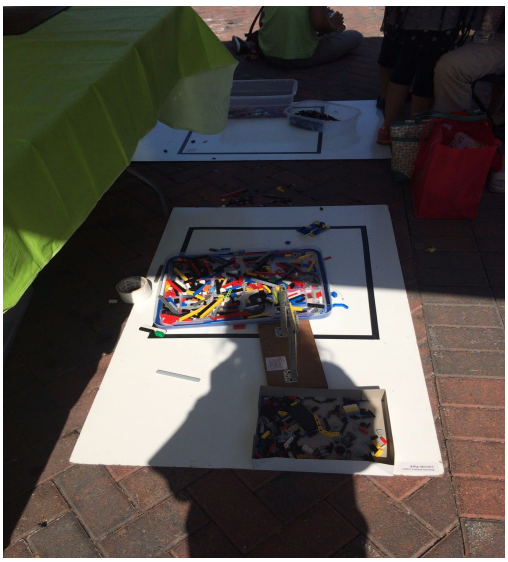
Location: Gibbs Elementary School 12615 Royal Crown Drive, Germantown, MD, 2087
Duration of event: 3 hours

The Cru arrived at the STEM night early to help the teachers set up the event. When the event started, we drove the robot around for the kids. Our robot was initially confused for an “alien ship”, but after the kids began to see it in action they really started to understand and enjoy the purpose of it. In addition to our demonstration, we also set up a lego play area for the kids to build their own FTC mini bot. We also handed out information to the parents about the different levels of FIRST robotics, and we are hoping that these elementary schoolers start as soon as they can.

Hometown Holidays

Location: Rockville Town Center
Duration: 10 Hours over two days
May 28th and 29th 2016

Our Team spent two days at Hometown Holidays exhibiting our Robot along with Rockville Science Center in their tent. We set up the foam flooring of an FTC field across from our tent, and created a mini course for our drivers to entertain bystanders with. The Cru also let some of the children at the event drive the robot around. Moreover, we set up lego stations for the kids to play with. The parents and kids at the event really enjoyed our stations because it was a great opportunity for them to get out of the heat that weekend. Our team also met with local reporters to discuss our involvement in both robotics and the community. The Cru met with members of the RM FTC teams to discuss FTC opportunities and possible scrimmages in the future. One of our goals as a team is to make sure the experience is as interactive, and informative as possible. Overall the event was successful because of how well we worked together as a team to get everyone involved in our event.



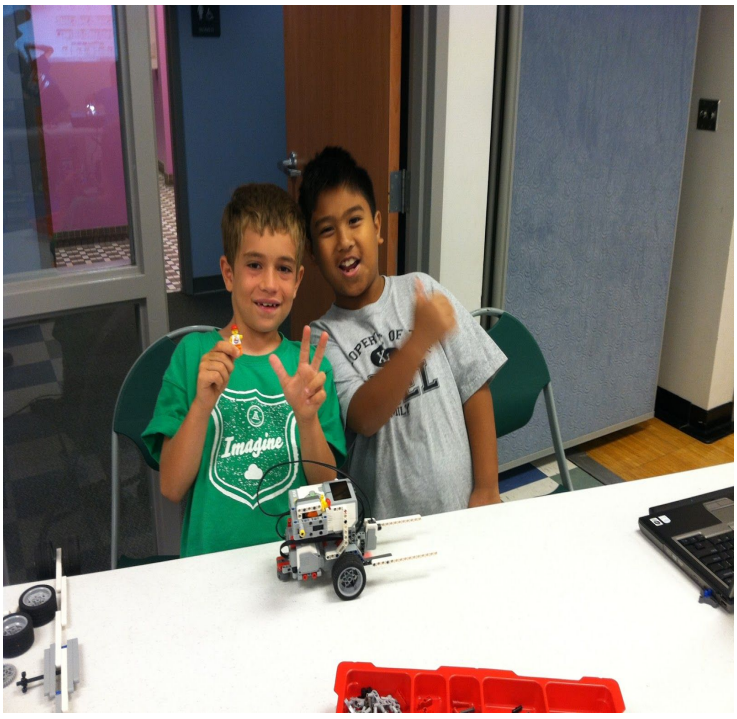
Left : Our lego stations set up underneath our tents. The stations helped the kids get out of the sun, and take a break for a couple minutes.	Right: Our Cru's headquarters for the the two days we were at the event.

Summer Robotics Camps (8/8/16 - 8/19/16)

Location :Twinbrook Community center
Duration : Days between August 8th and 19th 1-4PM

During the summer months our team hosts and visits various summer camps to teach middle and elementary schoolers the basics of the NXT and EV3 systems. We also mentored during numerous STEM camp sessions with our mentor, Bob Ekman. Our team sent at least five members to each session, to ensure that we could give the kids at the camps as much individual attention and instruction as possible. The goal for us at these camps is to try and pique interest of every kid there in hopes that they will possibly end up in programs like FLL, FTC, and FRC in the future. Overall this summer' s campers and the Cru really enjoyed the experience. This Spring Break we hope to host a mini camp for more kids in the community.

Robotics Camp!!!



Silver Spring Mini Maker Faire

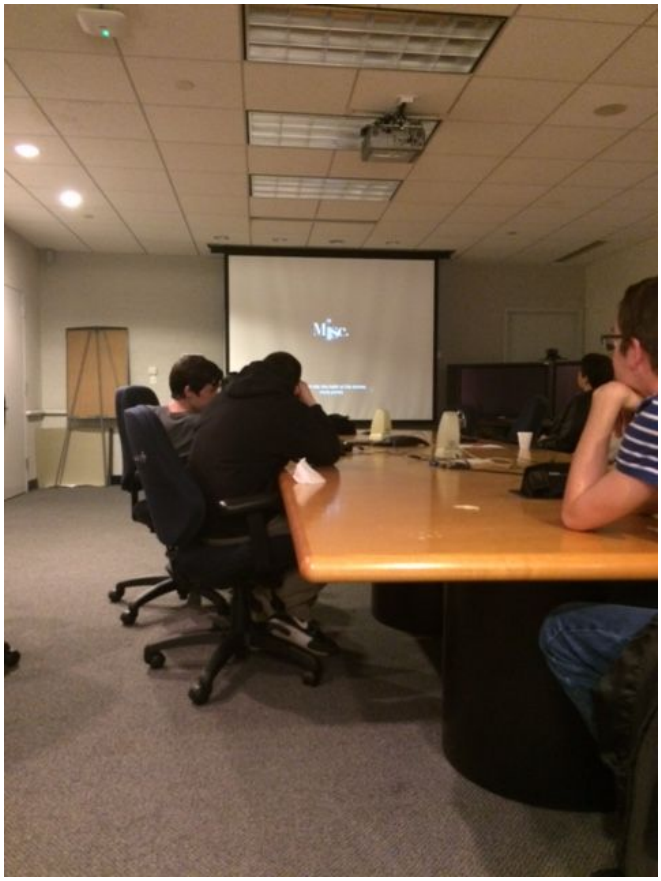
Location: Silver Spring Civic Center, 1 Veterans Place, Silver Spring, MD, 20910
Duration : 5 hours
September 25th, 2016

During this outreach event the Cru showcased 3D printers along with smaller autonomous robots with our Explorer Post 1010 counterparts in both rocketry, and botball. The Cru talked with parents and kids about the opportunities available in STEM for kids with Rockville Science Center and in the community. Throughout the day we also took requests (mostly pokemon) on what the kids would like printed by the 3D printer, and handed out the creations. Even though we were unable to bring our FTC robot because it was being remodeled for this season's challenge, we had a great time showcasing our other projects in the STEM field. We also took questions about this season's FTC game, and the ways to start a team. Hopefully in the near future we are able to help start more teams like Gaithersburg. We were also glad to connect with the other FTC teams gathered at the event. The Blu Cru really felt that kids and parents who saw our exhibit enjoyed, and as a team that is our first priority at outreach events.

Above a couple kids get to see their designs brought to life with a 3D printer built by a Blu Cru Alumnus.

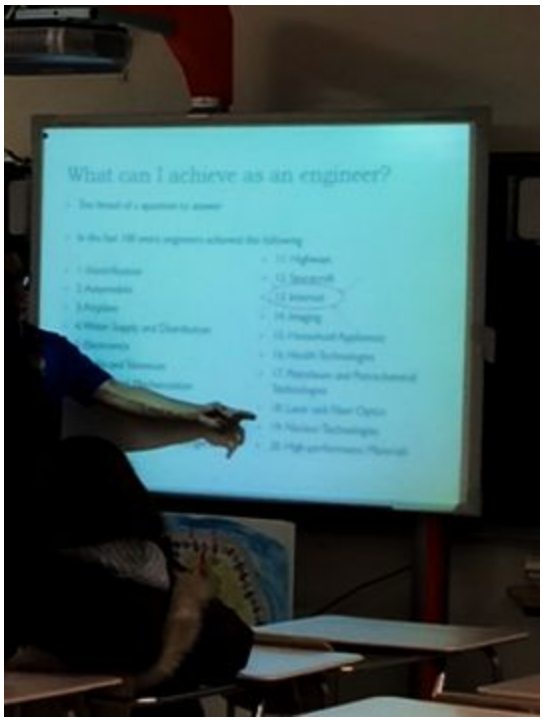
Increasing Robotics Awareness In the High Schools

Total Presentations Given: 5
Hours Spent @ Presentations: 10



We believe as members of FTC it is our duty to highlight all forms of Robotics in the community. Our team has travelled to different high schools, like Wootton and Wheaton in the area equipped with video presentations to spread the messages. During these presentations we play introductory FTC videos, and show students how our robot really works.

We also explain ways other students can get involved in Robotics and STEM related activities in the community. We've also hosted numerous open houses for people to spread interest in our team.



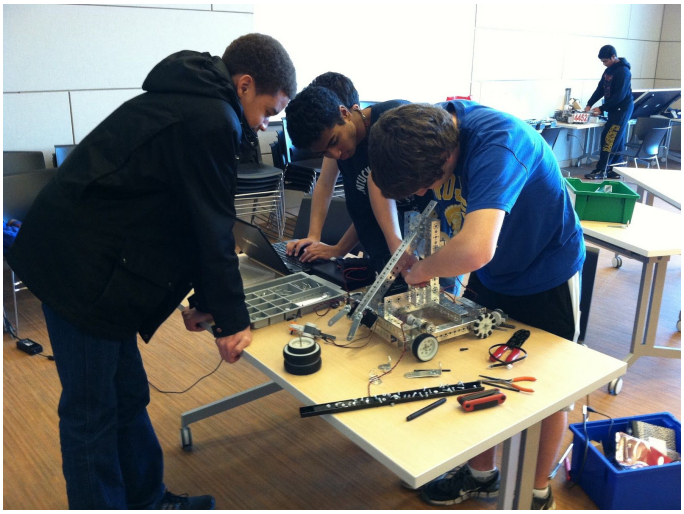
Top left : We start up a video presentation for some high schoolers to give them a taste of an actual competition at a Open house on **October 6th, 2016.**
Bottom Right: Our team presents an engineering powerpoint to stimulate STEM interest in an after school club at Wootton on **September 26th, 2016.**

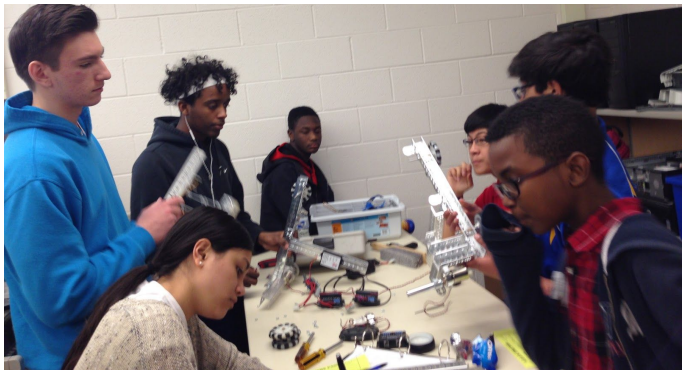
- Presentation at Robert Frost MS for Wootton HS's Women in Engineering **on November 23, 2016**
- Presentation at Gaithersburg HS for GHS robotics Nov. **7th, 2016**
- Presentation at Wheaton HS **Sept 30th 2016**

Gaithersburg High School Robotics & Watkins Mill Robotics

Our Blu Cru alumni helped found the Gaithersburg HS FTC robotics team. Over the years we have helped them find sponsors, create documentation, and learn how to build and program FTC robots. In addition to this we've hosted small scrimmages for Gaithersburg, where we shared tips and guidelines regarding the competition. Members of the Blu Cru were featured in the Gaithersburg Gazette after the outreach. Our Alumni even set up a demo with Mayor Jud Ashman to raise awareness for robotics. The article and the meeting with the Mayor provided a lot of exposure for our team, and the Gaithersburg team. The Gaithersburg team initially started with 10 people, and currently they have over 60 members. We are hoping that we can still help them expand, and improve with future scrimmages. The Blu Cru alumni also maintain active roles mentoring, and assisting the team along with us.

We also meet and share ideas with FTC Team 4452 Watkins Mill. We often mentor Team 4452 and exchange ideas on how to improve their coding and building. We've also set up numerous scrimmages with them, and work sessions at the Gaithersburg Library. In addition to this, both of our teams share a mentor, Bob Ekman. Bob helps regulate, and aid our team scrimmages.





Top left: A work session with both Watkins Mill and Gaithersburg at the library.
Top Right: Mayor Jud Ashman watches our demo at GHS.
Bottom Right: We help mentor, and guide a GHS robotics meeting.

Johns Hopkins University's Frontiers in Science

Duration : 6 hours

Location : 9601 Medical Center Drive (Johns Hopkins Montgomery Campus)

The goal of the JHU Frontiers in Science was to bring excitement to young kids about science and technology in today's world. For the entire day, we demonstrated our robot for this season, and performed a usability test. We also let the young kids play with the robot, and experiment with the controls to get a feel for how robots are maneuvered with controllers. This experience was very important for them, because by using the controller, the kids were able to understand and experience the tele-op part of the robotics game in FTC, as well as get excited about participating in FTC in the future. Moreover, the kids' interest in science and technology competitions and activities increased greatly, and many of the kids showed interest in participating in FTC once they are eligible to do so.

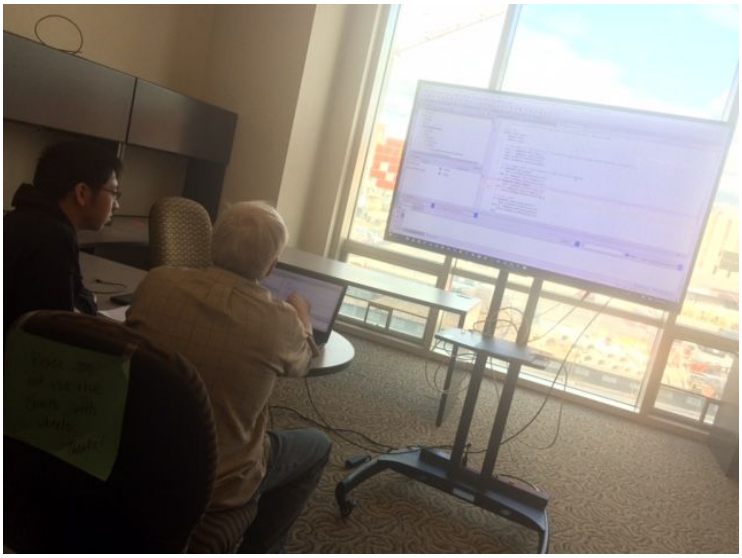
Scrimmage and Build Session At Rockville Library

Duration : 5 hours

Location : Rockville Memorial Library

November 26th , 2016

We decided to hold a scrimmage and build session with other teams competing in the qualifiers. During this session, we had three major goals: to work on the autonomous code, to determine the best method for shooting the balls, and to develop a system for ball intake and shooting. We also used this session to do more outreach towards other FTC teams and FLL teams. We began the meeting by working on the autonomous code for our robot. We worked on coding the robot, as well as testing the code to see how well it runs. Through iteration, we were able to work on the arms for pushing the beacons. Also, we were able to show the other teams how we made our robot, a very important skill in FTC and in engineering. We developed two methods for shooting the balls in the vortex: a flipper, and a feeder system. We further worked on figuring out which of the two shooting systems would be the optimal one. Moreover, we were able to show the other teams how important it is to have different ideas to accomplish a goal, as well as to pursue both ideas and test them out in practicality. Finally, we worked on developing a system to intake the balls and feed them into the shooter. We had some preliminary designs, and we decided to test them out to see which one would be the optimal one for our robot. This also helped teach the other teams how important designing systems are in the real world.

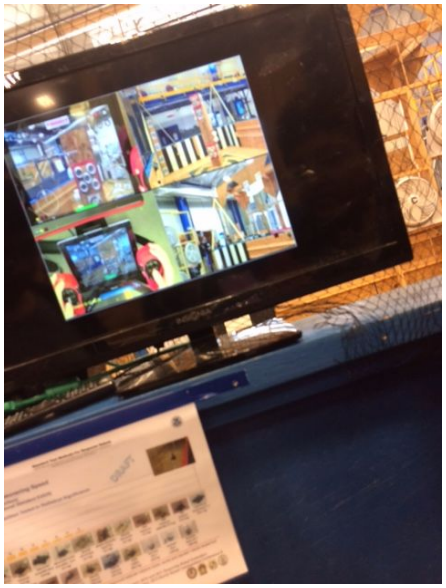


NIST Visit

Duration : 3 hours

Location: National Institute of Standards and Technology Gaithersburg Campus

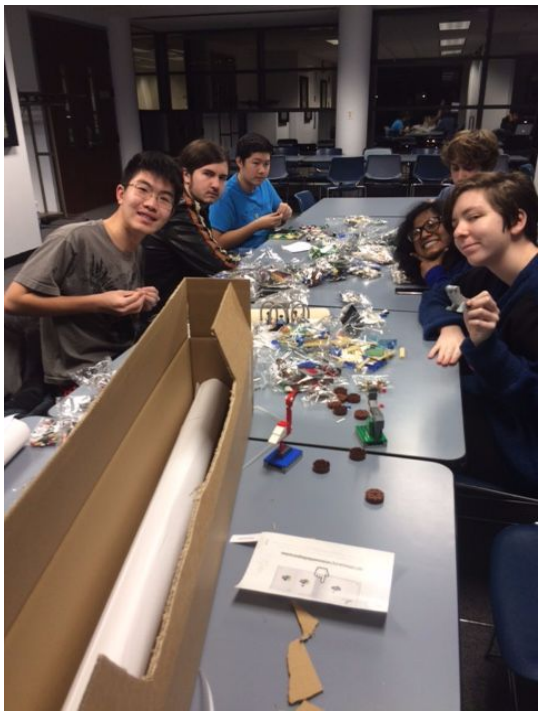
The National Institute of Standards and Technology is the country's leading organization in setting the standards for various measurement systems, as well as in developing and testing new robots to accomplish arduous tasks facing humanity daily. The entire Post took a tour of the NIST Gaithersburg Campus, where we learned about how NIST sets the standards for everyday measurements, how NIST constructs and tests robots for use in natural disaster situations, and how NIST experiments and develops methods-- such as augmented reality-- to improve human interaction with robots and machines. Moreover, we learned about how NIST develops new and improved ways to deal with everyday issues and current disasters affecting our world. This visit was very useful for all of us because we were able to get a first-hand experience on how robotics and computer science are relevant in our rapidly changing world, and how robots have a real-life purpose and serve our society by helping us deal with human or natural disasters. We now understand the various career opportunities in robotics and computer science that are available to us once we graduate from college.



First Lego League Build Session

Duration: 3 hours
Location : Johns Hopkins Shady Grove Campus
December 7th, 2016

We invited some FLL teams to come join us at Johns Hopkins for a build session. Together we assembled the new game board and parts for the competition. The board we assembled will be used by multiple FLL teams in the area who use Rockville Science Center facilities.We had a lot of fun building with the teams, and we encouraged them to come visit us in the future. Later, this month we will be attending more FLL qualifiers to assist teams, parents, and FIRST staff. Since the members of FLL are the future of FTC and FRC we feel it is our duty to get them interested in STEM and make sure they all have a strong base to build upon in their upcoming years. We plan on visiting other FLL teams as well during the FLL season. The Cru is excited about all the upcoming opportunities to get involved with the future of FIRST.



First Lego League Scrimmage Assistance

Duration: 3 hours
Location : Rockville Memorial Library
December 17th, 2016

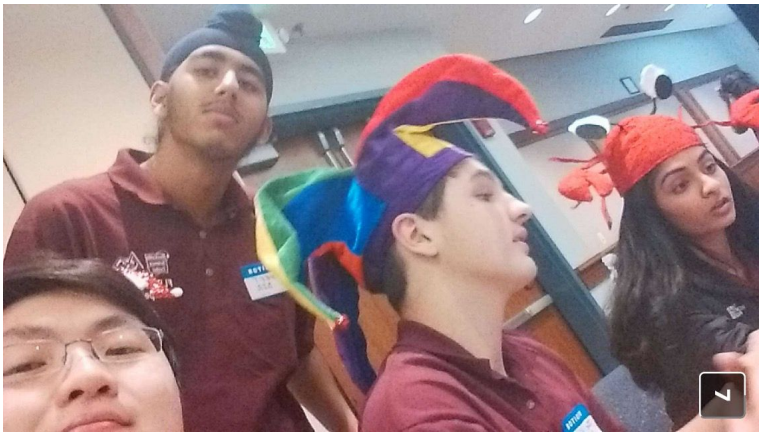
We visited an FLL scrimmage between a couple First Lego League teams that were in our area at the Rockville Memorial Library so we could aid the teams during their scrimmage. Some of the members from the Blu Cru helped the First Lego League teams primarily with their scorekeeping and timekeeping as the scrimmage took place. We really enjoyed the opportunity to help out the teams, parents and FIRST staff. Since people interested in FLL will likely join FTC/FRC in the future, we feel very inclined to inspire them and get them more involved in STEM so that they understand the fundamentals of engineering. We will continue to visit FLL teams' scrimmages so we can continue to inspire the future generation of FTC teams.

FLL team Fantastic pictured along with Cru member Rohit

First Lego League Qualifiers (2)

Duration : 16 hours over two days
Location : University of Maryland @ Shady Grove
Jan 7& 8th

Every year, we host a FLL qualifiers with our mentor Bob Ekman and Rockville Science Center. As a team, we believe that the younger generation is of utmost importance to stimulate interest in the STEM opportunities available. FLL competitions provided our team with the opportunity to spread FTC robotics and STEM interest in the community. Before these competitions, we mentored local teams, teaching them the fundamentals of engineering design and construction. In addition we gave tutorials on the basic functions of NXT programming. At the competitions, we demonstrated our robot for crowds of interested middle and elementary schooler. Our team also helped manage the match scheduling and organization, as well as setup and clean ups at the competition. Numerous members of our team participated in judging and scoring. We feel our efforts during these competitions had a positive lasting impact because of the positive feedback and interest we received from both parents and competitors.



Above members if the Cru at the competition assisting with judging and scoring

Robotics presentation at Rockville Senior Center

Location :1150 Carnation Dr, Rockville, MD 20850
Duration : 3 hours
January 10th, 2017

Mentor Bob Ekman and the Cru demonstrated the autonomous capabilities of both our robot and some smaller lego robots at the Senior Center. We detailed our journey as a team and showcased video footage of our robot in the presentation. Our mentor Bob Ekman also helped us detail the opportunities still out there to get involved with FIRST and robotics in the community for the seniors at the center. Moreover, the responses we got from the people at the center were very positive and it seemed like everyone involved enjoyed the experience thoroughly. It was interesting to hear different perspectives on how we could improve and our robot's unique design features like the conveyor belt and flickr launcher system. We will definitely be visiting again soon.

To the Left our mentor Bob addresses some questions on autonomous robotics

Our Biggest Platform : Social Media

Our team utilizes social media platforms like Facebook ,Twitter, Snapchat and our team website to communicate with a larger audience and expand our network in the community.

- Through these sites we were able to advertise and raise awareness about our local fundraisers, competitions, and educational events to members of the community.
- We also use these sites to chat among the team and keep members informed at all times.
- With access to social media, we're also able to communicate with other teams and share our ideas using facebook, twitter, and even Reddit.
- Set up scrimmages with other teams

As a team we feel that it is our responsibility to help those in need, social media allows us to extend our outreach further across the continent. Together we are able to communicate faster, and more efficiency to produce results for the community, other FTC teams, and ourselves.

Our twitter page advertises our outreach events, and accomplishments throughout the year.

Our website allows alumni and members of the community to keep up with all our events.

Twitter @Post1010

- Joined April 2015
- 167 followers
- 40 Posts
- Following over 40 FTC teams
- Outreach/fundraisers advertised

Facebook @Explorer Post 1010
@ Post 1010 FTC

- Over 180 members collectively
- Over hundreds of Posts & comments
- 5 FTC group chats over Messenger
- Parents, alumni, and community involved

Team website @http://www.post1010.org/

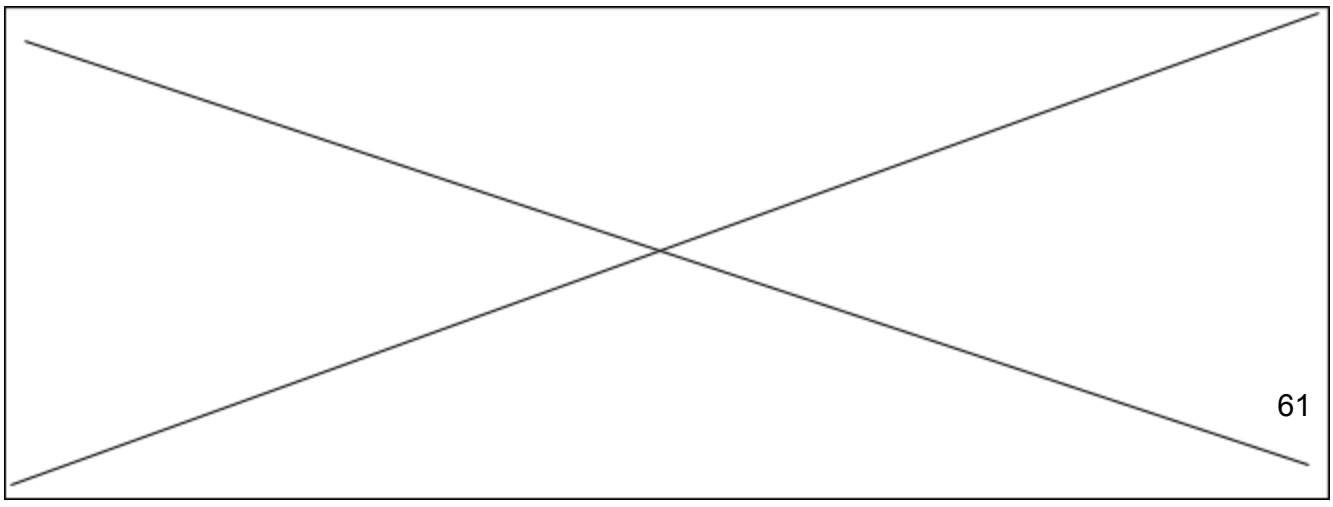
- News & Events updated weekly
- Gives community insight into team
- Provides contact direct info for other teams
- Showcases sponsors

Gmail @ explorerpost1010@gmail.com

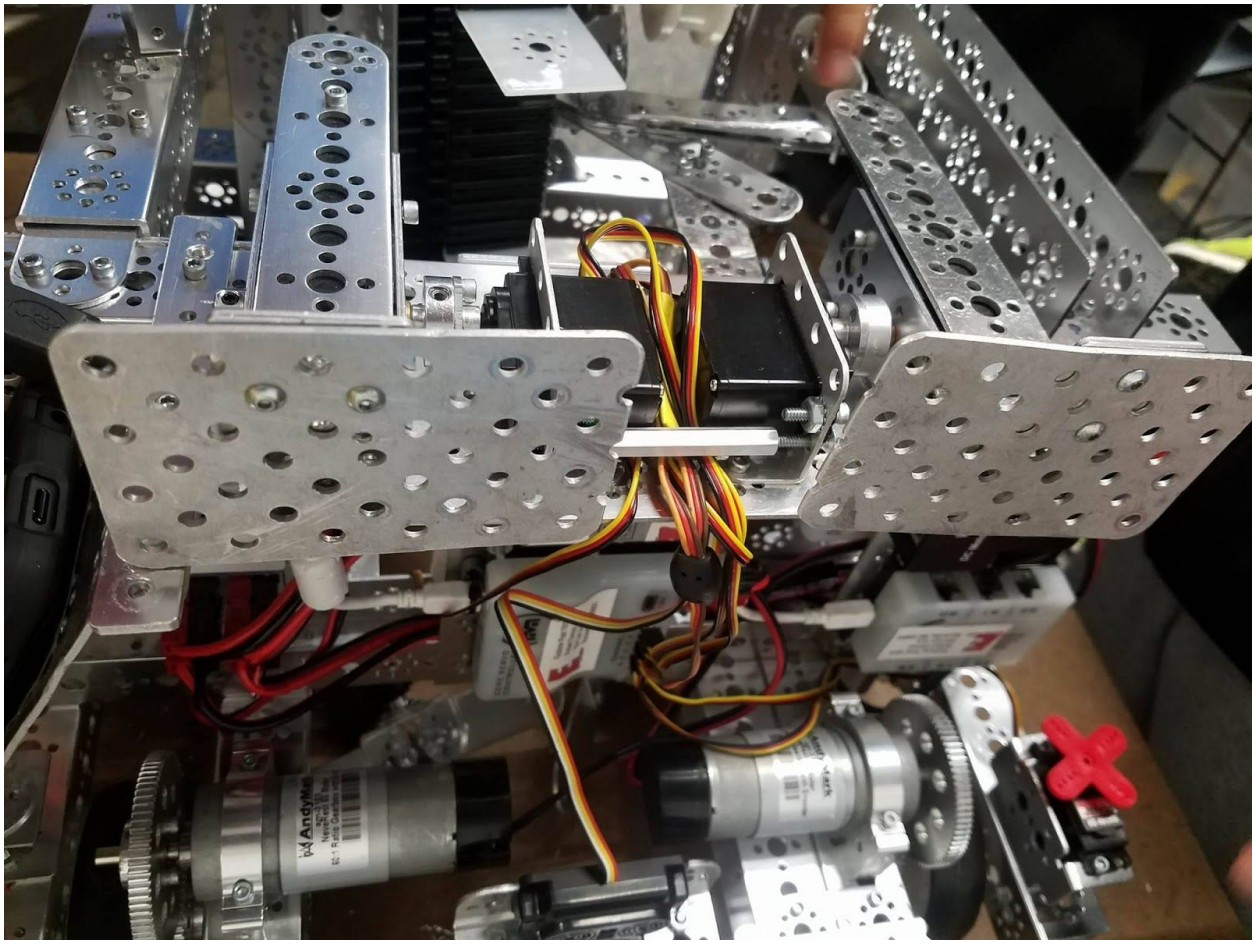
- 2 emails sent to members and alumni a week
- 150 Google Docs created
- Over 40 Google Spreadsheets created
- 15 Google slideshows created
- Hundreds of FTC related questions answered
- Monthly updates provided for our sponsors
- Includes pictures of competitions

Reddit & The Cru

- We use Reddit forums to ask and answer questions for other FTC teams
- We also use Reddit to inform others of our progress
- Cru members enjoy sharing their competition stories and experiences with other members of the FIRST community



Engineering Section



Meeting #1

September 12th , 2016
Attendance : Austin, Ragini
Duration of meeting :6-9 PM
Goals: Explore possibilities of game and design

Task : Brainstorm Session	Reflection
Decide Scoring Goals	1. Autonomous a. Possible Vortex Shoot b. Beacon (priority) c. Bump ball d. Park where we can with time 2. Driver period a. Attempt shooting into vortex b. Lift and place ball into top portion
Deciding Drivetrain	Objectives of train: High mobility ● Turn efficiently ● Get up ramp? ● Power Possible option: Using two omni wheel sets and a regular wheel on each side, geared accordingly and supported by metal panels
Decide plan for launching and lifting balls	We want to use a wheel system in the middle that uses friction to launch the balls, or we can use something similar to our past robot We may use some sort of slider system to lift and place the ball in endgame We may need to think more about the system during the next meeting

Journal entry by: Ragini Balachandran	Reviewed by: Austin Long

Meeting #1 Continuation

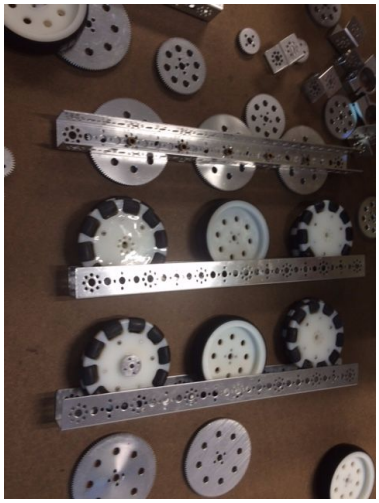
Wheel and Base Design in More Detail

1) This is one possible base/wheel setup idea that has interested us so far. We want to try to create support for our axles like this model does. We will most likely accomplish this using aluminium on the sides of our wheels that will also act as a wheel guard.

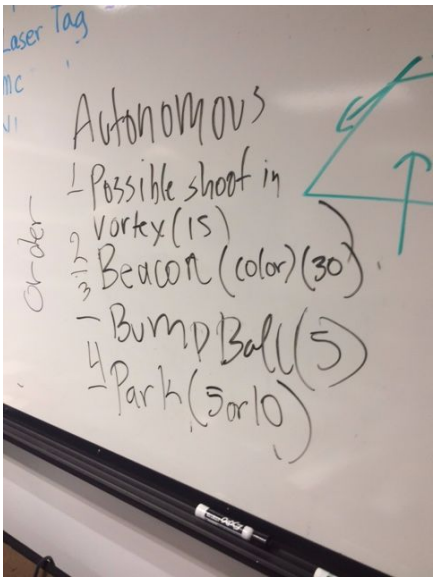
2) We might also want to add a plastic scraper on the base of our robot to help.

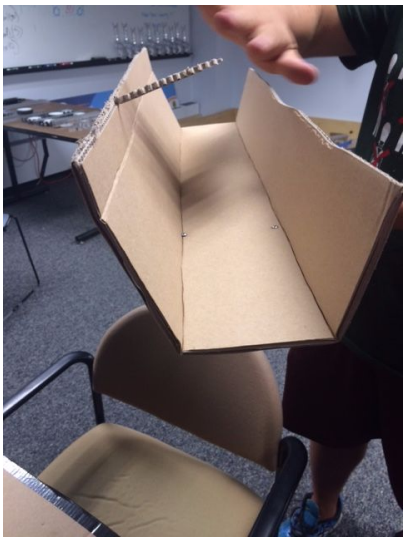
3) The omni wheels we plan on using will help us turn more effectively than treads did last year.

4) Gearing : We are not sure about the gear ratio at the moment, but we will test different combinations after finalizing the design. We still need to consider the amount of power and speed we need for our robot.



Left: Our progress so far with our wheel design

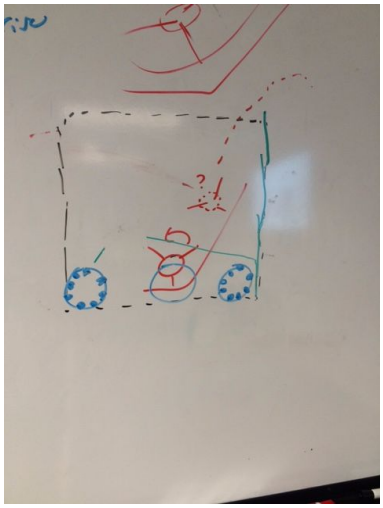




Left: Our prototype for our ball launcher taking shape

Right: Our autonomous priorities

Brainstorm



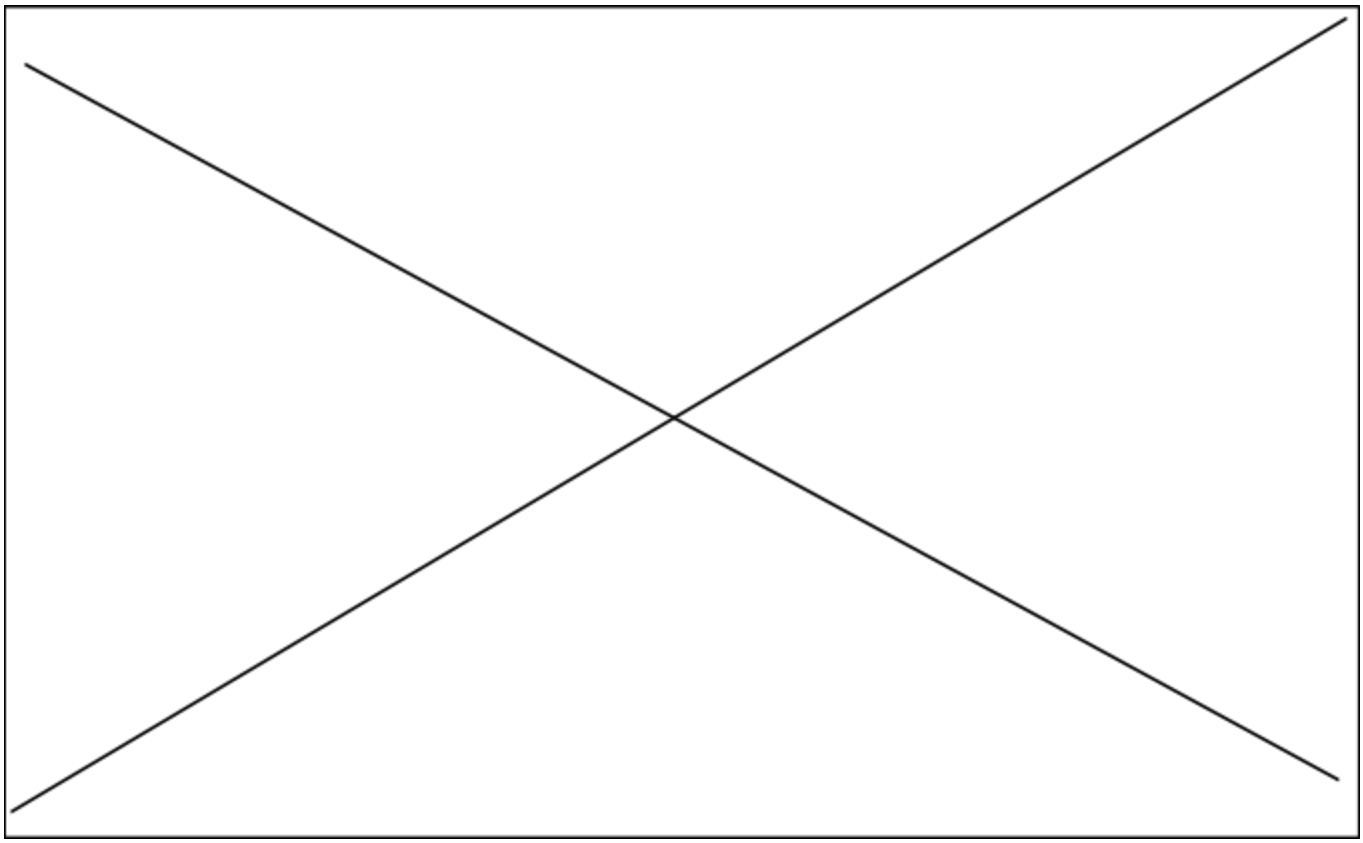
So far the team has brainstormed one possible design.

In the drawing.....

1. Green = lift mechanism
2. Red = launch mechanism
3. Blue = drivetrain
4. Black = structure

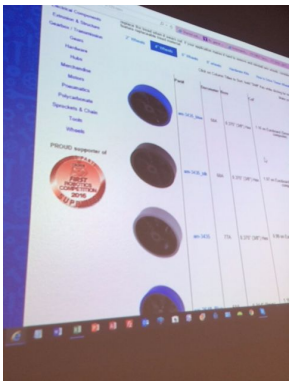
We want to eventually build up our design to addressing multiple scoring methods in the driver period.

- The middle portion of our design primarily addresses the launching.
- The back and top portions will address lifting the larger ball
- We might use a pulley or slider system to score with the larger ball



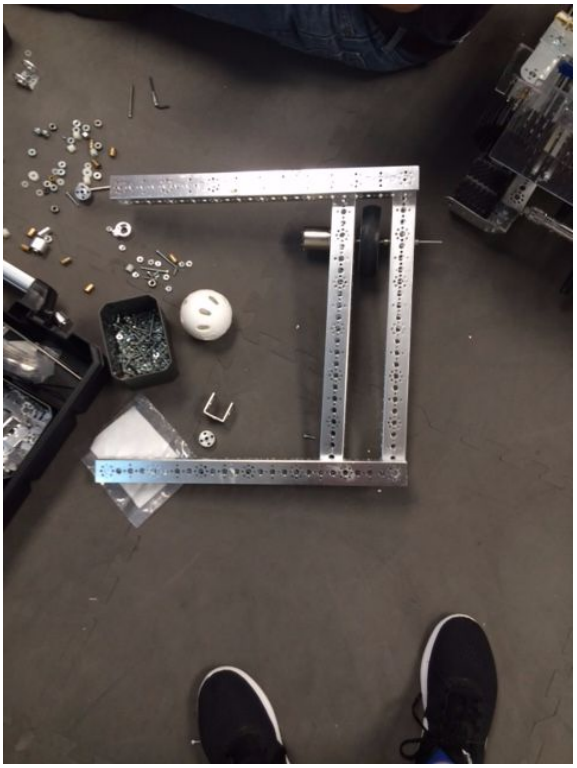
Meeting #2

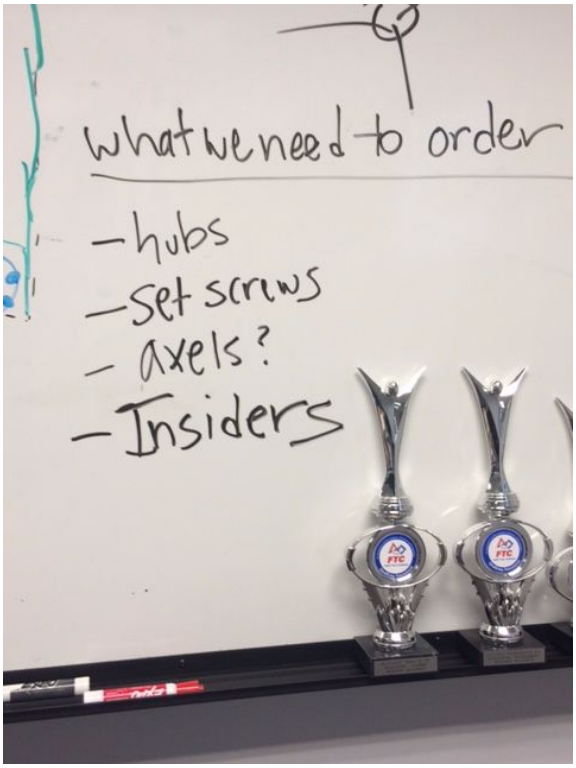
Date: September 17th, 2016
Attendance: Ragini, Avanish, Rohit
Duration : 11am-2pm
Goal: Further design, and decide what we need to order

Tasks	Reflection
Discuss wheel design further, and explore another type of wheel	We are thinking about possibly using stealth wheels instead of omni wheels because they provide more friction.  The team will decide within the next two meetings whether we should order them.
Start prototyping the chassis	We decided we wanted to test different types of chassis for our robot. Factors we want to consider during our testing • The support for the motors • Pressure being applied to the sides of the frame • The space for wiring with the shape of the chassis • 18x18in size limitation
Take inventory and prepare order	While prototyping a possible chassis, we took into account what was missing and needed tools and building materials. At the end of the meeting we submitted our order proposals to our mentors for approval.

Meeting #2 Cont

Mentor,and alumnus, Kai Huang leads a discussion on effective communication during the brainstorming process.





Above the chassis prototype started to help us test the wheel configuration. There will be discussion regarding the final motor and wheel placement in the design.

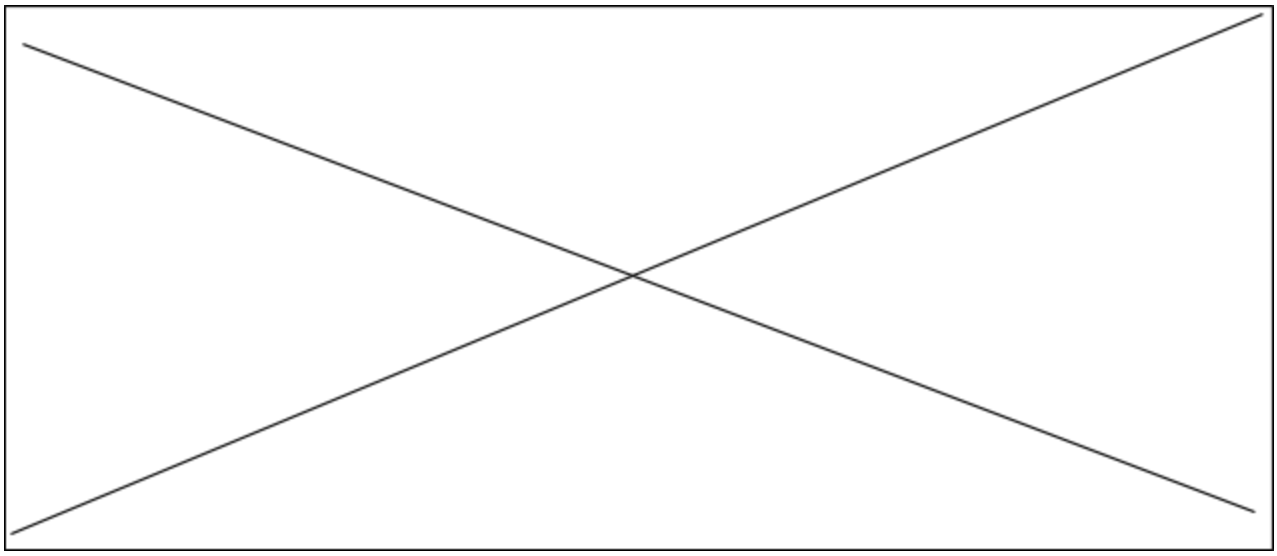
To the left our current list of what we need as a team. We may not order everything on the list, because some parts may still be in storage.

Meeting #3

Date: September 19th , 2016
Attendance : Eric, Ragini
Duration : 6-9PM
Goals: Begin Field Set Up

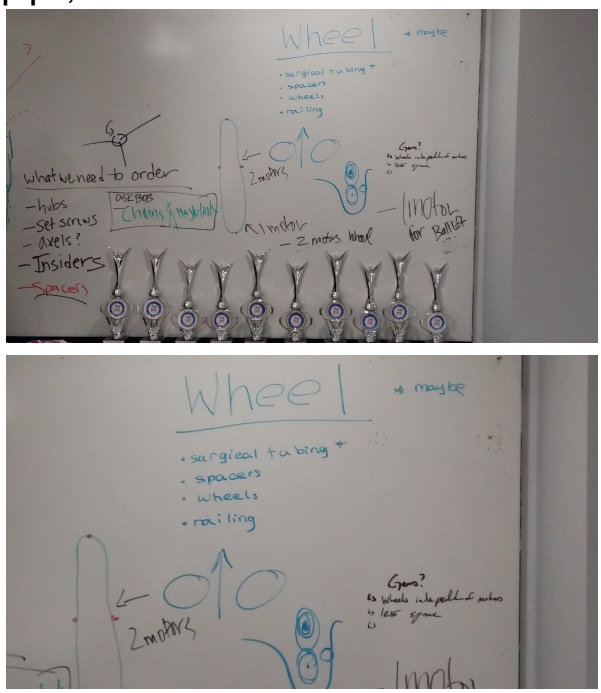
Tasks	Reflection
Unpack and organize	We sorted the red and blue sides of the field into two groups and decided what parts we wanted to assemble first.
Start Vortex build	Since this was a main element of the field we built it first. Safety was a huge priority when assembling the vortex.
Start ramp assembly	Since the ramp may determine our drivetrain and chassis, it was a big priority. Our mentors Bob and Silvia supervised us.

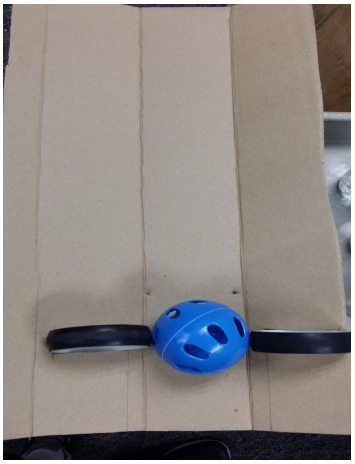
Journal Entry By: Eric Rong	Reviewed by: Upneet Singh

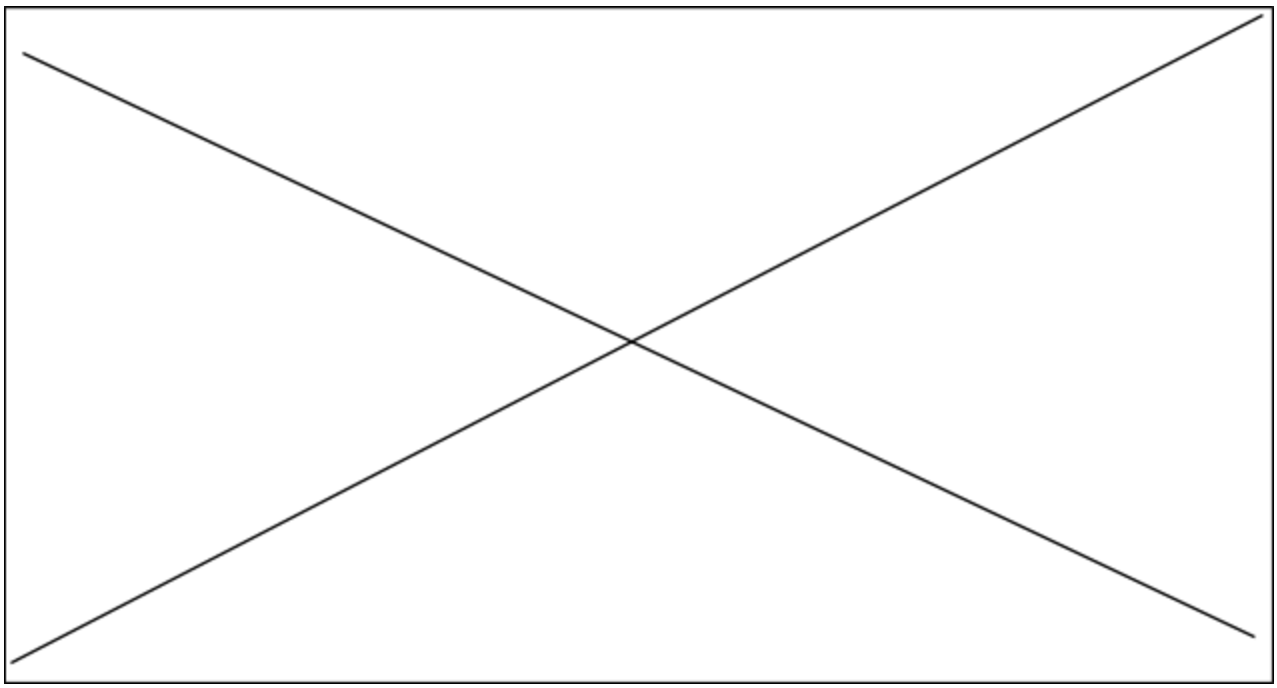


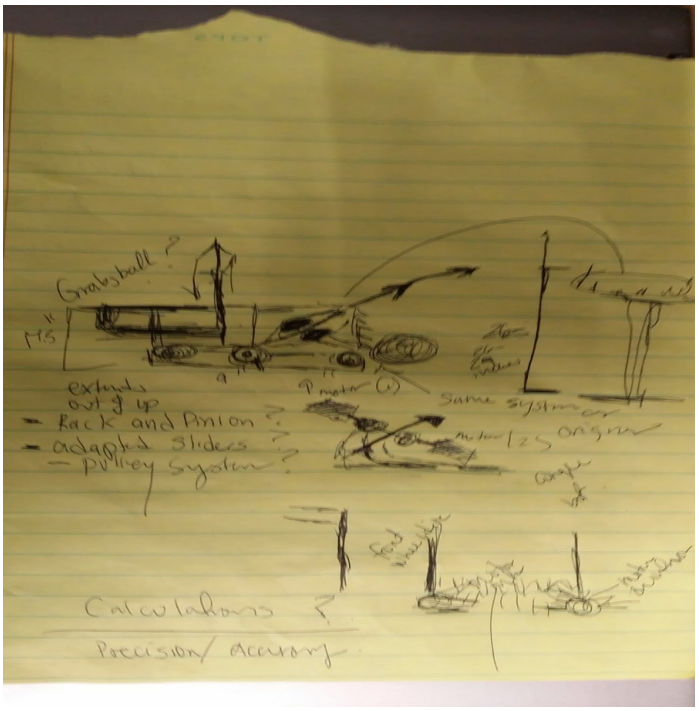
Meeting #4

Date : September 26th , 2016
Attendance : Ragini, Avanish, Rohit
Duration: 6 PM -9 PM
Goals: To create a ball lifter

Tasks	Reflections
Design the system of the ball launcher and the forklift.	We brainstormed on how we should build the ball launcher, and how it could fit on the chassis along with the forklift. We drew preliminary designs on paper, as well as on the board. 
Start designing the preliminary ball launcher system.	We designed the ball launcher system with two rubber wheels that will shoot the ball. We have drawn a preliminary design on the board, and Avanish worked on the material design.

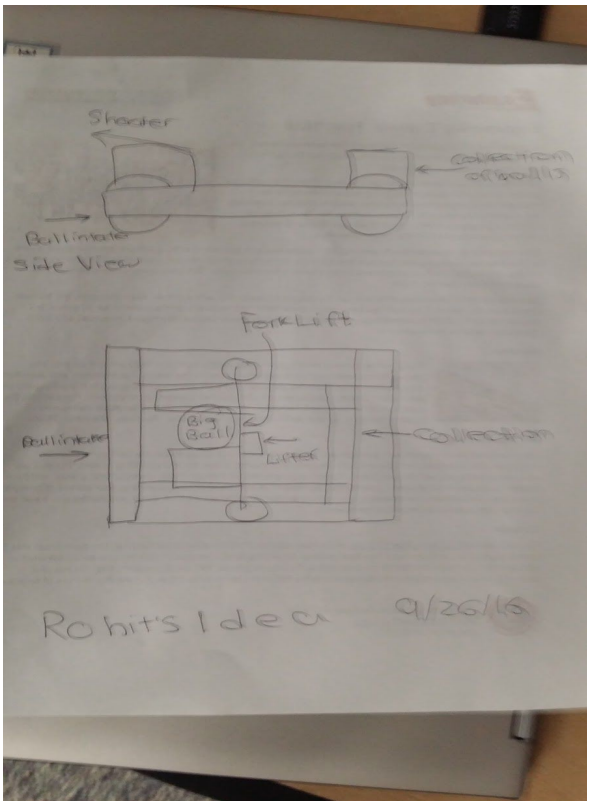
	
Work on the chassis in order to determine the angle of launch.	We worked on the chassis, and we added two tall beams because we needed to determine an angle to launch the balls. The angle will be determined after this is done.
Recorded By : Rohit Happarnahali	Reviewed by: Gunvir Labana





Sketches from the meeting

On the left was a possible design drawn out by Ragini. Her idea for the bot was to use a fork lift with extrusion sliders to lift up the ball in endgame. She also wanted to have two wheels spinning in the middle to create enough force for the ball to be launched.

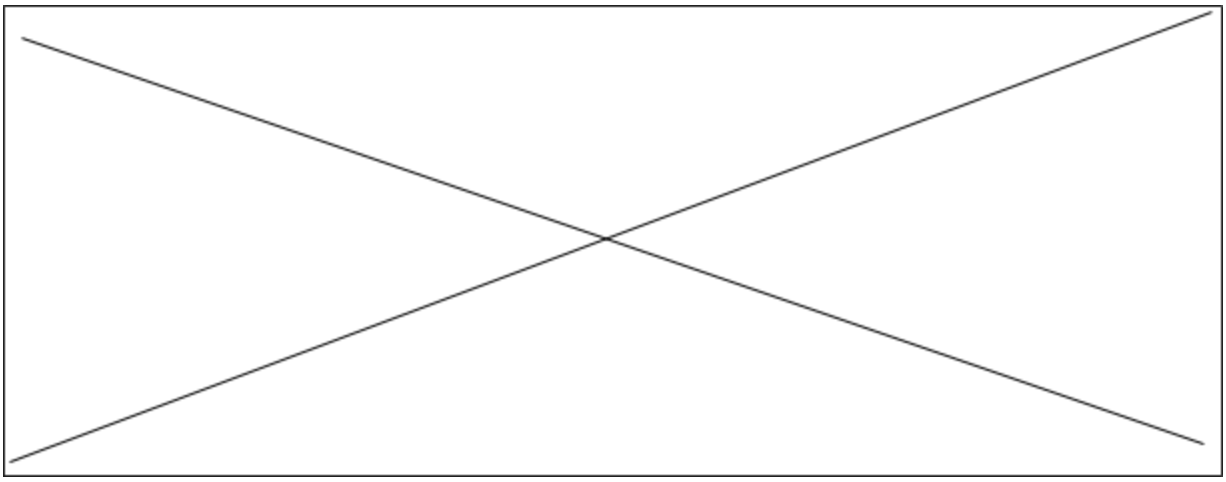


Rohit modeled how things would be placed with the system Ragini proposed. Space management will become a larger factor in our design as the season progresses.

Meeting #5
September 28th
Attendance : Connor, Gunvir, Ben, Austin, Rohit, Moses
Duration: 6 PM -9 PM
Goals: Teach Basic Wiring To New Members, Decide on Launching and Retrieving Mechanisms, Finish Chassis.

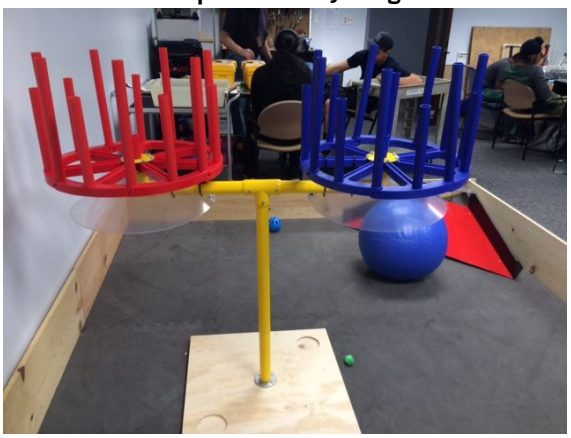
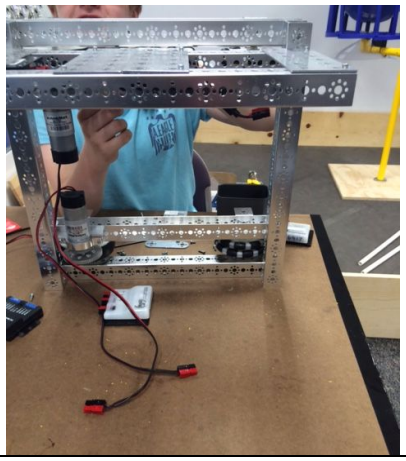
Tasks	Reflections
Taught new members the basics of wiring	The new members were taught the basics of the wiring and how the robot functions. A Powerpoint presentation was given by senior member groups
Decided and talked about the retrieving and launching mechanism	We decided upon a pulley system and a "Ball Launcher System" that pulls the ball up and then pushes the ball into two fastly spinning wheels and effectively send it up into the air and into the vortex
Not that much progress was made as it was just a majority of learning for the new members	New members were able to decide if they wanted to join electrical sub committee.

Journal recorded by: Gunvir Lubana	Reviewed by: Connor



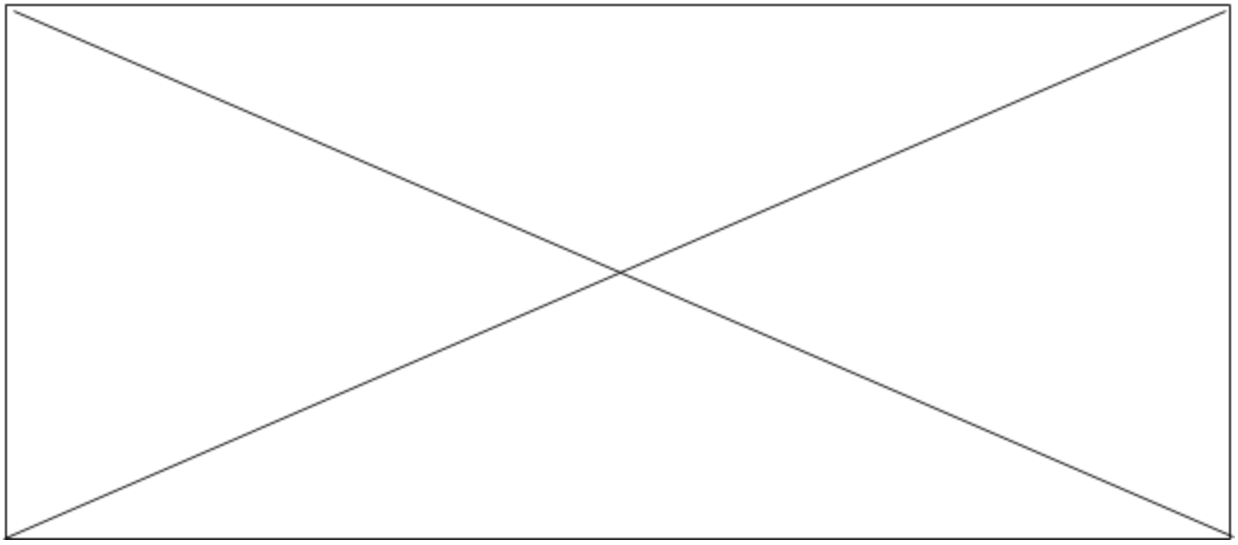
Meeting #6

October 1st, 2016
Attendance : Connor and Ragini
Duration: 10 AM -2 PM
Goals: Finish Vortex, finalize orders, organize electronics

Tasks	Reflections
Finished vortex and field	We finished drilling the vortex arms pieces into place, and added the plastic cone portions on the bottom. Then we placed everything on the field. 
Finalize orders	We decided that we will be using stealth wheels for ball launcher, and placed an order for them along with several other building materials.
Decide electronics placement and begin to place them onto bot	We decided that placing electronics on the side of the robot would be most productive. We added metal side plates to provide support for electronics. 

Create beacon pressing system for autonomous and teleop	Our plan for this system was to utilize a servo and a bar with enough surface area to turn and press either button with enough force. We may have to add some guides on the side to help our robot detect the beacon in autonomous. 

Journal recorded by: Ragini Balachandran	Reviewed by: Austin Long



Meeting #7

October 3rd, 2016
Attendance : Connor, Gunvir, Ragini
Duration: 6 PM - 7 PM
Goals: Test Cords and mechanics, test gear ratios

Task	Reflection
Testing the hardware	We worked on the placement of the cords and how they should be accessed. We settled on putting the Modules on a removable set of brackets for the time being until we have a better setup for it.
Make a way to speed up the discs to launch the balls.	We worked on trying how different gear ratios in a gearbox affects the speed of the overall speed of the ball pitcher.

Recorded by :Connor Gregory	Reviewed by : Ragini Balachandran

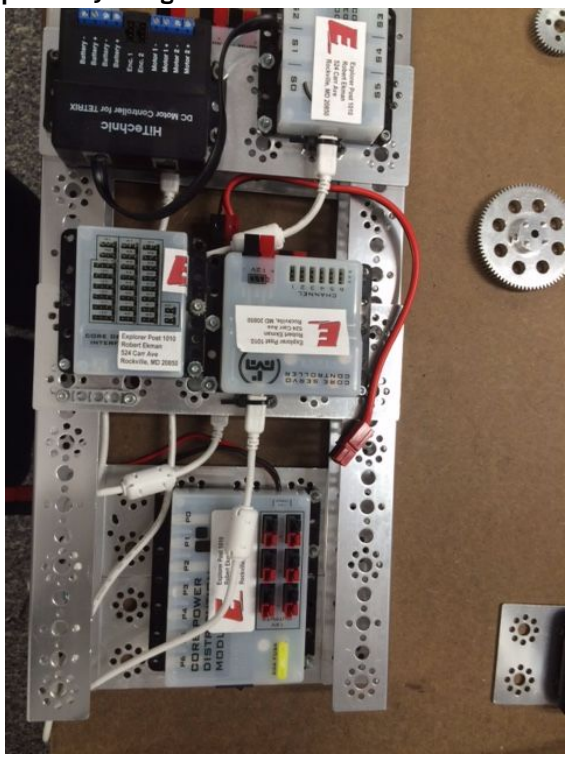
Meeting #8

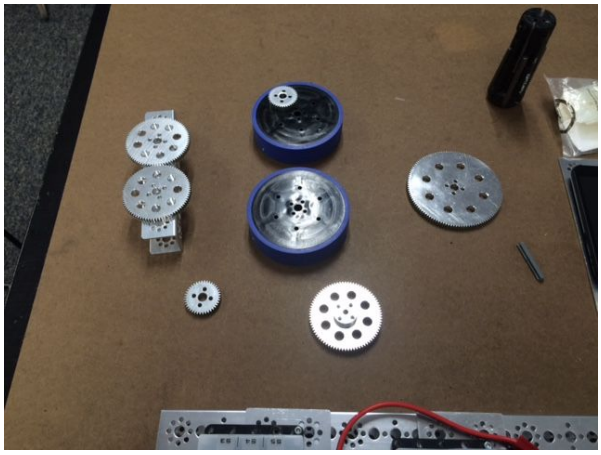
October 5th, 2016
Attendance : Moses, Austin, Rohit, Ragini, Gunvir
Duration: 6 PM - 7 PM
Goals: Create Spinner System to Pick Up Balls

Task	Reflection
Create a way to reliable pick up the balls	Using a series of spinners in the front of the bot, we force the balls into the launcher. We may not need this system, because driving over the actual ball may be more efficient than a spinner. This meeting involved a lot of trial and error along with a large amount of testing. We are adjusting to the size of the balls in comparison to last last year.
Recorded by: Moses Kang	Reviewed by: Gunvir Lubana

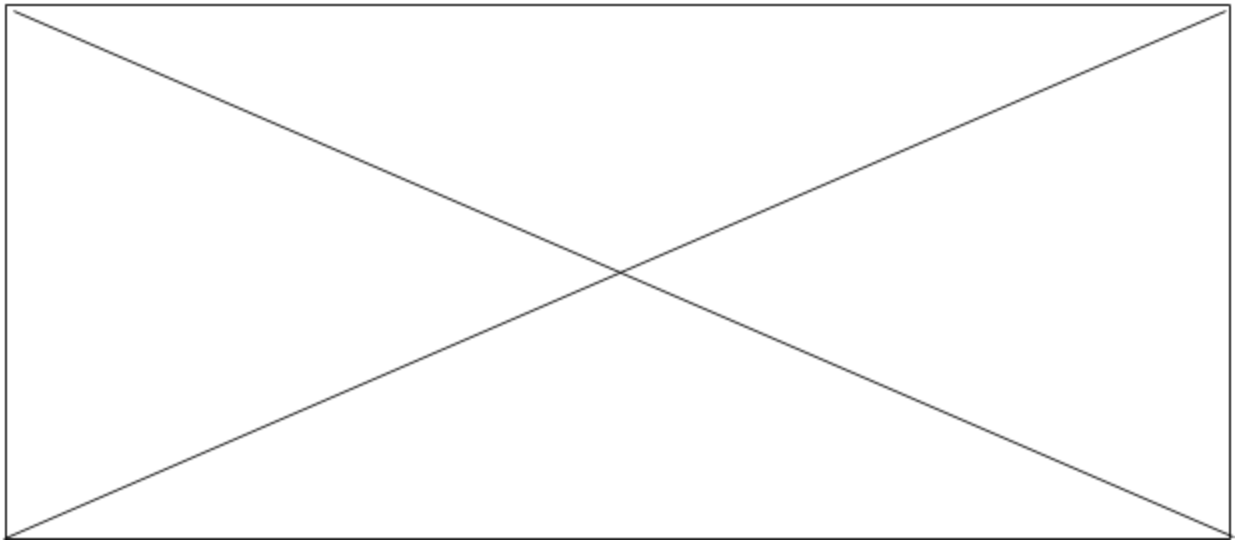
Meeting #9

October 9th, 2016
Attendance: Ragini, Gunvir, Connor
Duration: 6 PM - 9 PM
Goals: Start working on the ball launcher and finish electrical setup

Tasks	Reflections
Finish electrical set up	We had previously decided on an wiring setup for electrical, and decided that the electrical set up now would be stacked and to the side of our robot. This setup may be changed depending on further designs and their implementation. We are primarily using new electronics. 
Start constructing ball launcher system	We decided to focus on this system for the remaining portion of the meeting, because our main priority is to get our bot scoring , and when we get this system we will be able to identify the faults of our system. We are still developing the idea, but know that we have a general idea of what we want to do we can begin the building process.

	We will be using two stealth wheels geared accordingly, powered by one motor to spin extremely fast. We are hoping that the speed will create enough force to toss the balls into the vortex on the field. 

Recorded By: Ragini Balachandran	Review By: Connor G.

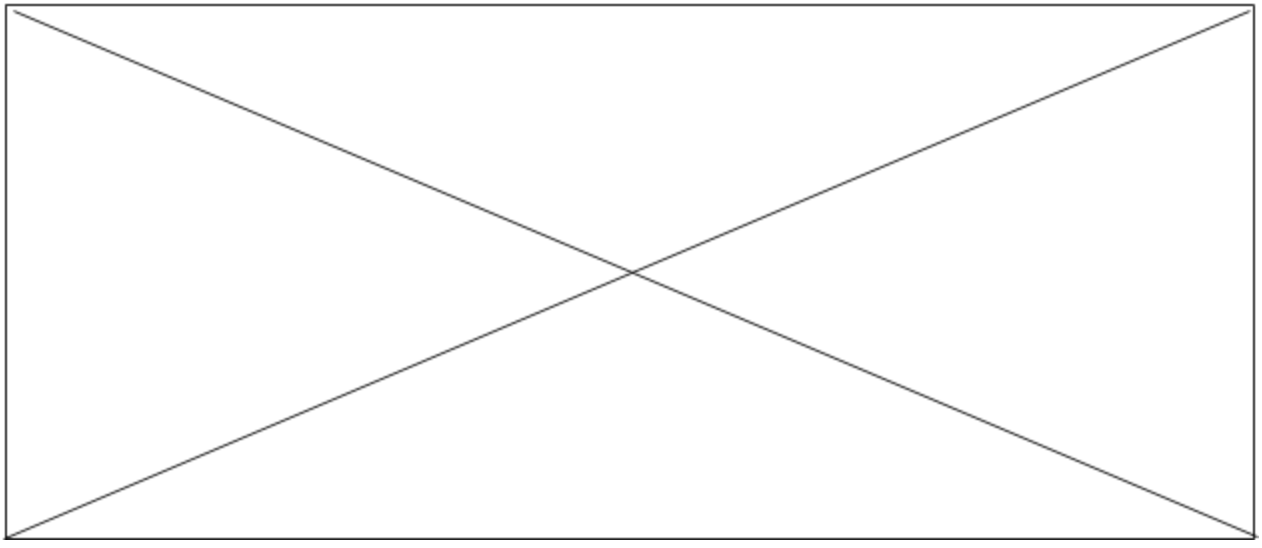


Meeting #10

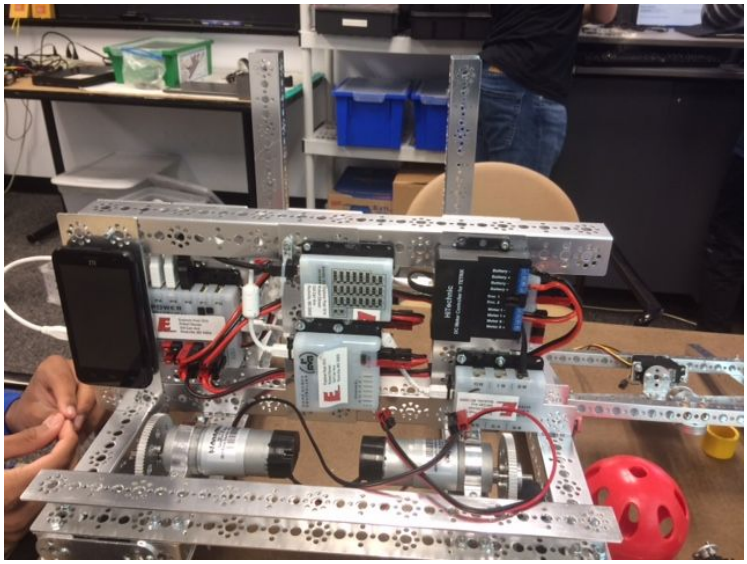
October 10th, 2016
Attendance : Ragini, Gunvir, Connor
Duration: 6 PM - 9 PM
Goals: Start working on the ball launcher and finish electrical setup

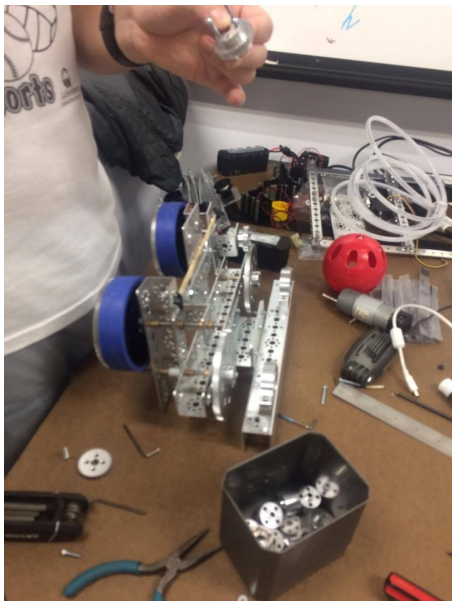
Tasks	Reflections
Finish a proposed ball launcher	At this meeting we determined the optimal ratio of gears and used a gear box to make sure the wheels being used were fast enough to be launched into the vortex. The construction of this launcher was finished at this meeting. Testing will be held off till next meeting.
Place electrical system on bot and get it functioning	After organizing our electronics we finally mounted them on our bot. We plugged the battery into the electronics and everything worked like it should have. We will make sure our bot is moving by our next meeting.

Recorded by: Ragini Balachandran	Reviewed By: Gunvir Lubana

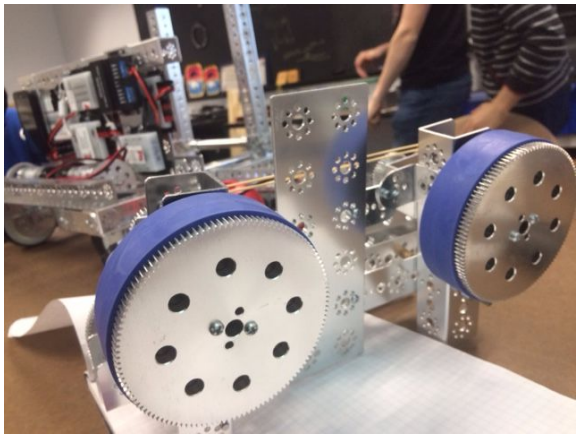


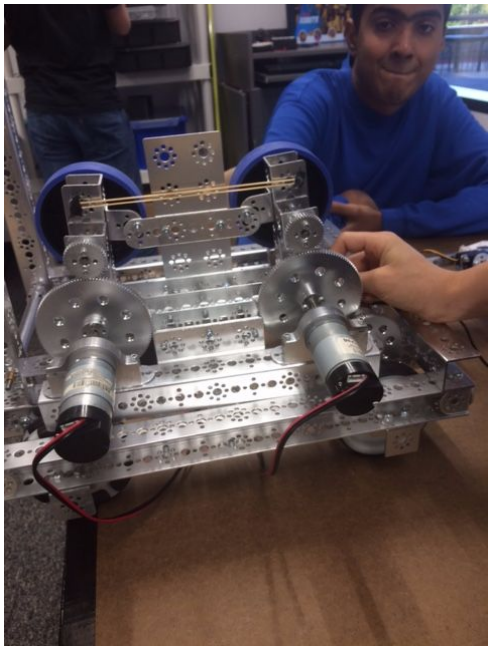
Pictures From Meeting

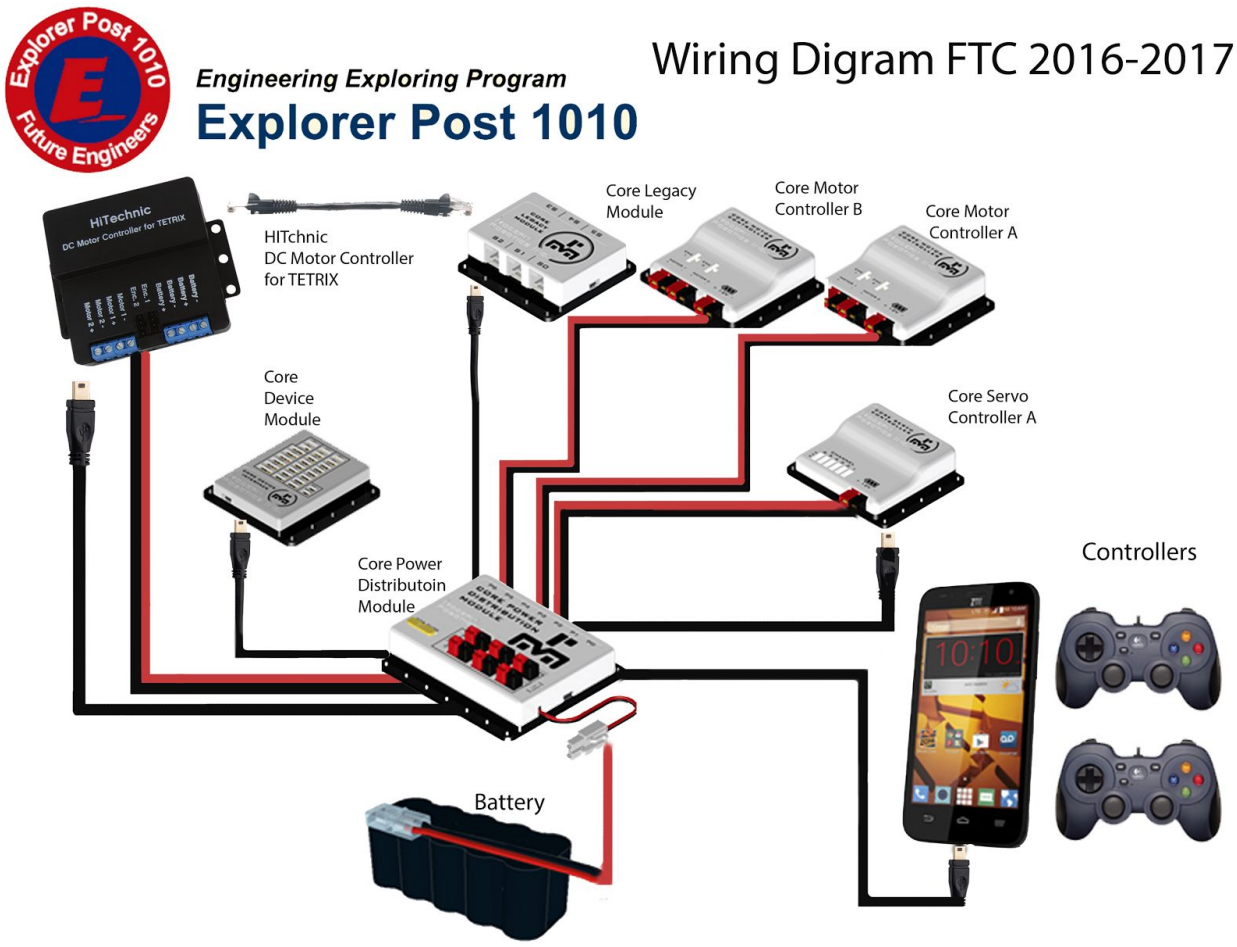




Our plan was to have the wheels spinning incredibly fast to launch the bills into vortex.
The rubber band on the back was to allow enough space and elasticity for ball to get through launch, and at this point we did not know how much space would allow for a good ball launch. We still have more calculations and modifications to do if we want to end up using this design.







Finished Wiring Diagram

Meeting #11

October 10th, 2016
Attendance : Ragini, Gunvir, Connor, Ben, Austin
Duration: 6 PM - 9 PM

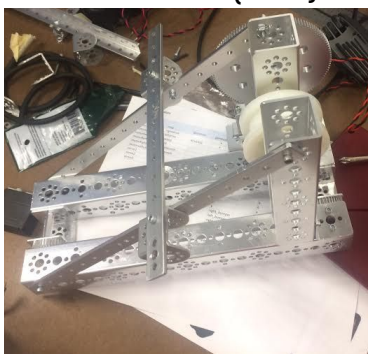
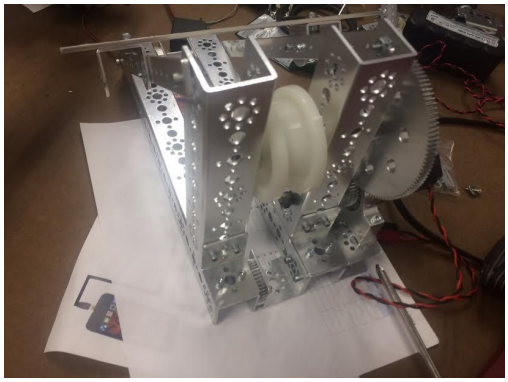
Goals : Test our ball constructed launcher and get robot moving

Tasks	Reflections
Configure electronics, update apps, and make sure everything is functional	In order to get our robot moving we needed to focus on getting our apps on driver and robot phones updated for the new season. The new updates provided us with much more information and organization than last year's system. We then had our programmer, Austin, and mentor download some of the sample code, to get things moving.
Have members drive robot around	We wanted our team members to get acclimated with the new drive system So we can later determine who will be driving in competition
Test ball launcher	From our modified test setup, we realised that we would need more speed for the balls to be launched with more height and distance. We decided that we would need to address in a later meeting.
Decide to build another launcher prototype	We had come to group consensus that would try another system of ball launching with a plastic flicker. We will do this next meeting as well.

Recorded By: Ragini Balachandran	Reviewed By: Ben G.

Meeting #12

October 18th , 2016
Attendance : Ragini, Gunvir, Ben
Duration: 6 PM - 9 PM
Goals: Finish working on the NEW ball launcher prototype and prove that it worked

Tasks	Reflection
Finish ball launcher (new system) 	Used high torque and plastic piece to launch ball This produced somewhat accurate results, but we decided that most likely a guard would be necessary.
Score in vortex 	Using new system managed to score into vortex from start position. We had to hold the launcher and angle it correctly to a get a shot into the vortex. We realized this method may take more trial to implement correctly on the bot. We weren't sure how exactly the balls would get to the launcher if mounted.
Assembled many plastic constructions for future use	Plastic strips for bending and launching blass far distances were needed because of how many times they broke. This method seems unreliable, so we may just adapt the former method .
Journal entry by: Ben G.	Reviewed By: Gunvir L.

Meeting #13

October 22th , 2016
Attendance : Ragini, Gunvir, Ben, Austin, Connor
Duration: 10 AM - 2 PM
Goals: Make another way to shoot and score the ball, Get the Robot Moving, get the Robot on to the ramp

Goals	Reflection
Make another way to shoot and score the ball	We started to create the Choo Choo Mechanism via extending axles as well as gear ratios and having bushings to catch catapult or cock up. After this meeting we decided to return to our old method of shooting. We have ordered the 20 neverest motors, but until we get them we will focus on refining the system.
Get the Robot Moving	We installed the code and now the robot moves. Controls are currently inversed but will switch values to make robot follow commands accordingly. Also tested out basic mechanism for analysis. (Old design)
Get the robot on to the Ramp	The Robot fits onto the ramp and stays there using servos and light pressure on motors to increase drag and friction to stay on the inclined plane. We believe with the added weight in the future will also assist with our robot's ability to stay on the ramp during autonomous. The current weight distribution is very uneven. Because not much has been mounted there was not much in the middle and back end. We are anticipating the robot will be able to balance if it' s more even. Further testing will be required.
Journal entry: Gunvir Lubana	Reviewed By: Ben G.

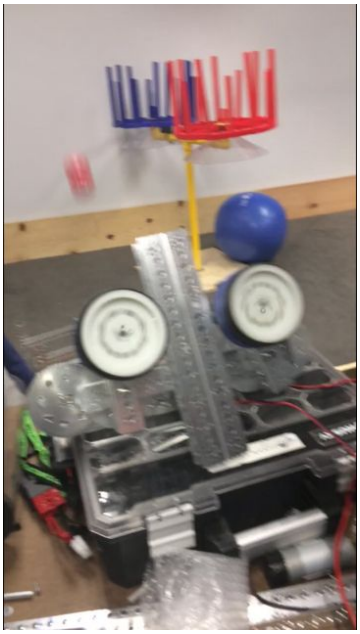
Meeting # 14

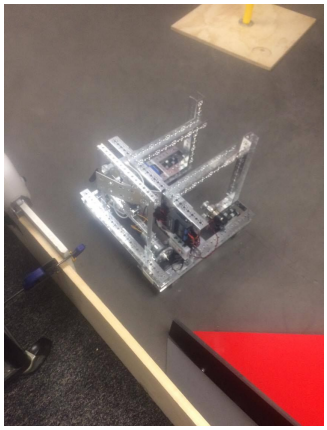
October 26th

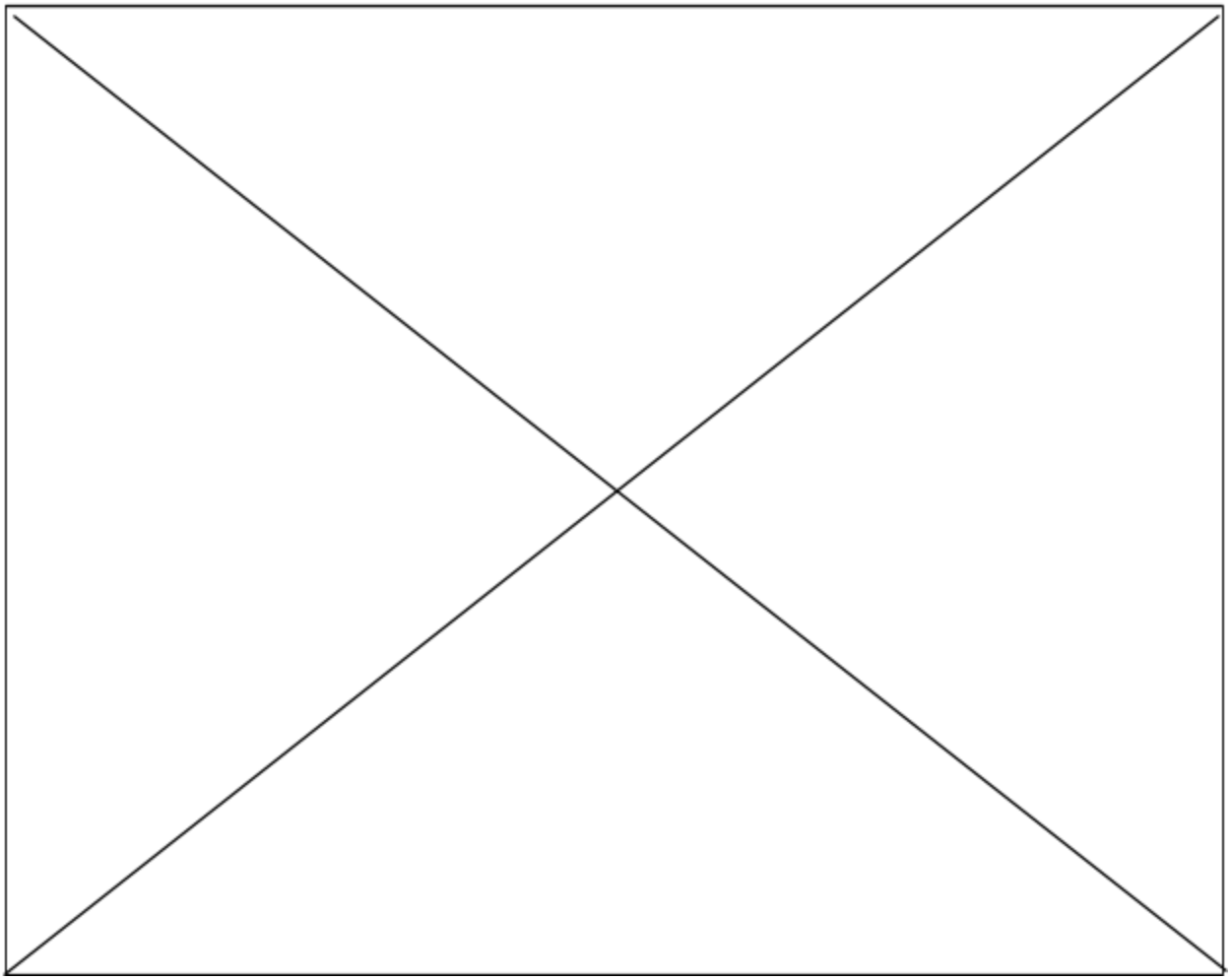
Attendance : Ragini, Gunvir, Ben, Austin, Connor, Moses

Duration: 6-9 PM

Goals: Test old spinner system out, continue to practice driving

Tasks	Reflections
1. Replace old 40 neverest motors with 20 neverest motors on our old design 2. Test 3. Find a space on the robot where it could be mounted 	After replacing these motors, we tested the old design . We soon discovered that system had too much power with the added speed of the neverest 20s. The spinner system also appeared extremely bulky and would be outside the 18 by 18 sizing requirement of the game if mounted on the robot. During our testing the ball had hit the ceiling numerous times,and the pieces of metal in the middle meant to guide the balls made it impossible for the design to stay within the size needed; we had removed the guidance metal but the ball would not go up without the support. This system was moving so fast it proved to be slightly unstable as well. We had some worries about how this could function in competition if used.
4. Continue Driving	We found that the more practice you get with driving the smoother rounds go in competition. We practiced capturing balls and hitting the beacon. Since beacons play a pivotal role in autonomous scoring, it was necessary to determine how to hit one in both drivers period and autonomous

	
Recorded by: Austin Long	Reviewed by : Moses Kang



Meeting #15

November 5th, 2016
Attendance: Connor, Gunvir, Ben, Rohit, Moses, Austin
Duration: 10 AM - 2 PM
Goals: Continue work on modifying the original ball launcher model, assign roles for competition.

Goals	Reflection
Find a way to be able to put the old ball launcher on the robot.	We looked at the ball launcher, which is now very powerful. We found it is too bulky and has unnecessary parts on it. We discussed on how to make it smaller, and settled that we need to change the positioning of the gearbox and remove the extra space, to be able to put the launcher on our robot.
Competition Roles Established	We later had a full group discussion on who is going to do what roles at competition. This was done to make sure we know who is supposed to be doing what there, including deciding drivers. We will have subgroups on competition day: 1. Battery Station to help teams understand the status of their batteries 2. Pit Cru consists of members to help repair and manage bot 3. Driver Cru to run bot in competition, and keep track of team's progress 4. Scouting and Spirit Cru to network with other teams and support us in events
Journal entry by: Connor G.	Rohit H.

Meeting # 16

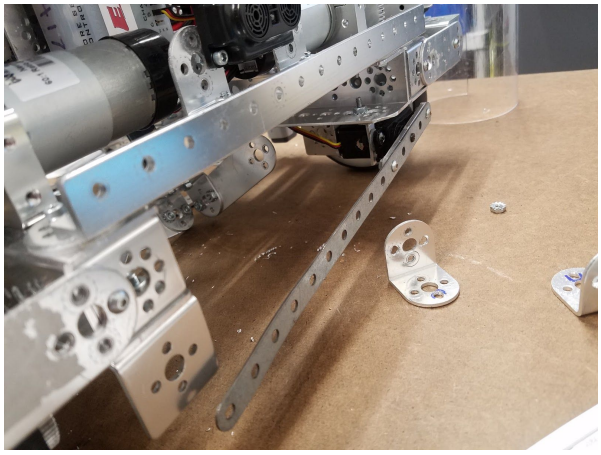
November 9th, 2016
Attendance : Ragini, Gunvir, Ben, Austin, Connor
Duration: 6-9PM
Goals: Redesign launcher and begin attaching/designing a ball capturing design

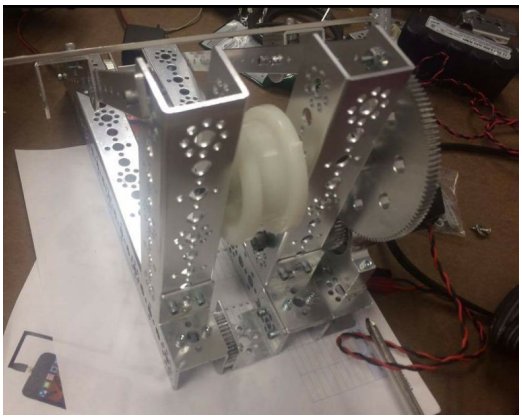
Goal	Reflection
Targeting system	We worked on a basic slope prototype with winglets on the side constructed of cardboard. This system is designed to direct the ball to the target with a high chances of success every time without sapping momentum away from the ball. System will be tested in future meetings and if practical will be constructed with more durable and more suitable materials to the task i.e plastic.
Better gearing for the launcher	Took apart old system as its vibrations unscrewed structural screws as well as set screws. Will try different gearing to reduce vibrations by creating better transfer through gears. If vibrations still too strong will fill empty space in bars with foam or other padding materials for increased reduction in vibrations.
Ball capturing mechanism	Started working on two different prototypes for capturing and holding balls. Suggestions are using servo gates to capture balls or using piece of plastic to bat balls into the assembly. Team has split up to work on each piece will decide in future what system to use
Journal entry by: Ben G.	Reviewed by: Ragini B.

Meeting # 17

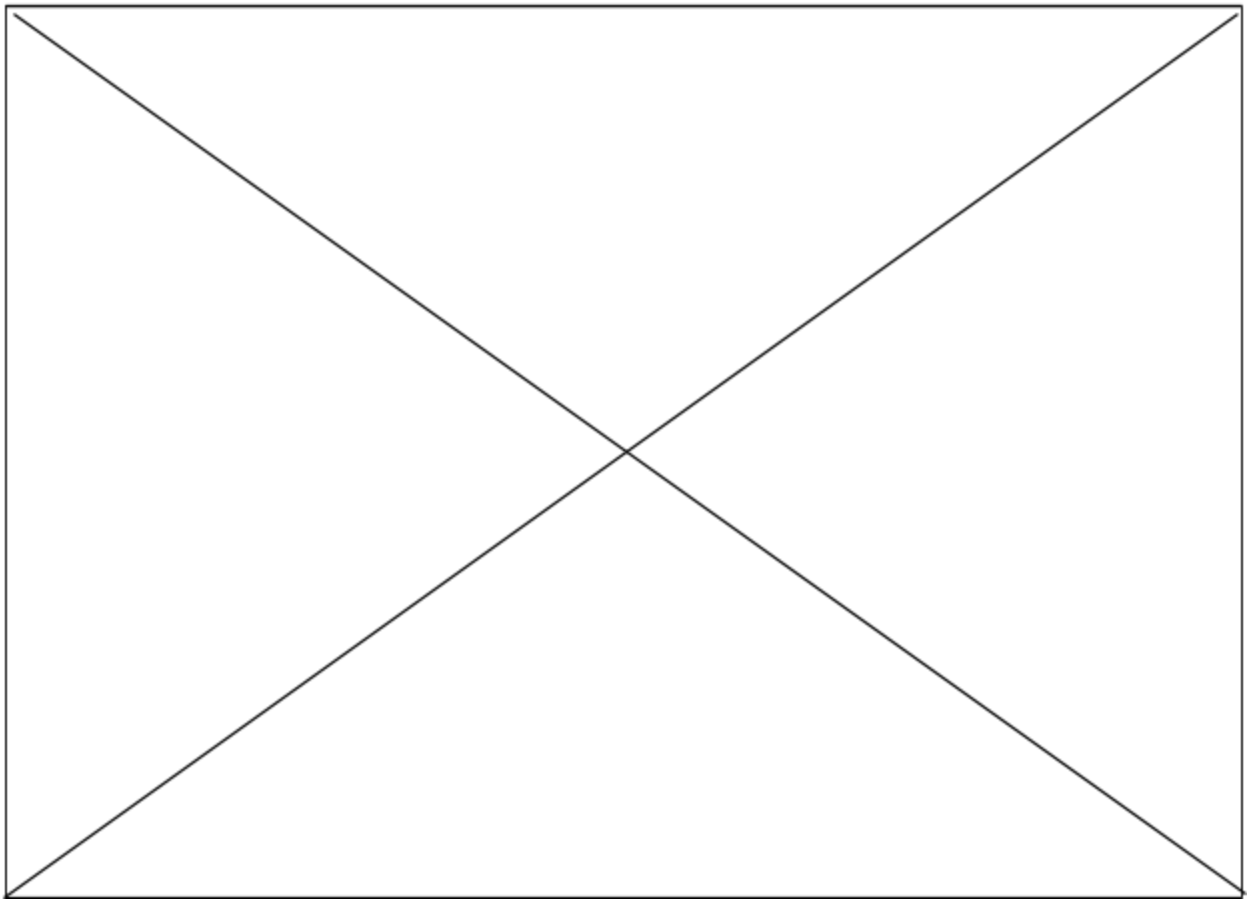
November 12th, 2016
Attendance : Ragini, Gunvir Austin, Connor, Moses,Eric, Rohit
Duration: 10-2PM
Goals: Add a system to catch, collect, and move ball into launcher/ settle on new launcher method

Tasks	Reflections

We had added a system catch and collect balls
 
	• We decided that spinners to collect balls proved to be unnecessary
	• The ball will be driven over and collected
	• So what we ended up adding was a system to hold and push ball into launcher, that would allow us to maneuver while holding the ball.
	  ○ Allowing for us to get in the right place to launch
	  ○ We used servo doors to get this accomplished

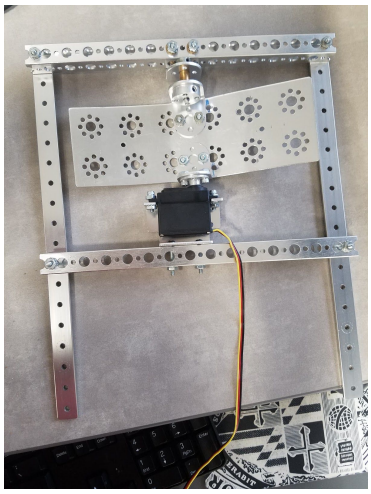
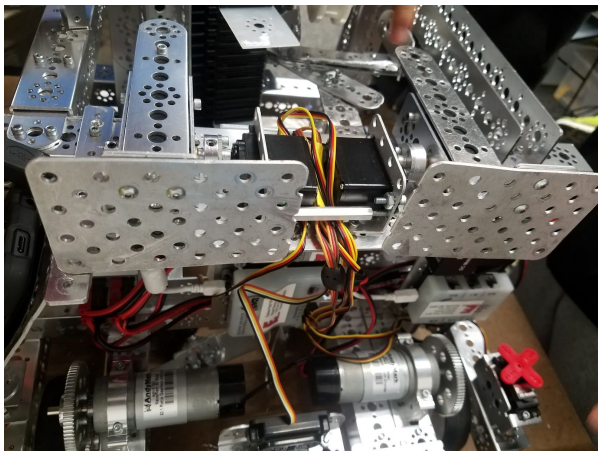
Test the built multiple designs for a launcher
 
	The plastic flicker shooter and wheel design
	Both of which have flaws, that can be improved.
	Neither are scoring very wheel so additional work will be needed on both.
	• The wheel design is being improved to only utilize one wheel and have a less bulky gear box
	  ○ It will be placed along the middle of the bot with a ramp
	• The flicker idea has broken using only one piece of plastic
	  ○ We will have to increase the amount of plastic being used to hit to distribute force.
	  ○ It will be mounted across the top of the robot
	  ○ It will however need a system to help the balls move up because a ramp won't be feasible with that design.

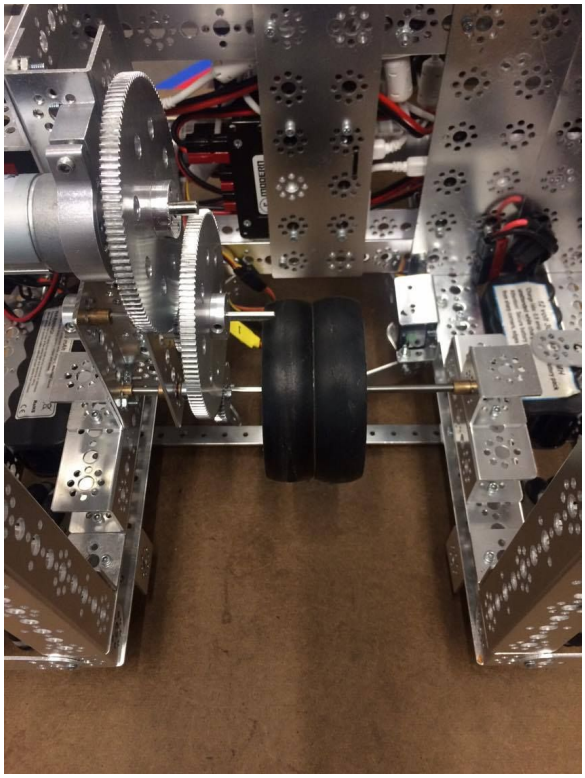
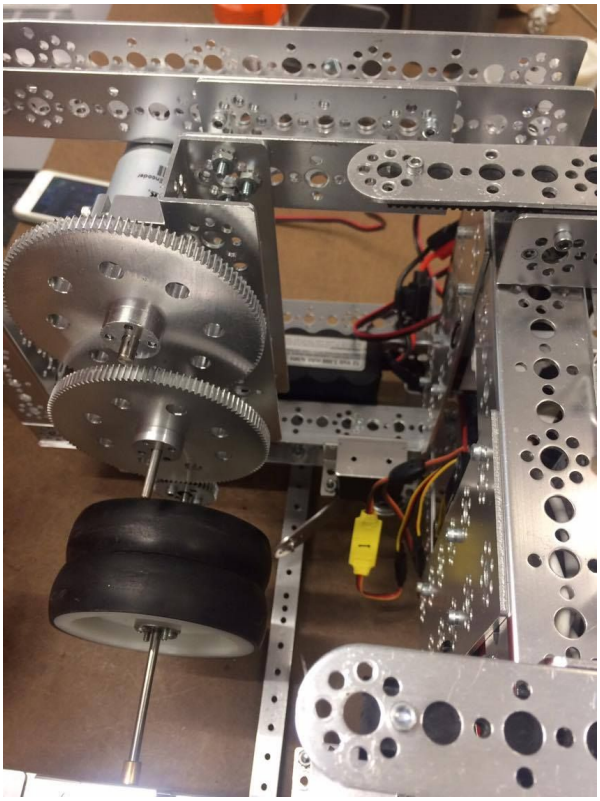
Recorded By: Moses K.	Reviewed by: Austin L.

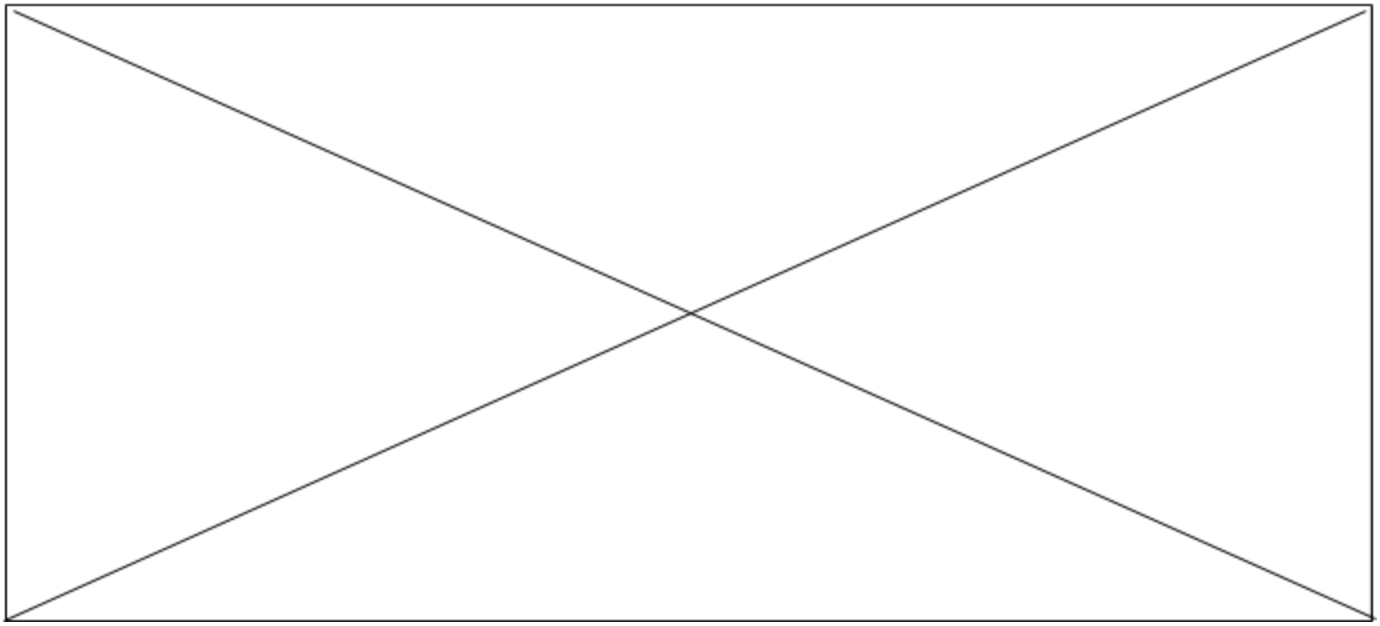


Meeting #18

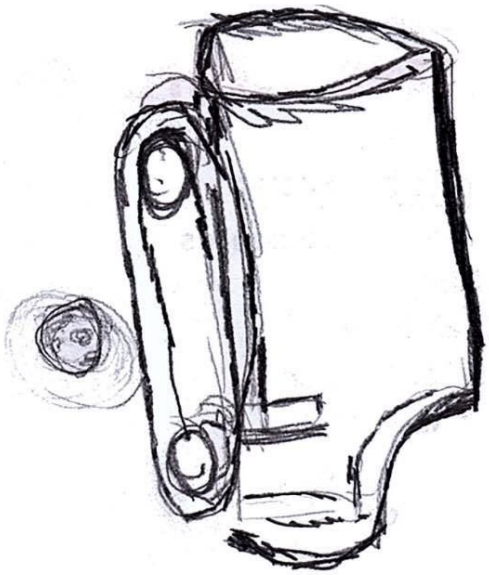
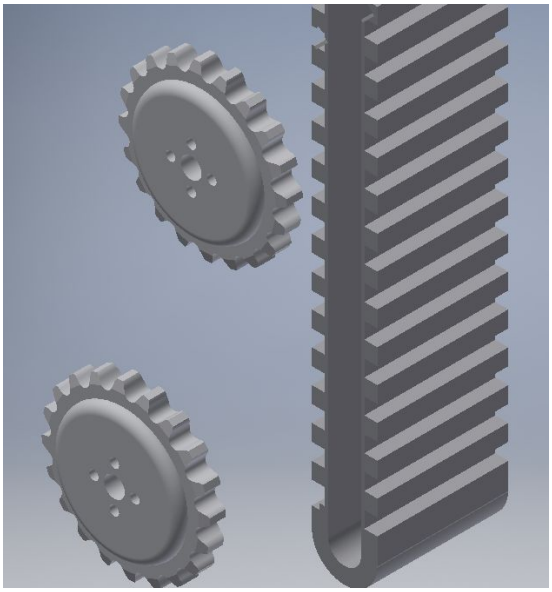
November 19th, 2016
Attendance : Ragini, Gunvir Austin, Connor, Moses,Eric, Rohit , Avanish
Duration: 6-9PM
Goals: Continue working on launchers and practice driving.

Tasks	Reflections
We needed to revise beacon design Before	• The beacon design was ineffective and was prone • The new idea was to have two separate plates rather than the single plate we had currently • This would allow more efficiency as the old beacon pressor was not able to press the button 100% of time, while the new one could do so After
	
Build/ Test out our adapted wheel launcher	Our wheel launcher system has been made less bulky by utilizing two wheels in the center of the robot and with a side gear box mounted on the robot to increase speed and torque of wheels. The former system would've also been much heavier in comparison to the newer wheel launcher.

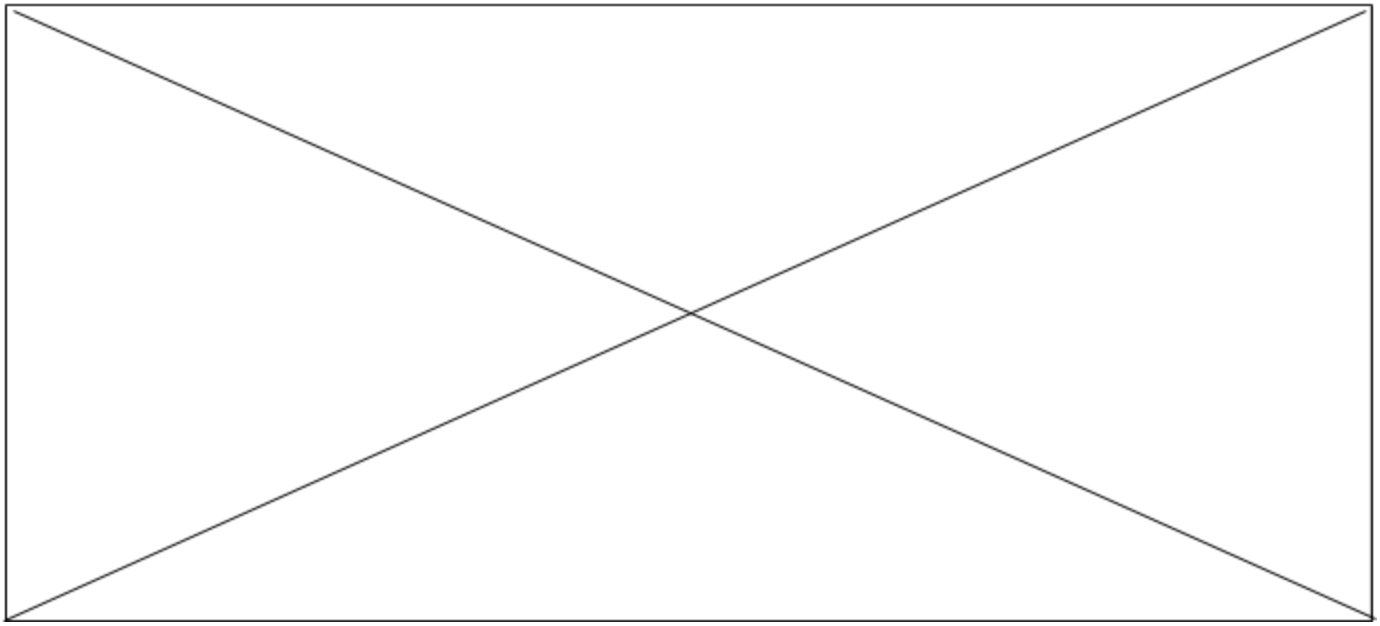
	
Recorded By: Upneet S.	Reviewed by: Avanish



Meeting #19
November 21st, 2016
Attendance : Ragini, Gunvir Austin, Connor, Moses,Eric, Rohit, Upneet
Duration: 6-9PM
Goals: work on methods of getting balls into launcher design/ autonomous prep with code

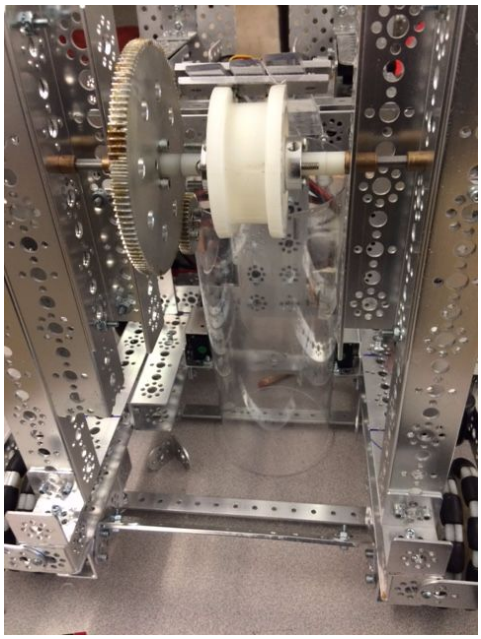
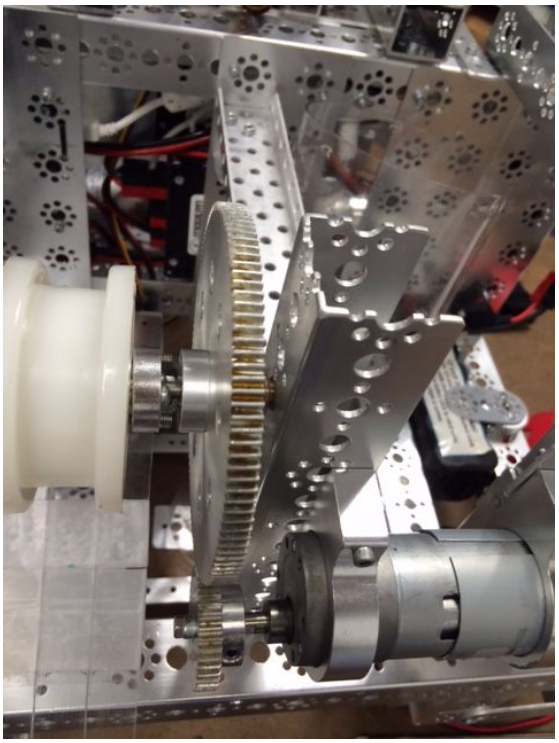
Tasks	Reflections
We needed to revise the wheel placement on the base of the robot	• The left wheel was a little off in placement and as a result it was hard for us to turn • The new idea allowed us more mobility throughout the playing field • The idea allowed us more stability and reduced vibrations throughout the robot
Create/refine improved flicker method launcher Design method that could get ball to launch from a flicker 	We decided to also refine our flickr Method by increasing the amount of surface area With more contact with the ball would • distribute the force • reduce the breakage of plastic flickers. • the system would be a lot less complex other ball launcher. • We thought that a conveyor belt could also help the ball get into launcher 
Test wheel ball launchers	We tested both launchers today and both presented with individual problems since

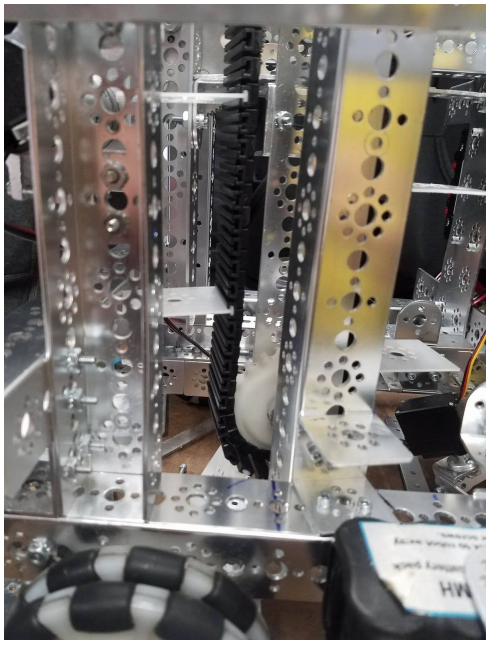
	neither method has method of getting the ball to the launcher. The wheel launcher system has jammed on occasion and since it requires Neverest 20 motors to work it may be unreliable in competition and not a good choice. The flicker system now requires a conveyor belt to get system working and requires further mounting. But this method is simpler and requires less maintenance than the other system.
Autonomous coding	We have a lot we want to accomplish in autonomous, and today we managed to get robot to detect the line and color of beacon using our sensor. Hopefully, we can get it working by competition.
Recorded By: Moses K.	Reviewed by: Upneet S.

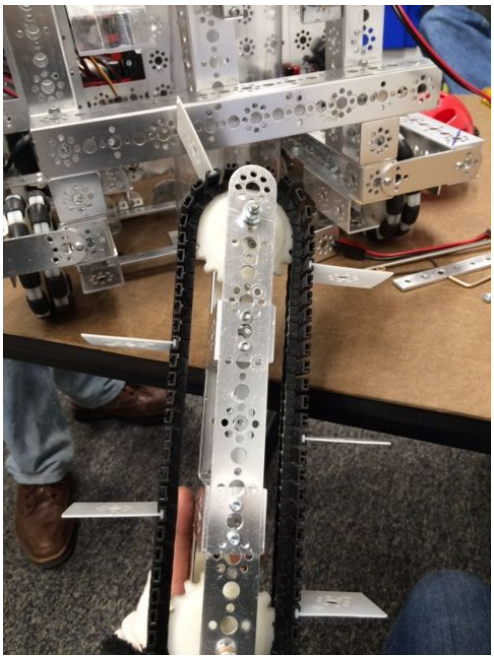


Meeting #20

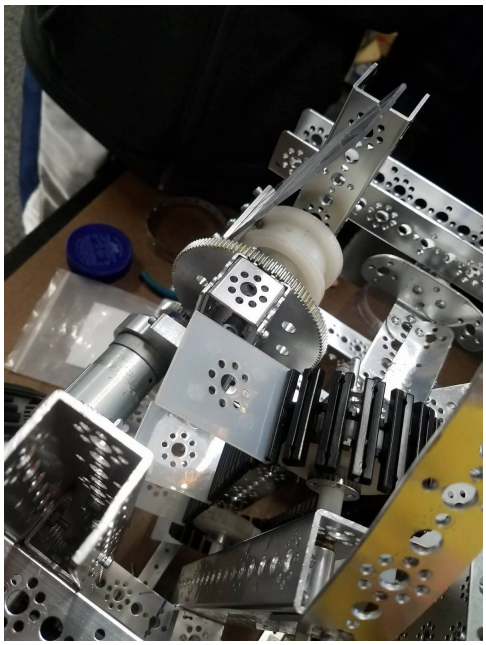
November 24th, 2016
Attendance : Ragini, Gunvir Austin, Connor, Moses,Eric, Rohit
Duration: 10AM - 2 PM
Goals : mount finalized competition launcher / add conveyor belt

Tasks	Reflections
Mount our flicker system on bot after removing the wheel system 	We had decided that the wheel method proved too problematic as we needed a ramp of rigid material and the gears kept jamming if the ball entered from varied angles 
We added a conveyer belt inside the robot	• The conveyer belt allowed the ball to be moved semi-autonomously from the ground to the firing mechanism • The advantages of the conveyer belt being inside the robot allowed us to keep within the restriction of the robot size

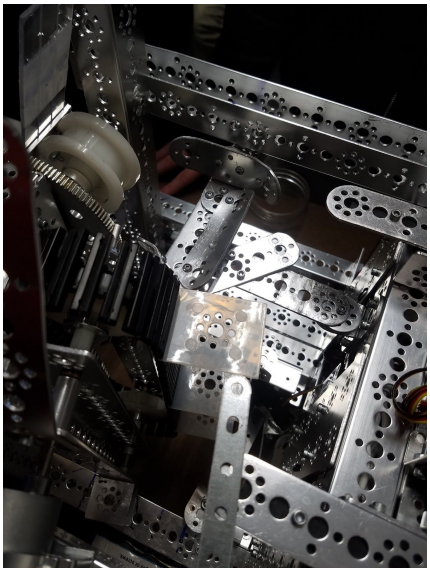




Add metal pieces to provide a way to move the ball to launcher from the to conveyor belt



These scrap metal pieces were attached in criss crossing pattern and gave the ball a place to roll into. They also allowed the flicker to have a rest on.

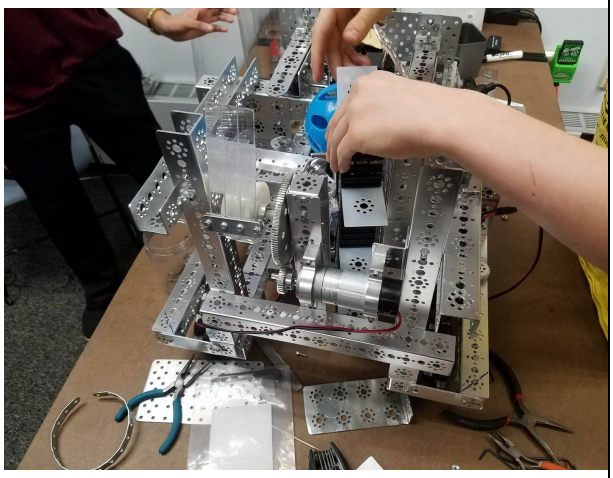
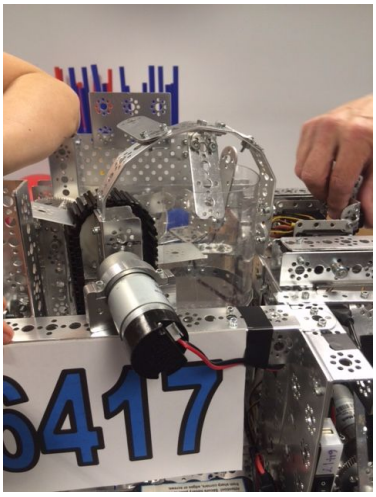


Recorded By: Upneet S.

Reviewed by :Ragini B.

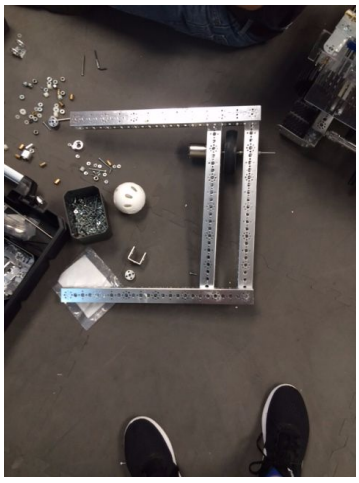
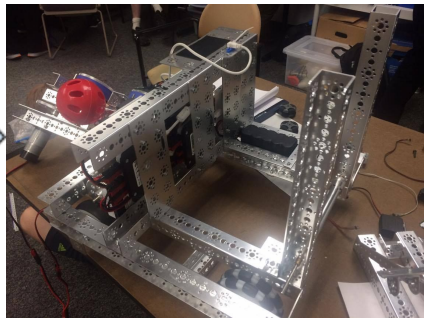
Meeting #21

December 3rd, 2016
Attendance : Ragini, Connor, Ben, Rohit, Upneet, Moses
Duration: 10AM - 2 PM
Goals : refine coding and ball launcher

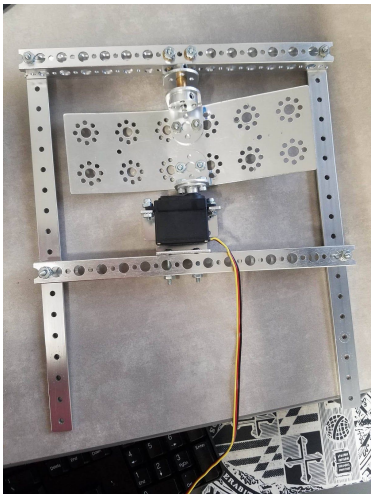
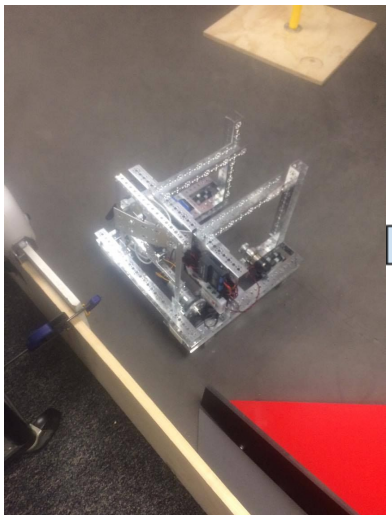
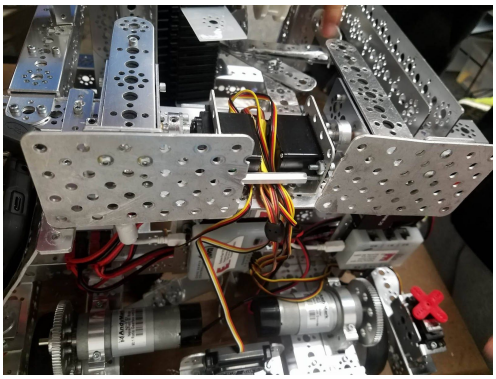
Tasks	Reflections
Create a hood to control ball Before	• The hood was created to make sure the ball went to the launcher • The new idea was to have to have an arch over to keep the ball from flying out • The plastic tubing helps keep ball in as well After
	
Add additional color sensor Work on programming	Our autonomous programming was extensively Worked on today; after adding a sensor we were able to further our code. We have determined that we may not be able to sit on middle portion of field where balls lie because of our robot's size.
Recorded By: Rohit H.	Reviewed by: Gunvir L.

The Road Map to First Qualifier (Sidwell)

The Chassis

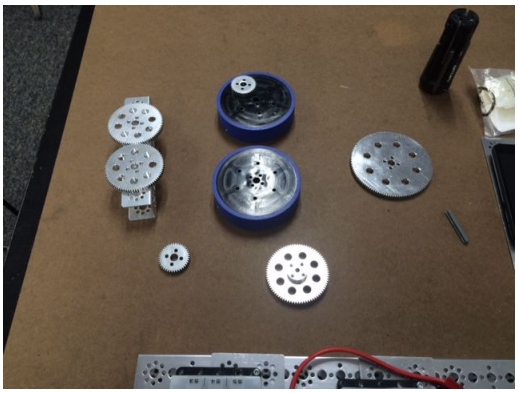
The Beacon Press

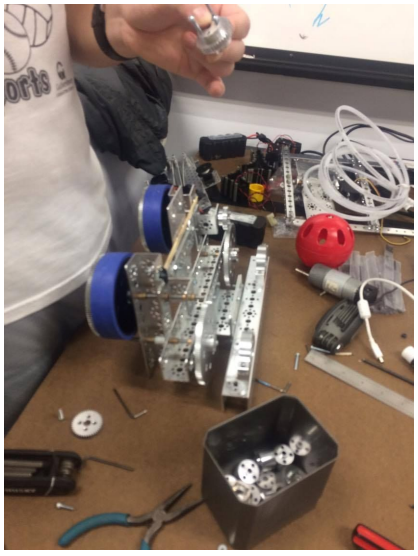




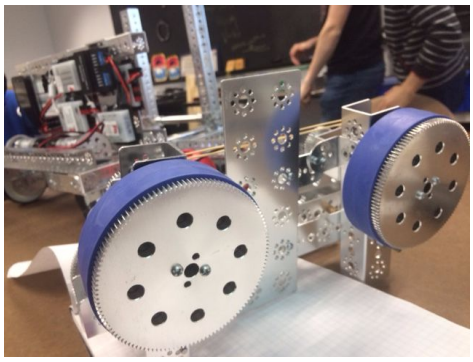
The Launchers and the Final Decision

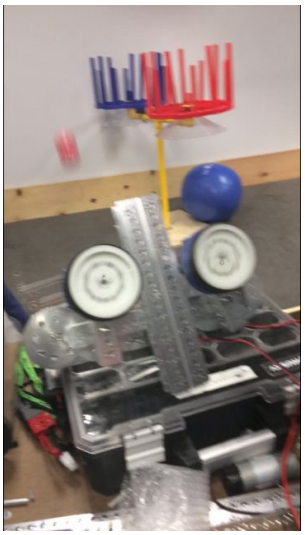
We developed two launcher systems and up going with launcher system 2

1. The Wheel System

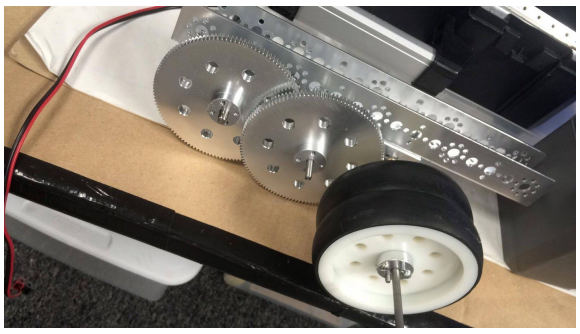


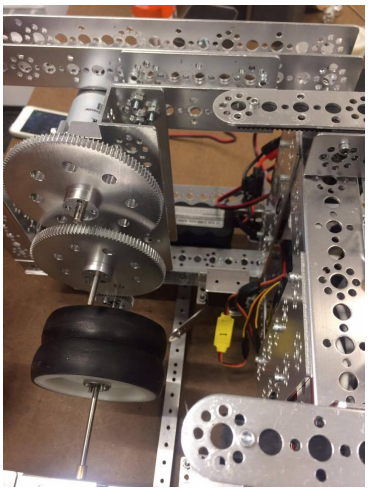




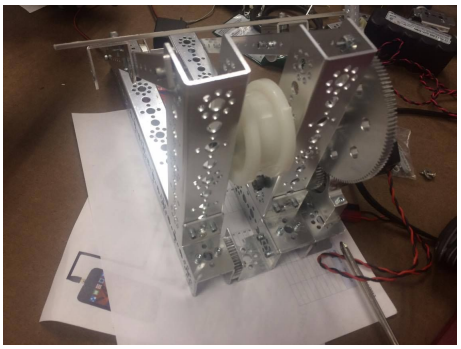


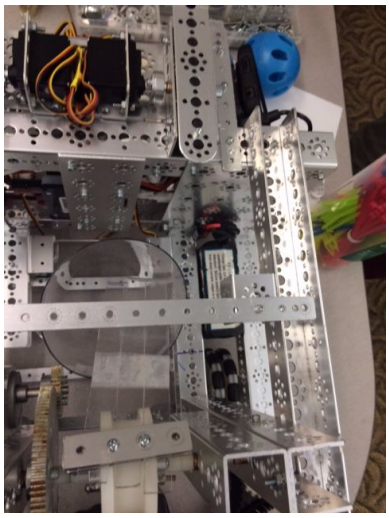
This initial design proved extremely bulky and unstable.

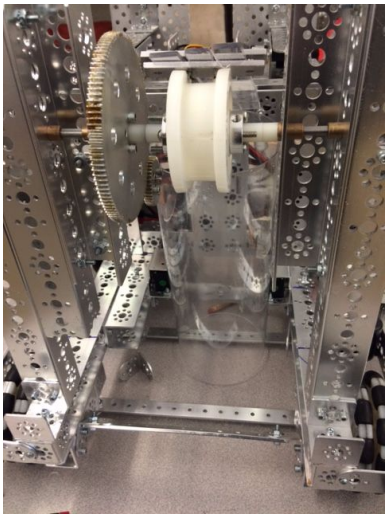


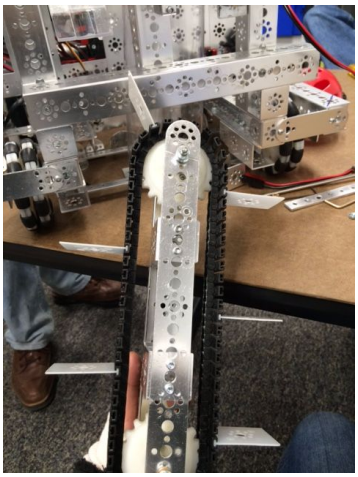


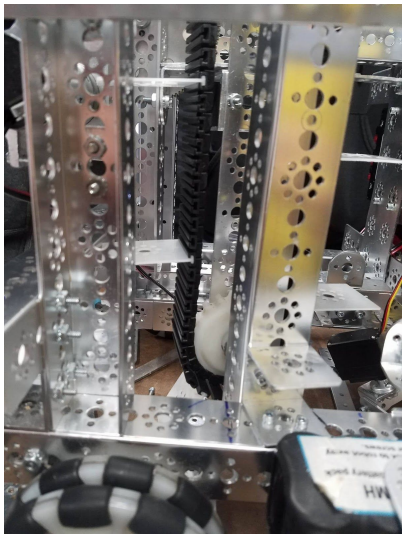
2. The Flicker System & Conveyor Belt Ball Lift

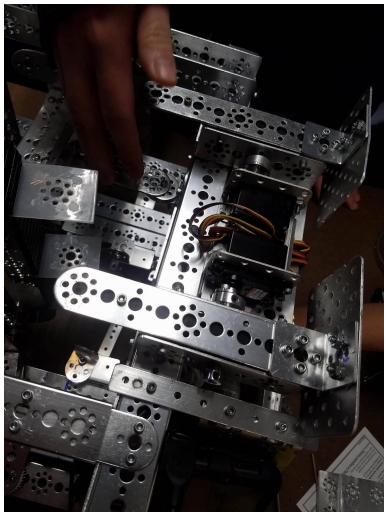


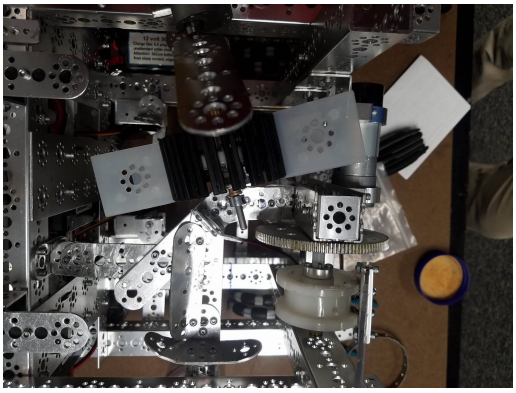


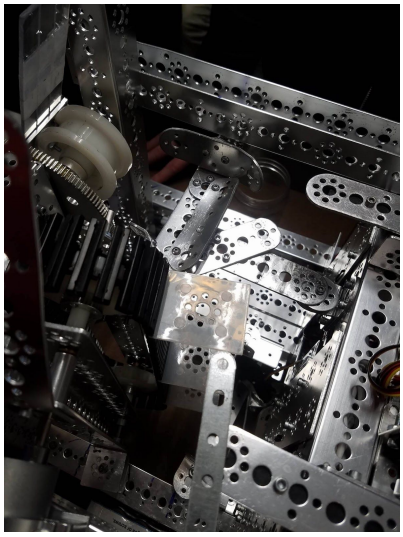


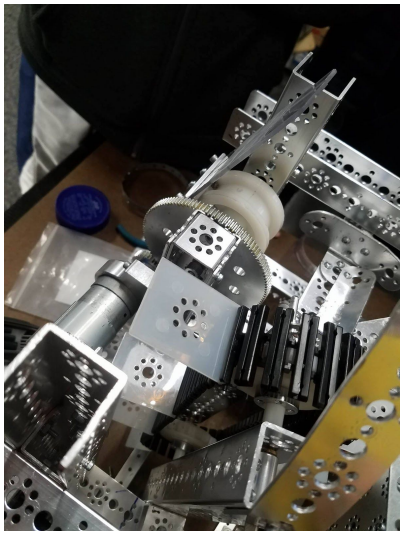


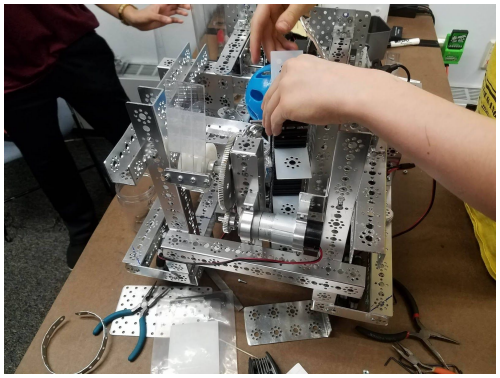


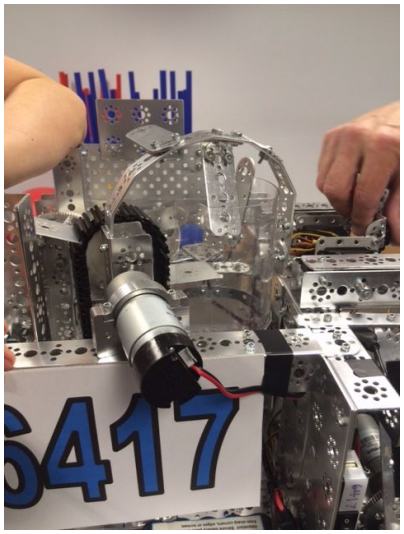










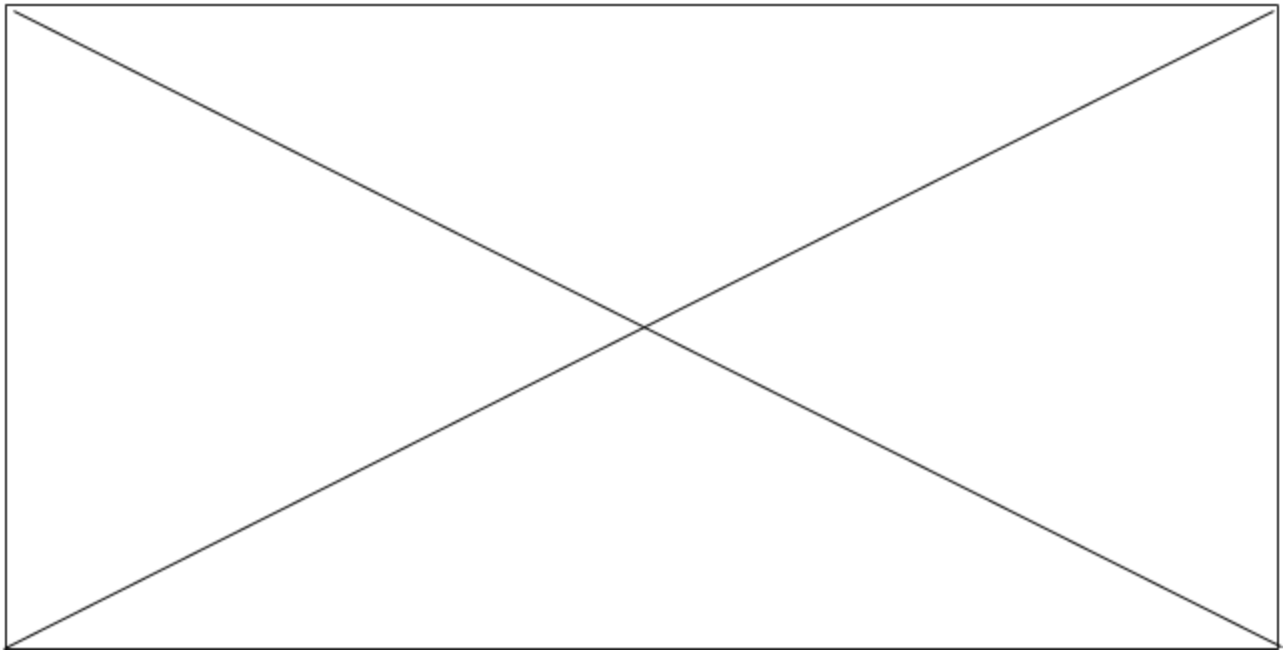

6417

Final Decision : Reasons for choosing Flicker launcher (Decided and Done in meeting 19)

After a systematic analysis of both launchers we rated them on different aspects to make our final decision. (1 -5) 5 being the best/most

System	Accuracy	complexity	stability	Usability
Launcher 1 wheel	3	5	2	2
Launcher 2 flickr	4	3	4	4

Based on the KISS (keep it simple) principle we decided that we wanted our design to be as usable as possible and we understood that in competition there would be lots of room for error. As a result, we felt that going with a launcher with best scoring potential and the least room for error, would be most beneficial.



Robot Checklist for Competition

- ❏ Make sure that both of them driving phones are on and connected
- ❏ Run through the connected devices
- ❏ Check all wires
- ❏ Check for dead servos
- ❏ Check for sharp edges
- ❏ Check Battery
- ❏ Check for loose screws

Established Meeting 20

Meeting #22
December 14th, 2016
Attendance : Upneet, Rohit, Gunvir, Ben, Connor, Moses, Austin
Duration: 6 - 9PM
Goals : Conduct a post-qualifier analysis

Breakdown of Awards and Successes at Competition:

Awards	Successes
1st Place Control Award	⅘ matches won in seating rounds
3rd Place Motivate Award	2nd place in seating rounds
3rd Place Connect Award	Consistent ball launching in autonomous
3rd Place Think Award	Sensors were used without many failures
3rd Place Inspire Award	Ball launcher was consistent
Overall Qualified for states !!!!!	

The cru pictured after the awards ceremony.

Scoring Data/ Breakdown

Match Detail	Alliance	Opponent 1	Opponent 2	Win/Loss
2	8582	9799	10025	Win
9	9802	10492	9770	Win
13	11552	5225	4234	Loss
16	11695	6029	10145	Win
20	5014	10929	11896	Win
Semi 1	6029	5821	4451	Loss
Semi 2	6029	5821	4451	Loss

Our Bot Performance							
	Autonomous Score				Teleop Score		
						Beacons	
Match	Elements	Beacon	Big Ball	Parking	Elements	Pressed	At End
2	1	0	0	0	0	2	1
9	0	0	0	0			
13	0	0	0	0.5	0	0	0
16	2	0	0	0.5			
20	2	0	0	0.5	3	1	4
Semi 1	2	0	1	0	1	2	2
Semi 2	2	0	0	0			

Improvements for future competitions :

Autonomous:

- Scoring:
  - We scored the majority of our points
  - We were able to shoot the balls into the vortex.
- Improvements Needed:
  - We need to find time to push the two beacons
  - We need to get the gyro working
  - We need reliability: 90% of the points estimated-

Tele-Op:

- Scoring:
  - Very weak scoring per round
  - Ball intake system was not optimal
  - Took time to push the beacons to our team color
- Improvements Needed:
  - Fix the ball intake systems so that it is faster and more reliable
  - Work around the beach balls on the field
  - Find a way to cap the ball on the vortex

Outreach increase :

- FLL Scrimmage:
  - Rohit volunteered at the FLL Scrimmage at the Rockville Library
  - Many teams came to compete with each other in a practice run
- FLL Competition:
  - Everyone is expected to come if they want to stay on the team

Pit Table:

- Establish Rules
  - Keep table clean
  - Organize parts and tools

Teamwork:

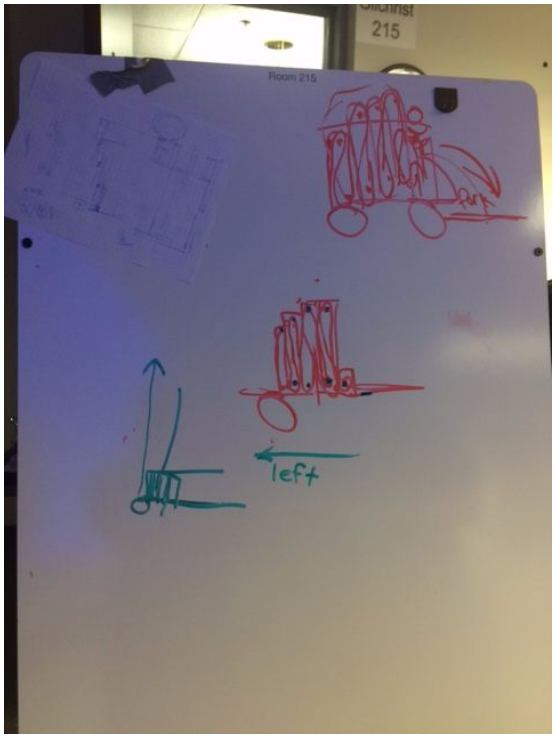
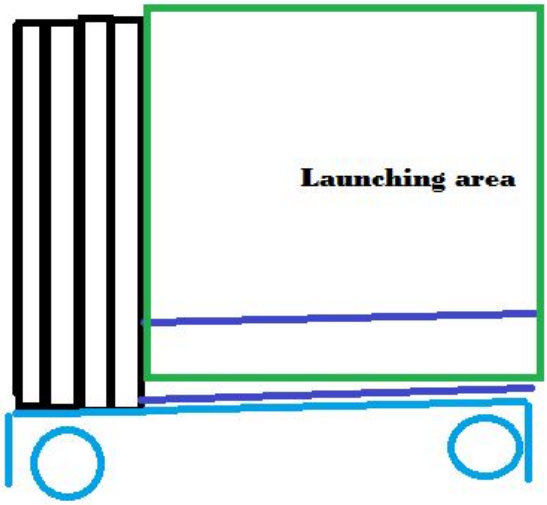
- Need a person responsible for keeping bot/phones charged
- Need to keep better records of score and performance
- Need to make sure we bring all of our stuff back with us

Scouting:

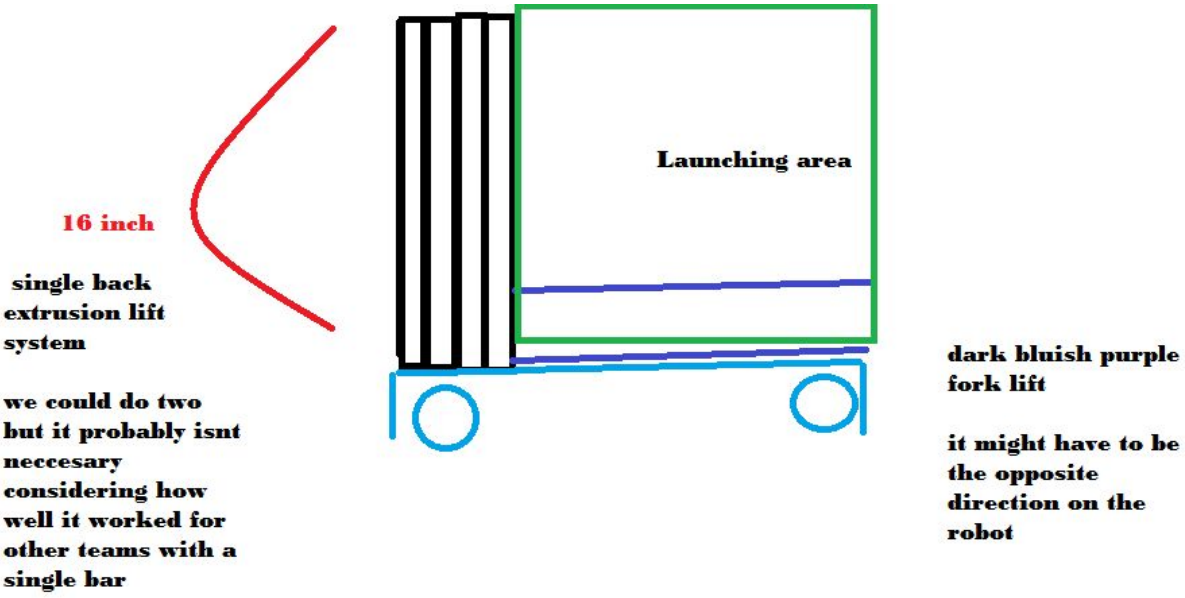
- Unreliable; did not use all given information

Meeting #23
December 19th, 2016
Attendance : Ben, Upneet, Gunvir, Ragini, Austin, Moses
Duration: 6-9PM
Goals : Find an efficient way to lift the big ball

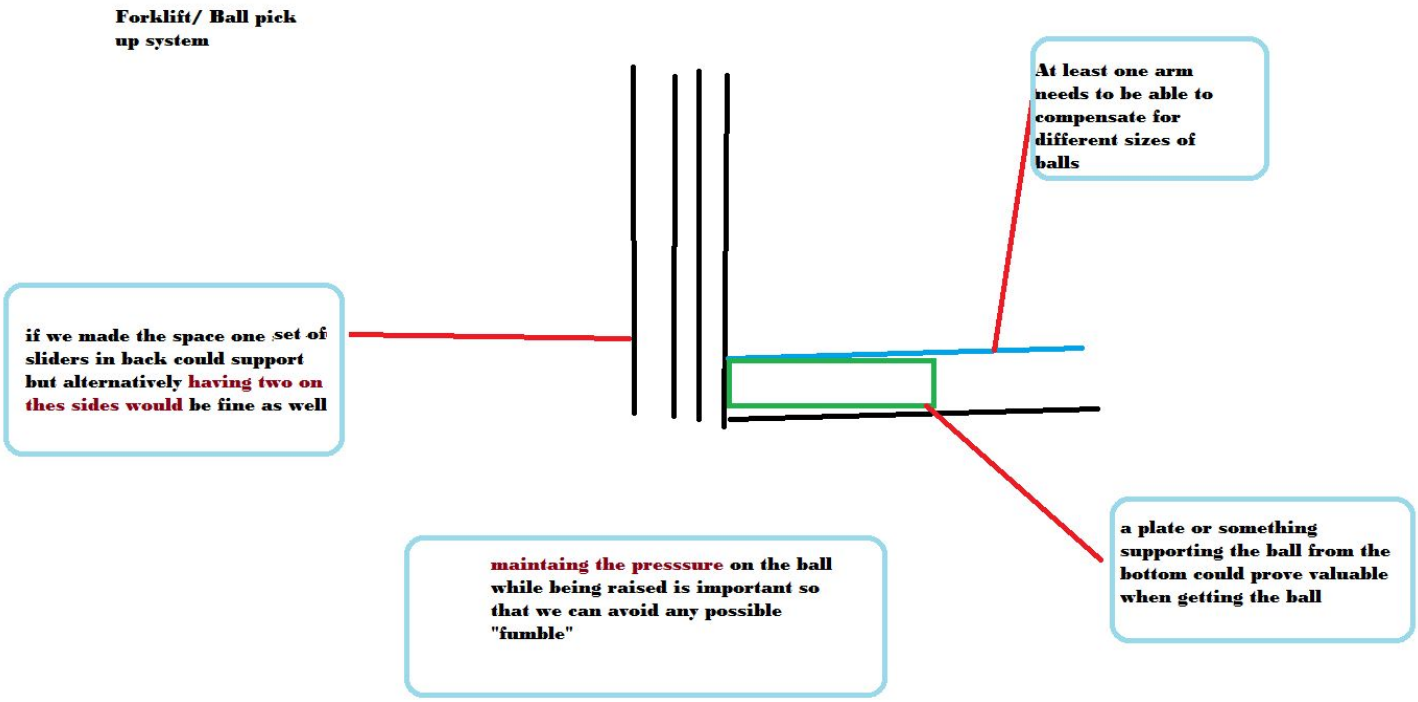
Tasks	Reflections
Design Ball lift system	We started by looking at other designs from teams and brainstormed some of our own ideas to lift the ball. Our final idea was to use extrusion sliders to complete our project. Benefits of extrusions 1. Light weight 2. Sturdy 3. Height 4. Easily adjustable 5. Maximizes space
Order extrusions and design fork lift portion of robot to collect big ball	We ordered extrusions from REV robotics. Approximately 2 M of extrusions were ordered for our robot.
Look at possible placement of robot for extrusions and come up with diagram of spacing	We realized we had a lot of open space on the sides of the robot because collection mechanism did not take that much room up.

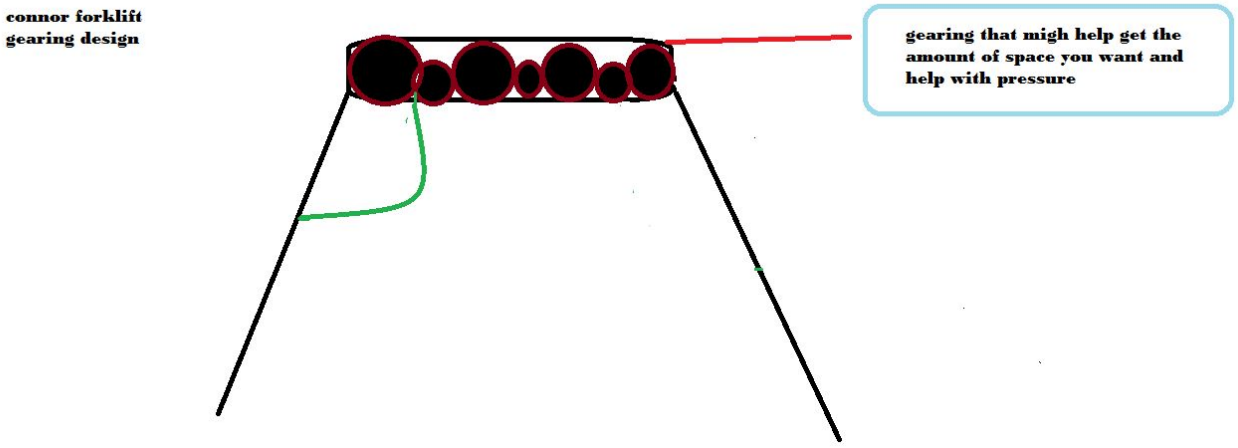
	
Recorded By: Rohit H.	Reviewed by: Gunvir L.

Meeting 23 continuation

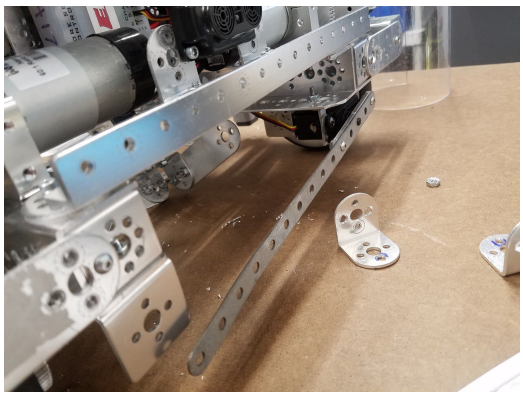
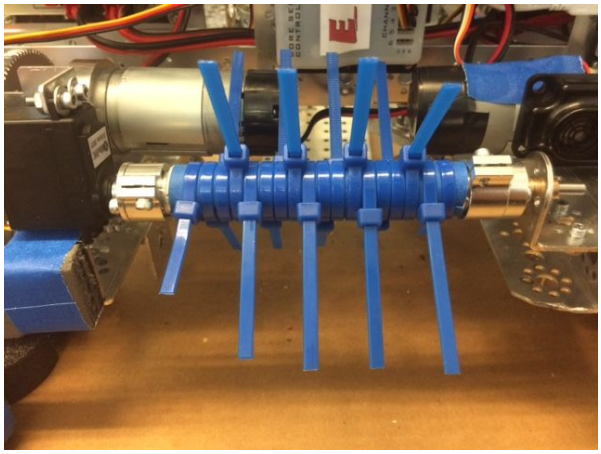


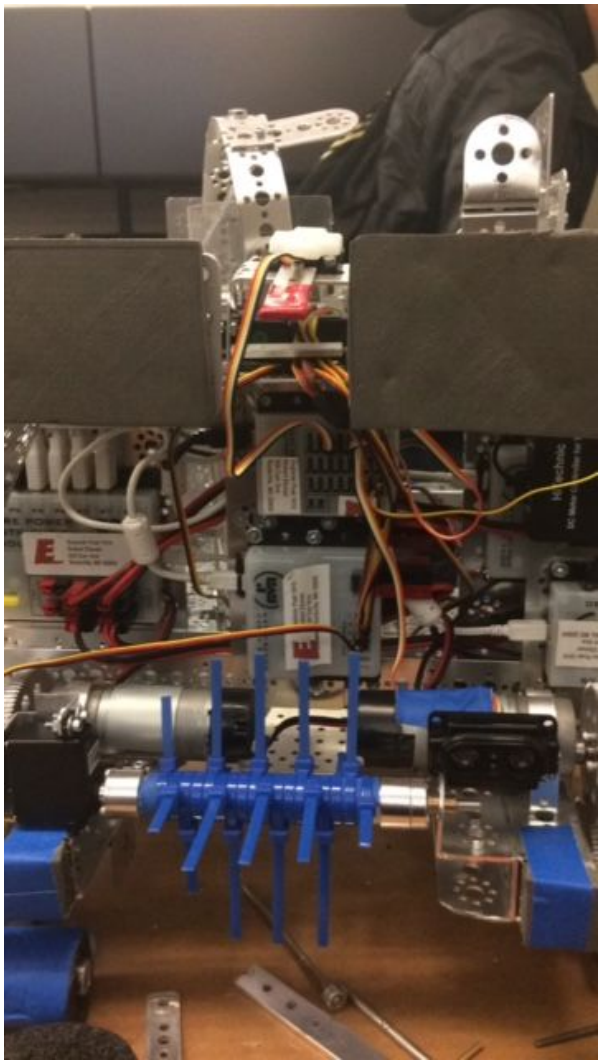
Diagrams continued below



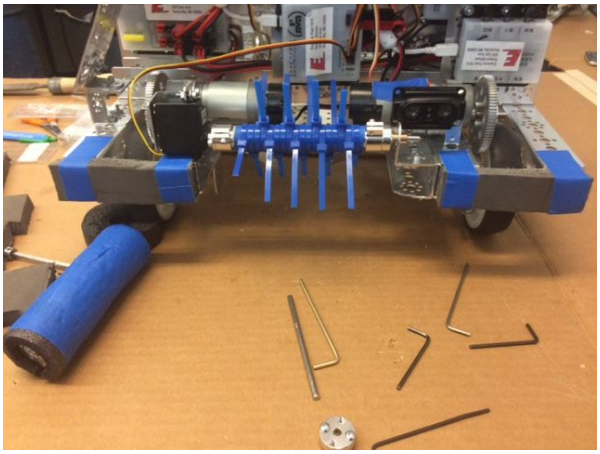


Meeting #24
December 21st, 2016
Attendance : Ragini, Connor, Ben, Rohit, Upneet, Moses
Duration: 10AM - 2 PM
Goals : refine coding and ball launcher

Tasks	Reflections
- Change servo door into a spinner Before: 	Based off testing results which proved the servo door to be inefficient because it would frequently bend and was not easy to control The reason for this: is the servo door formally on the robot was flimsy and does not efficiently collect because the robot would have to go against the wall to collect a ball into system After: 
Autonomous	We worked on the autonomous part of the competition. This is important because as noted above, we need to get the two beacons to be pushed and get our gyroscopic sensor working. We had to remount a sensor above the beacon pressers.
Add foam padding to front of bot	We added foam pads on the beacon pressers and to the bumpers of the robot to prevent any Damage to the game board and to make sure we did not prematurely press the beacons before we



were ready to score. The foam also seems to help our resistance against static related issue, that could render our robot unable to move in competition.



Recorded By: Upneet S.	Reviewed by: Gunvir L.

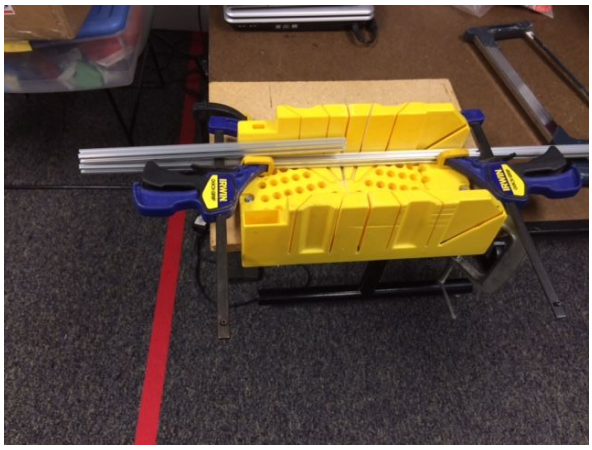
Meeting #25
December 28th, 2016
Attendance : Ragini, Connor, Rohit, Austin
Duration: 3-6 PM
Goals : Test autonomous and work on ball intake system,

Tasks	Reflections
Collaborate with RM on methods of ball lifting	While in the Rockville Library, we were sharing the space with the RM Teams. We talked about the various types of lifts, and sliders out there that could produce effective lifts with little possibility of dropping the ball. We both will be using extrusions this season to lift our balls and produce fork lift type systems.
Test autonomous code	After various testing on the autonomous code, we iterated through the code and made minor adjustments to it. We were able to make the robot move quite accurately on the field during autonomous mode, but we need to work on increasing our point intake during the 30 seconds for autonomous. We utilized gyroscopic technology to ensure better turning capacities and more accurate positioning to reach both beacons. Now our autonomous is able to fulfill tasks more reliability. **We estimate that now our beacon press accuracy is about 75%. This is a huge increase from last qualifier**
Work on ball intake system	We continued to work on redesigning the ball intake system such that it is more efficient and accurate. We are working on improving the servo powered system with zip ties for bringing the balls, and the tube for bringing the balls to the shooter. However, zip ties may be too rigid.
Recorded By: Rohit H.	Reviewed by: Gunvir L

Meeting #25
January 4th, 2017
Attendance : Ragini, Connor, Ben,Rohit, Upneet, Austin, Moses, Gunvir
Duration: 6-9 PM
Goals : Continue working on ball intake system as well as lift

Tasks	Reflection
Started thinking of ideas to replace zip ties on intake system	Due the constant stresses applied to the zip ties they have started breaking at the base essentially making the mechanism ineffective and short lived. Consideration has started in plastic or surgical tubing instead.
Continued consideration on forklift ideas and how to implement ideas into reality on the current body	We continued to work ideas by using extrusion sliders as pickup mechanism. Current idea for mounting is on the side of robot. Current plans are not to score in vortex but just to lift the ball off the ground. We also realized that an extendable arm may not be necessary.
Further testing	We tested the autonomous and ball launching systems to ensure that everything would be good for competition. **Results of testing:** ➔ **8/10 auto runs successful** ➔ **30/40 balls successfully launched into vortex** ➔ **Positioning would help address failed attempts**
Recorded By: Ben G	Reviewed by: Ragini Balachandran

Meeting #26
January 9th, 2017
Attendance : Ragini, Connor, Ben,Rohit, Upneet, Austin, Moses, Gunvir
Duration: 6-9 PM
Goals : Prototype/Build Forklift and Develop extrusion lift system

Tasks	Reflections
1. Using previous forklift designs, construct a prototype	We built the forklift with a simple back bar attached to metal lengths with circular grabars. On the back of the backbar there was a piece that could compensate for the different angles of ball capture and placement on extrusions.
2. Test Prototype	When we tested the forklift grabber portion with the ball, it appeared to work. It also held the ball incredibly stable and maintained the pressure on the ball when off the ground. Using the walls surrounding the feild to get the ball may help us grab ball more efficiently. Balls of slightly varying size are able to fit in the device.
3. Start working on assembling connecting pieces of extrusions and cut extrusions to the correct size 	Our Rev extrusion parts all arrived and we looked at numerous assembly guides to understand the system. We then assembled the small connecting pieces to hopefully speed up the build process in the future. We decided to cut extrusions into 14 inch segments and we will have approximately 6 segments on each side lining our robot. That will give us nearly 5.5 feet clearance to get balloff ground and possibly into the center vortex.
Recorded by: Ragini Balachandran	Reviewed by Austin Long

Meeting 26 continuation

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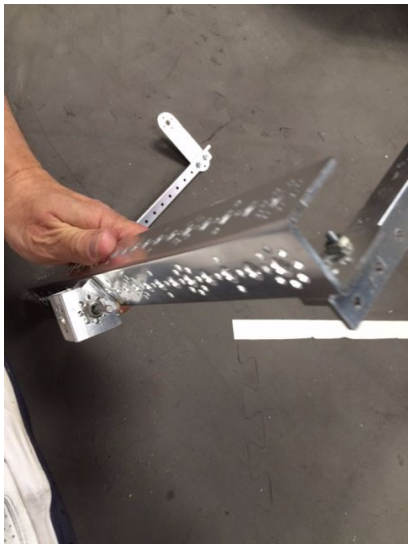
<td>  </td>
<td>  </td>
<td>To the left our forklift/grabber design.
• The bars on the side simple squeeze the ball to keep it captured.
• The cut square pieces on the back of the bar have an axle through them allowing for maneuverability</td>
</tr>
<tr>
<td>  </td>
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<td>Our system in action
• The ball easily fits between the side bars
• When the ball is supported by the larger back bar it does not move
• Moving the ball against the wall to capture allows for the easiest results</td>
</tr>
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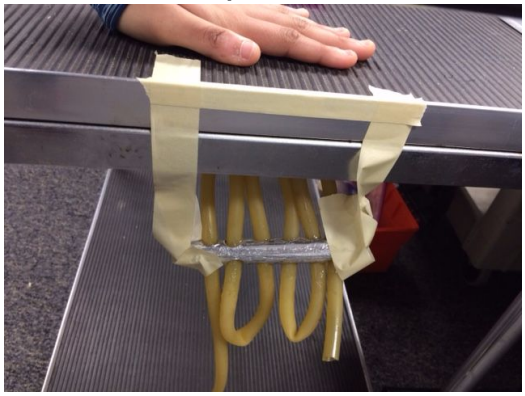
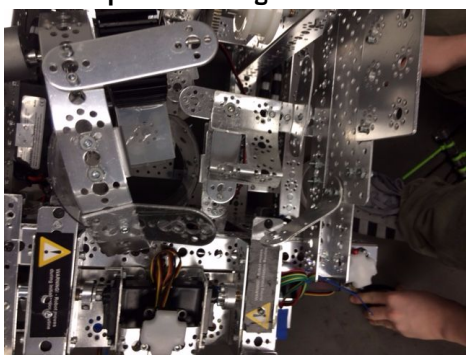
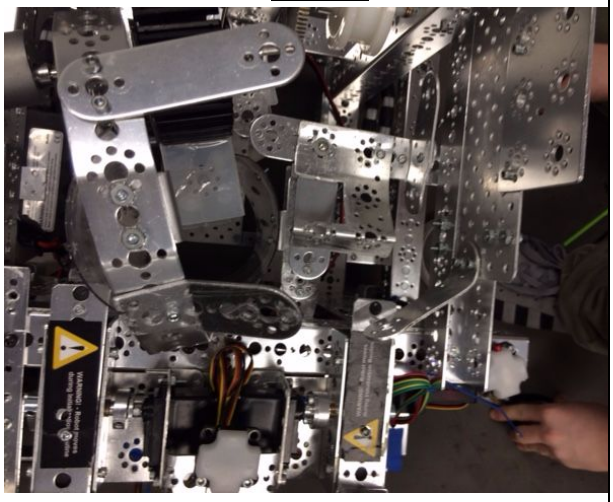
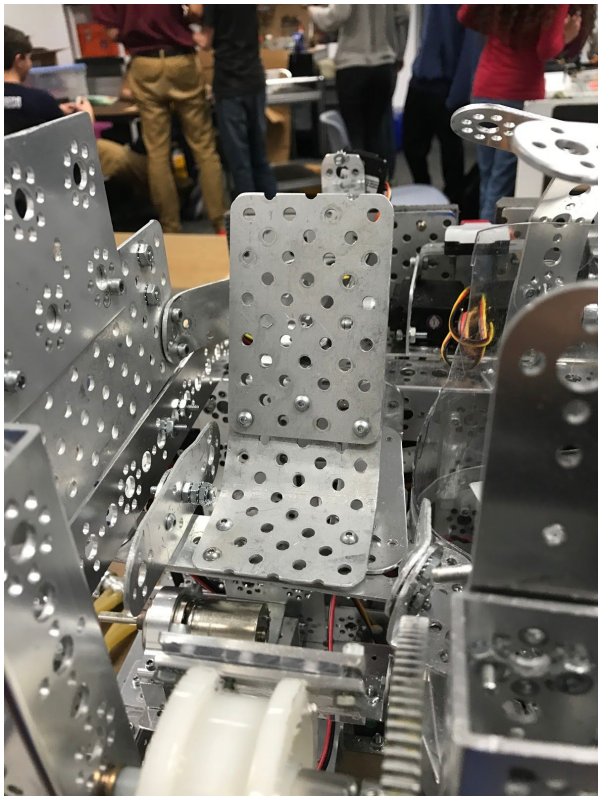
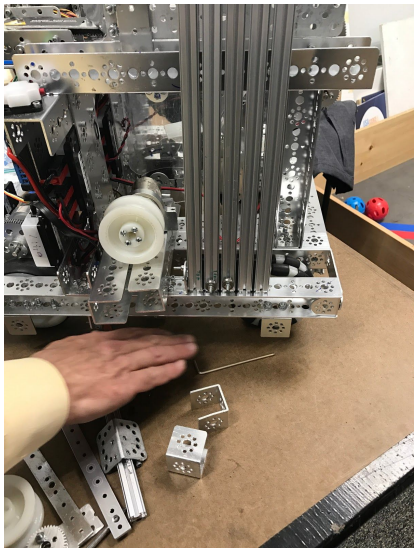
Meeting #27
January 14th, 2017
Attendance : Ragini, Connor, Ben,Rohit, Upneet, Austin, Moses, Gunvir
Duration: 6-9 PM
Goals : Finish surgical tubing spinner and attempt to simply ball launcher

Tasks	Reflections
1. Thread surgical tubing 2. Epoxy Surgical tubing to ensure it stays in the metal spinner 	We realized that since zipties may prove to be too weak, surgical tubing would be our best option for getting the balls in. Additionally, the tubing is not too rigid or hard so it wouldn't damage other portions of the robot in competition or practice. However, since we are only able to use a continuous servo it may not work very well with the tubing being heavier and thicker than the former zipties. 
3. Reconfigure area ball is launched into with a more simplified setting 	We had previously used many pieces to get the ball to land in the right position to be launched. Some members felt it could be simplified down further to get optimal results. We tried replacing with one metal piece , but this unfortunately did not work because the metal was bent at the right angle and did not block ball from leaving robot before launch. We will have reconfigure later.
Recorded by : Ragini Balachandran	Reviewed by: Conor Gregory

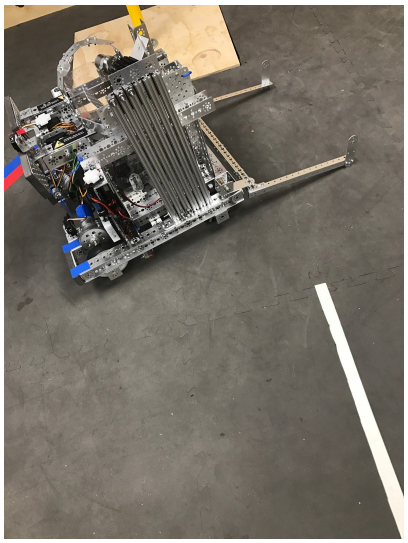
Meeting #28
January 23rd, 2017
Attendance : Ragini, Connor, Ben,Rohit, Upneet, Austin, Moses, Gunvir
Duration: 6-9 PM
Goals : reconfigure ball launcher setting , work on extrusion mounting

Tasks	Reflections
Change ball launcher setting Before: 	We had initially had issues with missing the vortex in past competitions and the trajectory of the ball proved to be an issue with the past designs so we decided we we would change by: 1. Adding a guide for the ball (a mini ramp) 2. Adding a few side pieces to prevent the ball from flying off of the robot After: 
Mounting of extrusions	We decided placement of extrusions on the robot and then tentatively mounted pieces to get a sense of where the motor would need to go. Necessary additions:

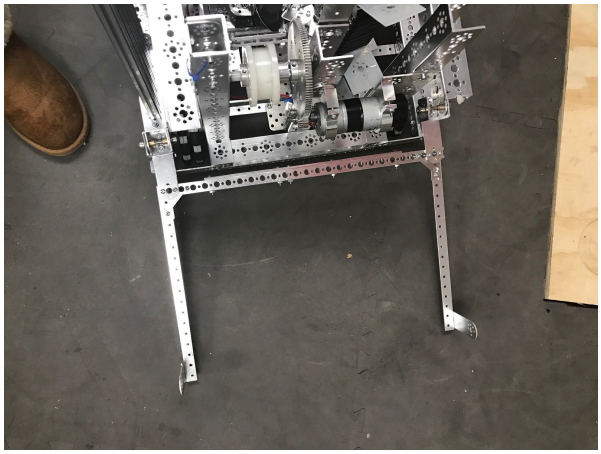


1. Obtain capping structures to keep extrusions together (3d Print)
2. Build a bridge to hold motor
3. Mount motor and connect
4. String extrusions (cascade vs continuous stringing decision)
5. Find out how and where to connect our ball forklift on the extrusions so they work in sync
6. Replicate the same steps for the other side of the robot
7. Overall we need to weigh the disadvantages and advantages in the details in our system to improve

Model forklift placement



We just wanted to get a feel of our system's overall layout and this provided us with a lot of insight. We may need to add a mini piece of extrusion to attach the forklift in order to get big ball to fall into vortex when we extend up.



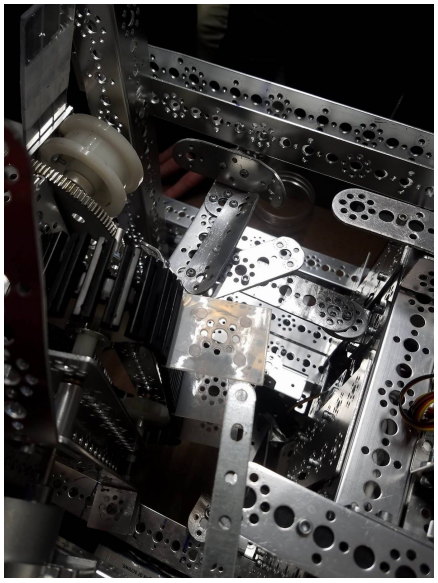
Recorded by: Ragini Balachandran

Reviewed by: Upneet Bir

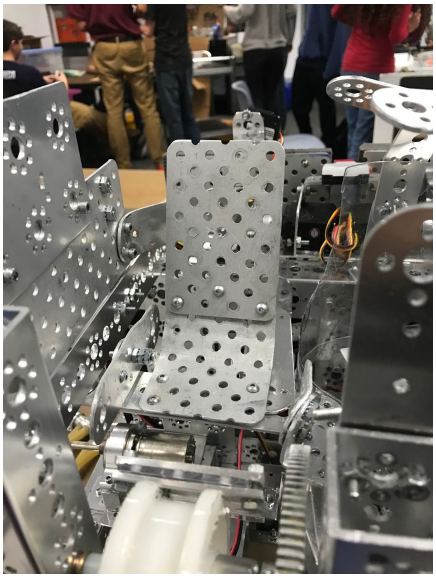
Meeting #28 continuation

Changes in ball launcher setting

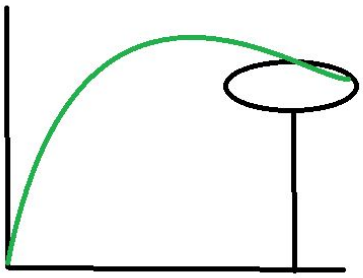
Competition Setup

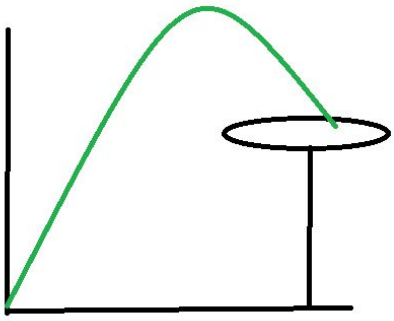


Current setup



Trajectory Change: Before and After

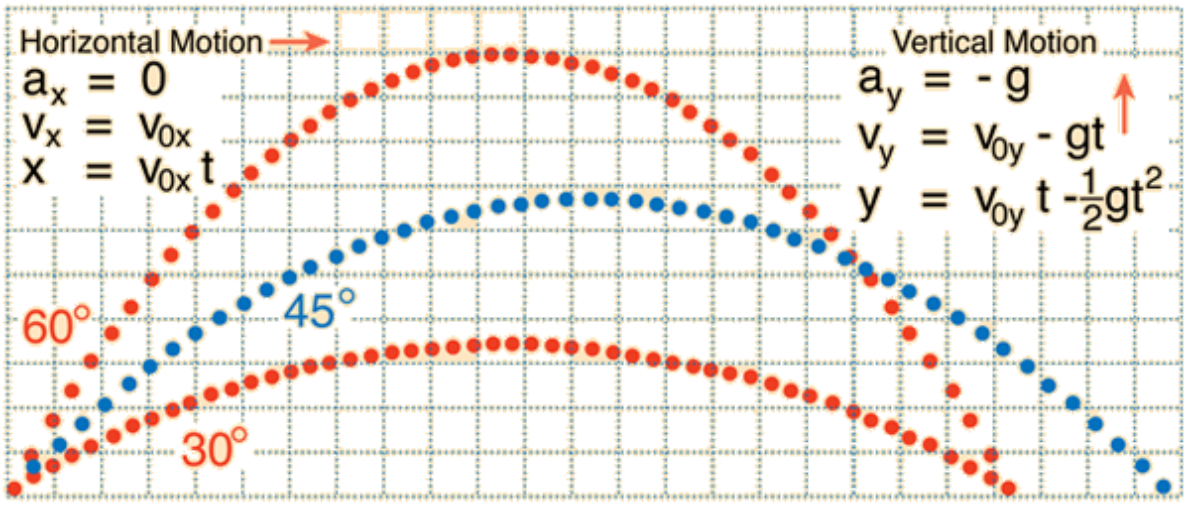




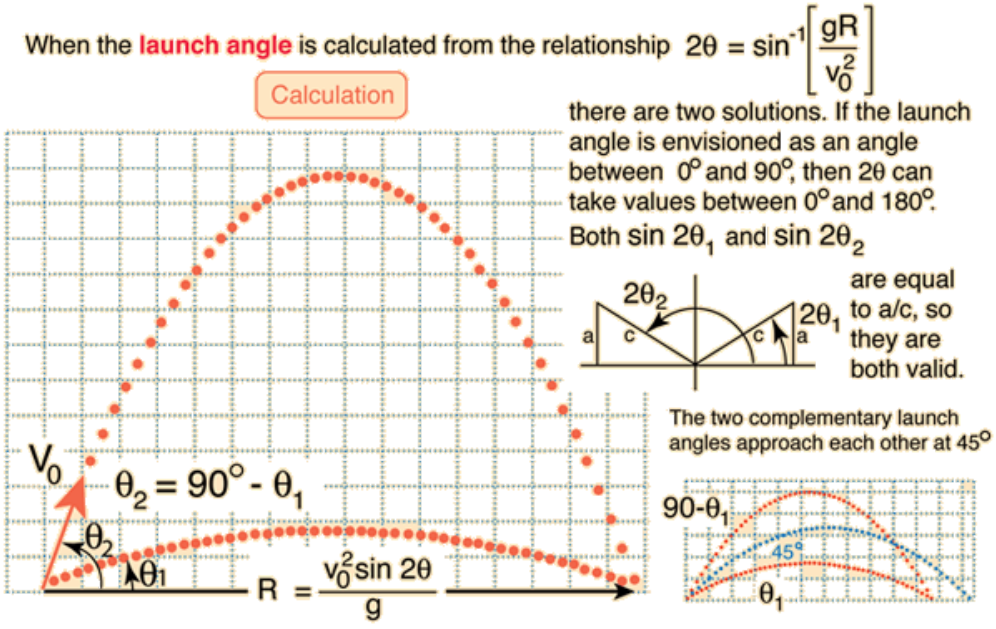
With this change in ball launching trajectory, our launching mechanism became more precise as the balls have less of a chance of hitting the vortex poles instead of scoring. The angle of the ramp caused the difference in trajectories, the sharper angle of the newer launcher allows for the ball to go higher without as much horizontal distance traveled. Thus we avoid a possible an overshoot in both periods.

The math behind our reasoning

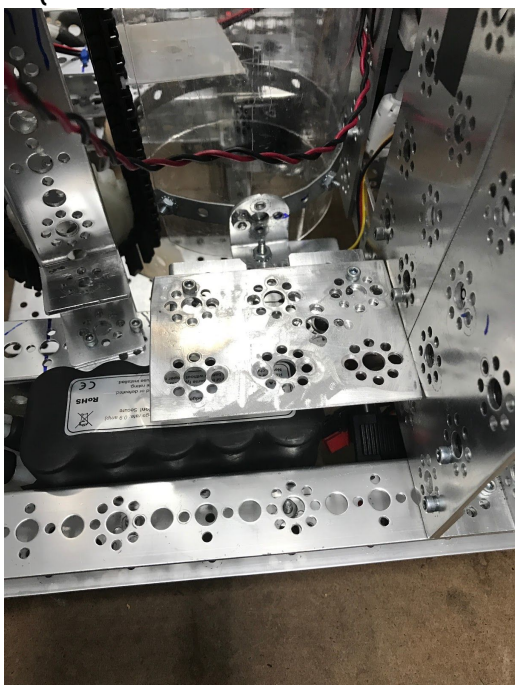
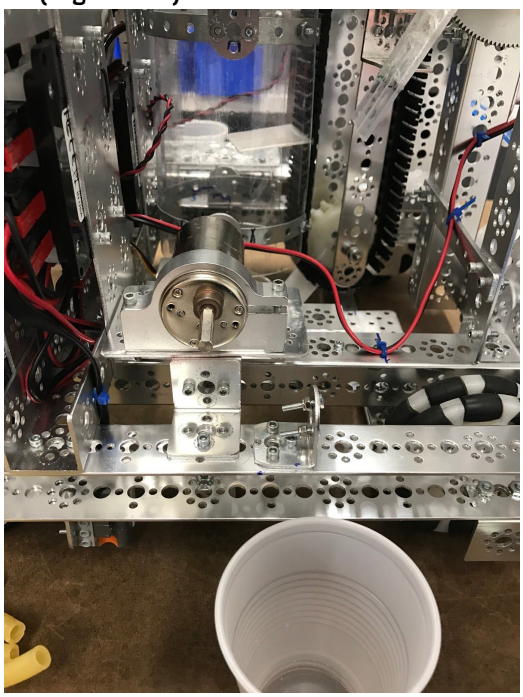
The motion of an object under the influence of gravity is determined completely by the acceleration of gravity, its launch speed, and launch angle provided air friction is negligible. The horizontal and vertical motions may be separated and described by the general motion equations for constant acceleration. The initial vector components of the velocity are used in the equations. The diagram shows trajectories with the same launch speed but different launch angles.

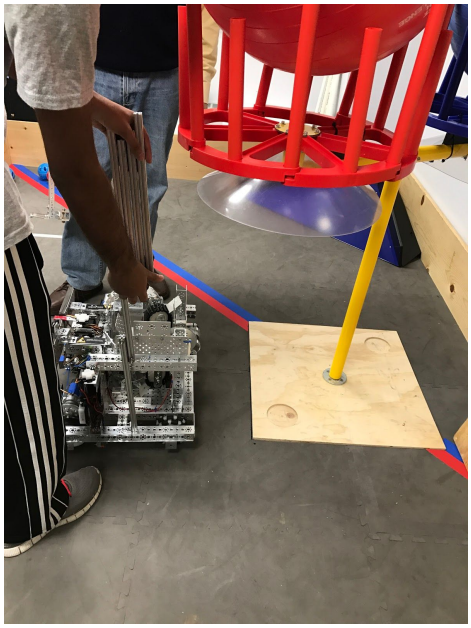
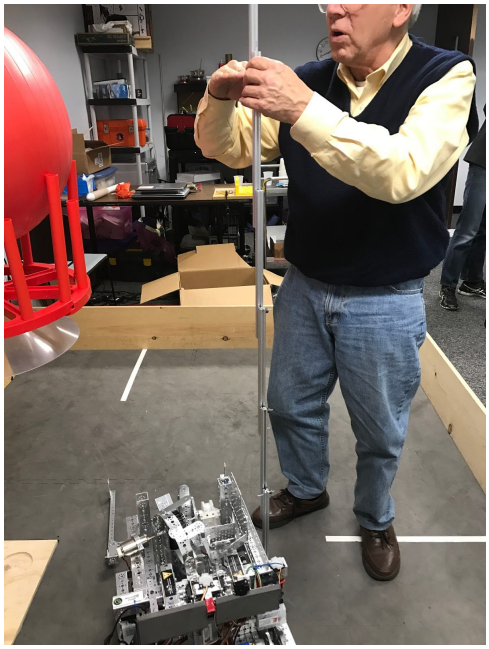


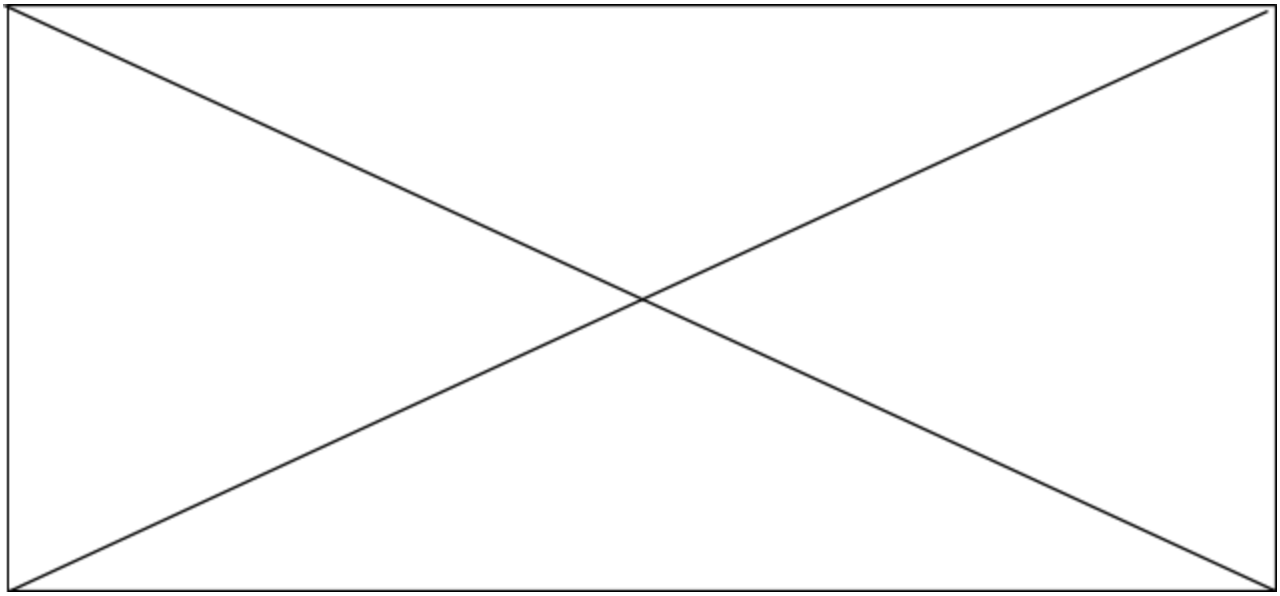
Note that the 60 and 30 degree trajectories have the same range, as do any pair of launches at complementary angles. The launch at 45 degrees gives the maximum range.



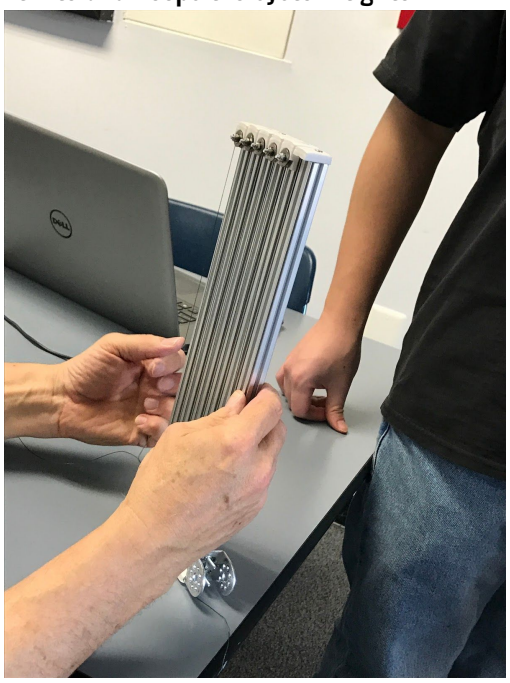
Meeting #29
January 25th, 2017
Attendance : Ragini, Connor, Ben,Rohit, Upneet, Austin, Moses, Gunvir
Duration: 6-9 PM
Goals : Add motor mounts and work on electrical

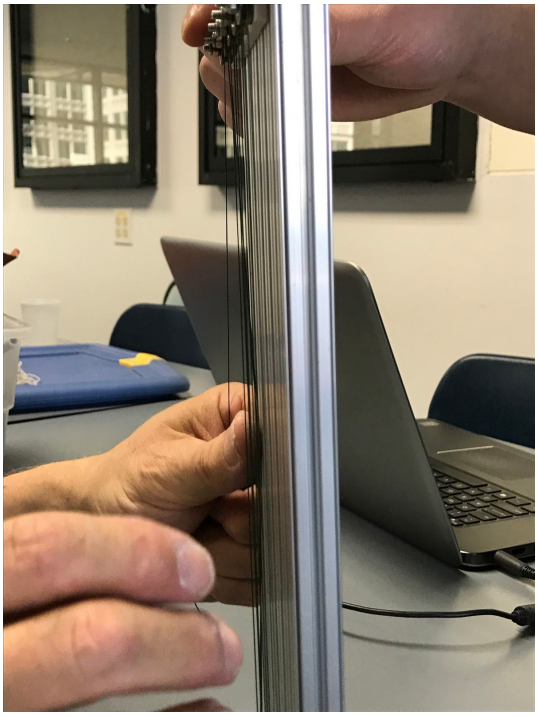
Tasks	Reflection
1. Finish motor mounts 2. Work on electrical formatting with the new motor wires 1# (left side 	We created a bridge system that allows us to mount the motor over the two bars on each side of the chassis. On the left side we we will have to add extra support to the motor mount because there is no room for standoffs underneath (our battery is currently located underneath). 2# (right side) 
3. Look at the potential height of the extrusions and how much we may need to extend	After extending the extrusions outward we realized that six extrusions would be more than enough to reach the vortex. However, we may need to practice dropping the ball into the vortex and letting go so that we get the full 40 points instead of 20 for the just above the robot.

	
Recorded by: Moses Kang	Reviewed by: Ben G.

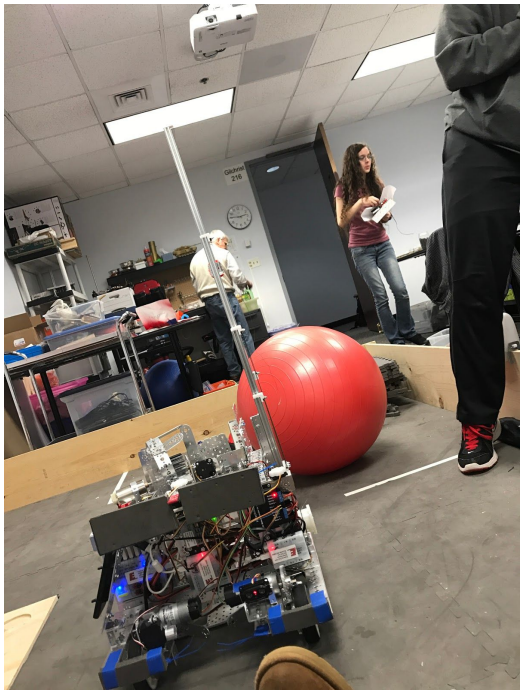


Meeting #30
January 30, 2017
Attendance : Ragini, Connor, Ben,Rohit, Austin, Moses
Duration: 6-9 PM
Goals : Work on extrusions

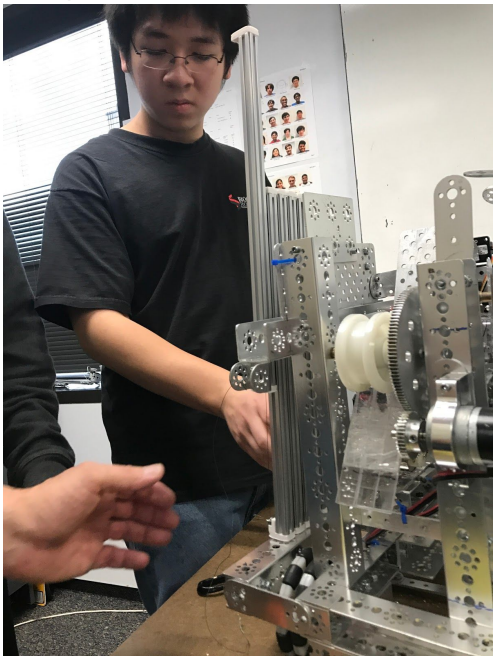
Tasks	Reflection
We added caps on extrusions 	The caps allowed us to keep extrusions together. In addition , to this it gives a place for the string to fit into and keeps the system tighter . 
We worked on stringing of the extrusions	We decided to use continuous stringing on our extrusions. Initially, we had thought that we would use cascade stringing, because it would go faster. Due to the complexity of the cascade stringing we decided to go with continous stringing.



We attached the pulleys to the robot to test for stability and functionality.



The system functioned well, but there was string slippage, so we need need to improve the string management.

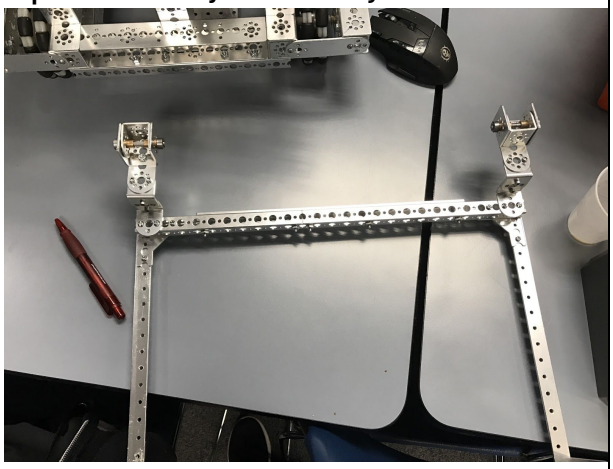


Recorded by: Moses Kang

Reviewed by: Ben G.

Meeting #31

Attendance : Ragini, Connor, Ben,Rohit, Austin, Moses
February 1st, 2017
Duration: 6-9 PM
Goals : Work on extrusions

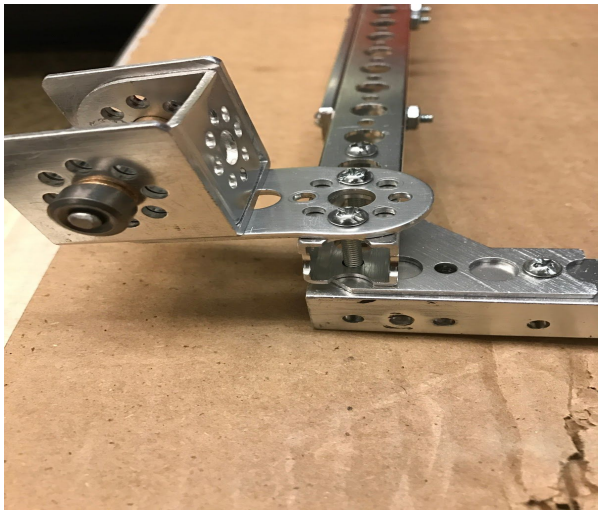
Tasks	Reflection
Modify our forklift system	Before modifying out forklift system we had not been low enough to capture the ball. The corner pieces allowed us to us simar lengths but push the system lower to the ground to catch the ball. The system may be too tall for the size requirement so adjustments may need to be made. 
Work on using encoders for our motors	We added encoders to better control the speed of our extrusions when they rise up with the ball.

	
Continue testing and simulating the competition	Leading up to states we would like as much practice as possible, so we have designated time at the end of each meeting for driving.
Recorded by: Austin Long	Reviewed by: Ben G.

Meeting #32

Attendance : Ragini, Rohit, Gunvir, Eric
February 6th , 2017
Duration: 6-9 PM
Goals : Testing and improving the extrusions, improve forklift design.

Tasks	Reflection
Improve: 1. Stability through a bar attachment 2. Forklift size through angled brackets 3. Forklift attachment through a right angle attachment	Below are a series of pictures detailing the various improvements we made to the extrusions and the forklift.
	Here, we see the extrusion with a bar attached on one end. As we were testing the extrusion on the field, we noticed that stability was a huge issue for our robot. This bar was attached in order to balance the robot as we drove it on the field. We also designed it such that it would attach to multiple points on the robot's frame, further improving the stability.

	Another issue we had was the size of the forklift. Originally, our forklift was exceeding the robot's size specifications. In order to fit the forklift in the size constraints, we shortened the length of the attachment seen here, keeping the original method of attachment.
	Finally, the size problem wasn't fully solved with shortening the length of the attachment. In order to solve the problem once and for all, we attached angled brackets to the ends of the forklift, which helped to reduce the size enough to the dimensions. It also helped with capturing and keeping the ball at an angle.
Practice driving and simulating competition	We decided to practice driving for the competition. Additionally, we received a new controller so we wanted to make sure our drivers, mentors, and pit crew members were familiar with it.
Recorded By: Rohit Harapanhalli	Reviewed by: Eric Rong

Meeting #33

Attendance : Ragini, Gunvir, Rohit, Ben, Upneet, Eric, Connor, Avanish

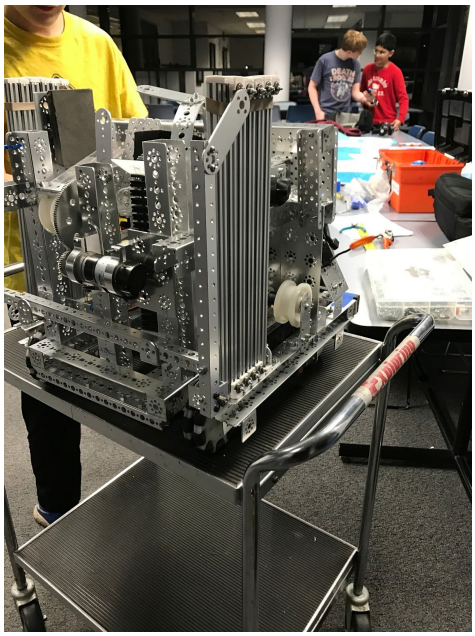
February 8th , 2017

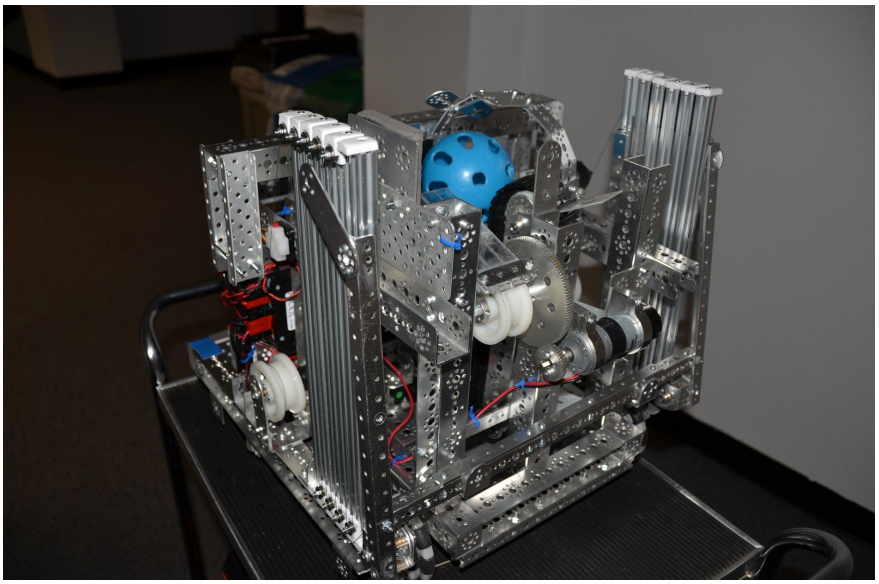
Duration: 6-9 PM

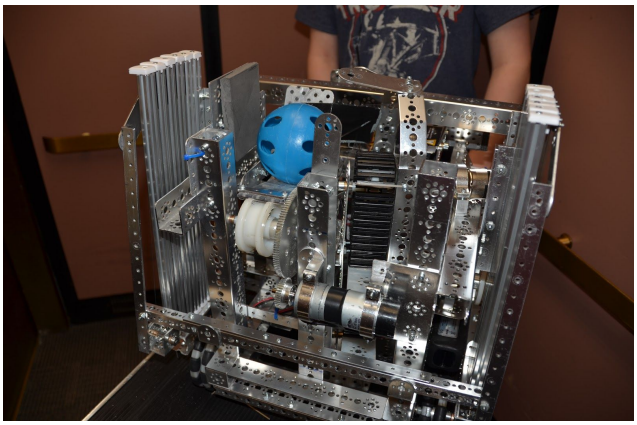
Goals : Finish wiring up string for functional forklift, and attach all sign to robot. Continue working on poster.

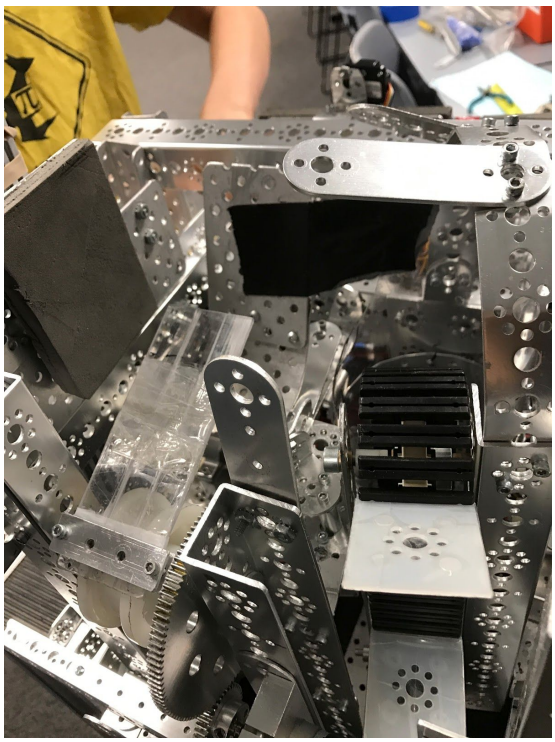
Tasks	Reflection
Continue and finish up the competition poster with spaces designated for all electronic and paper components	We successfully managed to make a cutout for the tablet that will run through our outreach presentation. Use architecture tools to create crisp corners and smooth edges.
Wire up extrusions for forklift & Attach forklift	Added in strings via knots and full wiring between extrusions for full motor control of extrusions. Moved extrusions for successful ball lifting and easy capture of beach balls.
Added cross bar for additional support and for banner	Cross bar shields unimportant components as well as providing additional support that was lacking on the top of the robot. Also gives easy Access to mounting of banners and signs.
Add padding and tape to improve the ball launcher	The ball wasn't smoothly going into the launcher. So we added foam padding and duct tape to make sure ball sits perfectly in launch setting, before being launched to ensure the correct trajectory.
Practice driving and simulating competition	We decided to practice driving for the competition. Additionally, we received a new controller so we wanted to make sure our drivers, mentors, and pit crew members were familiar with it.
Recorded By: Ben Ganelin	Reviewed by: Ragini Balachandran

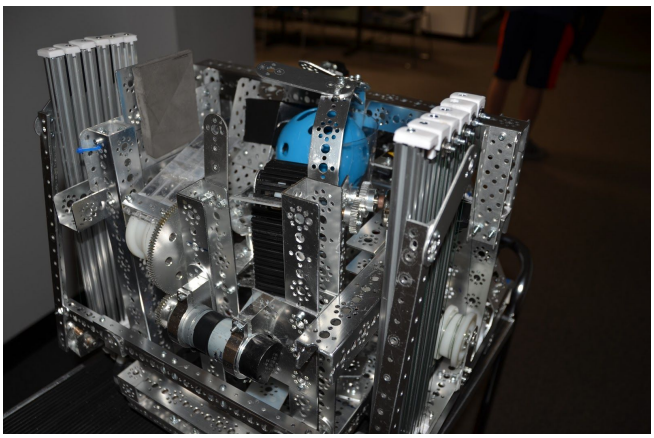
Pictures From the Meeting



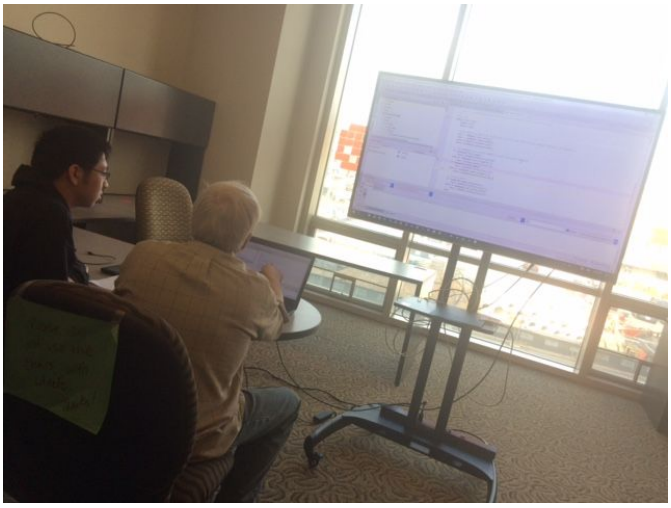








Coding & Autonomous Development Section



Using The templates given to us by FTC resources, we have adapted them to fit to our needs

Our autonomous scoring has multiple scoring strategies to adapt to every alliance.

First Autonomous strategy

- Score two balls
- Attempt one beacon
- Push ball
- Attempt 5 point parcial park
- End a point A

Second Autonomous Scoring Strategy (preferred Scoring Strategy)

- Score one ball
- Attempt two beacons
- May prove more lucrative for possible point in take

Third Autonomous scoring strategy

- Score one- balls
- Push ball (if needed that can be removed)
- * IF alliance has better beacon pressing system with proven reliance

Autonomous Code Analysis

```
* It uses a modified version of the Pushbot hardware class to define the drive on the
robot.
 * The code is structured as a LinearOpMode
 * <p>
 * The code shows using two different light sensors:
 * The Primary sensor shown in this code is a legacy NXT Light sensor (called
"sensor_light")
 * Alternative "commented out" code uses a MR Optical Distance Sensor (called
"sensor_ods")
  */

@Autonomous(name = "6417 Auto Gyro Drive", group = "Pushbot")
//@Disabled
public class AutoDriveGyro6417 extends LinearOpMode {

    /* Declare OpMode members. */
    Hardware6417 robot = new Hardware6417();   // Use a Pushbot's hardware
    // could also use HardwarePushbotMatrix class.
    LightSensor frontLight;      // Primary LEGO Light sensor,
    LightSensor backLight;      // Primary LEGO Light sensor,
    ColorSensor colorSensor;    // Hardware Device Object
    TouchSensor touchSensor;
    ModernRoboticsI2cGyro gyro;   // Hardware Device Object
    // OpticalDistanceSensor   frontLight;   // Alternative MR ODS sensor

            colorSensor = hardwareMap.colorSensor.get("color sensor"); // get a
reference to our ColorSensor object.
        touchSensor = hardwareMap.touchSensor.get("touch sensor");
        gyro = (ModernRoboticsI2cGyro) hardwareMap.gyroSensor.get("gyro")
;
```

We decided to utilize the capabilities of NXT light sensors, color sensors, distance sensors, and gyroscope to facilitate our autonomous goals. The gyroscope helped make the scoring more accurate. Additionally, the usage of two LEGO light sensors makes the line detection more accurate.

```
        if (redTeam) {
            rotate(35);
        } else {
            rotate(-35);
        }

        //sleep(5000);

        // Start the robot moving forward, and then begin looking for a white line.
        robot.leftMotor.setPower(APPROACH_SPEED);
        robot.rightMotor.setPower(APPROACH_SPEED);
        sleep(1000);

        // run until the white line is seen OR the driver presses STOP;
        while (opModeIsActive() && (frontLight.getLightDetected() <
WHITE_THRESHOLD)) {

            // Display the light level while we are looking for the line
            telemetry.addData("Light Level", frontLight.getLightDetected());
            telemetry.update();
            idle();
 }

      sleep(100);
        //back up a little so we can hit the center of first beacon
        robot.rightMotor.setPower(-APPROACH_SPEED);
        robot.leftMotor.setPower(-APPROACH_SPEED);
        sleep(620);

        //rotate towards beacon
        if (redTeam) {
            rotate(86);
        } else {
            rotate(-86);
        }
```

Op Mode Function : It is based on which alliance color we are. We have different values for turning and realigning for each alliance color. The rotation values were carefully picked as we've had issues in the past with missing beacons because of a bad turn beginning a match.

```
public void approachBeacon(){

      while (opModeIsActive() && (robot.rangeSensor.getDistance(DistanceUnit.CM) >
DISTANCE)) {

            double fLight = frontLight.getLightDetected();
            double bLight = backLight.getLightDetected();
            double left = APPROACH_SPEED;
            double right = APPROACH_SPEED;

            robot.rightMotor.setPower(left); //left
            robot.leftMotor.setPower(right);

            // Display the light level while we are looking for the line
            //telemetry.addData("Front Light Level",  fLight);
            //telemetry.addData("Back Light Level",  bLight);
            telemetry.addData("cm", "%.2f cm",
robot.rangeSensor.getDistance(DistanceUnit.CM));
            telemetry.update();

      }

   }
```

Approach Beacon function: Engages range sensor on the robot and collects data for later use. Robot begins approach to the beacon at same approach speed established.

```
public void pressBeacon() {

    telemetry.addData("Red  ", robot.colorSensor.red());
    telemetry.addData("Blue ", robot.colorSensor.blue());
    telemetry.update();

    int stillBlue = robot.colorSensor.blue() - robot.colorSensor.red(); //stillblue if +

    if (redTeam == (stillBlue > 0)) {

        robot.rightHand.setPosition(robot.HAND_MIN);

    } else if (stillBlue != 0) {

        robot.leftHand.setPosition(robot.HAND_MAX);
    }

    //if color was found
    if(stillBlue != 0)
        sleep(1000);

    robot.leftHand.setPosition(robot.HAND_MIN);
    robot.rightHand.setPosition(robot.HAND_MAX);
}

public double trim(double value, double min, double max) {
    return Math.min(Math.max(value, min), max);
```

Beacon Press function : Called 1-2 times (depending on strategy used) in the main after getting into correct positioning. Depending on the color the sensor detects, another beacon press may be triggered after some delay to ensure 30 points go to our own alliance. This function is vital to the success of our autonomous code. Data is updated in this code as well to ensure precise results.

Gyroscope Usage next Page

```
public void rotate(int target) {

    int angle = gyro.getIntegratedZValue(); //use double for floating point precision
    telemetry.addData("Heading", angle);
    telemetry.addData("Target", target);
    telemetry.update();

    double totalDelta = Math.abs((target - angle) / 2.0); //full turn speed until halfway there

    //positive is counter-clockwise (left)
    //error tolerance of 2.5
    while (opModeIsActive() && Math.abs(angle - target) > 2.5) {

        double currentDelta = Math.abs(target - angle);
        double turnRate = trim(currentDelta / totalDelta, .15, TURN_SPEED); //trim speed
within acceptable range

        if (angle < target) {

            //left turn
            robot.leftMotor.setPower(-turnRate);
            robot.rightMotor.setPower(turnRate);

        } else {

           //right turn
            robot.leftMotor.setPower(turnRate);
            robot.rightMotor.setPower(-turnRate);
        }
        angle = gyro.getIntegratedZValue();
        telemetry.addData("Target", target);
        telemetry.addData("Heading", angle);
        telemetry.update();
    }
    robot.leftMotor.setPower(0);
    robot.rightMotor.setPower(0);
    sleep(300);
  }
}
```

Problem without the gyro technology incorporated : our turns were inaccurate and often lead us off course from reaching the second beacon. The second beacon was a major challenge for us to reach, because we had to turn with precision in order to detect the white line and align with the beacon. After extensive testing and making slight changes in our code format, the gyroscope proved to be the solution we were looking for.

Rotate function: This function incorporated the gyroscope to help us make better turns that allowed us to reach both beacons more consistently. Nearly, 75% time we are able to reach both beacons. This function also adapts to either alliance, and based on alliance the directionality of turn changes. Turn rate is also calculated to help determine the speed for which our motors should be at.

Teleop Code and How it Translates into Drive Capacities

```
    // Run wheels in tank mode (note: The joystick goes negative when pushed
forwards, so negate it)
        left = -gamepad1.left_stick_y;
        right = -gamepad1.right_stick_y;
        robot.leftMotor.setPower(left);
        robot.rightMotor.setPower(right);
```

The drivers on the Cru prefer using tank drive to control to movement, as it is reminiscent of video games. Tank drives ensures high level of mobility as well.

Functions of Driver 1 Controller	Functions of Driver 2 Controller
1. Accept Ball 2. Launch Ball 3. Overall movement of robot 4. Conveyor belt movement	1. Servo Control 2. Spinner 3. Press/Withdraw Beacons

Team Scoring Strategy

Autonomous Scoring

During the autonomous period, we plan to launch two balls into the vortex. Then, we plan on hitting one beacon and insuring it is the correct color. Lastly, we will move to the center of the field and move the ball and park in the center.

We plan on ending up at point A at the end autonomous

Tele-Op

In our teleop time, we will try to score as many balls in the vortex as possible. At the same time we would like to guard the beacons that our side has won. We plan to also lift the ball, and hopefully score into the vortex.