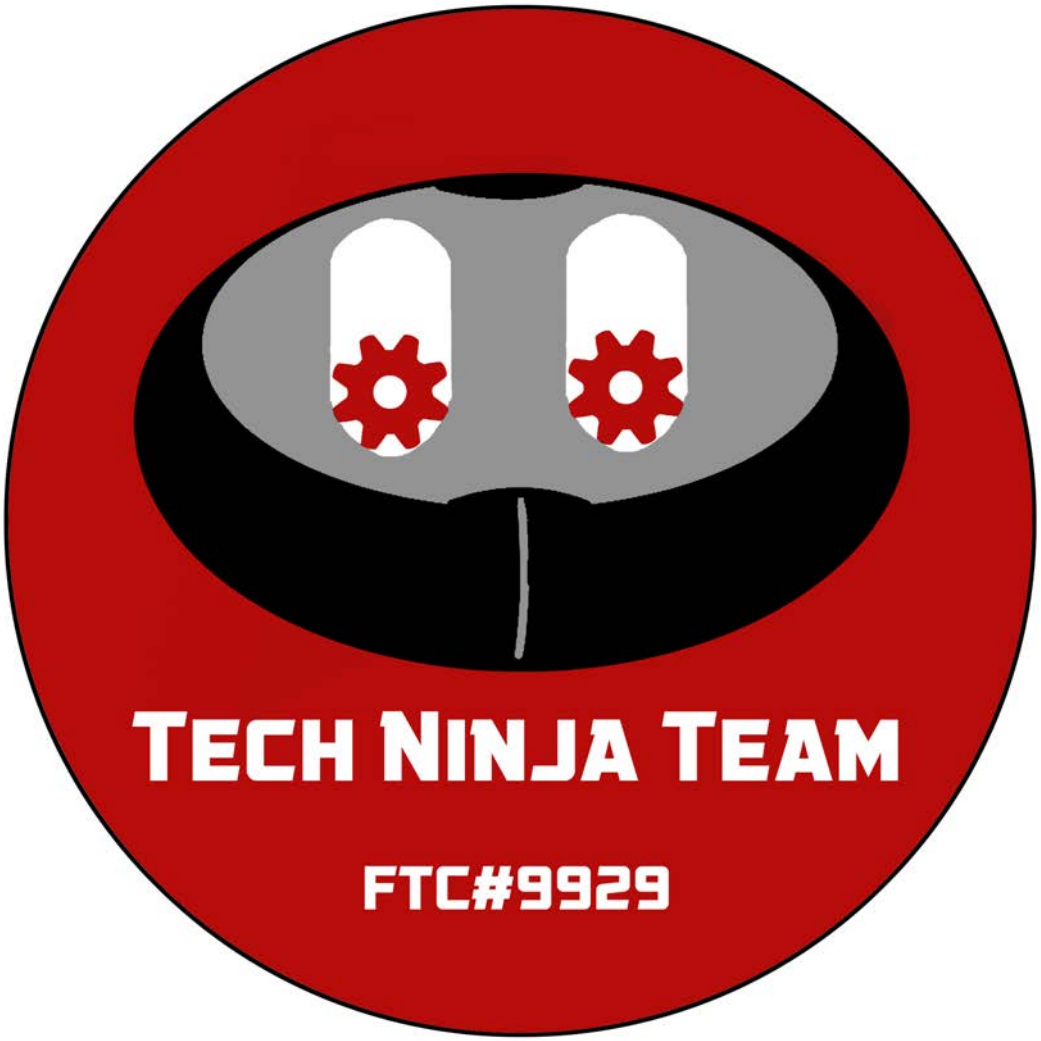

Engineering Notebook

2017-2018 Relic Recovery

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An Introduction to FTC Team #9929 "The Tech Ninja Team"

It all started in a basement with the Nelson family and the Matthews family. They were in the process of completing an overly complicated machine to, drum roll please, unzip a zipper. These two families had decided to complete the 2014 rube Goldberg machine challenge over a couple of weekends, for fun. After a few hours, one industrial shelf, and a ton of tape later, it finally worked. Then we went on hiatus for a few months before starting FLL. The team choose to "dominate" with education as LED (Lego Education Domination). The final robot didn't do so well but at least our name was cool.

Year two of our team's engineering adventure to becoming the Tech Ninja Team we are now brought some changes. A lot of changes. A few of the older team mates (Calvin, Kate, and Lauren) pushed the coaches to offer FTC after seeing the robots built for this competition online. They managed to convince the FLL coaches to start a FTC team. We unpackaged our first kit to build a robot in the basement of Coach Matthews. All of the team members were excited to begin building. Our team name came from a joke when we were unpacking the boxes of robot parts. We were all pretty excited about the cool parts that we unpacked and thought they were really cool, when someone said "Just wait until we unpack the ninjas". Thus the Tech Ninja Team was born, along with a cool acronym (T.N.T). after beginning work on the robot we moved to coach Nelson's garage for more space. The name for our robot, Skittlebot, came from an exercise we did to better understand programing. Shortly before the team's first qualifier we got a new space to practice in at the to be Homewood Science Center. Little did the team know at the time how lucky we were to have the space. We would end up 11th place with a Control Award when the season was over.

During the off season we moved into our own room in the science center that is often referred to as the robot room. This space would allow us to expand more and start to learn more advanced techniques for building our robot. We are also started using Slack (a communication platform) and GitHub (a program storage platform) to better our team's communication. We researched prior seasons and worked on building mechanisms we noticed were used throughout the challenges. For kick-off we did some outreach and threw a kick-off celebration.

In our second year we used a lot more planning and critical thinking to bring a robot together. We communicate and keep our engineering notebook up to date using Slack, we plan tasks with a Kanban board, and we installed 33 feet of whiteboard in our workspace to use when brainstorming designs and working out programming algorithms.

This year's robot is much more advanced than last year and is taking us further then previous robots. This is our second year participating in FTC league play. We prefer league play because the opportunity to iterate is more like engineering then a single qualifier. We hope that changes we made to the team will help us move farther.

Team - Bios

Hannah Beezie
3rd year with FIRST
Freshman

I enjoy reading, drawing, and riding my bike in my spare time. I am a member of my school's Scholastic Bowl team and an IB Prep Academy student. I am also pursuing the PLTW Engineering courses available to me. Also, I enjoy attending team meetings and practices.

I am primarily a part of the build team, but I also am the robot operator on the drive team.

I joined FIRST because I was interested in engineering and robotics, and wanted to learn more about STEM than I did in school.

Lauren Matthews
4th year with FIRST
Freshman

My name is Lauren Matthews. I am 15 and attend HF High School. I have participated in FIRST as a whole for four years. For my first year I competed in FLL. After that season was over I, along with a few other team members, crossed over to the new FTC Team. I have always enjoyed engineering and have done other science related activities outside of FIRST. I also enjoy Olympic recurve archery, reading, drawing, and writing. I am on the programing team, have helped the build team occasionally, and am a coach for a drive team. I am excited to see where this team will go in the future years.

I'm a 9th grader at HF High School. This is my 4th year with HF Robotics, third year in FTC. I really like the programming and driving/operating challenges that FTC gives me. In addition to robotics I play tenor saxophone in the school bands and a basement band. I would like to go into physics or computer sciences in the future. Science is cool and good.

Calvin Uecker
4th year with FIRST
Freshman

Jeremy Wesley
3rd year with FIRST
Sophomore

I am in track and field and I plan to attend the United States Air Force academy in CO, I play alto saxophone in band for Homewood-Flossmoor High school, I am the 2 vice president for my chapter in Top Teens of America, I am a mentee in 100 Black Men of Chicago and I am in Kappa League.

I am on the build team
My mom introduced me to FIRST one day and it was something I found special so I stuck with it because I love building and understanding how things work. I always had a thirst for knowledge so when I heard about FTC I was interested real quick.

I am in Science Olympiad, I play soccer, and I like art.

I am on the build team and a robot driver.

I joined FIRST last year, after I went to a LEGO robot programming event and learned about FTC.

Taylor Washington
2nd year with FIRST
Freshman

Kaylin Matthews
4th year with FIRST
7th grade

I am a 7th grader at Parker Jr. High. This is my first year with FTC, although I was the "intern" last season. I participated in 3 years of First Lego League (FLL) before joining FTC. I am on the build team and enjoy constructing things and then being able to see them work to do a task. FTC has taught me valuable skills, such as teamwork, engineering, and and perseverance, that I will remember my whole life.

Outside of FTC, I enjoy playing soccer, playing my flute, and reading.

I was introduced to FIRST when my dad and some of the other coaches started a FLL team 4 years ago. I've stuck with it ever since.

Ernest Woods
3rd year with FIRST
7th Grade

I do lacrosse and track and field. I am in band. I enjoy hanging out with friends. I am 12 years old. I joined FTC because when I was in FLL it looked cool how they were building bigger robots.

Liam Nelson
4th year with FIRST
7th Grade

I am 12 years old, and I enjoy playing the trumpet, violin, and lacrosse. This is my fourth year with FIRST, but my first three years were in FLL. I learned how to code over the summer, and learned to do CAD as well. I am planning to get into IMSA for high school and then maybe pursue a career in physics or engineering, or even the military.

I was introduced to FIRST several years ago when I joined First Lego League. I was interested, and I have been a big part of every team I've been on ever since.

Team -- Outreach

1,500

People reached overall

1 Mile

Marched with robot - July 4

12 Schools

Reached at STEAM Network – along with 9 school districts and 3 colleges

3 League Meets

Hosted – including qualifier

3 New Teams

Started via STEAM Network and our on-going help

26

Corporations reached

11 Events

Held overall

549

Followers on social media

Hosting league meets, qualifiers

We believe that in order to be successful as a team, outreach to both the community and competing teams is necessary. Last season we hosted two league meets and this season we have hosted two league meets and one qualifier to stir excitement about robotics in the community. We worked hard to open the Homewood Science Center to the community and other teams. We wanted community members to see the energy at these tournaments.

Relic Recovery Season Kick-off

The team hosted a season kick-off at the Homewood Science Center. We networked with other teams and community members during this event. We helped other teams analyze this season's game and we even had a full field. We were able to have the field setup because we had special permission to receive the game pieces early. Above all we had fun with decking the Science Center with themed decorations and snacks.

Homewood Science Center - STEAM Network Meeting

During the Homewood Science Center's STEAM Network Meeting, we were able to talk to about 100 different educators, corporations, and community members.. They were able to visit our workshop, drive our robots, and talk to our mentors. Some of the educators we talked to ended up starting 3 new teams, 2 at Andrew High School and 1 at Thornton Fractional. We also met the person who helped us get our grant from Schneider Electric, Mr. McClain

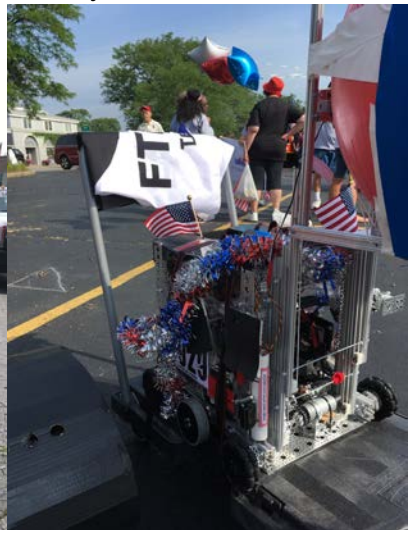
The Steam networks meets twice a year and is a good opportunity for us to reach out to other networks and spread the word of our team.

Helping new teams get started

We talked with teachers from Thornton Fractional and Andrew High School at the STEAM Network Meeting at the Homewood Science Center. These teachers ended up starting teams at their schools. We welcomed these teams and others into our workshop to help them get their robots running. We also helped these teams with their code and hardware at the league meets.

Homewood Fourth of July Parade

We walked with our robot in the Fourth of July Parade. We did this to show off our previous robot and make ourselves known in the local community.



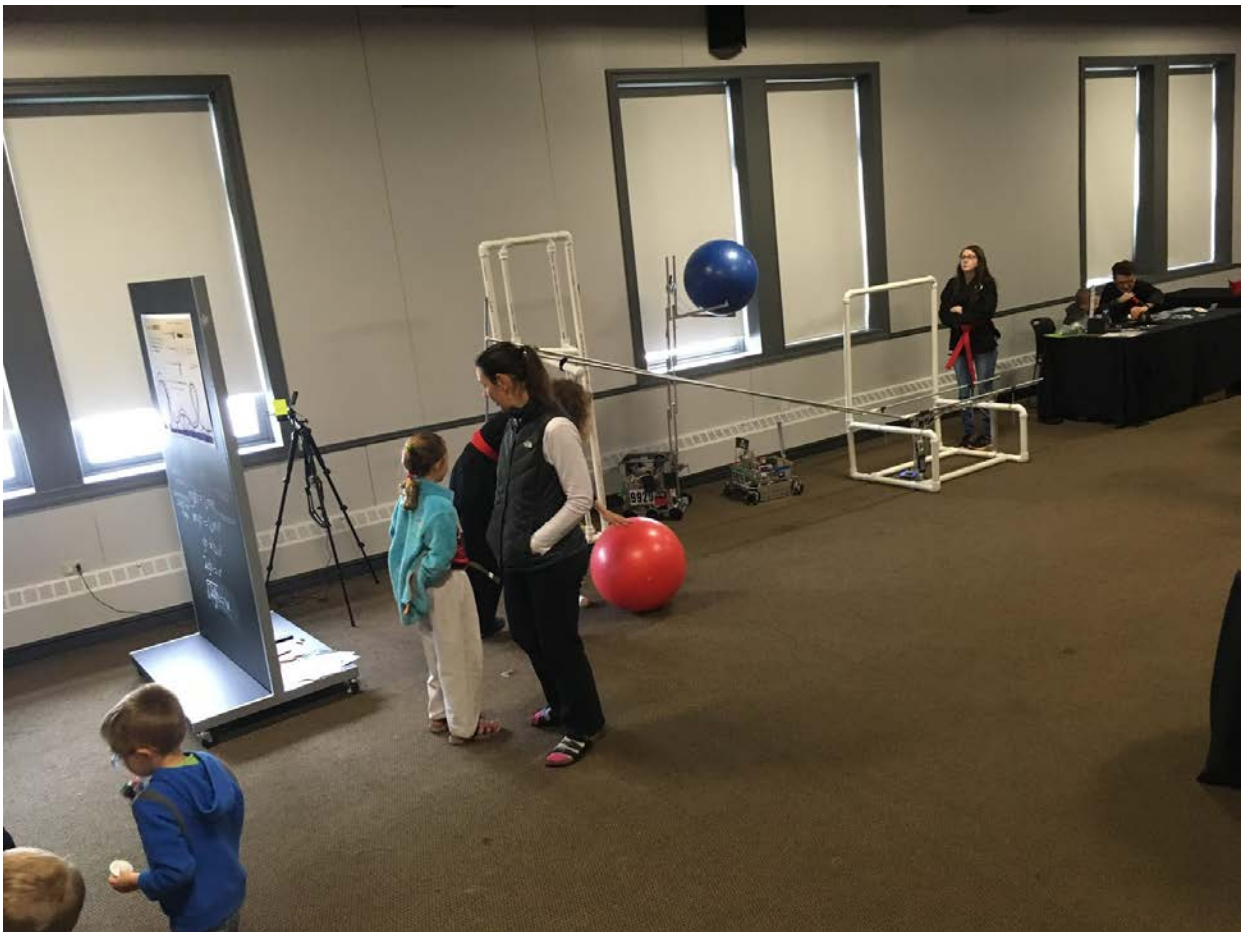
Presence at Farmers' Markets

We had a booth at the Homewood Farmers' Market multiple times. We let the community drive a robot. This was our first robot to use Mecanum wheels and the REV expansion hub. This was a good reliability test for technology that was new to our team. We collected donations and made buttons. Over the summer, we raised enough money to purchase a 3D printer for our workshop!

HSC Walk Walton

We had a booth at Homewood Science Center's fall fundraising event at Homewood's Izaac Walton preserve. We brought a Lego Mindstorms robot that solved Rubik's cubes to show off to the community. We also talked to local families and community members about FIRST and our team.

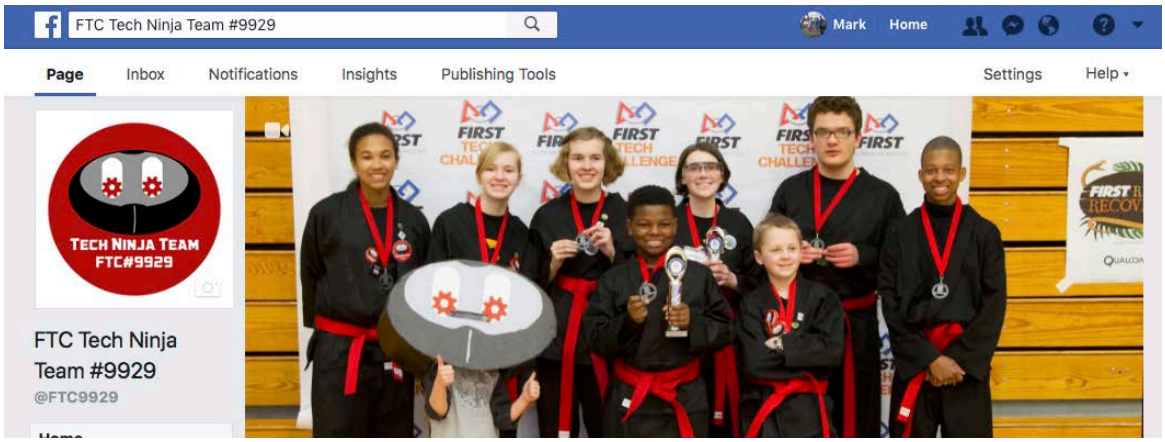
HSC Railroads and Rollercoasters



The Homewood Science Center holds PopUp Science monthly. These events attract local families with children ranging from ages 2-10. About 300-500 people attended these events. We set up an experiment at the “Railroads and Rollercoasters” PopUp Science. We used yoga balls from last year’s game, Velocity Vortex, and the FTC SDK to demonstrate the concepts of potential and kinetic energy. Attendees would choose a height and predict a speed, “speed gate” software we wrote measured actual speed. We graphed predictions and actual measurements on a large chalkboard. We also took donations to let people make “special limited edition” pins.

Social Media

Facebook – We have our own Facebook Page, used more to reach local audiences (upcoming events, news). We have 130+ followers that are primarily within the state of Illinois or are family and friends of the team members.

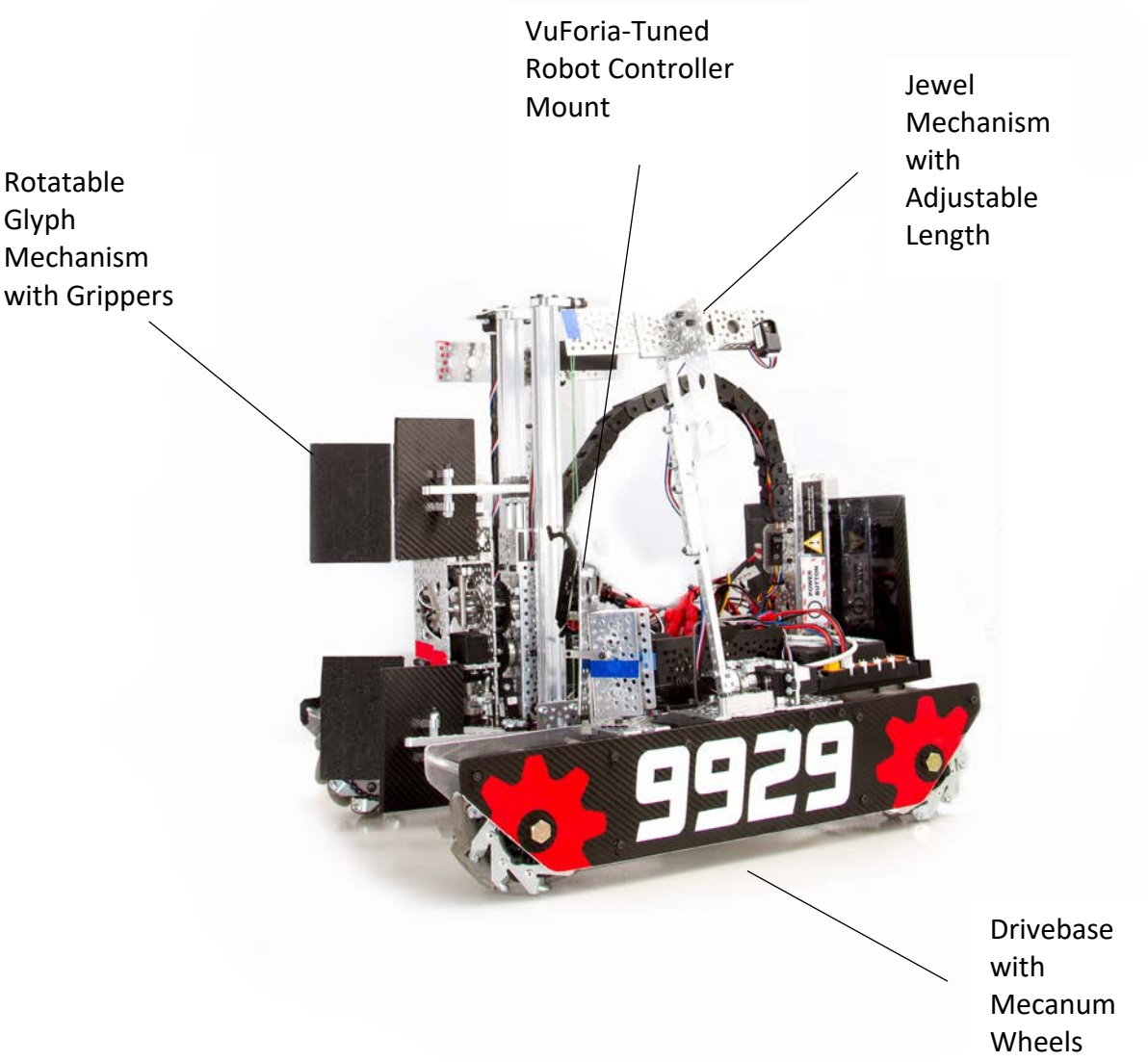


Twitter – We are @FTC9929 on Twitter. Here is where we tend to keep up with other FTC teams, sharing our successes (and experiments that don't quite work out). We have over 400 followers, and we enjoy seeing how teams around the world are having fun with robots and STEM.

YouTube – we've produced our first "tech tips" video, which is "Say No to KEP Nuts" advising build teams to use nylock nuts instead. We're looking forward to producing more videos in the off-season around engineering and programming topics.

GitHub – We share all our robot code with the world as we write it at *https://github.com/HF-Robotics/ftc_app/*. We've structured our program such that much of it is reusable season-to-season and we're hoping that it may be a jumping off point for teams that need help in this area.

Robot Overview



Game Analysis and Strategy

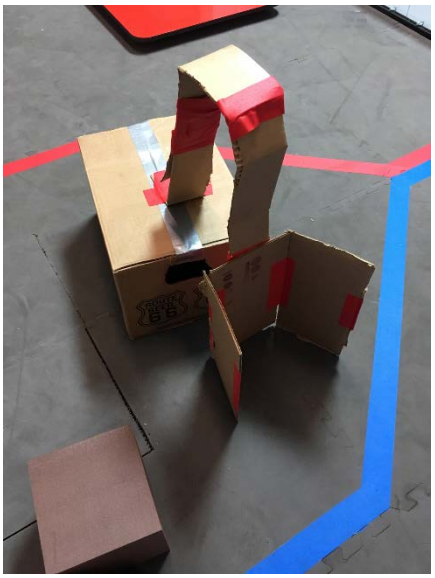
The entire team came together to watch the season kick-off video and discuss it.
What we decided:

- Time Wasters - Not worth it
    - Scoring only 1-2 glyphs per cryptobox. That is only worth 2-4 points as opposed to 16 for a full row.
    - Relic in zone 1- worth 10 points. An upright relic in the third zone is worth 45 and is more helpful.
- Game Changers/Chokeholds - Big scoring chances

    - Full Cryptobox - we get bonuses for each column and row, plus a full-box bonus.
    - Cipher - gives an additional 30 points on top of the full box score
- Must-Have Accomplishments
    - 1-2 rows or columns. It's the only way to score in TeleOp.
    - Jewel autonomous - earns 30 points
    - VuForia - correct glyph placement gives a fair amount of points and allows us to fill a TeleOp cryptobox faster.
- What is a "decent" score?
    - 40-60 autonomous
    - 60+ TeleOp
    - 120+ total
- Immediate To-Do's
    - Drive Base
    - Something to move glyphs
    - Balancing - test stone
    - Something to place glyphs
    - Mechanism to identify/move jewel
    - Decoder for crypto key
- Dream Goals
    - Fill cryptobox
    - VuForia crypto key

Glyph Mechanism

The path to the creation of our glyph mechanism wasn't straightforward. One element of the design process *was* concrete - our goals and requirements.



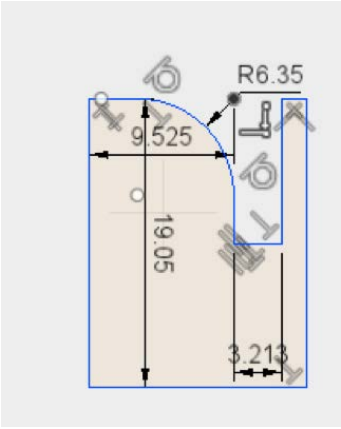
Requirements:

- Fill a cryptobox during Tele-Op
    - This is the only way to score during Tele-Op.
- Works reliably in autonomous to place a glyph
    - If the robot isn't reliable, all sorts of issues will spring up during a match.
    - If we cannot score a glyph, then VuForia will be useless.
- Moves up and down over 18 inches.
    - Each glyph is approximately 6 inches tall, and 4 glyphs stack in a column. To finish a column, we have to lift over 3 glyphs.
    - Filling entire columns is necessary to complete a cryptobox.
- Fast and Efficient
    - If you need to place 12 glyphs in 90 seconds (the duration of TeleOp), there is a maximum time of 7.5 seconds to grab and place each one.
- Two Individual grippers
    - Having two grippers allows us to grab any glyph we want and saves time.
    - It will not be necessary to pick up already stacked glyphs.
    - We can choose the color of the glyph to finish a pattern

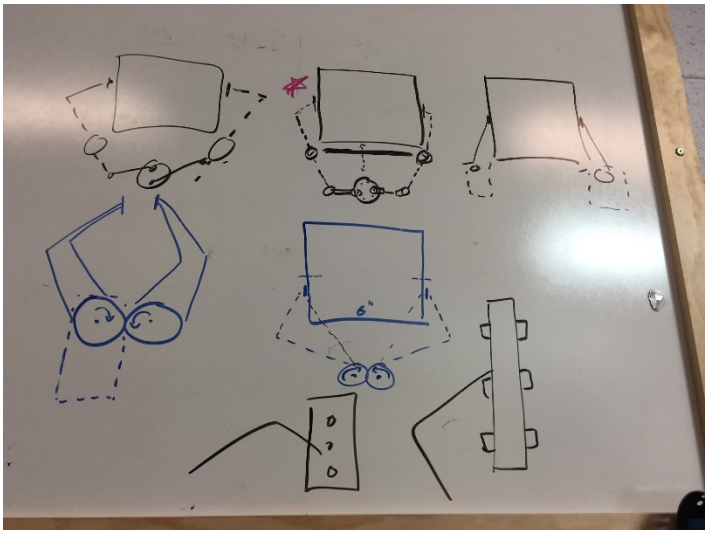
Prototyping

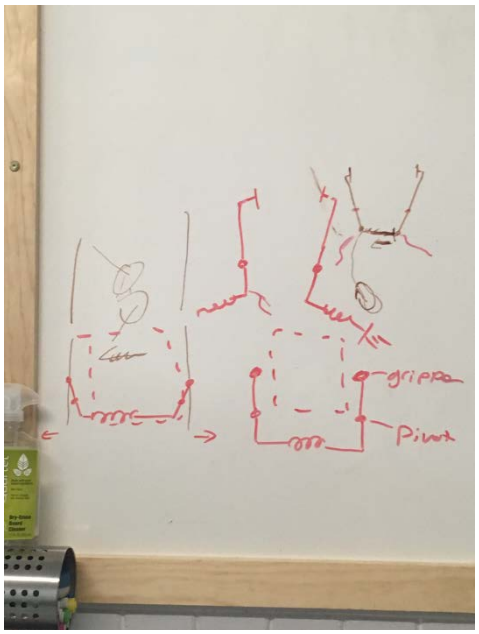
- Early glyph lift mechanism

- Spool CAD drawing for glyph mechanism that will be 3D printed, and on the robot

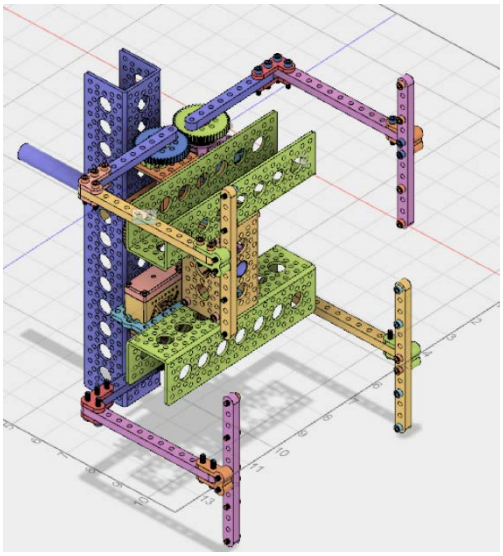


- Brainstorming Gripper design





- CAD drawing of Original Gripper mechanism



Our prototyping consisted of two basic categories - “claw/gripper” and “wheeled” intakes.

- Wheeled intake
  - Consists of one or more pairs of wheels on opposite sides
  - The wheels would run to “pull” in glyphs
    - The glyphs have an “allowed range” of sizes that exceed 6 inches. When built, the wheels were often a hair to close or far to collect glyphs.
    - Wheels could get stuck, or not push out glyphs entirely.
    - There is a difficulty in placing wheels at the proper 90* angle
    - Can’t easily collect glyphs at an angle - takes longer
    - Held glyphs securely
    - Could damage glyphs if sucked in too long
- Claw/Gripper
  - Has two arms or claws on opposite sides
  - The arms would open and close to pick up/release glyph
    - Can’t pick up glyphs on an angle
    - Could get stuck in Cryptobox when stacking
    - Will grab all size variations
    - Held glyphs securely
    - Does not inflict much/any damage

We chose the claw/gripper design.

To lift the grippers, we decided to use spools and thread as a pulley system to lift the grippers, mounted on a sliding base on two poles.

One big obstacle was getting the spools to hold the string without tangles or getting stuck.

- What happened?
  - Spools were too thin and lost the string
  - Knots and tangles formed
- Next, we tried to 3D print spools with “walls” on each end to funnel the string.
  - It was a pain to replace broken or untied string.
  - The string didn’t always “find” the inside of the walls, so the mechanism became unbalanced.
- Finally, we made the spools with a wider opening for the string, walls angled to a point, and sized to exactly fit the available space..
  - This was more successful
  - The only issue is that it will snap easily if we exert lots of pressure on the mechanism.

Jewel Mechanism

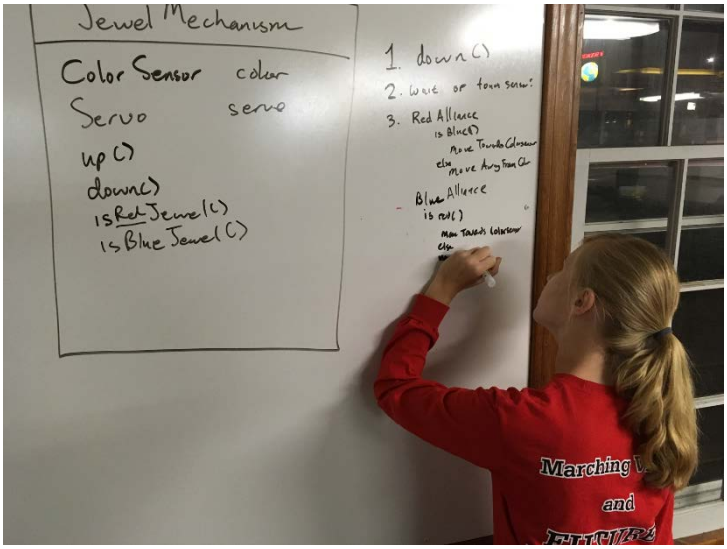
Our robot has two jewel mechanisms that function the same way, one for Red and the other for Blue. This mechanism was not as complex to build, but we still made many improvements.
Requirements:

- Move Jewel in Autonomous
  - If we cannot move, we don't score points.
- Uses a color sensor to detect jewel
  - If you move the incorrect jewel, the opposing alliance earns points.

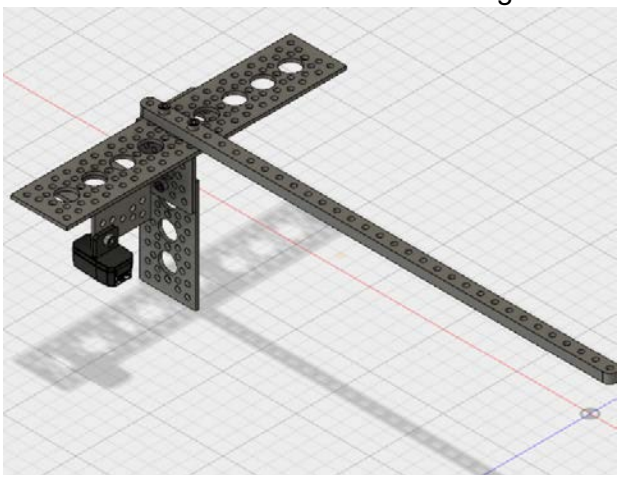
Prototyping

- Basic form
  - Our ideas all consisted of a pole or metal rod with a color sensor attached.
  - The idea was refined into "T" shaped mechanism with sensors on each side.
  - We realized that two sensors were not necessary, so we removed one.
- Fine tuning
  - The color sensors were not always very accurate in all light values. To filter excess light, we placed black plastic over the upper side of the "T" that each sensor was mounted under.
  - At League Meets, each field had a slightly different alignment of the jewels, and our mechanism sometimes hit the field wall. We re-sized the mechanism so that there is an adjustable extension to be used before inspection to fix that.

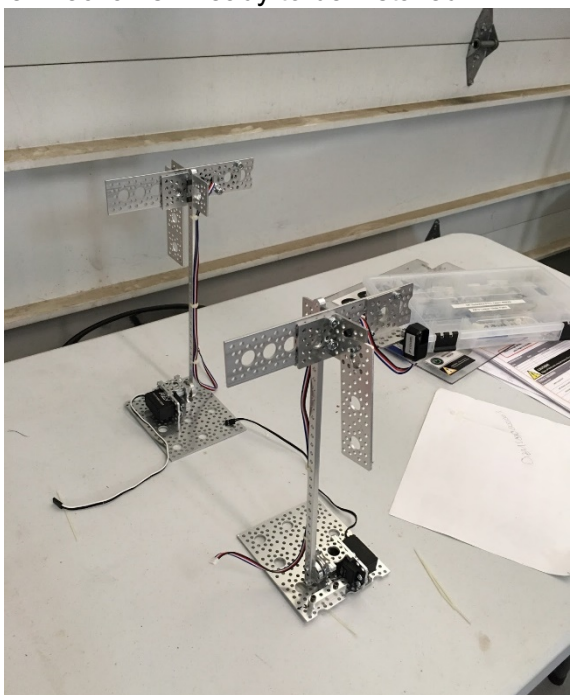
Discussion of Jewel mechanism and defining requirements



- Jewel mechanism CAD drawing



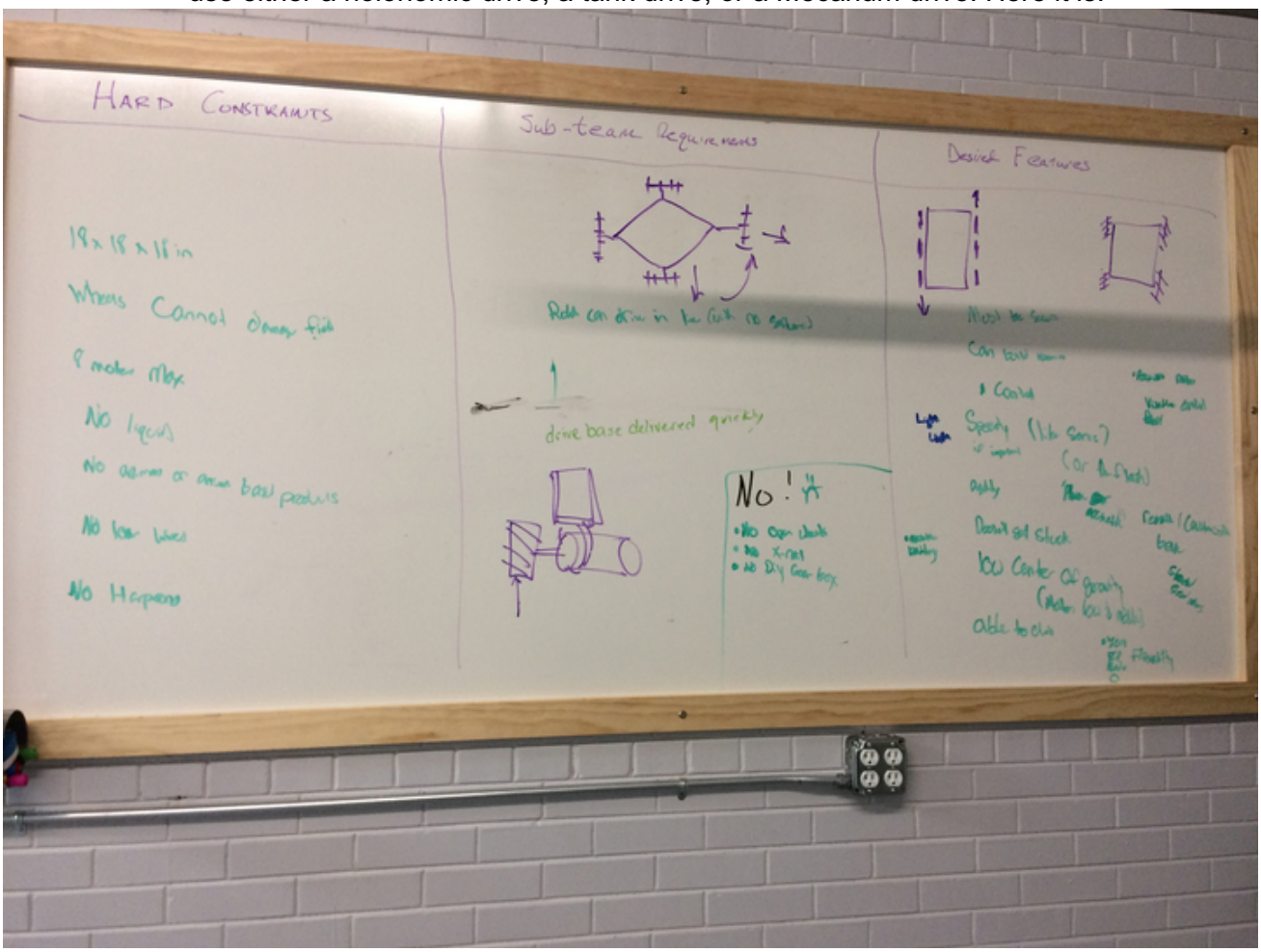
Jewel mechanism ready to be installed



Drive Base

This year's drive base was machined by us and not from a kit. AndyMark was selling a drive base kit that looked promising, but we chose to start from scratch.

- Why we manufactured a custom drive base:
  - The "building kits" were not adjustable. Having a drive base that suited our specific needs would benefit the design process of the robot.
  - We did a whole chart deciding what drive scheme to use. Our options were to use either a holonomic drive, a tank drive, or a Mecanum drive. Here it is:

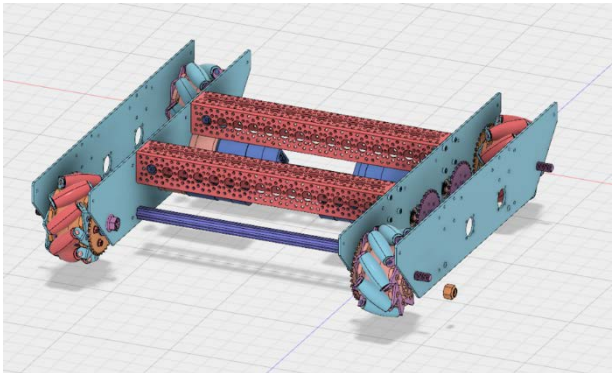


- What makes up the drive base?
  - Four side plates, one on each immediate side of the wheels. This protects the chain-and-wheel system from outside interference.
  - Three aluminum channels connecting the inner side plates to support the mechanisms.
  - Angled corners on the side plates to prevent the robot from damaging itself or the balancing stone.
  - Mecanum wheels.
  - Easily customizable and removable side plates.
  - Carbon fiber and red gear designs on the outer side plates.

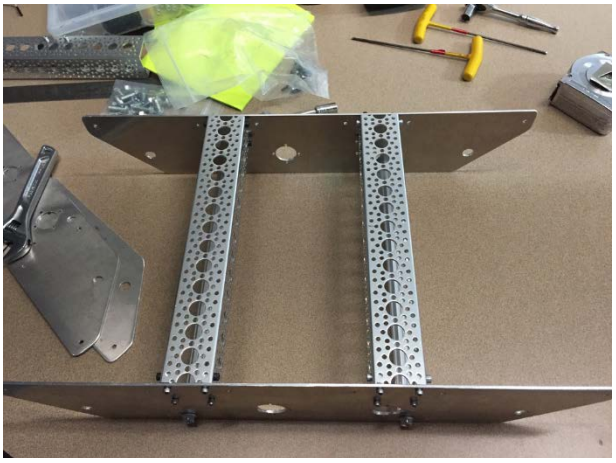
Build progression of the Drive base

- Mock-up of drive base

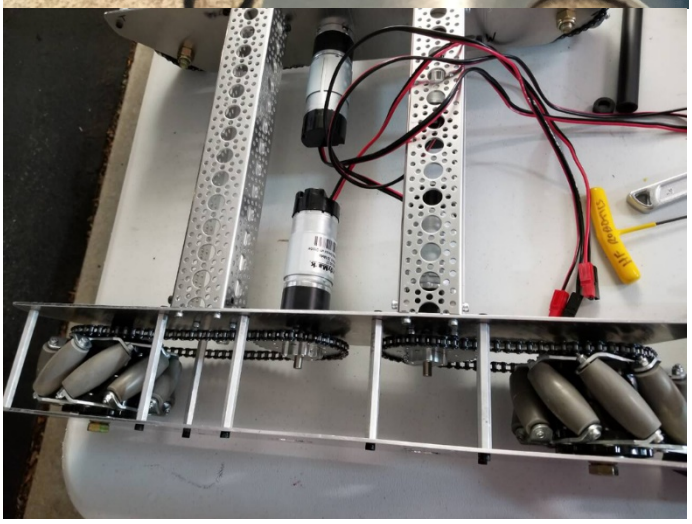
- Early CAD model of drive base



- Constructing the drive base




LOCTITE
222MS
THREAD LOCKER
Henkel
LOCTITE
242
BLUE
THREAD
LOCKER



Software

This season the programming team focused on improving driver to robot compatibility, especially a better throttle curve, and including a low pass filter on the joysticks. Something we're especially proud of is our Autonomous. We use an improved PID that is used in both axes because of our mecanum drive and an adaptive autonomous interface that allows us to use multiple goals from the drivers' station. Below is a list of our programing achievements and capabilities.

Software -- General Functions

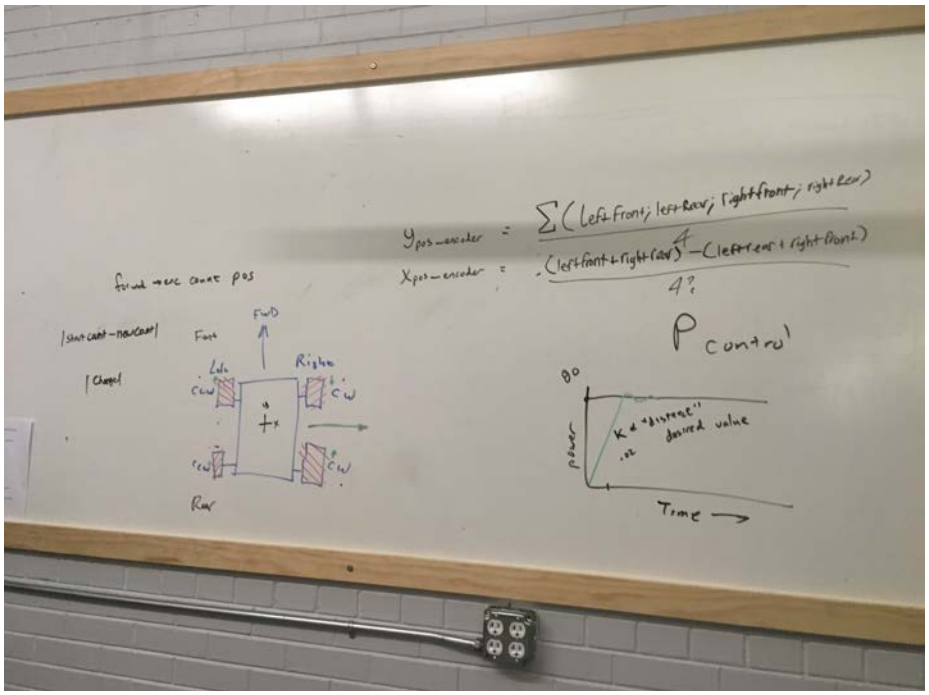
- Classes programmed for all subsystems
    - Drivebase code
        - Driving in the Y axis (forward and backwards)
        - Driving in the X axis (strafing left and right)
        - Computing positions and rotations
        - Used both by tele-op and autonomous
    - Glyph mechanism code
        - Raising and lowering of grippers
        - Rotational and height limits
            - Hardware - protects rotation servo and lift mechanism
            - Software timer - if limit switches malfunction
        - Used both by tele-op and autonomous
    - Jewel mechanism code
        - Color sensor and servo
        - Creates the state machine for mechanism
        - Tells the way for robot to turn when jewel is detected
            - Retracts arm and doesn't turn if no jewel is detected
        - Knows mechanism deploy and stow times
- Library of useful code we grow each season
    - PID control
        - proportional drive based on distance from goal
        - Used to reliably achieve distances during autonomous
    - Driver control enhancements
        - de-bounced buttons
            - Allows us to easily detect button presses versus holding a button
            - Opens more uses for buttons
        - adapters to treat variable inputs like buttons and vice-versa
            - Allows us to use triggers as buttons which allows use of trigger with code expecting buttons
            - Easier adjustment for driver preferences
    - State machine executor
        - Reusable state machine classes
            - Delay
            - States that include a timeout

- On-robot debugger

- Logging of performance data -
  - Post-match analysis
    - adjust throttle curves
    - PID values
    - Sensor value requirements
    - Motor power values
    - distances

Software - Autonomous

- State Machine
  - Same code despite alliance color
  - Adjustable for start position and goal
- Setup at init from Drivers' Station
  - Alliance color
  - Path or goal for match
- Jewel Detection and Motion
  - Detect jewel color by what it sees more of
  - Turns using IMU based on color detected
  - Stows arm if no jewel is detected
- Custom PID controller
  - We don't use RUN_TO_POSITION because of less control
  - We also found calculating our position using averages leads to more accurate positioning on field
  - Although we haven't used it yet, we could use it to hold heading and drive a distance at same time
    - Would help with driving in a direction when obstacles are in play.
- Estimating robot position
  - encoders
  - math for straight and strafe with Mecanum drive



Y axis equation:

$$\frac{left\ Front\ +\ left\ Rear\ +\ right\ Front\ +\ right\ Rear}{4}$$

X axis equation:

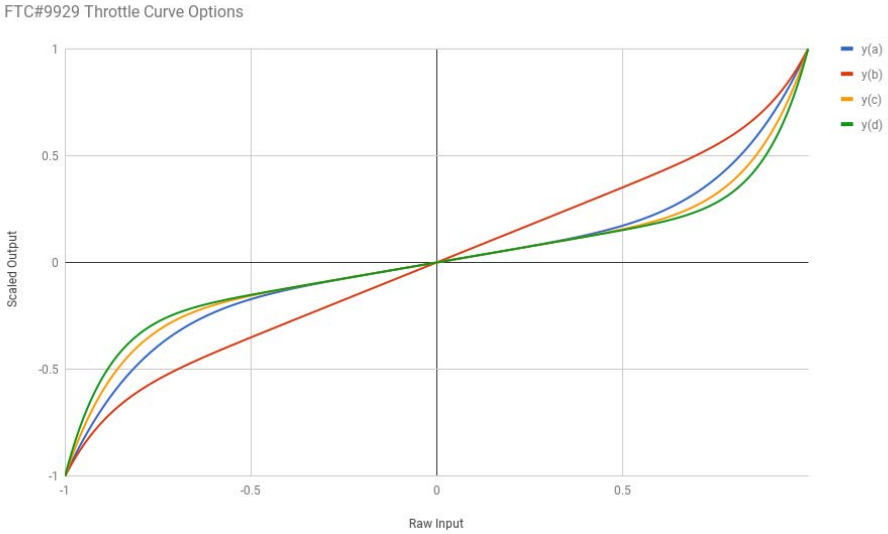
$$\frac{(left\ Front\ +\ right\ Rear)\ -\ (right\ Front\ +\ left\ Rear)}{4}$$

- VuForia
  - Runs on separate thread to let autonomous code run even if VuForia fails, stops, crashes, etc.
  - We can score plenty of points even without VuForia
  - If no VuMark is detected we place glyph in center column
    - Even if we miss center we will make one of the others
    - 33.33% chance of scoring crypto key by chance
- Glyph mechanism
  - Both grippers in case mechanism is upside down at start
  - Grabs glyph and lifts it before moving at all to be more accurate

Software - TeleOp

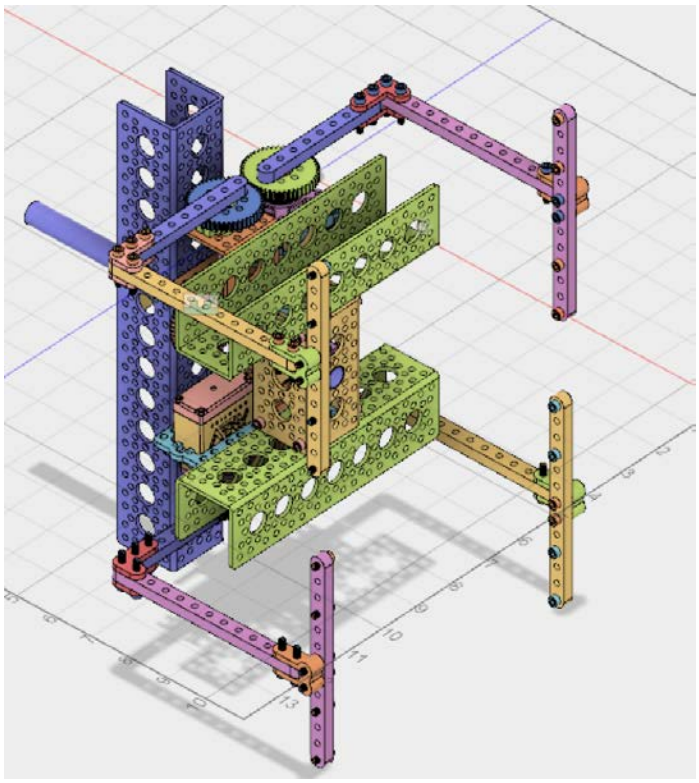
- Flip of Glyph Mechanism
  - limit switches and timeouts
- Automated Gripper state
  - top/bottom automatically switches when flipped
- Limit switches for glyph mechanism lift
  - Helps prevent breaking of the lift motor and wiring of glyph mechanism
- Low-pass filters

    - Smooths out driving and prevents jerky movements
- Independent throttle curves
    - Allows us to give different speeds and limit to different parts of the robot



- Controls support code allows quick “experiments” to change controls for driver and operator

Engineering



08/25/2017 7PM-9PM

Design Meeting

Team Members: Lauren, Taylor, Hannah, Kaylin, Liam, Ernest
Coaches: Matthews, Nelson, Uecker, Beezie

AGENDA

1. Drivebase Design

DETAILS

DRIVEBASE *ALL*

Requirements:	1. *Fast* 2. *Maneuverable* 3. *Holonomic (x/y)*
We used this opportunity to learn how to use Fusion360 together	

Design:	1. *Arm descends from side of robot* 2. *Color senses jewel color as arm is descending* 3. *"T" shape in XY and YZ planes*

Started design of side plate for drive base. Looked at an AndyMark drive base in CAD for inspiration. We debated length of the side plate. Hannah suggested we use a measurement of 17 ¾" for a small margin of error. Kaylin suggested that we should compensate for a collector and make it even shorter. The build team decided that the length should start at 17 ¾" because it easier to take away material rather than add it in. Then the team decided the height of the plate should be 3 ½" to leave room for a 4" wheel while it hangs down from the base ½". The team then went on to decide the placement of the holes for the axles on the side plate. The team finally decided to put the wheel holes 2 ⅜" from the end and ¼" below the center line. We then tried placement another set of axle holes ½" from the center of the first one and decided that it looked too close, and we changed the placement to be 1" center-to-center. After the wheel catastrophe was resolved, the team went on to discuss support for the "wheel sandwich" between the plates. We decided to use churros to support the plates, spaced ¼" from the sides and top.

Evaluate / Next Steps:	1. *Continue refining design* 2. *Construct from aluminum*

09/22/2017 7PM-9PM

Design and Build Meeting

Team Members: Jeremy, Lauren, Taylor, Hannah, Calvin, Kaylin, Liam, Janet, Zaniya, Bill.
Coaches: Matthews, Nelson, Uecker, Beezie

Agenda

2. Build a prototype Jewel Mechanism
3. Continue Design Requirements Discussion of Relic Mechanism
4. Continue Design Requirements Discussion of Glyph Mechanism
5. Develop CAD model of Drive Base

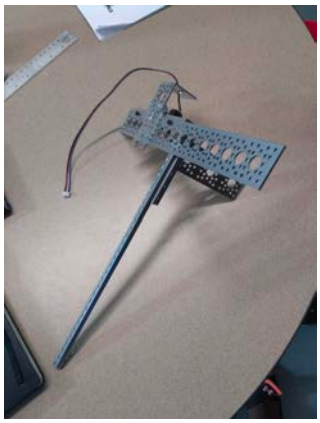
Details

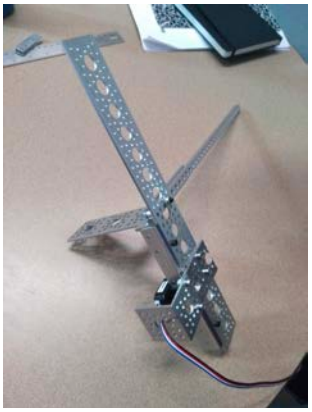
Jewel Mechanism *Kaylin, Taylor*

Requirements:	4. *Reaches Jewels from balancing stone* 5. *Detects color as it is deploying* 6. *Extends and detects in 10 seconds*
We did not change any requirements from our last meeting.	

Design:	4. *Arm descends from side of robot* 5. *Color senses jewel color as arm is descending* 6. *"T" shape in XY and YZ planes*
Our current design is an arm that descends from the robot, and is "T" shaped in both the XY and YZ planes. A color sensor looks downward as the arm descends and assesses the color of one of the jewels.	

Build:	1. *We built a first prototype of our design at tonight's meeting.*





Evaluate / Next Steps:	3. *Bottom of "T" sticking out of robot envelope* 4. *Test the color sensor in this configuration*

5. *Assess the height of the bottom "T" section*
6. *Refine materials and dimensions, develop CAD models*
7. *Develop the "descend" mechanism*

The part of the "T" that would be between the jewels would stick out of the robot's 18" envelope when the arm is up. We will need to change this, possibly by allowing it to pivot.

We need to confirm the color sensor will work in this configuration and whether the height of the bottom part of the "T" is correct.

Our next step is to design this mechanism in CAD and refine its dimensions.

We will assess how to attach this to the robot and get it to descend and raise when the other components of the robot are more complete.

Relic Mechanism *Janet, Zaniya, Hannah*

Requirements:

1. *Speed – entire relic placement needs to be 15 seconds or less to permit alliance partner to also place relic.*
2. *Extension – 32" to 48" for highest-scoring zone*
3. *Grip from above – to minimize interference with other relics*

We continued to discuss requirements from our last meeting.

We discussed using a string or lasso to grab the relic, but it isn't balanced; it tips over when picked up this way.

We discussed possible extension mechanisms, and built a prototype scissor-type lift.

We also discussed a "claw" mechanism that can grip the relic from above in order to minimize the interference with other relics. We considered a mechanical or spring-based mechanism that would not require the use of a servo. It *almost* works but it's unclear how we'd drop off once we've picked up.

Design:

1. *We are currently experimenting with a scissor-lift*

Build:

1. *We built a very rough scissor lift. Need to build one that can extend full length.*

Evaluate / Next Steps:	1. *We need to develop a complete, full-length prototype scissor mechanism and see if it can handle the weight of the relic mechanism.* 2. *We need to develop the relic gripping mechanism further.* 3. *We need to come up with at least one additional alternative to the scissor design.*

Glyph Mechanism

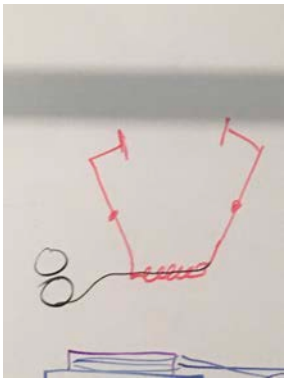
Requirements:	1. *Ability to pick up two glyphs.* 2. *Ability to pick up glyphs independently.* 3. *Ability to rotate or flip 180 degrees (i.e., swap top glyph with bottom glyph).* 4. *If we can flip the glyphs, we only need 12" of vertical travel.* 5. *Speed is essential.*

We continued to discuss requirements from our last meeting and sketched out a variety of ideas on the whiteboard.

We discussed whether the glyph mechanism needs to pick up two glyphs or one glyph. Two glyphs cuts the number of trips to the crypto box in half, but you lose some flexibility in building a cipher.

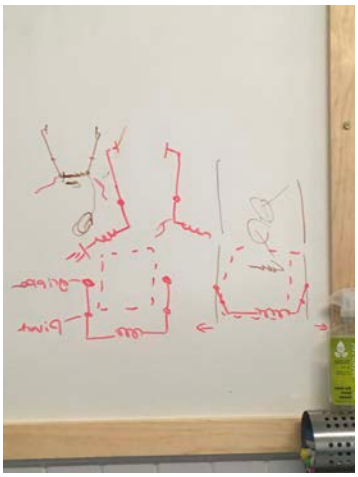
This led to a discussion on rotating or flipping two glyphs once they have been picked up. A mechanism that can pick up two glyphs and can flip doesn't have a flexibility disadvantage. We discussed which *direction* to flip, and decided the robot's front vertical plane is fine for now; the robot's centerline vertical plane was also discussed, but it seemed more complicated.

We discussed various gripping mechanisms for the glyphs, and how to reduce the total number of servos.



This gripper design relies on a spring to bias the grippers closed, and a string concentric with the spring to pull them open.

These were drawings of other spring-biased grippers we were considering (and trying to understand)



Design:	1. *We are still very much at the conceptual phase, no design yet*

Build:	1. *We have not yet developed a prototype.*

Evaluate / Next Steps:	1. *We feel good about the concept, we need to develop this into an actual design or prototype.*

Drive Base *Liam Nelson*

Requirements:	1. *Rapid movement from Glyphs to Cryptoboxes* 2. *Able to climb balancing stone.* 3. *Able to balance on balancing stone.* 4. *Able to navigate tight spots on field.* 5. *Able to push through or past glyphs.* 6. *Able to translate sideways for cryptobox positioning.*
We did not refine our requirements in this meeting.	

Design:	1. *"Tile-Runner"-style side plates* 2. *Mecanum Wheels* 3. *Motors drive wheels via sprocket and chain*
We worked on the CAD model of our drive base.	

[Screenshot]

Build:	1. *We have not yet developed a prototype.*
We will build our drive base when the CAD model is complete.	

Evaluate / Next Steps:	1. *We have already assessed mecanum wheels with a basic drive base to confirm that they can climb the balancing stone.* 2. *We need to complete our CAD model of the drive base and fabricate the side plates.*

09/24/2017 6PM-8PM

Design and Build Meeting

Team Members: Jeremy, Lauren, Taylor, Hannah, Calvin, Kaylin, Liam, Ernest, Bill.
Coaches: Matthews, Nelson, Uecker, Beezie

Agenda

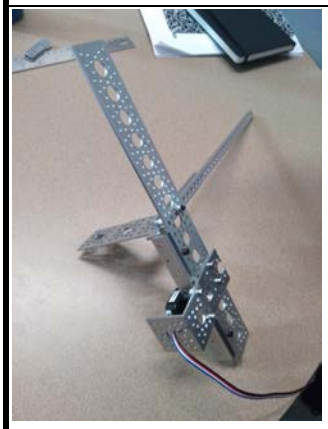
1. Evaluate IMU-based turns for autonomous using prototype Mecanum bot
2. CAD tutorials and help for Hannah, Kaylin
3. Build a CAD model of the jewel mechanism
4. Continue work on CAD model of the drive base
5. Continue Design Requirements Discussion of Glyph Mechanism

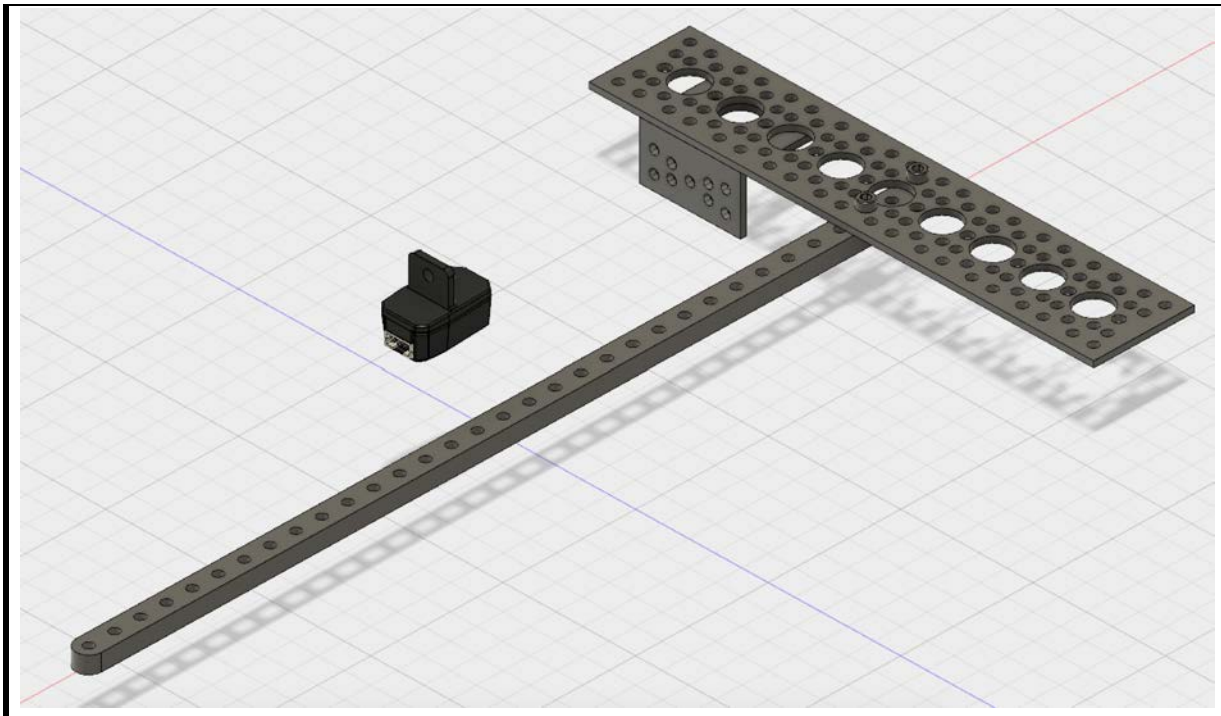
Details

Jewel Mechanism *Kaylin, Taylor, Ernest*

Requirements:	1. Reaches Jewels from balancing stone 2. Detects color as it is deploying 3. Extends and detects in 10 seconds
We did not change any requirements from our last meeting.	

Design:	1. Arm descends from side of robot 2. Color senses jewel color as arm is descending 3. "T" shape in XY and YZ planes
We did not change our design from our last meeting.	

Build:	1. Develop a CAD model of the mechanism
	The image on the left is the prototype we developed at our last meeting.



The image above is the beginning of our CAD design of the jewel mechanism. We are refining the dimensions of the prototype as we work.

Evaluate / Next Steps:	1. Refine materials and dimensions, develop CAD models 2. Bottom of "T" sticking out of robot envelope; needs to be hinged. 3. Test the color sensor in this configuration 4. Assess the height of the bottom "T" section 5. Develop the "descend" mechanism
We are refining the dimensions and evaluating the design as we work on the CAD model.	

Relic Mechanism *Janet, Zaniya, Hannah*

Requirements:	1. Speed – *entire* relic placement needs to be 15 seconds or less to permit alliance partner to also place relic. 2. Extension – 32" to 48" for highest-scoring zone 3. Grip from above – to minimize interference with other relics
We did not work on the relic mechanism at this meeting.	

Design:	1. We are currently experimenting with a scissor-lift
We did not work on the relic mechanism this evening.	

Build:	1. We built a very rough scissor lift. Need to build one that can extend full length.
We did not work on the relic mechanism this evening.	

Evaluate / Next Steps:	1. We need to develop a complete, full-length prototype scissor mechanism and see if it can handle the weight of the relic mechanism. 2. We need to develop the relic gripping mechanism further. 3. We need to come up with at least one additional alternative to the scissor design.

Glyph Mechanism

Requirements:	1. Ability to pick up two glyphs. 2. Ability to pick up glyphs *independently*. 3. Ability to rotate or flip 180 degrees (i.e., swap top glyph with bottom glyph). 4. If we can flip the glyphs, we only need 12” of vertical travel. 5. Speed is essential.
We reviewed our requirements discussion from the prior meeting.	

Design:	1. We are still very much at the conceptual phase, no design yet
We began modeling a mechanism in CAD, but shifted to mocking up a design with parts first.	

In the photo above, the plate would travel along with the chain as it moves.

Build:	1. We have not yet developed a prototype.

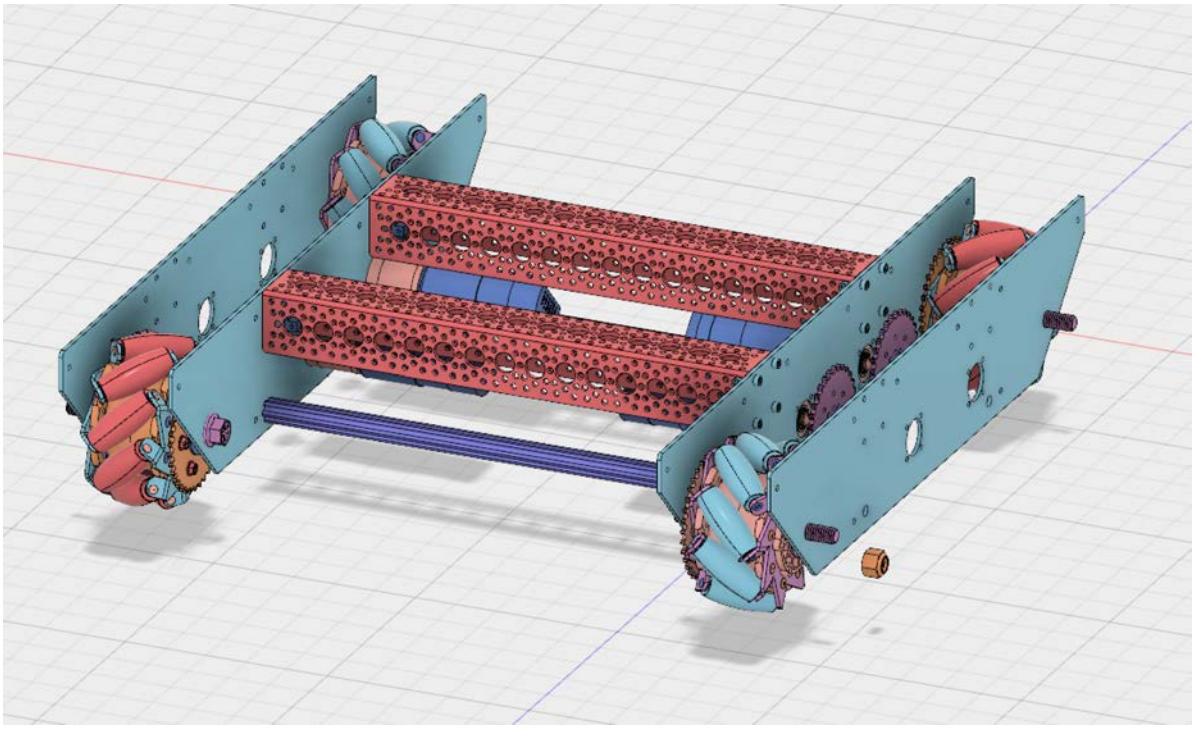
Evaluate / Next Steps:	1. We need to further develop our design.

Drive Base *Liam Nelson*

Requirements:	1. Rapid movement from Glyphs to Cryptoboxes 2. Able to climb balancing stone. 3. Able to balance on balancing stone. 4. Able to navigate tight spots on field. 5. Able to push through or past glyphs. 6. Able to translate sideways for cryptobox positioning.
We did not refine our requirements in this meeting.	

Design:	1. "Tile-Runner"-style side plates 2. Mecanum Wheels 3. Motors drive wheels via sprocket and chain

We worked on the CAD model of our drive base.



The above drive base design is nearly complete. A couple of issues remain to be addressed. First, we initially used 12" Actobotics channel, but that results in a drive base that is about ¼" too wide. We'll have to change the 12" in channel to 10.5" channel, and shorten the Churros as well. We should be ready to machine this at our next practice after preparing a good set of shop drawings.

Build:	1. We have not yet developed a prototype.

We will build our drive base when the CAD model is complete.

Evaluate / Next Steps:	1. We have already assessed mecanum wheels with a basic drive base to confirm that they can climb the balancing stone. 2. We need to complete our CAD model of the drive base and fabricate the side plates.

10/01/2017 6pm-8pm

Design and Build Meeting

Team Members: Lauren, Hannah, Kaylin, Liam, Taylor, Ernest, Jeremy, Calvin
Coaches: Matthews, Nelson, Beezie, Uecker

Agenda

1. Work on engineering notebook
2. Fabricate drive base
3. 3D printing relic "jaws"
4. Continue design of glyph mechanism

Details

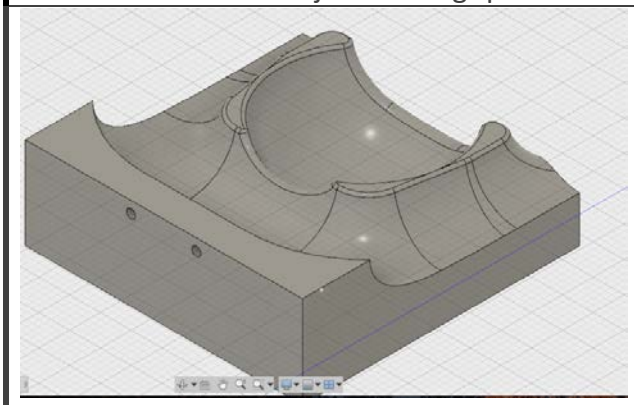
Engineering Notebook

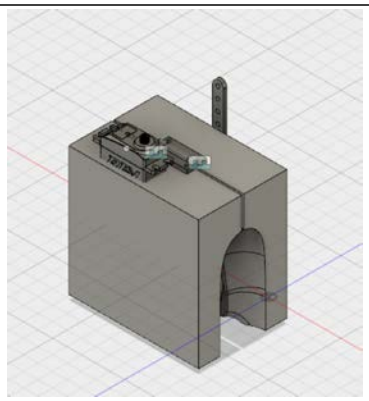
Lauren and Hannah worked on getting caught up on engineering notebook entries.

Relic Mechanism

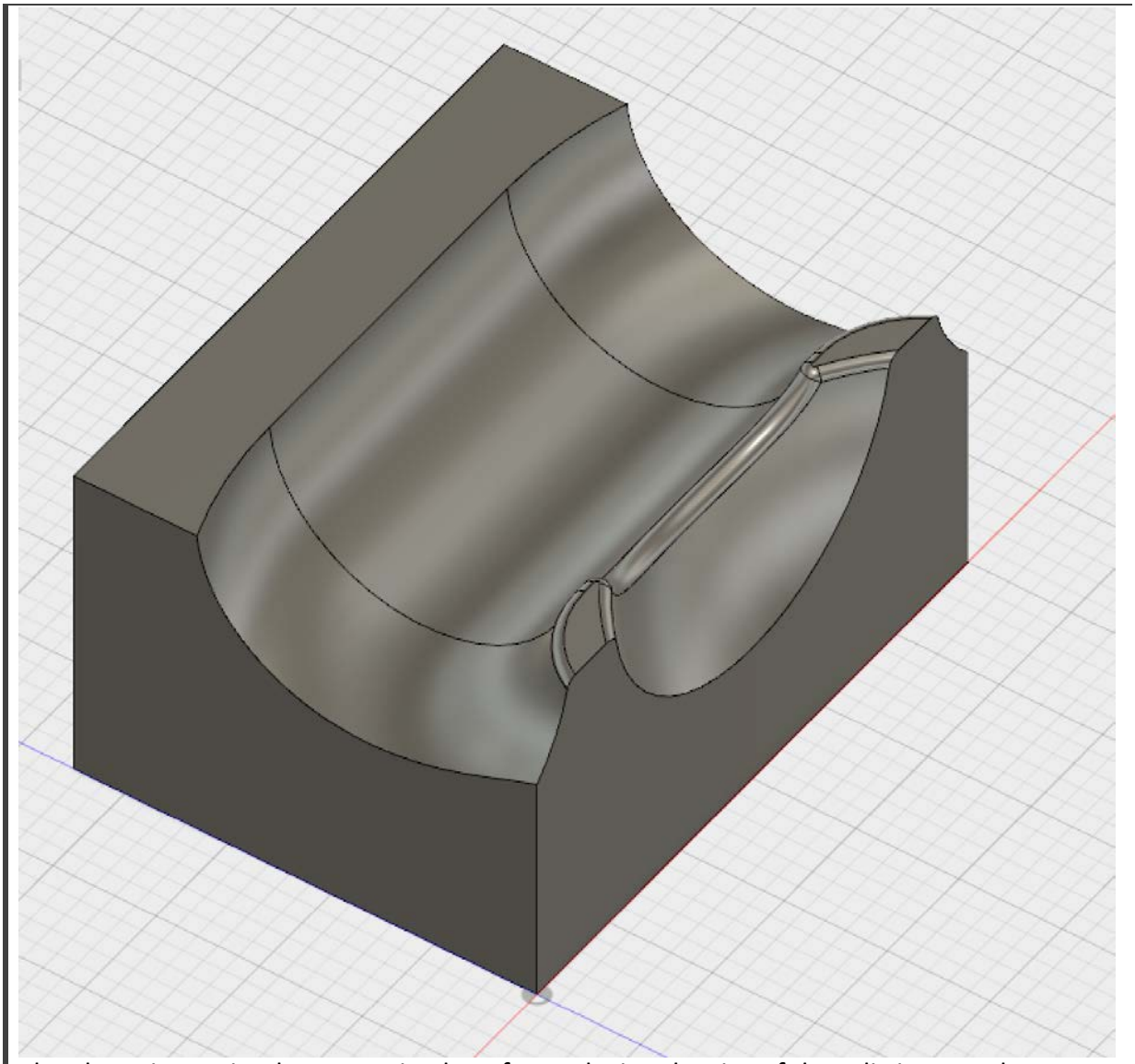
Requirements:	1. Speed – *entire* relic placement needs to be 15 seconds or less to permit alliance partner to also place relic. 2. Extension – 32" to 48" for highest-scoring zone 3. Grip from above – to minimize interference with other relics

Design:	1. We are currently considering a scissor-lift design for the extension mechansim 2. For the relic gripper mechanism, we are considering a 3D-printed jaw which grips from above





The above images were our initial concept for "jaws" to pick up the relic, modeled in Fusion 360 by simply using a 3D model of the relic to "cut" a block. We discussed that this initial idea might be too restrictive, and require too careful driving or registration. We need to pick up the relic quickly. Also, these jaws were too big to print on our 3D Printer



The above image is what we arrived at after reducing the size of the relic jaws so they can be printed on our 3D printer, and after considering what the best and fastest way to pick up the relic would be. We decided that picking up the upper "arms" of the relic would be the fastest and most forgiving of small errors in "registration."

Build:	1. We have built an initial scissor lift prototype and are awaiting parts for a full size one. 2. We began printing the jaws illustrated above. Technical challenges withour 3D printer (SD card reader busted) prevented us from making progress.

Evaluate / Next Steps:	1. We need to develop a complete, full-length prototype scissor mechanism and see if it can handle the weight of the relic mechanism.

	2. We need to brainstorm and evalute other extension mechanisms; we need to come up with at least one additional alternative to the scissor design. 3. We need to complete our 3D print of the relic jaws, figure out how to make them "close," and test them.

Drive Base

Requirements:	1. Rapid movement from Glyphs to Cryptoboxes 2. Able to climb balancing stone. 3. Able to balance on balancing stone. 4. Able to navigate tight spots on field. 5. Able to push through or past glyphs. 6. Able to translate sideways for cryptobox positioning.

Design:	1. "Tile-Runner"-style side plates 2. Mecanum Wheels 3. Motors drive wheels via sprocket and chain

Build:	1. Machine parts for the drive base 2. Begin building 3. Take apart old robot for wheels

We began machining our parts for the drive base. Taylor and Jeremy worked with Mr. Beezie to lay out the holes and get ready to drill them. We got 8 holes laid out and 2 holes drilled.

Evaluate / Next Steps:	1. We need to complete the drive base.

10/08/17 6pm-8pm

Design and Build Meeting

Team Members: Jeremy, Lauren, Hannah, Kaylin, Liam, Bill, Calvin
Coaches: Matthews, Nelson, Uecker

Agenda

1. Machine the side plates for the robot
2. Finalize the design for the glyph mechanism
3. Start building the relic mechanism
4. Gather starting point data for programming

Details

Drive Base *Kaylin Matthews, Hannah Beezie*

Requirements:	1. Rapid movement from Glyphs to Cryptoboxes 2. Able to climb balancing stone. 3. Able to balance on balancing stone. 4. Able to navigate tight spots on field. 5. Able to push through or past glyphs. 6. Able to translate sideways for cryptobox positioning.

Design:	1. "Tile-Runner"-style side plates 2. Mecanum Wheels 3. Motors drive wheels via sprocket and chain

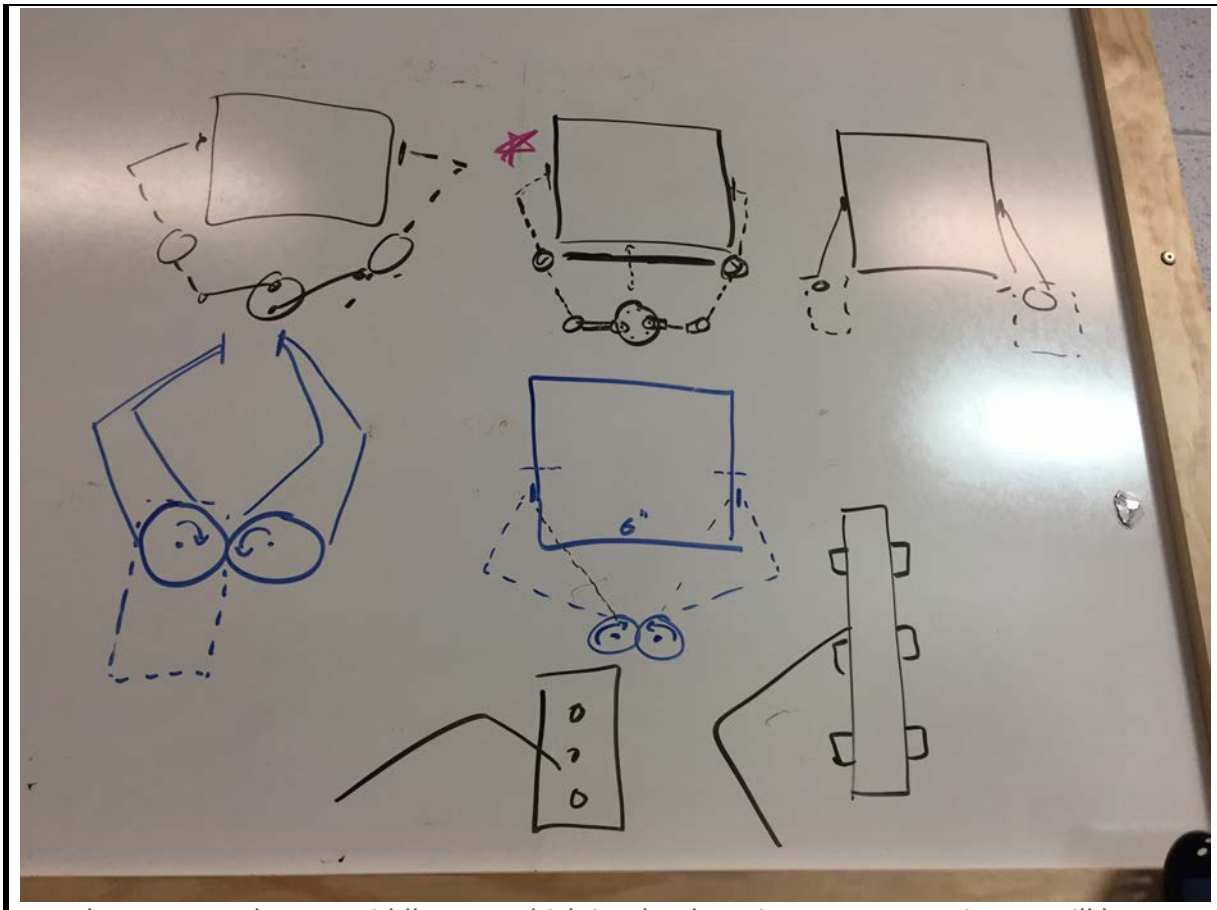
Build: 1. We are working on machining the side plates right now
We made abysmal progress on the side plates this practice, only drilling eight of thirty holes.

Evaluate / Next Steps:	1. We have already assessed mecanum wheels with a basic drive base to confirm that they can climb the balancing stone. 2. We need to complete our CAD model of the drive base and fabricate the side plates.

Glyph Mechanism *Bill, Jeremy, Christina*

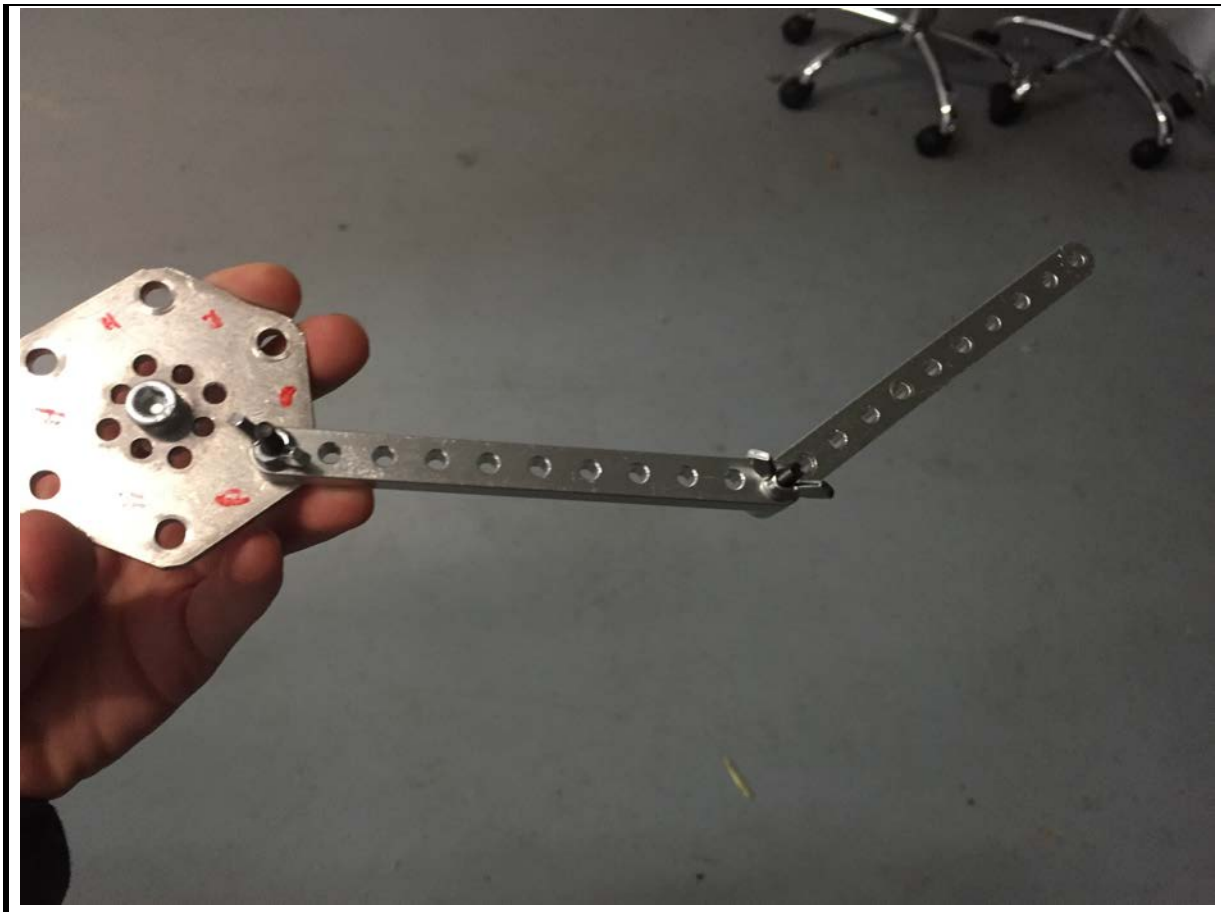
Requirements:	1. Ability to pick up two glyphs. 2. Ability to pick up glyphs *independently*. 3. Ability to rotate or flip 180 degrees (i.e., swap top glyph with bottom glyph). 4. If we can flip the glyphs, we only need 12” of vertical travel. 5. Speed is essential.

Design:	1. We have a mental picture of the design so far
The mechanism will be essentially a gripper on a vertical swivel, on a mount that slides up and down. We decided on stuff in practice, and we started figuring out how exactly we were going to put together our gripping mechanism.	



We chose to use the top middle one, which is why there is a star next to it. We will have a central servo horn on a servo, and on that horn will be pieces of aluminum. Those pieces will connect to the two segments of the gripper claw, and will open and close the gripper.

Build: 1. We are currently working on a prototype
About halfway through the practice, this is what we had:



Evaluate / Next Steps:	1. We need to get a design in CAD so we know *exactly* what to build and how to build it, but other than that we are off to a good start.

10/09/17 6pm-8pm

Office Hours

Team Members: hannah, lauren, kaylin, liam
Coaches: Matthews, Nelson, Uecker

Agenda

1. drill drive base
2. assemble drive base
3.

Details

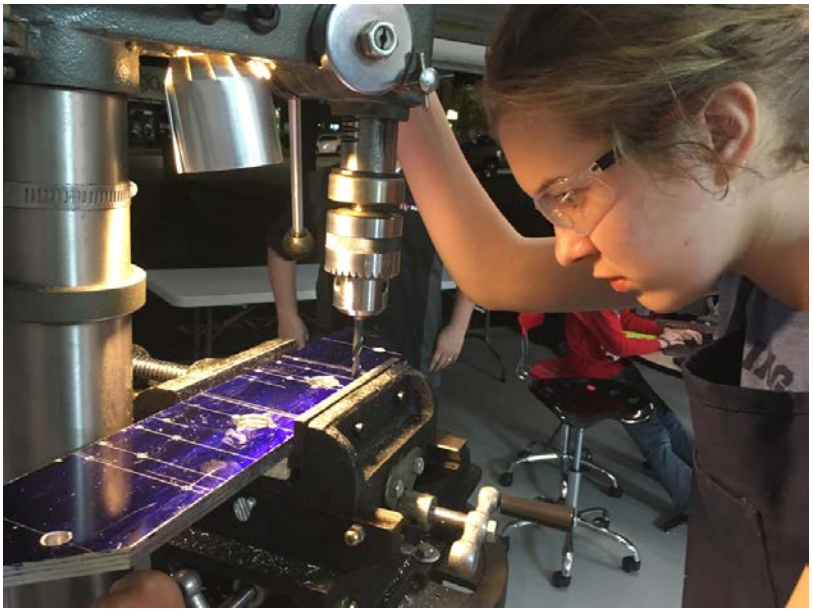
Drive Base

Requirements:	1. Rapid movement from Glyphs to Cryptoboxes 2. Able to climb balancing stone. 3. Able to balance on balancing stone. 4. Able to navigate tight spots on field. 5. Able to push through or past glyphs. 6. Able to translate sideways for cryptobox positioning.

Design:	1. has not change since last meeting

Build:	1. Manufactured and began assembly of the drive base 2. tapped rods that go between side plates

We drilled the holes into the marked and measured plates that will be used to form the sides of the drive base. To make the plates as identical as possible we bolted them together and cut all the plate as once.



Once we drilled the pieces we began to assemble the pieces to match the CAD model.

we also taped the rods that go between the drive base plate as structural support. We had issues with the taps used as they would break frequently.

Evaluate / Next Steps:	1. finish assemble of drive base 2. brainstorm how to build mechanisms around the new drive base style

10/13/17 6pm-8pm

Design and Build Meeting

Team Members: Bill, Kaylin, Cal, Lauren, Ernest, Liam, Christina, Jeremy
Coaches: Matthews, Nelson, Uecker

Agenda

1. Prototype slidey things (lifts for Glyph Mechanism)
2. Build servo blocks for Jewel Mechanism
3. Start assembling side plates.

Details

Drive Base

Requirements:	1. Rapid movement from Glyphs to Cryptoboxes 2. Able to climb balancing stone. 3. Able to balance on balancing stone. 4. Able to navigate tight spots on field. 5. Able to push through or past glyphs. 6. Able to translate sideways for cryptobox positioning.

Design:	1. Design has not changed since last meeting.

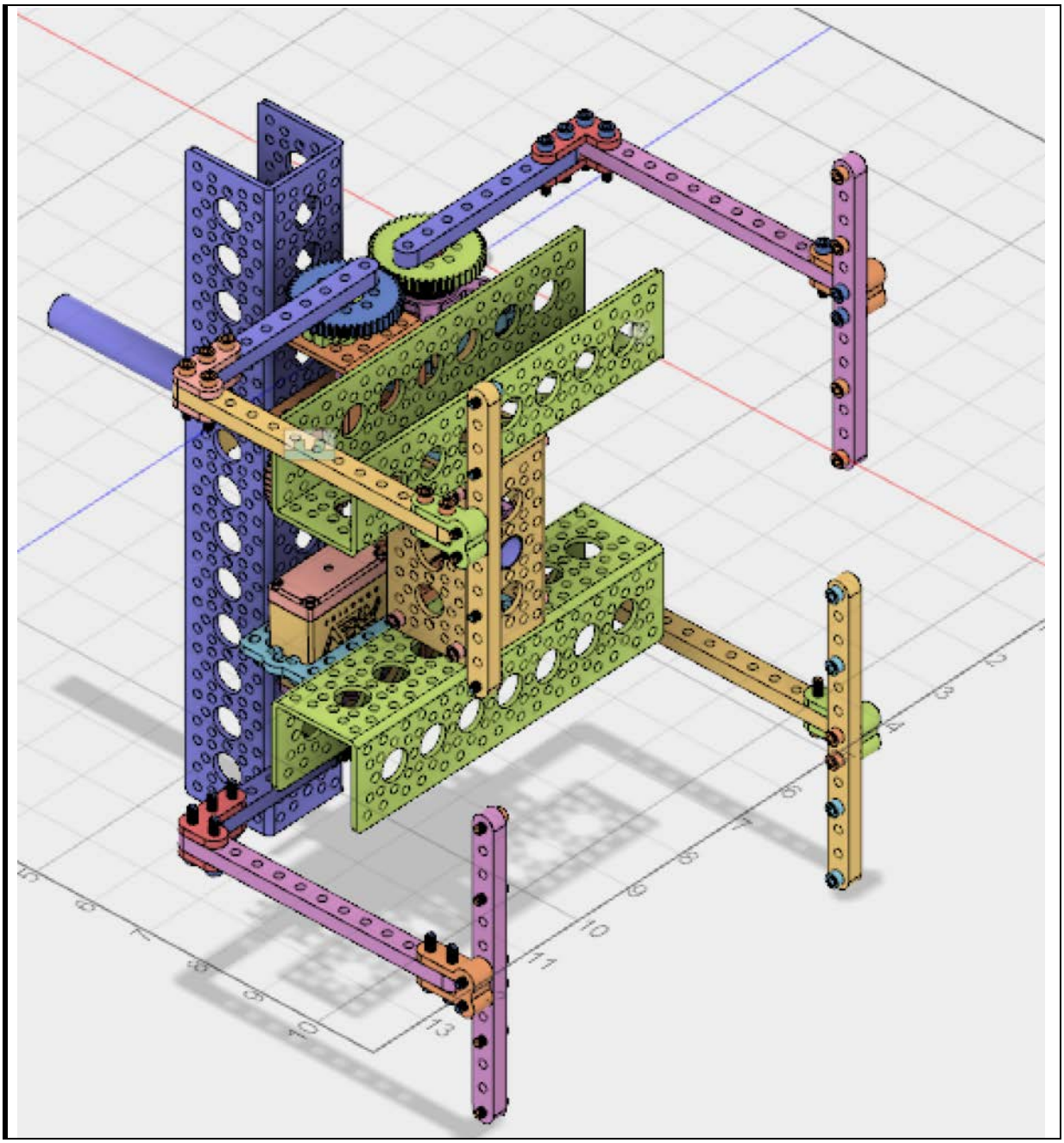
Build:	1. We started to assemble the side plates
We assembled the aluminium side plates, the mecanum wheels, and the nuts.	

Evaluate / Next Steps:	1. 2.

Glyph Mechanism *Liam, Christina*

Requirements:	1. Ability to pick up two glyphs. 2. Ability to pick up glyphs *independently*. 3. Ability to rotate or flip 180 degrees (i.e., swap top glyph with bottom glyph). 4. If we can flip the glyphs, we only need 12” of vertical travel. 5. Speed is essential.

Design:	1.
This is the glyph mecanim without the slidey part.	



Build:	1. Prototype slidey parts.
We already have the gripper part but we need a way to lift the whole mechanism. We prototyped with lifts (aka slidey parts) to lift the mechanism.	

Evaluate / Next Steps:	1.

Jewel Mechanism *Kaylin, Cal*

Requirements:	1. Build Servo Blocks

Design:	1. Design has not changed since last meeting.

Build:	1. Build Servo Block
We constructed servo blocks from REV. The servo blocks help us place the servo and secure it tightly. It is almost like a cage for the servo. The construction did not take long as it was straightforward. We attached the pieces sent to us by REV and then added a servo horn.	

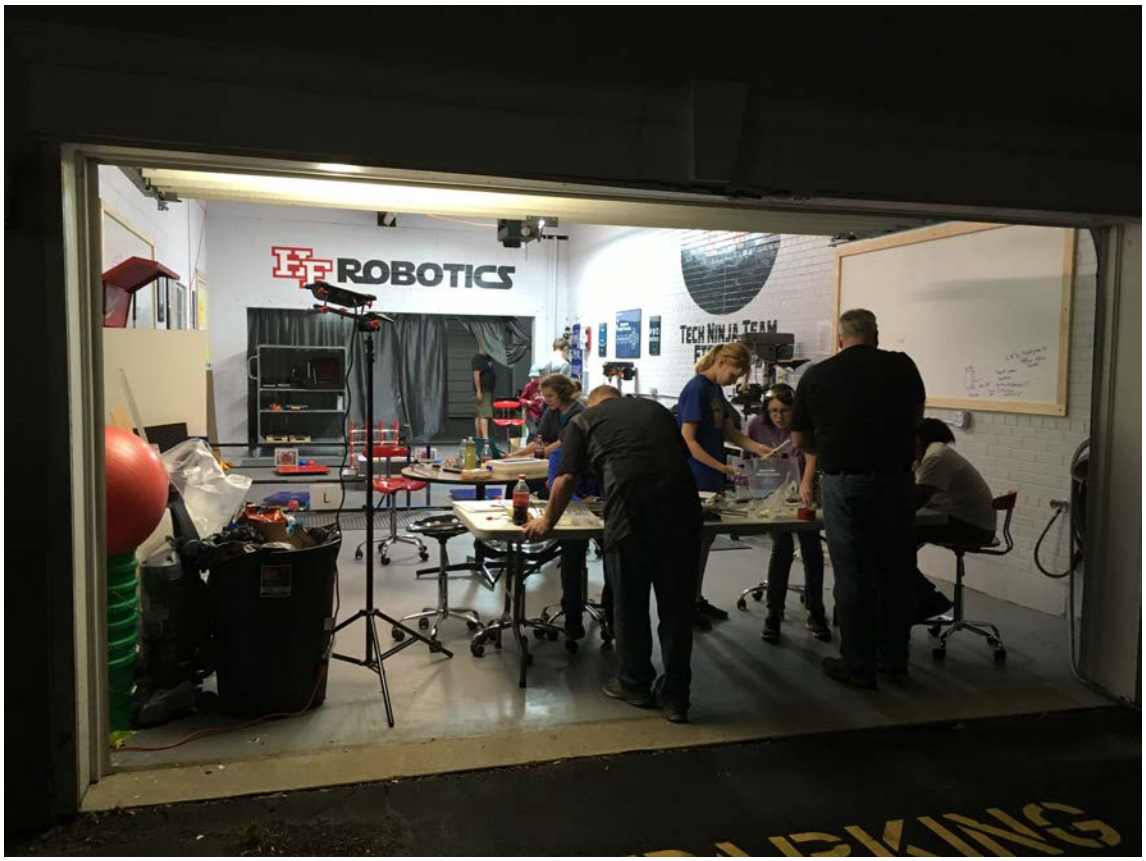
Evaluate / Next Steps:	1. Put servo blocks on Jewel Mechanism. 2. Make sure color sensor housings don't come off on Jewel Mechanism.

10/20/2017 7PM-9PM

Design and Build Meeting

Team Members: Kaylin, Hannah, Lauren, Liam, Ernest, Bill, Calvin, Taylor
Coaches: Coach Nelson, Coach Matthews, Coach Uecker, Coach Beezie

It was really nice weather, so we had the garage door open. People in the village were able to stop in and visit if they wanted to, which some did. We talked to them about what we do, which was a different form of outreach than what we usually do.



Agenda

1. Work on the jewel and relic mechanisms.

Details

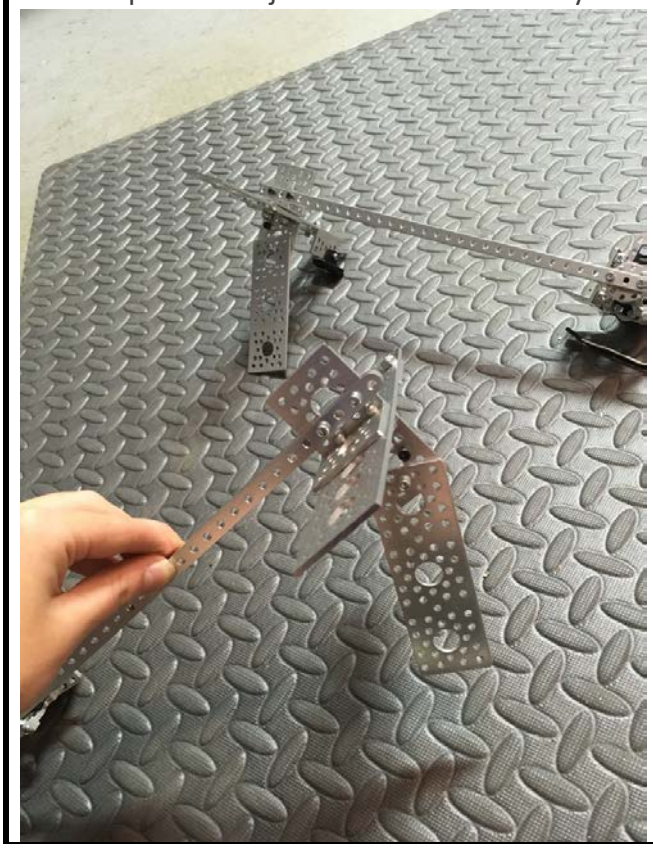
Jewel Mechanism *Kaylin, Taylor, Ernest*

Requirements: 1. ….
We did not change any requirements from our last meeting.

Design: 1. …
We did not change our design from our last meeting.

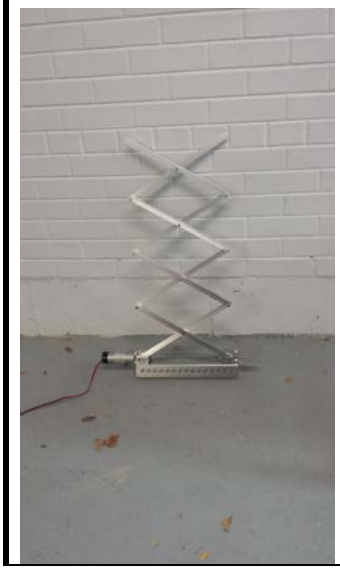
Build:	1. Complete

We completed the jewel mechanisms. They were ready to be put on the robot.



Evaluate / Next Steps:	1. Construct the relic mechanism

Ernest constructed the relic mechanism prototype of some sort of scissors lift mechanism.



Learning Relic Recovery Rules *ALL*

Requirements:	1. Lauren built a Kahoot! With the Relic Recovery Rules and we played it

10/24/2017 6pm-8pm

Office Hours

Team Members: Kaylin
Coaches: Mr. Matthews, Mr. Nelson

Agenda

1. Design spools to run our glyph mechanism.

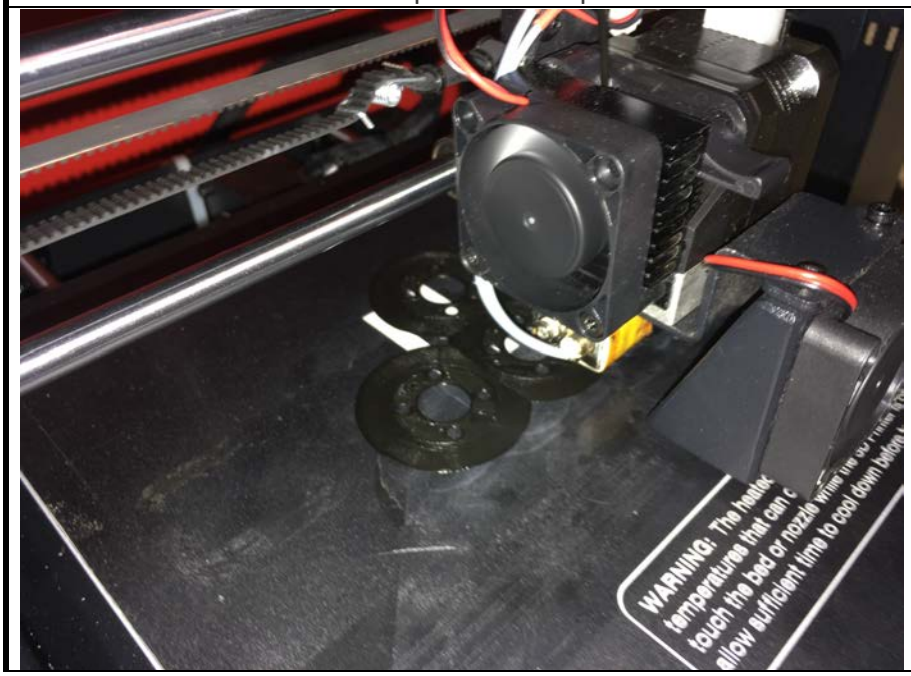
Details

glyph Mechanism *Kaylin*

Requirements:	1. the spool needs to fit between the motor and the sideplate

Design:	1. Cad model
We designed a spool based on data derived from the requirements. This was a first attempt at the spool used to make sure that the glyph mechanism would work. we plan to change it	

Build:	1. We 3D printed the spools



Evaluate / Next Steps:	1. Install spools and test them.

10/27/2017 7pm-9pm

Full Team Meeting

Team Members: Ernest, Taylor, Liam, Hannah, Bill
Coaches: Mr. Matthews, Mr. Beezie, Mr. Nelson

Agenda

1. Work on jewel mechanism and assembling drive base

Details

Jewel Mechanism *Kaylin, Taylor, Ernest*

Requirements:	1. We did not change any requirements from our last meeting.

Design:	1. We did not change our design from our last meeting.

Build:	1. We have a rough idea of what the final mechanism will look like and a prototype to base it off of.

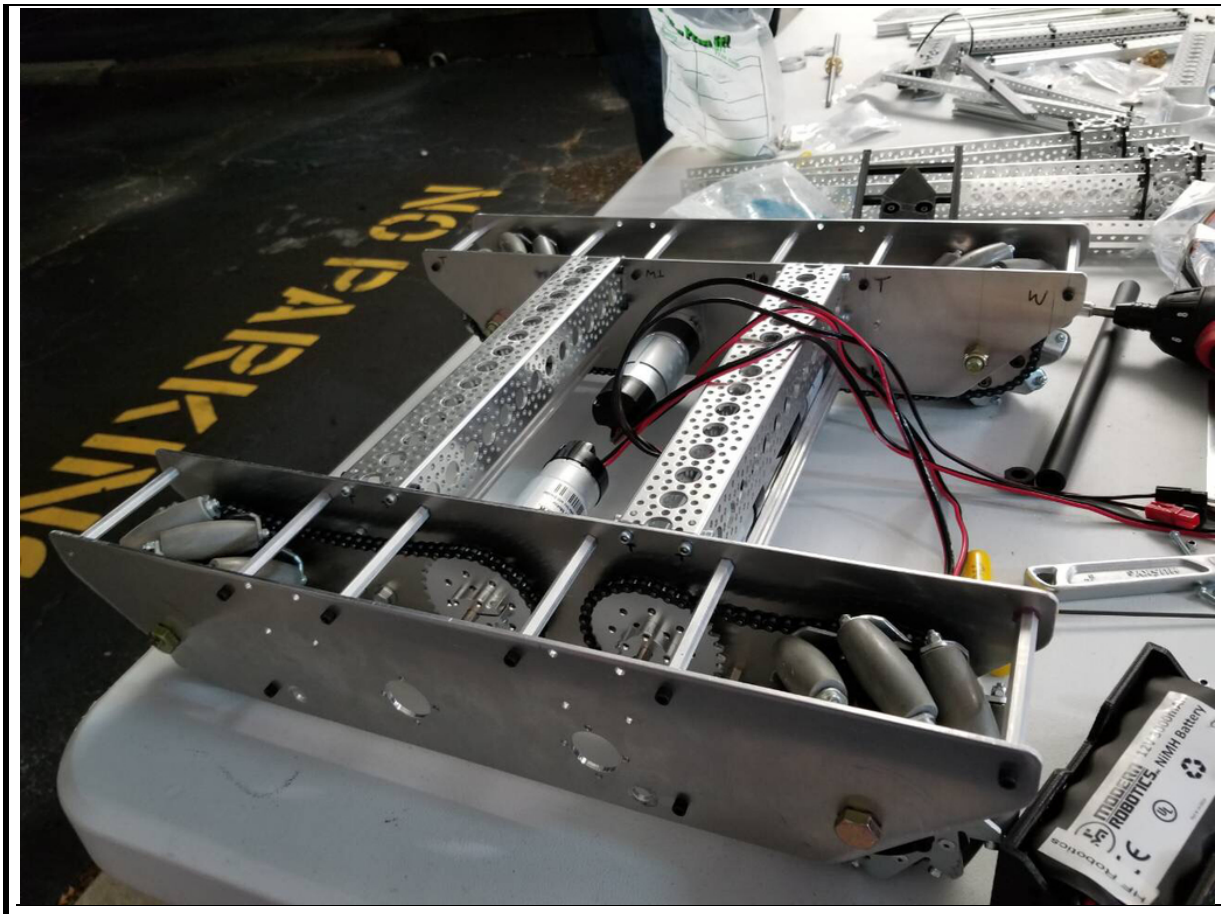
Evaluate / Next Steps:	1. Now all we need to do is to finalize the design and mount it on both sides of the robot.

Drive Base *Hannah, Liam, Bill*

Requirements:	1. We did not change any requirements from our last meeting.

Design:	1. We did not change our design from our last meeting.

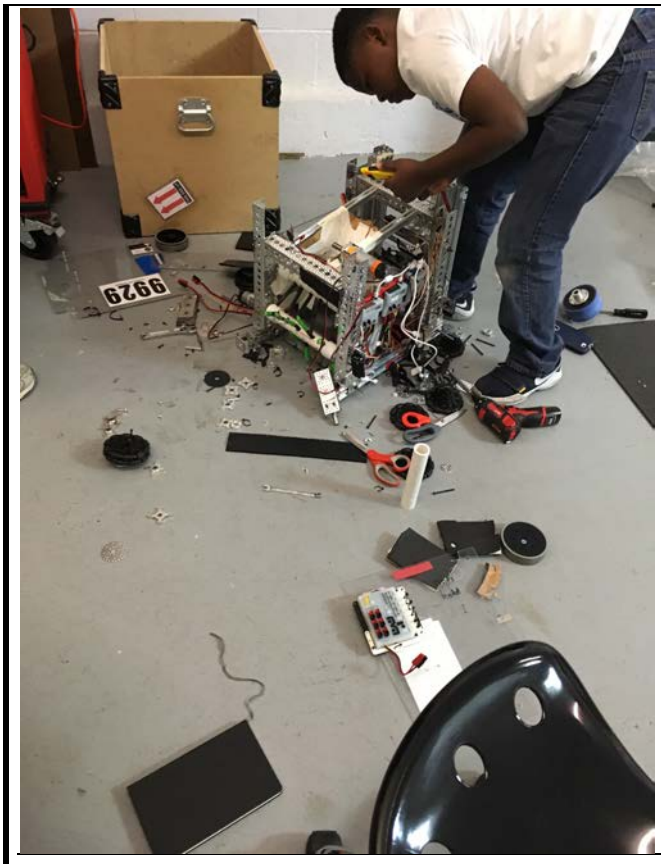
Build:	1. We finished assembly of the drive base.



Evaluate / Next Steps:	1. Mount and wire electronics. Attach mechanisms.

Killing LlamaBot *Liam, Ernest*

Destroying	1. We took apart last year's robot, LlamaBot, for parts. We needed some pillow blocks that we knew were on LlamaBot, but we had to take the wheels off to get to them, so we just completely destroyed LlamaBot in favor of Sensai Bob, this year's robot.


9929

10/29/2017 6PM-8PM

Design and Build Meeting

Team Members: Kaylin, Ernest, Taylor
Coaches: Mr. Matthews, Mr. Nelson

Agenda

1. Complete building jewel mechanism

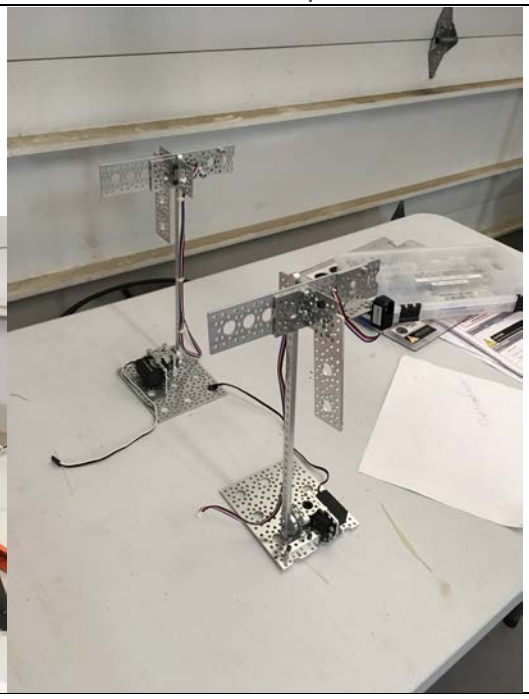
Details

Jewel Mechanism *Kaylin, Taylor, Ernest*

Requirements:	1. Be able to sense one of the ball's color 2. Be able to drop down and come back up 3. Be able to knock a ball off of the platform
The current design meets all our requirements	

Design:	1. We have completed our design

Build:	1. We have built the mechanism itself. Now all we need to do is attach it to the robot in a way that allows us to fulfill its requirements.



Evaluate / Next Steps:	1. We need to finish up attaching this mechanism to the robot on both sides, and then the programming team can take it from there.

11/10/2017 6PM-8PM

Design and Build Meeting - League Meet (Following Day)

Team Members: Lauren, Calvin, Liam, Kaylin, Ernest, Taylor, Bill, Hannah
Coaches: Mr. Uecker, Mr. Nelson, Mr. Beezie, Mr. Matthews

Agenda

1. To set up for the league meet

Details

Requirements:	1. Move the field from workshop to theater 2. Make alliance flags 3. Put down boxes for the driving teams to stand in 4. Set up tables and power strips in pit

Evaluate/Next Steps

What we did right:	1. We set up the field correctly 2. We set up the pit correctly 3. We taped out the boxes for the driving teams correctly
What we did wrong:	1. We made flags of different lengths 2. The tape was not measured correctly
What we should do better next time?	1. We need to improve our gracious professionalism 2. Need to improve our flag making skills

11/12/2017 6PM-8PM

Competition Recap/Discussion

Team Members: Lauren, Ernest, Hannah, Taylor, Calvin
Coaches: Mr. Matthews, Mr. Nelson, Mr. Beezie, Mr. Uecker

Agenda

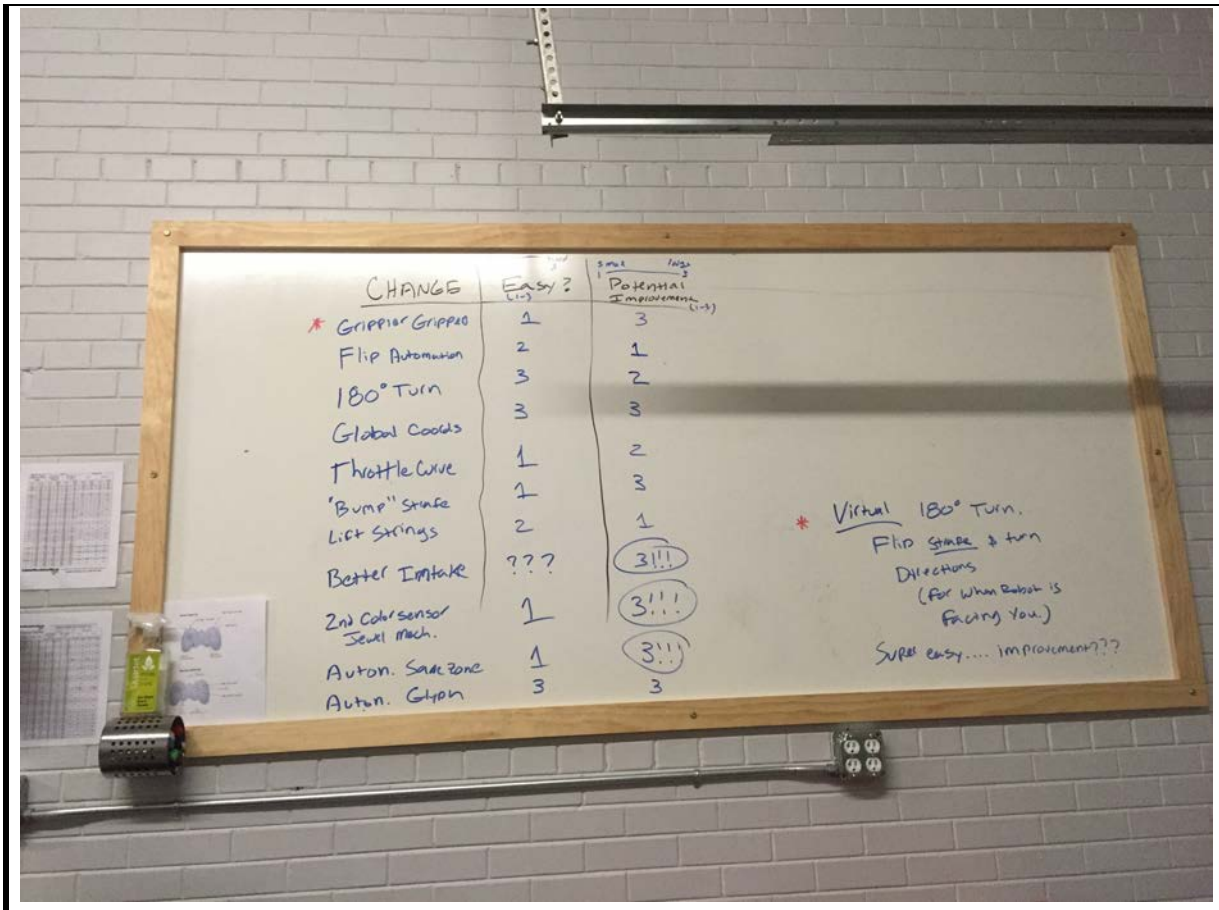
1. Post league meet de-brief

Details

Post League Meet *Everyone*

Requirements: We discussed current requirements and revisions.

- We created a list of possible changes to the current robot design. Then we rated them in order of importance and usefulness.
- They were given numerical scores for usefulness and easiness (to complete)
- Additional scoring abilities in Autonomous and a better “intake” or “pickup system” for the glyph mech were deemed most important.



Design:	We evaluated the current design on the robot.
	• Ideas were tossed around for a better glyph mech. No prototyping began, but we decided to test different materials on the "claw" to hopefully increase gription.

Build:	1. We did not build anything at this meeting.

Evaluate / Next Steps:	1. Work on identified items (auto safe zone, auto glyph, grippier grippers)

11/17/2017 7PM-9PM

Driving Practice

Team Members: Bill, Calvin, Ernest, Liam, Lauren, Hannah
Coaches: Mr. Beezie, Mr. Matthews, Mr. Uecker

Agenda

1. Drive team practice - robot, mechanism, strategy and tactics evaluation
2. Prototype new gripper end effectors

Details

Driving Practice *Hannah, Lauren, Ernest, Liam, Bill, Calvin*

Requirements:	1. We did not change any requirements from our last meeting.

Design:	1. We did not change our strategy from our last meeting.

Evaluate / Next Steps:	1. We learned that you ABSOLUTELY CANNOT drive onto the balancing stone while the glyph mechanism is down!!!!!! 2. 3D parts break easily when you drive recklessly. 3. Ernest was able to drive onto the balancing stone in 3 seconds, Liam in 4. 4. Sandpaper is an effective way to increase friction when grabbing glyphs. You can pick up at some angles. 5. Practiced placing glyphs in pattern formation by hand, to make sure we know the patterns.

Glyph Mechanism

Requirements:	1. Requirements have not changed since last meeting

Design:	1. Design has not changed since last meeting.

Build:	1. Fix broken grippers!
Built new lexan grippers. 3D printed new connectors for glyph mech.	

Evaluate / Next Steps:	1. We need to further develop our design.

11/19/2017 6PM-8PM

Driving Practice

Team Members: Calvin, Ernest, Lauren, Hannah, Kaylin
Coaches: Mr. Matthews, Mr. Uecker

Agenda

1. Fix Glyph Mechanism
2. Driver Practice

Details

Driving Practice *Hannah, Ernest, Calvin, Kaylin*

Evaluate / Next Steps:	1. We learned that screws can be problematic and fall out if not put in correctly 2. We learned that if our battery power is under 12 (when not under load) then we are not able to drive 3. We learned that it's hard to complete adjacent columns in the crypto box with the current geometry of the robot and glyph mechanism

Glyph Mechanism

Requirements:	1. It should be put back together completely for driver practice

Design:	1. Reliability issues need addressed - not discussed in this practice, but see evaluation
Nothing changed from last practice	

Build:	1. Replaced servo with stripped gears 2. 3D-printed new joints for gripper arms 3. Re-strung the lift (multiple times) 4. Found parts for the broken gripper to be able to put it back together

Evaluate / Next Steps:	1. Improved gripper "plates" are effective 2. Need more experimentation - but it appears it will be difficult to complete adjacent columns with the "depth" of the current gripper setup. 3. Strings continue to come off pulleys - would tensioners help? Do we need to evaluate chains or belts?

4. Others observed what Hannah did - that the button for rotate/stop rotate is easy to press instead of toggling a gripper -- we should experiment with moving it to bumpers
5. We stripped a gearbox on a REV servo on one set of grippers
    a. Is too much “close” position or too open hard on the servo?
    b. Serviceability is not as good as it could be (many spacers/tricky screws in the servo block) - if we have spares they should be ready to go with gear and spacers mounted and drop into the existing servo block.

11/20/2017 6PM-8PM

Glyph Mechanism Repair

Team Members: Lauren, Kaylin
Coaches: Mr. Matthews

Agenda

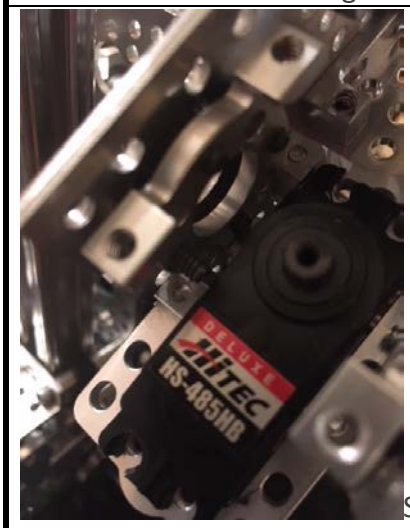
1. Fix Glyph Mechanism

Details

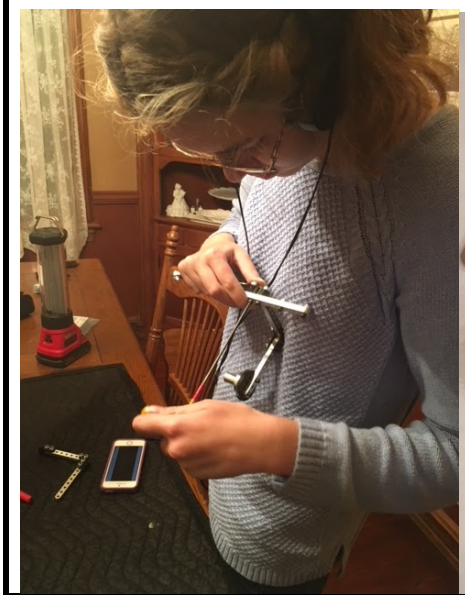
Glyph Mechanism

Requirements:	1. It should be put back together completely for driver practice

Design:	1. N/A
Nothing changed from last practice	

Build:	1. Replaced female connector on spare REV servo to fix nicked white wire and mounted in the glyph mechanism 2. Re-assembled glyph arms with newly-printed joints 3. Re-tensioned the lift 4. Tightened screws on v-wheel standoffs
 Swapped out this servo for the repaired REV servo. Take note that some screws in the servo block were too long - replaced those as well	

Now using 3mm socket head cap screws to attach servo hub.



Evaluate / Next Steps:	1. Re-program or remove limits on servos and handle directly in code 2. Clean up some of the wiring 3. Drive, drive drive!

11/24/17 6PM-8PM

Drive and Build Meeting

Team Members: Liam, Taylor, Hannah, Lauren, Kaylin, Calvin, Ernest, Bill
Coaches: Nelson, Beezie, Uecker, Matthews

Agenda

1. Do drivers' practice to find and diagnose problems with the current robot.

Details

Driver Practice *Liam, Taylor, Ernest, Bill, Hannah, Lauren, Kaylin, Calvin*

What we did:	1. We drove the robot around a few times, and got a high score of 30 with one column and an extra glyph. We decided to change out the driver controls to something more like a video game, rather than having one stick for forward and backward, one for strafe, and the triggers to turn. The left stick was now the move button, and the right was the turn button. The operator controls remained the same. We brainstormed changes to the robot as well.

11/26/2017 6PM-8PM

Glyph Mechanism Repair / Programming

Team Members: Lauren, Kaylin, Liam, Ernest, Christina, Hannah
Coaches: Mr. Matthews, Mr. Nelson, Mr. Beezie

Agenda

1. Driving Practice
2. Programming autonomous driving distances

Details

Driving Practice

Evaluate / Next Steps:	1. Bottom has to be open to be able to stack 2. Watch pulley before a match starts- the string should be taught for good results during the match 3. Need to set up faster for practice 4. We need to be less jerky on the sticks 5. Don't hit the edge of the sticks when driving 6. Hit glyphs at 90 degree angle 7. Flip the glyph mechanism right after you obtain first glyph 8. Keep battery above 12 9. Don't bang the robot into anything 10. Jewel mechanism fell over and got in the way 11. Make sure to communicate with teammate(s) 12. Slow movements can save time by increasing accuracy 13. Grab already stacked glyphs if you can 14. Be smooth in movements - don't start and stop frequently 15. Think carefully about which glyphs to go for 16. Use tactics that work, and abandon tactics that don't 17. Know which batteries are charged, and which are not 18. The glyph mechanism is slow at picking glyphs up 19. It is difficult to pick up glyphs by running into a stack of them that are close together

Programming

Requirements:	1. Drive an accurate distance in autonomous

Design:	1. Add math into code for measuring encoder counts when traveling on X and Y axis.

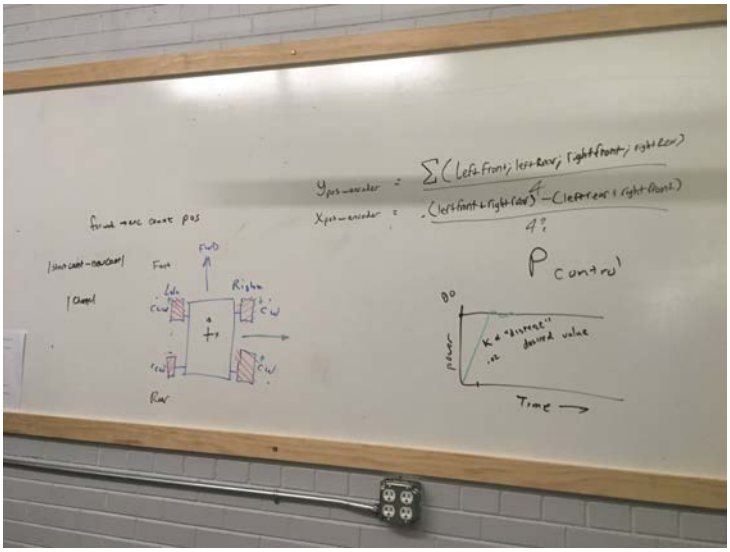
We added the math to the code to determine the distance traveled by encoders. We used average to determine total encoder counts when traveling across the Y axis. we then used a slightly altered equation to solve for the X-axis.

Y axis equation:

$$\frac{left\ Front\ +\ left\ Rear\ +\ right\ Front\ +\ right\ Rear}{4}$$

X axis equation:

$$\frac{(left\ Front\ +\ right\ Rear)\ -\ (right\ Front\ +\ left\ Rear)}{4}$$



The first equation is a basic average because all the motors, when viewed by the code, are traveling in the positive direction. We can simply add all the values to determine the relative value of all the motors. The X axis equation had to be modified due to the direction of the motor. When traveling across the X axis two motors travel in the positive direction (the left front and right rear motors in our case) and two travel in the negative direction (right front and left rear). The motors that are traveling in the negative direction will have a negative encoder count. This means we need to find their absolute value, which can be found by multiplying by negative one. After that the equation functions like a normal average, finding our relative encoder count when traveling on the X-axis.

Build:	1. Wrote the math into code for our autonomous driving.

Evaluate / Next Steps:	1. Test that the code is causing the robot to drive the correct distance.

11/27/2017 4pm-5pm

Jewel Mechanism Repair

Team Members: Kaylin
Coaches: Mr. Matthews

Agenda

1. Determine why the jewel mechanism is not reliably detecting the color of the jewels

Details

Jewel Mechanism Repair

Requirements:	1. Nothing changed from last practice

Design:	1. Nothing changed from last practice

Build:	1. Experimented with color sensor and jewels.
We looked at the jewel mechanism and found that the color sensors were plugged into the wrong ports thus making everything backwards (the blue alliance program ran on the red alliance mechanism and the red alliance program ran on the blue alliance mechanism). After we changed that we ran experiments on the mechanism. We ran autonomous in all possible scenarios and they all worked. We then tested the color sensor's ability to detect through the "holes" in the jewel. The color sensor read correct whether or not it was sensing a "hole" or not.	

Evaluate / Next Steps:	1. Label wires (port numbers and use) 2. Figure out why servos aren't holding position 3. Add minimum light and minimum difference between red and blue

11/28/2017 7PM-8:30PM

Driving Practice

Team Members: Hannah, Kaylin, Taylor
Coaches: Mr. Matthews, Mr. Beezie

Agenda

1. Driving Practice

Details

Driving Practice

Requirements:	1. N/A
Nothing changed from last practice	

Design:	1. N/A
Nothing changed from last practice	

Build:	1. Changed throttle curve 2. Fix gripper beam brackets.
Instead of taking the power value from the throttle curve and multiplying it by 0.5 we took the input position and divided that in half. At Hannah's request the rotate button on the operator's gamepad was changed to use the right bumper. We also had to replace the gripper beam brackets multiple times - as they would break when pushing blocks into the cryptobox. Coach Matthews suggests making the pieces thicker to improve stability.	

Evaluate / Next Steps:	1. Stronger gripper beam brackets a. Use 100% infill? b. Use ABS? c. Add material, make thicker 2. Need to purchase longer button head screws 3. We were able to fill a crypto box by pushing blocks with the robot to get them into a stable position but it took 4 minutes.

11/30/2017 7PM-8:00PM

Driving Practice

Team Members: Kaylin
Coaches: Mr. Matthews

Agenda

1. Driving Practice

Details

Driving Practice

Requirements:	1. N/A
Nothing changed from last practice.	

Design:	1. N/A
Nothing changed from last practice.	

Build:	1. Labeled the jewel color sensor wires
From the suggestion from 11/27, Mr. Matthews made labels with the name and port numbers for the jewel sensor wires, and Kaylin and Mr. Matthews applied them to the robot.	

Evaluate / Next Steps:	1. Kaylin spent the time getting familiar with the driver controls, becoming comfortable with: a. Climbing onto the balancing stone b. Breaking apart masses of glyphs c. Driving quickly, precisely and lining up to pick up glyphs d. Arcing turns e. More aggressive braking by a momentary opposite change of direction 2. Kaylin at time noticed that the left rear wheel would become stuck. This would always be preceded by a clicking noise. The stuck wheel could be cleared by a quick forward/backward movement of the robot. Further examination showed that the chain is loose enough that it can start to slide off one of the sprockets and become wedged. 3. Next step - fix the chain tension - we've observed it to be a problem when driving - it would cause failure of an autonomous operation should it happen then. Possible fixes - replace half with full link, add idler/tensioner, see what conditions cause it to happen, slow speed with autonomous might not cause it to happen - if so, then just need to check all wheels before the match begins.

12/01/2017 7:00PM-9:00PM

Full Team Meeting

Team Members: Hannah, Lauren, Kaylin, Ernest, Bill, Cal, Jeremy
Coaches: Mr. Nelson, Mr. Matthews, Mr. Uecker, Mr. Beezie

Agenda

1. Driving practice – continue to test/change/fix grippers

Details

Driving Practice

Requirements:	1. Score more than one column of glyphs every time.

Build:	1. Labeled the jewel color sensor wires 2. Replaced grippers broken during driving practice
We broke a few grippers, but we had extras, so we replaced them relatively quickly. 	

Evaluate / Next Steps:	1. We need more driver practice to score more points 2. Continue to eat food from Burito Express down the street – they comped us a bunch of food!

12/03/2017 7PM-8:00PM

Normal Meeting

Team Members: Kaylin, Liam, Lauren, Hannah, Taylor, Ernest, Bill
Coaches: Mr. Matthews, Mr. Beezie

Agenda

1. Programming Team - add to autonomous for 2nd league meet.
2. Driving Practice

Details

Programming *Calvin, Lauren*

Requirements:	1. selects correct jewel 2. drives off of balancing stone 3. parks in safe zone 4. place cube in correct column
Add functionality to autonomous mode that is reliable enough to run at our 2nd league meet.	

Build:	1. Measure the amount of error between section of cryptobox to find values for auto drive 2. Tested values within code
During today's meeting we worked on, and got to the testing stage, the left (closest to relic zone) autonomous. The tasks we have completed in this auto option is: score a jewel, drive towards the crypto box closest from the relic zone, and park in the safety zone. Note that we wish to score a glyph in the future with this code. We also started work on the right (farthest from the relic zone) autonomous. This program is similar to the other code but to get off the balancing stone we have to first drive forward then drive inwards towards the center of the field. The rest nearly identical to the left stone autonomous. We had to invert the encoder as they count in the direction opposite of what is expected.	

Evaluate / Next Steps:	1. Finish an opmode that works from the stone furthest away from the relic recovery zone. 2. Add scoring a glyph to the opmode. 3. Add using Vuforia for scoring a crypto key (after league meet).

Relic Mechanism *Ernest, Bill*

Build	● Ernest and Bill put together part of a scissor lift. ● Both sides were constructed and expand properly
The mechanism needs to be continued.	

Driving Practice *Kaylin, Taylor, Hannah*

Drive	● We practiced placing glyphs in the cryptobox.
Driving practice is always in need of improvement.	

12/08/2017 7PM-9:00PM

Driving Practice

Team Members: Kaylin, Jeremy, Bill,
Coaches: Mr. Matthews

Agenda

1. Driving practice before league meet

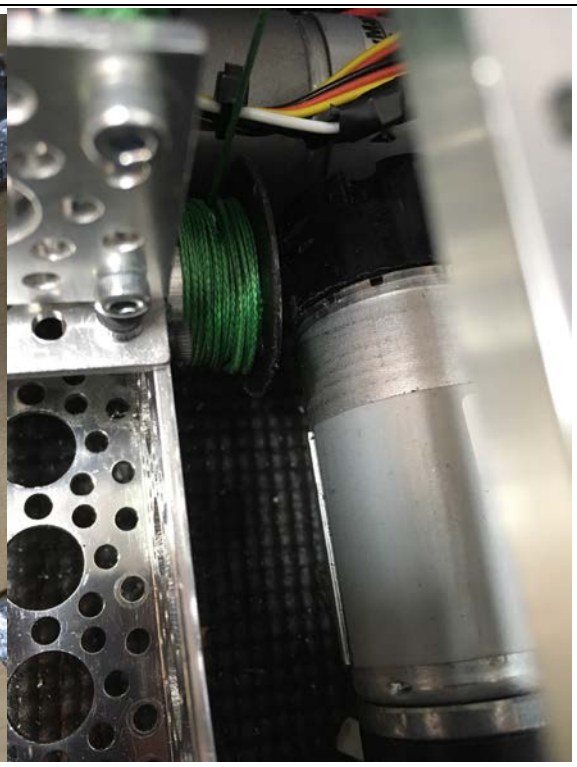
Details

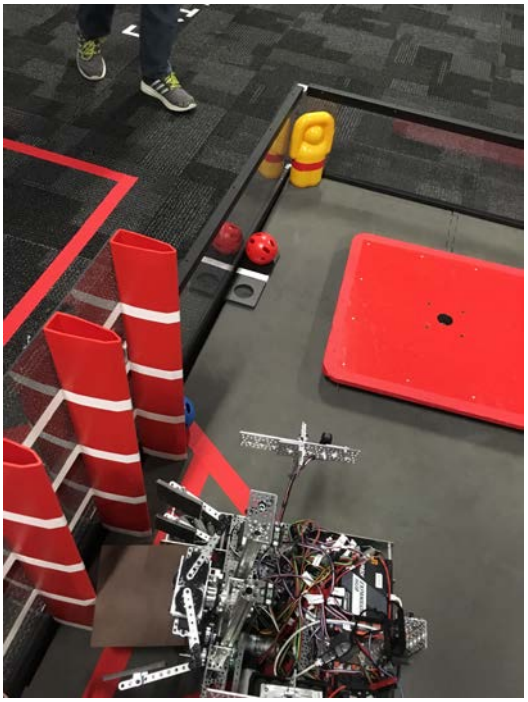
Driving Practice

Requirements:	1. Score at least an entire column of glyphs in 90 seconds, every time we ran the game.

On this day, we were able to get a lot of driver practice in and were able to test the new autonomous opmode. Almost everyone was able to coach, operate, or drive the robot. some of us timed each other for stacking the glyphs to be able to determine who was doing the best.

Sadly, during the practice our spool was damaged and was not able to lift our glyph mechanism. some of us had to stay late so we could fix it. We had to take apart some gears near the bottom to find the problem. We saw that the spool would get its string out when we would lower the glyph mechanism on a glyph. some hard work and a few sodas later we were able to fix it and we knew something new about our mechanism.





Evaluate / Next Steps:	1. We need a more efficient way to score glyphs; our current mechanism just isn't efficient enough. Maybe some sort of conveyor belt design...

12/15/2017 7:00PM-9:00PM

Driving Practice

Team Members: Lauren, Liam
Coaches: Mr. Matthews,

Agenda

1. Improve autonomous opmodes based on performance at league meet

Details

Programing *Lauren, Liam*

Requirements:	1. selects correct jewel 2. drives off of balancing stone 3. parks in safe zone 4. place cube in correct column
Use observations and logs from the robot controller from the league meet to make it better for the next competition.	

Build:	1. Changed the autonomous opmode to pick up glyphs first. 2. Added driving backwards 2 inches after placing glyph 3. Tested values within code
Today we moved the timing of the gripper mechanism in the autonomous state machines. We placed it to occur before the jewel mechanism functions compared to after the jewel mechanism runs - with the idea that the glyph will be better gripped. We also introduced Liam into the programing team. Lauren fixed a bug within the altered code where the wrong state was placed and would have caused the code to skip over running part of the jewel mechanism. Lauren added a 2” backwards drive after placing the glyph to all state machines. Liam and Lauren also averaged out the autonomous times for our 2nd league meet to determine how long we have to use Vuforia vision software. We determined it was about 11 seconds to run our current autonomous opmode completely. Our last run of the league meet had unexplained behavior during autonomous, the robot drove straight across the field into the opposite wall (which ended up ok, we ended up pushing our alliance partner into the safe zone). We noticed that there was a Lynx Nack exception during autonomous and our PID was never run, instead our state timed out (maybe the timeout is too long?). We researched the cases the Lynx nack error that occurred and determined that it was because we had low battery voltage.	

Evaluate / Next Steps:	1. Adjust timeouts for states to be closer to their average runtime 2. Start working on Vuforia and Vumarks for the crypto key 3. Ask the team to start using a process that tracks battery voltage better

12/17/2017 6PM-8:00PM

Driving Practice

Team Members: Kaylin, Liam, Bill, Hannah
Coaches: Mr. Beezie, Mr. Matthews, Mr. Nelson

Agenda

1. Relic Mechanism Build (grabber, linear slide)
2. Install new pulleys in glyph mechanism lift

Details

Relic Mechanism *Kaylin*

Requirements:	1. Fits within robot sizing cube 2. Extends four feet 3. Extends in five seconds
Nothing changed from last practice.	

Design:	1. Use a 3 stage linear lift
We wanted to explore a linear lift. We were familiar with the REV linear lift but we had not used the side plates with the system and we wanted to try a cascade lift instead of a continuous lift.	

Build:	1. Assemble an example lift from last season's parts
We were looking at a scissors lift but we wanted more options for a steady mount spot for the relic mechanism. We had used a linear lift in last season's robot, but the parts are not in the greatest shape. We added the side plates and made the lift into a cascade, and tested it.	

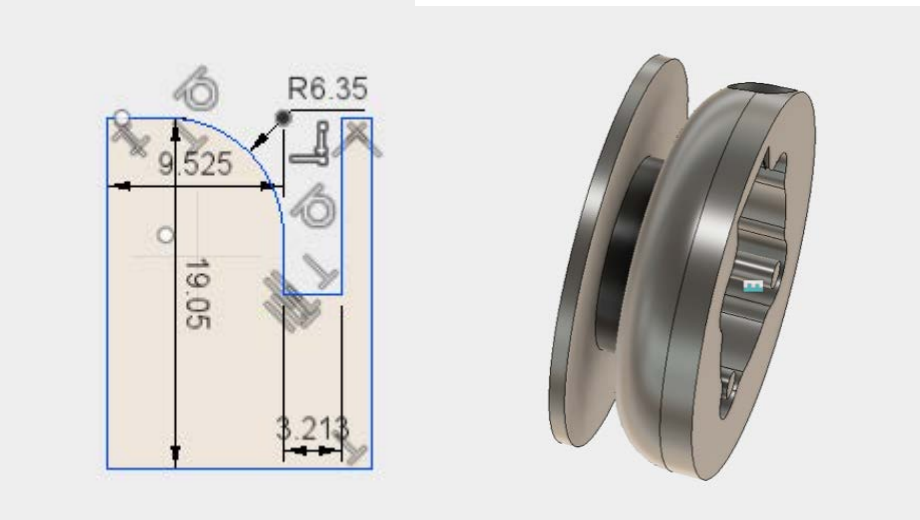

ROBOTICS

Evaluate / Next Steps:	1. Use smaller lines on the pulleys - with shrouds (like last season) 2. The mechanism moves quickly and doesn't take much force to move but we need newer parts.

Glyph Mechanism *Hannah*

Requirements:	1.
Nothing changed from last practice.	

Design:	1. Finish up on the specs of the new pulley



This pulley, when completed, will house a ¼" clamping hub inside the hole on the right side of the picture because of space constraints. We also made it so that the clamp would be nice and tight inside the pulley. Finally, we put a hole in the top side of the pulley where we could screw in the clamping screw. When measuring the space in between the motors and where we wanted to install this, we discovered that one of the motors was at a really odd angle, so we had to resize everything. The large curved part will help route the string into the inside part of said pulley. We did not have time for printing. Although it doesn't show it in the drawing, we have a hole in the thin side so we can attach the string.

Build:	1. We have yet to print one of these pulleys.

Evaluate / Next Steps:	1. We need to get these things made before our next league meet, which shouldn't be too hard.

12/21/2017 12:00pm-2:00pm

Driving Practice

Team Members: Lauren, Calvin
Coaches: Mr. Matthews

Agenda

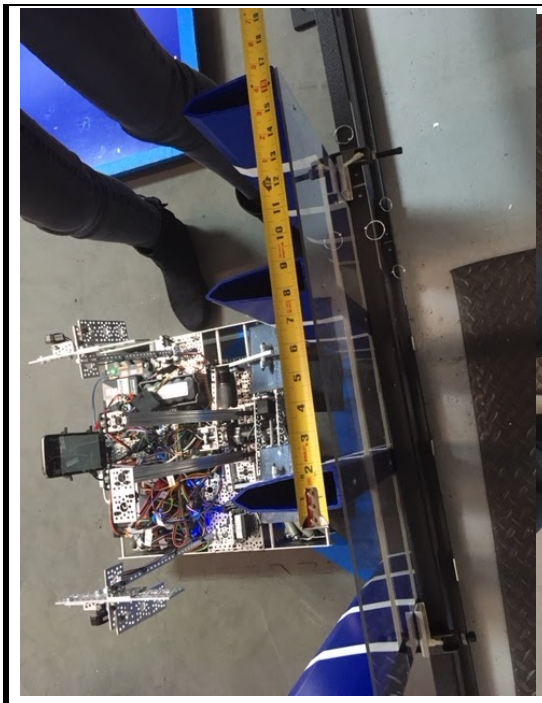
1. Determine distances to drive to place glyphs in the 3 columns in the cryptobox.

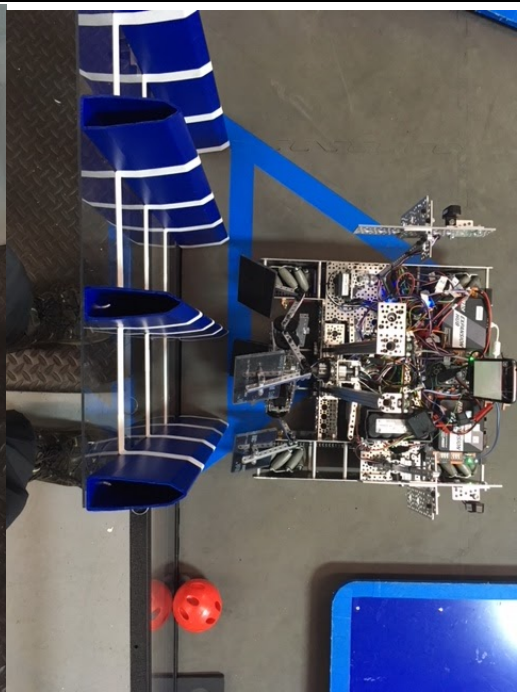
Details

Programing *Calvin, Lauren*

Requirements:	1. selects correct jewel 2. drives off of balancing stone 3. parks in safe zone 4. place cube in correct column
We conducted research to determine values for driving into the safe zone and aligning with the correct column in the cryptobox to prepare for using Vuforia and Vumarks.	

Build:	1. Measure the amount of error between section of cryptobox to find values for auto drive 2. Tested values within code
We had to revert our code to an earlier version as some recent changes broke the code we had. After that we tested different values for the robot to drive once off the balancing stone to get the robot to drive as close to the center as we could. We then used measurement to see how far the center of the robot would have to drive in order to align with the other two columns (which we titled “left” and “right”). We found it had to move exactly 8 ¾ inches. In the end we ended up moving 8 inches as the robot would skid or move a little too far. It seems the robot does well with “round” values. the values we use are 25 for the left, 34 for the center, and 40 for the right.	





We also faced some difficulty with the mechanical part of the robot as one of the chains on the drive base came off and the malfunction messed with our encoder input.

We ran out of time before we could test the autonomous mode that uses strafing.

12/28/2017 2PM-4PM

Design and Build Meeting

Team Members: Hannah, Calvin, Liam
Coaches: Beezie

Agenda

1. Do some driver practice
2. Finish the prototype intake mechanism for our new glyph mechanism design

Details

New Glyph Mechanism Prototype *Liam*

Requirements:	1. Is able to pull in a glyph using compliant wheels, enough for said glyph to be inside the robot
We did not change any requirements from our last meeting.	

Design:	1. Make a "U" shape out of channel, and mount motors with compliant wheels on the ends of that shape
We did not change our design from our last meeting.	

Evaluate / Next Steps:	1. Refine materials and dimensions, develop CAD models 2. make a full CAD model of the whole mechanism
We are refining the dimensions and evaluating the design as we work on the CAD model.	

Driver Practice *Hannah, Liam, Calvin*

What We Did:	1. Calvin broke one of our glyph gripper arms by ramming it into something. Hannah replaced that and got back to work 2. Calvin broke the same arm again the same way. Hannah replaced it again 3. After driving it a little bit, Hannah and Liam found that the bottom gripper servo was broken from the force of running into things. We believe the gears inside of it are stripped. 4. It was ridiculously cold in the Science Center's garage, and none of us knew what rotational position we had to put a replacement servo in at, so we packed up, moved the batteries and chargers up to a warmer room, and went to Starbucks, which is a block or two away. 5. At Starbucks, we got warm drinks and put together notes for the engineering notebook for the last 20 minutes of practice

01/5/2018 7pm-9pm

Design and Build Meeting

Team Members: Jeremy, Lauren, Taylor, Hannah, Calvin, Christina, Kaylin, Ernest, Bill.
Coaches: Matthews, Uecker, Beezie

Agenda

1. Completed unfinished notebook entries
2. Summarized judging presentation
3. Talked about public speaking

Details

Engineering Notebook

Requirements:	1. Entries finished 2. Cover required info from date
We did not change any requirements from our last meeting.	

Design:	1. N/A

Build:	1. Worked on backlog of engineering notebook entries.
We had multiple computers open with access to google drive folder with unfinished engineering notebook entries. We split into groups to work at these computers to finish these entries. We did this so we would not have as many to complete before the qualifier. We talked about stuff to know during judging Mr. Uecker talked about public speaking and good listening Story idea for judging presentation Must watch all matches and keep track of good teams Must have lots of people in pit area to chat with judges Defer- " i cant answer about X, but so and so can. So and so is driving now but i can grab them later"	

Evaluate / Next Steps:	1. COMPLETE ENGINEERING NOTEBOOK ENTRIES DAY OF!!!!

01/14/2018 6:00-8:00pm

Design and Build Meeting

Team Members: Lauren, Kaylin, Hannah, Ernest, Liam, Bill
Coaches: Matthews, Nelson, Beezie

Agenda

Details

Hannah, Liam, Ernest, Bill

Build	1. Built prototype for a new glyph mech design 2. Began constructing updated relic mech

Design	1. The new relic mech will use the drawer slide from last year because we know it works well

Evaluate	1. Had a discussion about what mechanism to continue work on 2. Both the relic and new glyph mechanism designs are partially complete. 3. We decided to work on the glyph mech. a. It puts about the same number of points on the board as a third cryptobox column. b. Most other teams in our league are not likely to have a good relic mechanism. Will help with alliance selection. c. There isn't enough time to realistically build an entire new mechanism from scratch. The relic mech is partially built already. d. All teams can push glyphs around to score, so our teammate can potentially finish a box during that time instead.

Programming

Requirements:	1. detect VuMark 2. selects correct jewel 3. drives off of balancing stone 4. parks in safe zone 5. place cube in correct column

Build:	1. We added vuForia to our autonomous state machine.
The vuforia detection works in a thread, separate from the main state machine. We did this so we could run the vuForia detection at the same time as other steps in the state machines. The thread looks for the the crypto-key VuMark. It moves onto the next step if it	

times out or finds the crypto-key. If it finds the crypto-key it states what place it should place the cube as a text to speech command, and adds the crypto-key to a queue to be used by a later state.

Evaluate / Next Steps:	1. Use the detected VuMark to drive the correct distance to place the glyph.

01/18/2018 7:00-9:00pm

Design and Build Meeting

Team Members: Lauren, Taylor, Liam
Coaches: Matthews, Nelson

Agenda

1. Get VuMarks Working

Details

Programing *Lauren*

Design	1. Use VuMarks at far stone

Build	1.
The use of vuMarks from the far stone was very similar to the one we use on the close stone. That being the target was similar within certain limitation. the main difference was we had to strafe to reach the goal instead of turn. We determined more effective distance compared to the ones used prior as well as the measurement used to reach the different columns in the crypto box. We used the same code as we did for drive using Vumark but instead made change so it would work with strafing. one change was inverting the staffing distances based on what alliance we were on. Red being the inverted mode. we also institute new values that would align the robot with the correct column when strafing. We used the same roughly 8 inches between each cryptobox measurement as before, only with measurements that matched the far crypto strafing path. We tested out the distance before implementing the state VuMark state that would determine which value would be used to avoid errors in the code that could cost us points.	

Evaluate / Next Steps:	1. Test, observe in operation at league meet. 2. Test VuMark in different lighting

01/21/2018 6:00-8:00pm

Design and Build Meeting

Team Members: Bill, Lauren, Kaylin, Hannah, Liam, Taylor
Coaches: Beezie, Matthews, Nelson

Agenda

Evaluate the league meet that we participated in on 1/20.

Details

Evaluate Yesterday's League Meet — *ALL*

Obs. from League Meet	1. Replaced gripper servo in 10 mins. 2. Use the checklist--have someone hand it to you after robot put down 3. Get pictures and less spacing and bigger font on the checklist 4. Jewel mechanism sometimes doesn't reach 5. Lining up on rivets difficult 6. THIS SIDE DOWN!!!! ALWAYS!!! 7. No one cheering in the audience 8. Distractions 9. Once people were on their phones while a coach came by to look at our robot 10. We have concentration issues 11. When you're getting glyphs, other robots push the blocks away suddenly 12. We need hot chocolate 13. No stakes in practice 14. Robot has no individuality or personality 15. Different color shirts under uniforms

Conclusions	1. We are awesome at fixing stuff, we need more servos and motors, and once everything's packed, it's packed and can't be moved. Have spare servos programmed specifically and labeled as CR or regular. 2. Use the checklist 3. User of checklist makes it what they want (and not day before match) 4. Longer jewel mechanism, do experiments on color readings 5. Tape to line up on rivets, measure distance between rivets and jewel holder middle 6. Both grippers closed, rescue button 7. We need team spirit! YAAAAY!!!! Make schedule for qualifier (1st hour this, 2nd hour that, 3rd hour another thing, etc.) 8. USE GRACIOUS PROFESSIONALISM IN PRACTICE AND LIVES! Less stress if no making fun of each other. 9. We need to use our phones less or put them in a phone jail

	10. Walk through what you do in the match before you do the match, maybe pick up the controller and move the buttons around while imagining. “It’s like me to drive well.” Have a drive team cheer or something to relax drive team’s minds after a match. 11. Don’t hesitate. AT ALL!! Practice how we compete, have an aggressor squadron using Skittlebot (Deathbot) as an opposing team’s pushbot 12. Get a Keurig 13. We should have a leaderboard and a personal jar of candy for each person, having some taken out every time the corresponding person makes a bad call, a mistake, etc. INCENTIVES!! YEAH!!! 14. Design the robot in pretty colors that make it look AMAZING! 15. All of us wear Fusion or black shirts under outfit

Evaluate / Next Steps:	1. Lauren and Liam work on aesthetics 2. Kaylin and Hannah do wiring. Maybe Liam 3. Bill and Ernest get Deathbot running 4. Hannah makes document for design award with help of teammates 5. PRACTICE LIKE WE COMPETE! 6. Programming team looking at fixing P value in autonomous 7. Lengthen jewel mech. and make more reliable 8. Programming team dealing with controls 9. Slow mode default 10. Look at making smoother 11. Make list of every spare part (and special tools) needed for competition

01/25/2018 6PM-8PM

Design and Build Meeting

Team Members: Kaylin, Hannah.
Coaches: Matthews, Beezie.

AGENDA

1. Fix our wiring issue.

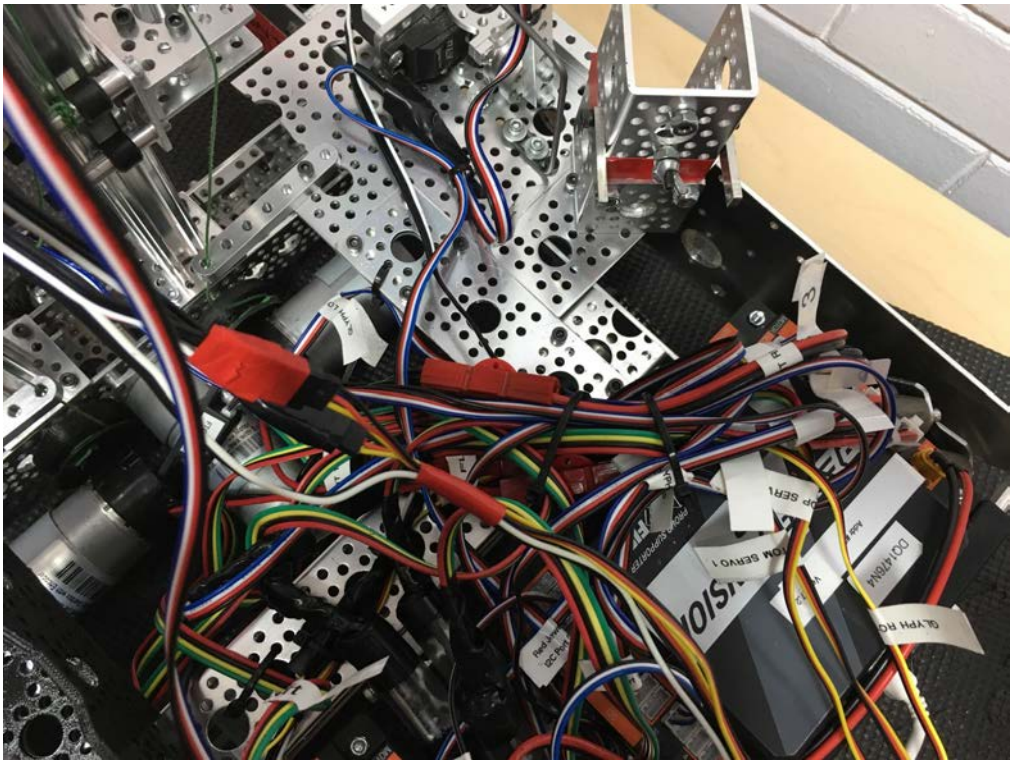
DETAILS

WIRING *Kaylin, Hannah*

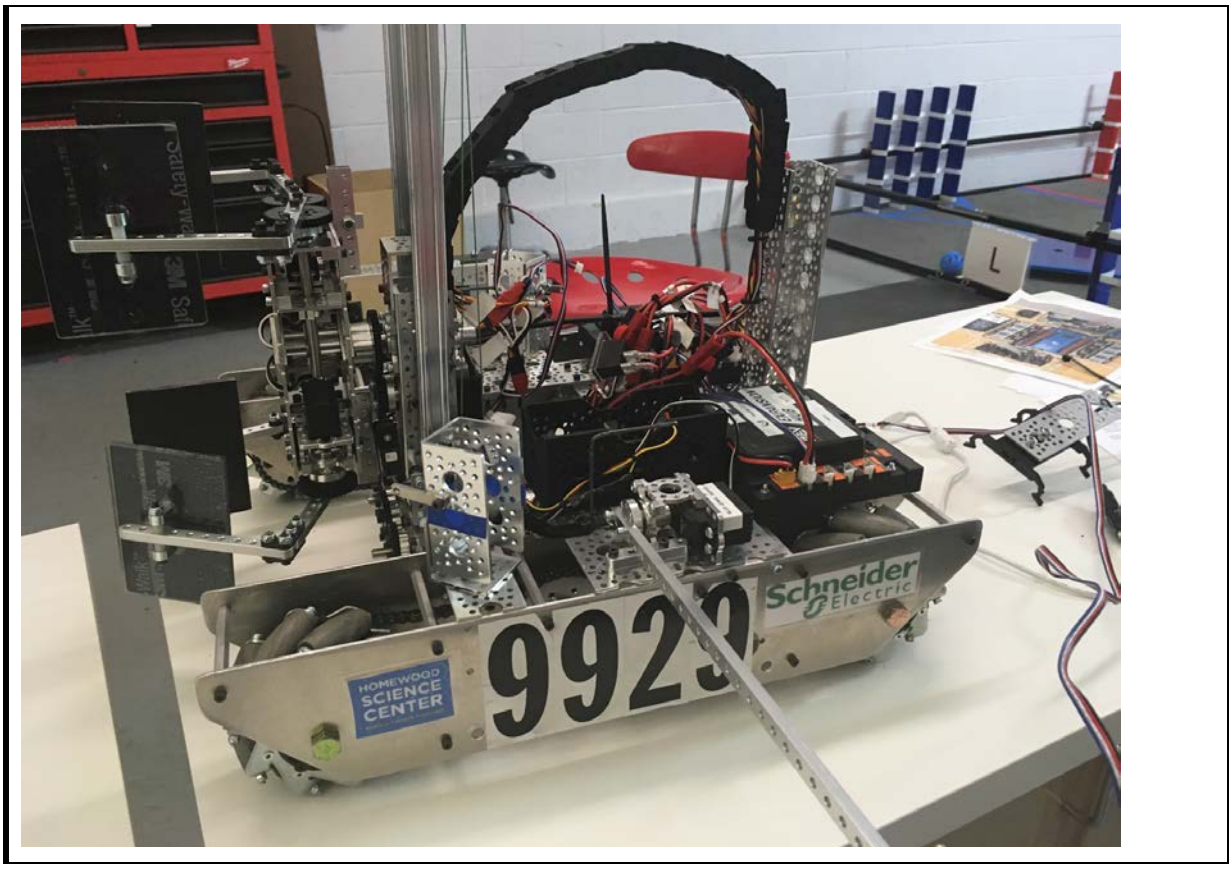
Requirements:	1. Doesn't look like a rat's nest 2. All of the wiring needs to be sorted well 3. Everything needs to be strain-relieved yet still able to be worked on

Build:	1. Organize all the wires

The image below is a "before" picture:



And the next image is an "after" picture: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HOMEWOOD SCIENCE CENTER
Schneider Electric
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01/28/2018 6pm-8pm

Design and Build Meeting

Team Members: Jeremy, Lauren, Taylor, Hannah, Calvin, Kaylin, Liam.
Coaches: Matthews, Nelson, Uecker, Beezie

Agenda

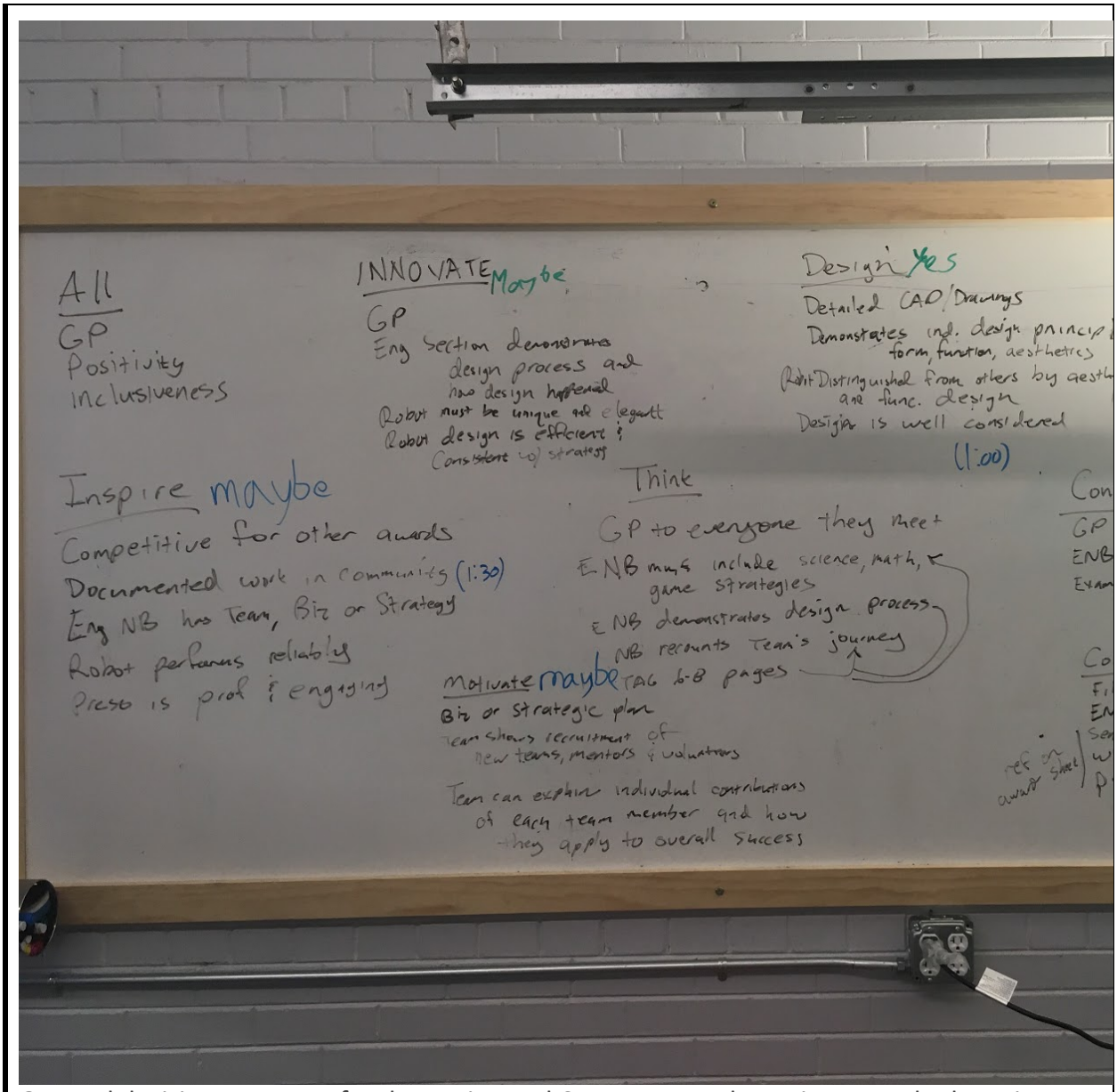
1. Figure out what awards we want to go for

Details

Award Mapping *Everyone*

Requirements:	1. Must be achievable

Decide
Here is the board we used to decide what awards to go for:



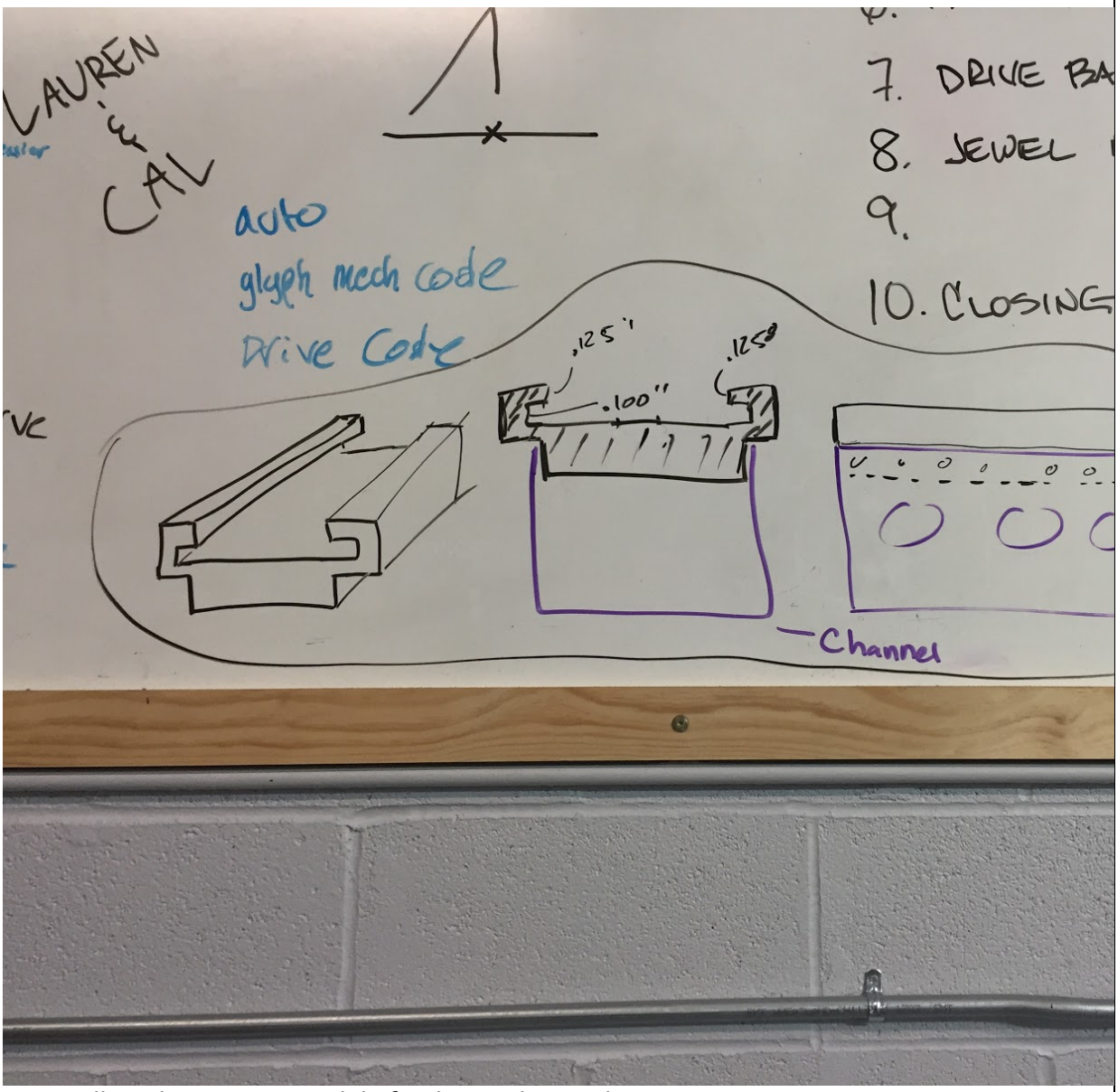
Our end decision was to go for the Design and Connect Awards, seeing as we had a unique design, and that we've done a lot of community outreach.

Evaluate / Next Steps:	1. We need to get a bunch of papers put together for the sake of the Design Award, as well as one for the Connect Award

New Phone Holder *Liam*

Requirements:	1. Must be able to go inside an Actobotics channel and hold an Actobotics plate.

Design:	1. We will have a design something like this:



Liam will work on a CAD model of it during the week.

Build:	1. We will 3D print a model of it once the CAD work is done.

01/30/2018 7pm-8pm

Design and Build Meeting

Team Members: Taylor, Hannah.Liam
Coaches: Beezie

Agenda

1. Place our phone mounts horizontally instead of vertically to help with Vuforia in our autonomous state.
2. Finish lengthening the jewel arms

Details

Jewel Arms Hannah, Taylor

Requirements:	1. Reaches Jewels from balancing stone
We did not change any requirements from our last meeting.	

Design:	1. We changed our current design to have a third piece in between two pieces of the arm to let it extend or shorten.
We did not change our design from our last meeting.	

Build:	1. Install the three pieces onto our current model.

Evaluate / Next Steps:	1. The mechanism works great! Nothing else to do.
Nothing will be changed, most likely.	

Phone Mount Liam Nelson

Requirements:	1. See more of the pictures on the walls
We did not refine our requirements in this meeting.	

Evaluate / Next Steps:	1. We need to build a better way to mount a phone – where it sees more wall.

02/06/18

Design "Meeting"

Team Members: Lauren.
Coaches: Matthews.

Agenda

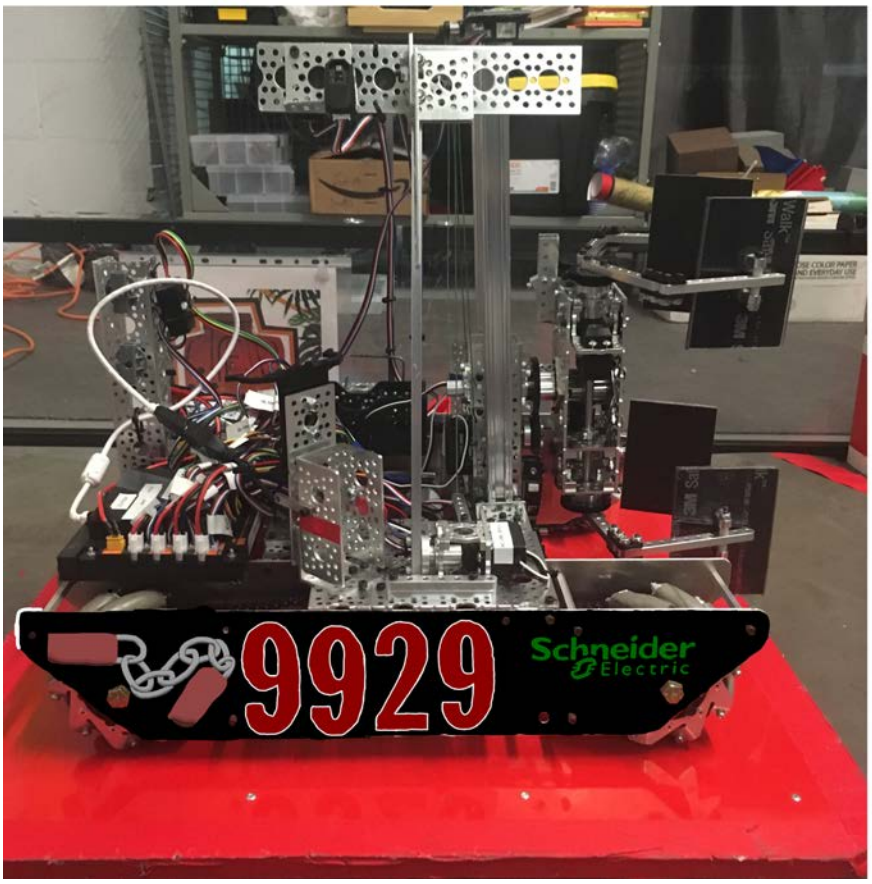
1. Assemble the design for the side plates and install it.

Details

Fancy Designs — Lauren

Requirements:	1. Red numbers and black carbon fiber backdrop, with gears on the ends of the side plates
We did not change any requirements from our last meeting.	

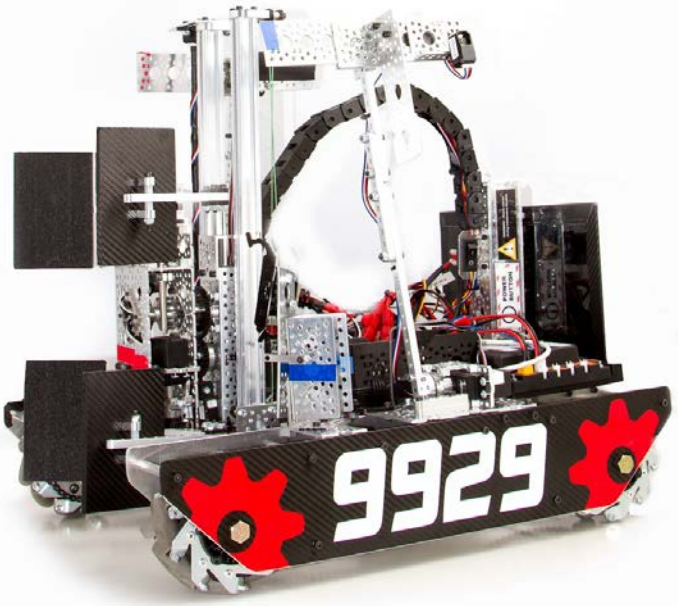
Design:	1. Both plates look something like the below image.



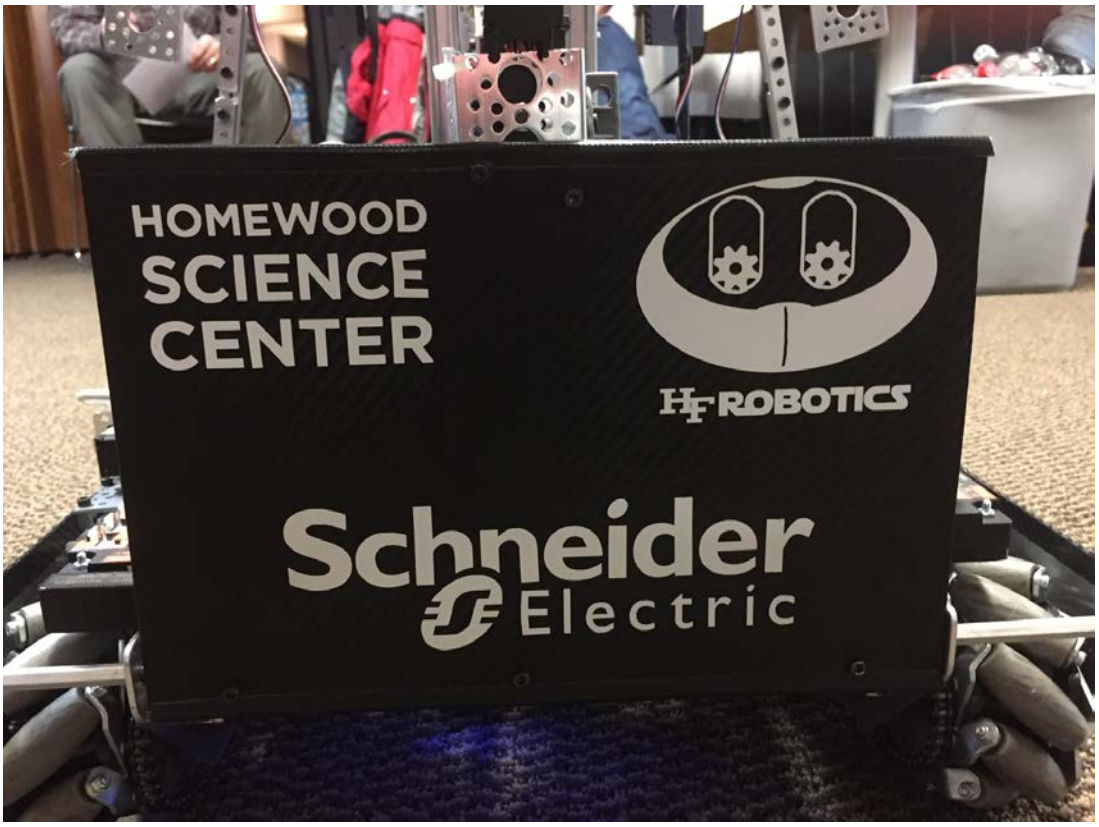
Build:	1. Wrap the plates in carbon fiber 2. Attach the numbers

3. Attach the gears.

This is what we ended up with:



The logos went on the back of the robot on another carbon fiber sheet:



Evaluate / Next Steps:	1. The robot looks SO much better now. 2. Everyone loves the robot.
Nothing else needs to be done.	

02/11/2018 6PM-8PM

Reflection Meeting

Team Members: Jeremy, Lauren, Taylor, Hannah, Calvin, Kaylin, Liam, Ernest.
Coaches: Matthews, Nelson, Uecker, Beezie

Agenda

1. Reflect on yesterday's meet
2. Decide what to work on for the next two weeks until the state meet

Details

Yesterday's meet **Everyone**

Observations:	• Good scouting
	• Control award
	• 2nd place Inspire
	• 2nd place Connect
	• 3rd place Design
	  ○ Polite, GP
	  ○ Contender for all awards
	  ○ Outreach/community

Needs Improvement:	• Autonomous bug (Lauren/Calvin)
	  ○ Raise arm if no color detected
	• Color sensor reliability
	• Setup
	• Phone crash (WiFi?)
	  ○ Test channel changing (Kaylin and drive team)
	• Lift didn't work
	  ○ Pit checklist (Kaylin)

02/12/2018 6pm-8pm

Build Meeting

Team Members: Hannah, Taylor, Lauren
Coaches: Beezie, Matthews

Agenda

1. Get the field set up
2. Fix coding bugs
3. Replace a gripper servo
4. Undo the angle on the blue phone mount

Details

Field Setup — Hannah, Taylor

Field Setup:	The field was all taken apart from our qualifier tournament, so we set it back up

Coding — Lauren

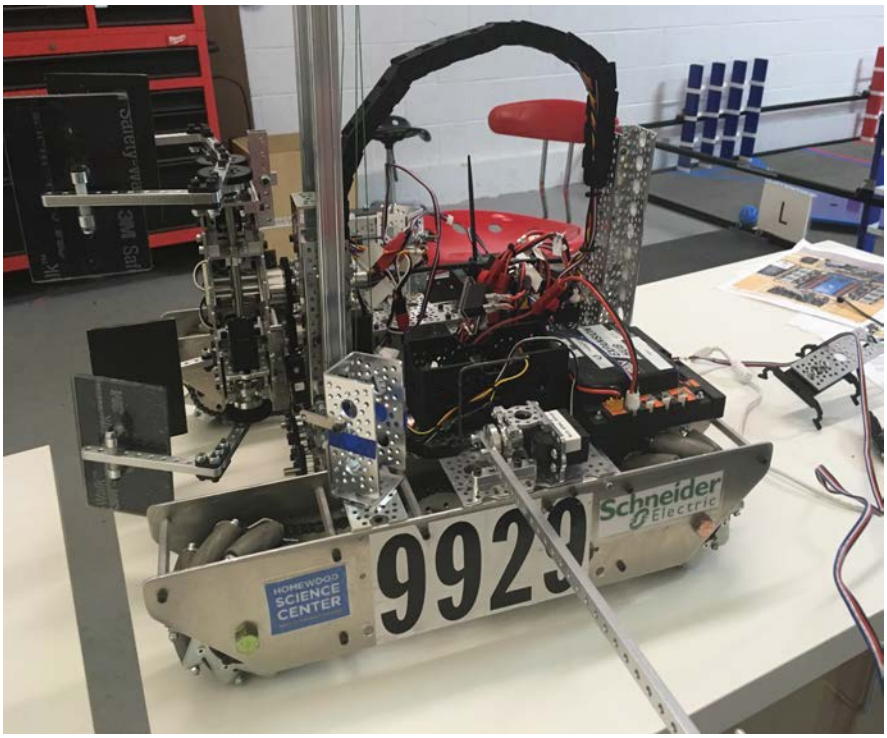
Requirements:	1. Fix the bug where if no jewel is detected, the jewel detector isn't retracted (which can sometimes remove the wrong jewel) 2. Continuously send the position to all servos to avoid "brownout" of the PWM signal that we sometimes see at low voltages.

This was a problem we noticed during the qualifier to finish.

Programming:	1. We fixed the bug; nothing else to say about that, and it ended up working. 2. The "brownout" issue was solved

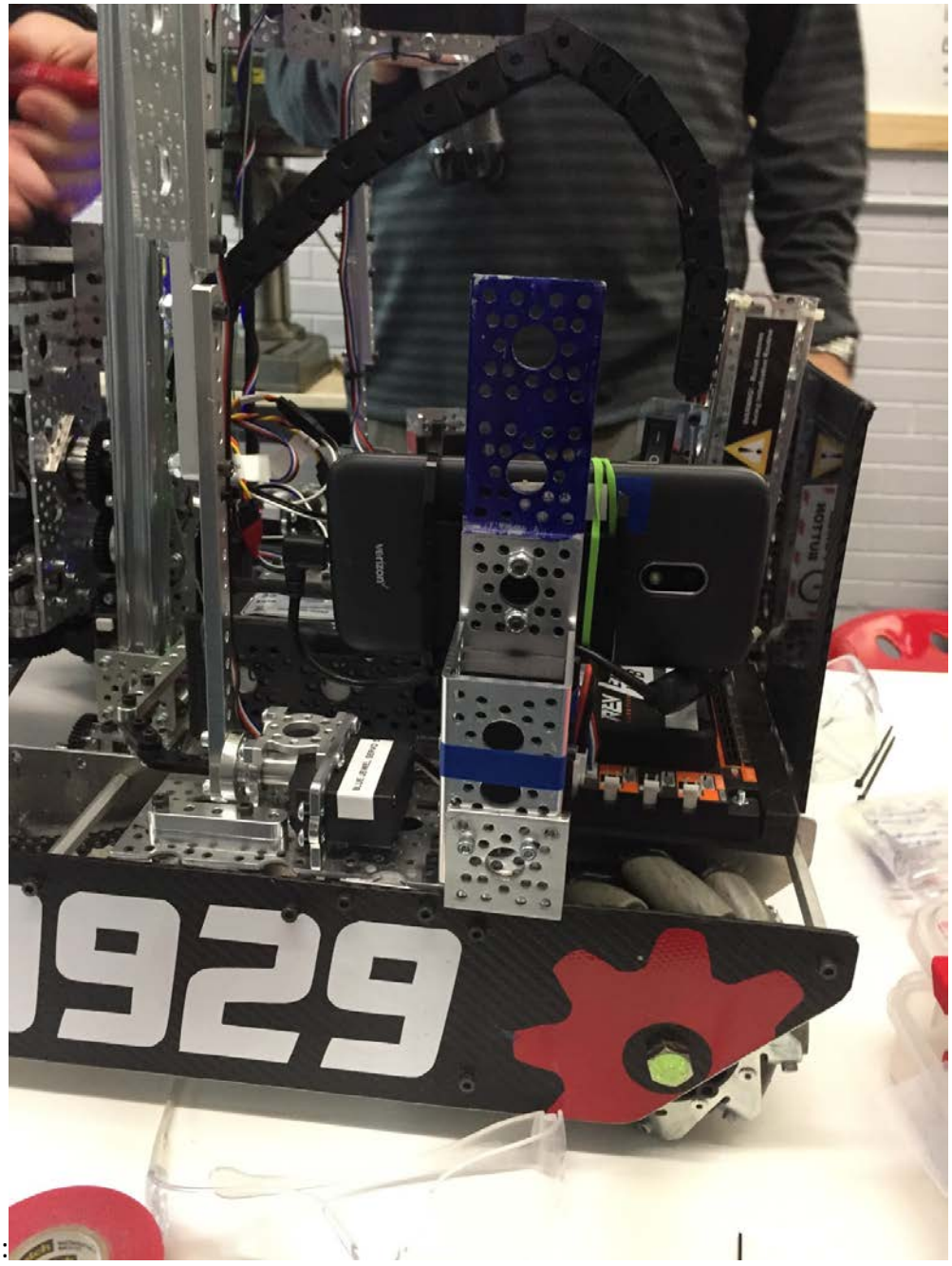
Repairs — Hannah, Taylor

To do:	1. Replace the top glyph servo 2. Move the blue phone mount off of its angle



This is the blue phone mount before we moved it:

And this is it after we moved it:



Repairing:	1. We didn't run into any problems with anything this time. Yay!

02/15/2018 6PM-8PM

Build Meeting

Team Members: Liam, Kaylin, Calvin
Coaches: Uecker, Matthews

Agenda

1. Test the new blue phone mount placement
2. Get promo material ready for state

Details

Testing — Kaylin

Schedule:	1. Make sure the new rotated phone mount works with Vuforia 2. Test the code change to the IMU for teleop

Testing:	1. Tested phone mount placement 2. IMU change was good

Promo — Liam, Calvin

Promo Material:	1. Finished up what we felt was an appropriate advertisement sheet to appeal to other teams

02/19/2018 6pm-8pm

Build Meeting

Team Members: Lauren, Kaylin, Hannah, Liam, Jeremy, Calvin
Coaches: Uecker, Beezie, Matthews

Agenda

1. Test our autonomous starting positions based on their ability to let us score the glyphs indicated by the cryptoboxes
2. Organize our "to-go" bin for state
3. Update phones
4. Go over the presentation board to get old content removed and the new content decided upon.

Details

Autonomous testing — *Lauren*

Plan:	1. Test autonomous in all setups and rank how well they work

Testing:	1. All the autonomous starting positions were ranked according to how well we could score the glyphs in the places they were supposed to be scored in, according to the cryptograph.

Presentation Board — Everyone

Old Content That Needed to be Removed:	1. Everything except for the titles for the big section needed to be removed

New Stuff:	1. We basically took our old ideas, gave them a slightly different look, and called it a day. 2. We got everyone to pitch in on making the new parts of the board

Business/Sustainability

This season we were awarded a grant from Schneider Electric. This was a great process for our team to go through. To apply, the team sat down with Jeff McLain from Schneider to discuss our needs and wants for the season. He asked us questions about the cost of running the team.

Some of the costs we talked about:

- Power Tools ($400)
- Robot parts and spares ($1400)
- Competition Registration ($275)
- Robot Game Elements ($450)
- Food and travel ($300)
- Team Tee shirts ($120)
- Pit-banner sign ($25)
- Stickers/buttons ($75)

With this grant money we covered much of this season's expenses.

Last February, we were invited to The Washington Award dinner where the team met Mr. Chuck Hull – the inventor of 3D printing. We did fundraising at local farmers markets by making buttons and collecting donations. With these funds we brought a 3D printer and use it to make parts we design on CAD for the robot, such as the spools for the lift.