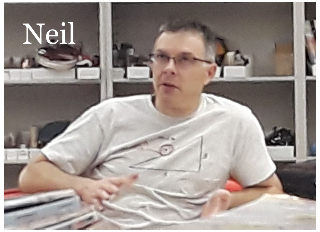
About the Blu Cru

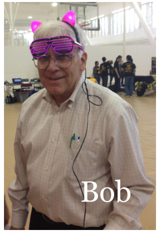
The Blu Cru is part of the **Explorer Post 1010 organization**, based in **Rockville, Maryland** and founded by our mentor, Bob. Explorer Post 1010 is dedicated to offering students exciting hands-on opportunities to learn about engineering and STEM.

The Blu Cru made its debut in the FIRST Tech Challenge in 2012. The team has returned every year since, advancing to the state level of competition in a significant number of its past seasons.

Our Mentors

Both of our mentors have been a huge help in this year's competition. They have helped manage the organizational and financial aspect of the team, as well as making sure that we never did anything catastrophic.



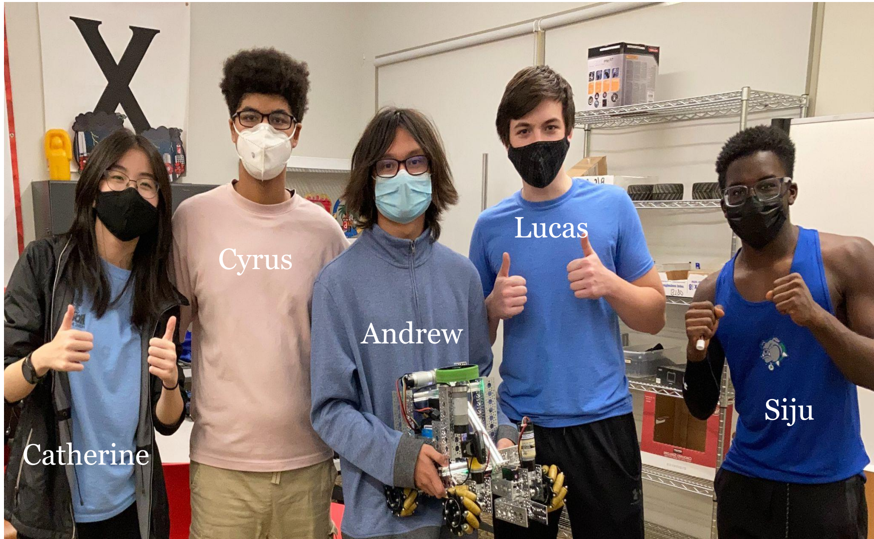


Team Structure

To keep our team running efficiently every season, we elect a captain or two co-captains, a head of design & build, a head of programming, and a head of team management to oversee all sub-crus' activities and events. During the season, we divide into "sub-crus" to increase efficiency. Our main sub-crus are each focused on programming, building, and team management.

Who We All Are

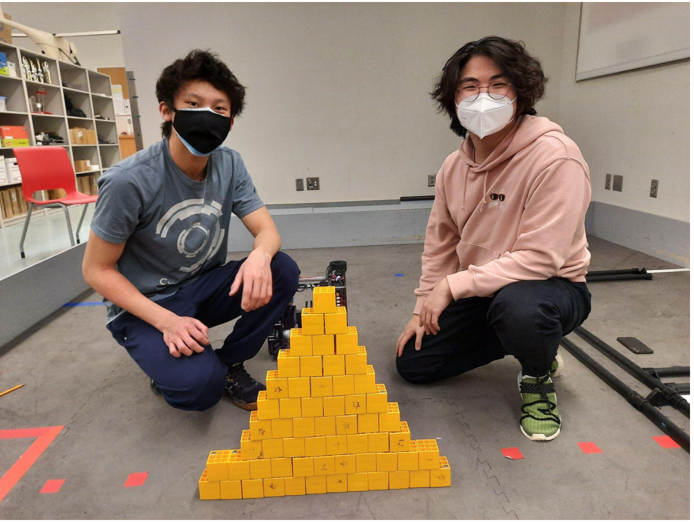
Catherine: I am a Builder, and Driver.
Cyrus: I am a Builder and Management Head.
Andrew: I am the Coding Captain.
Lucas: I am the Build Captain on the team. This is my 4th year, and want to go off on a great year.
Siju: I am a Builder and a learning Coder. I can't wait to



The Space We Work In

We work in the Rockville Memorial Library, inside of the Makerspace on the 2nd floor. This is a great location for us, as it has all sorts of tools including multiple 3D printers, a laser cutter, CNC machine, and a plethora of power tools. We also have access to the amazing and helpful staff who manage the place.

The BluCru shares a working space with multiple other FTC teams, allowing us to collaborate with them, share idea, and have a larger sense of community within our local FTC groups.



A crowning achievement of RM'd Dangerous

Seen here is an average interaction with a member of the other teams that we work with.

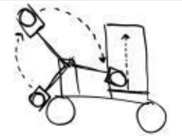
Our Current Robot

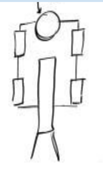
1. Define Problem(s)

- Discuss as a team
- Develop game strategy, considering point values, time constraints, feasibility, available resources
- Break down problems into parts
- Develop a coherent timeline and strategy
- Revisit constraints for robot and game field.

2. Brainstorm

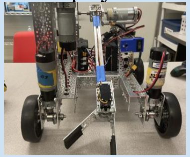
- Collaboration! (a whole group effort)
- Combination of our own knowledge and research
- Ideas grounded in physics and math
- Make decisions as a group through pros and cons analysis, combining and improving solutions
- Sub-crus keep other sub-crus in check

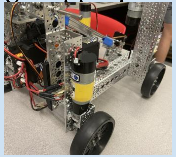


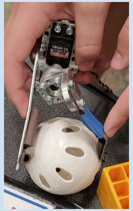


3. Plan Solutions & Prototype

- More focus on details of design
- Hand-drawn diagrams at meetings → CAD at home through Discord
    - determine if feasible
    - better visualize ideas and proposed solutions.
    - allow all members to easily provide input
    - maximize efficiency and results.
    - Blueprint/framework for prototyping and construction
- Prototype to test a simplified model of our
- design in a physical setting if appropriate

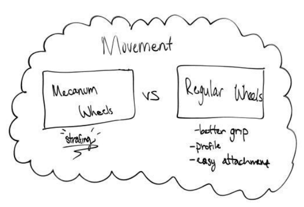






4. Build (& Implement)

- Using our CAD design and prototype, our Cru constructs the design solution
- Ideas for improvement and decisions made by whole team
- Areas of improvement learned from prototyping implemented
- Usually opt to test solution before implementing entirely, repeating prototyping and testing until a much improved robot is completed



5. Test

- Test in the order of:
  - Functionality (does it work?)
  - Accuracy (is it providing accurate results?)
  - Consistency (is it providing consistent results?)
  - Efficiency (could it work faster? using fewer parts? using simpler mechanisms? rely less on the human driver? etc.)
- Prefer quantifiable (objective, concrete, easily comparable) testing data
- Further improvements can be made, steps repeated
- Not only improvements engineering-wise will be made (ex. through testing, we realized a coded preset arm height would increase accuracy and consistency)

6. Evaluate & Get Feedback

- Consider improvements to robot in key areas of accuracy, consistency/precision, efficiency
- Typically use outreach events to test robot "health"
- Also consider alternative design solutions
- Get feedback from all team members and mentors
- If no feasible alternative solutions → move forward, else back to the brainstorming phase
- Essentially the brainstorming phase take 2!

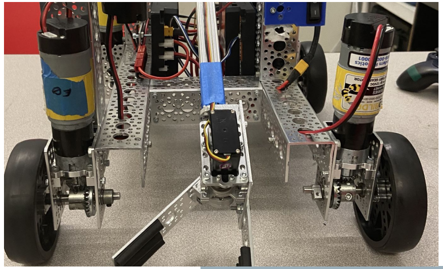
7. Improve

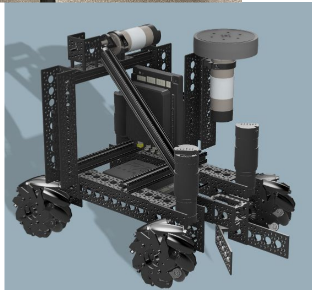
- Implement brainstormed solutions
- Quantitatively and qualitatively evaluate improve compared to original solution
- Continuously get feedback

8. Finalize & Communicate

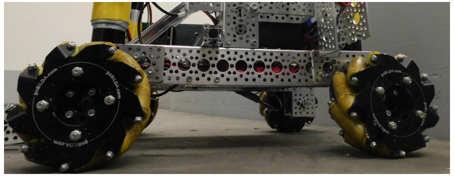
- Always room for improvement, but finalize robot ~2 weeks before competition for practice
- Drivers practice tele-op period
- Coders improve autonomous code
- Document final robot in notebook
- Display robot to other Explorer Post teams

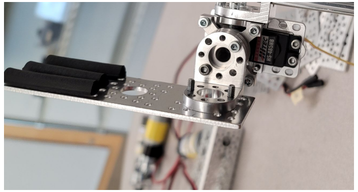
Our chassis has a higher center of mass than in previous years. We used CAD to ensure that the arm would have proper clearance to swing through the robot. We used normal channels because we did not see a benefit to using x-rails at the time. The motors are sticking straight upward, and use bevel gears because we wanted to have a high clearance, and room in the front to put a grabber.

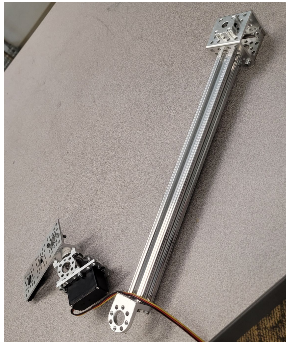


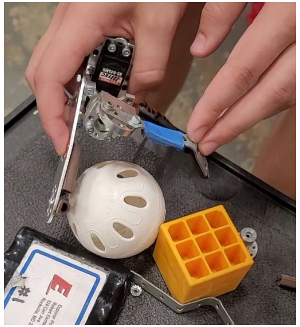


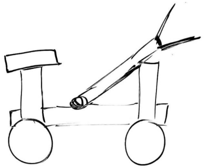
We planned to have our arm be long, and be able to swing over the entire robot. This was because we thought that an arm would be the most efficient system for something of this competition, because of being allowed to hold just one block at a time. We ended up putting our grabber on the robot parallel to the ground, that way we would have a very easy pickup, that was flat and in line with the blocks.



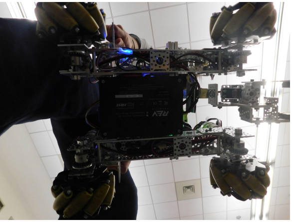


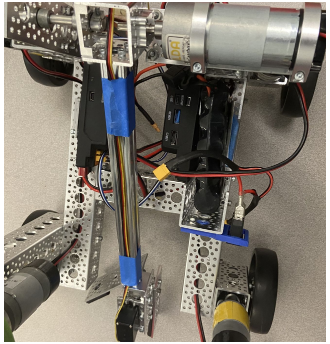


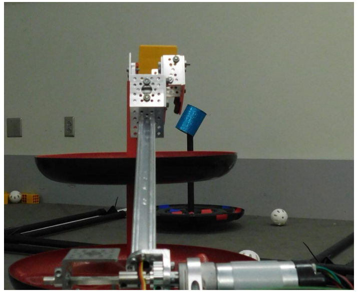


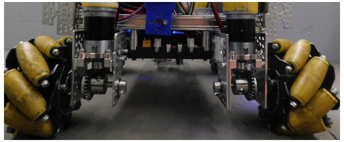


Our change from normal wheels to mecanum wheels was made somewhat challenging by not being able to find the right mounting hubs for the wheels, but was all worth it in the end. The ease of use of mecanum wheels will never be forgotten, no matter how long it has been since we have used them. We also attached a plate that the arm rests on when in is in the intake position. This allows a consistent position and intake every single time.



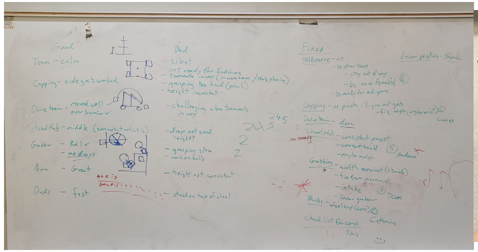
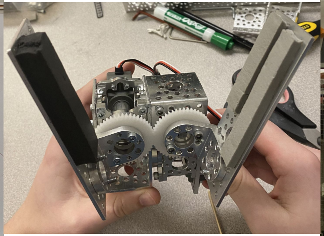






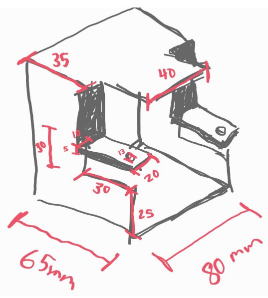
Planning Designs & Prototyping

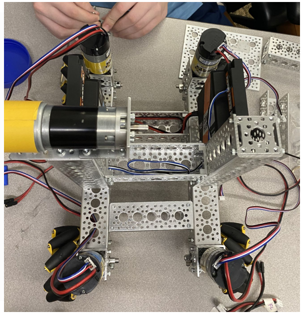
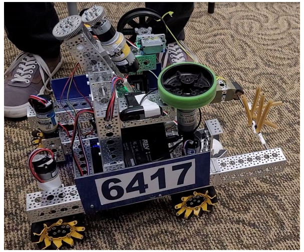
- Sketching and CADing a possible intake idea
- Physically prototype some iterations of the arm/intake
- Explore other possible designs for intake

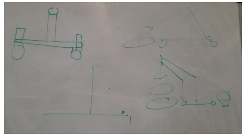




Building

- Rebuild robot and decrease max extension to minimize profile
- CAD/print and/or build intake designs to test
- Build and test “wrist” (simultaneously with the other intake designs, allowing us multiple designs to choose from)





Improving

- Adjust robot size if needed
- Continue redesigning, printing/building, and testing intakes

Final Design

- We went with the “box” intake, as it was the most efficient form of intake
- Since we cannot cap with the box, we removed our “wrist” idea, as it was resulting in some inconsistencies
- We ended up shifting some parts of the robot around to conform to our box intake