CCPA Robotics | PiE 2023 | Engineering Notebook

Team

Members

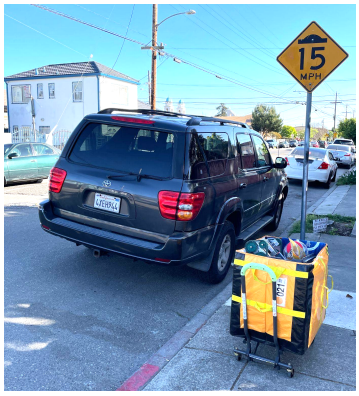
Overview

- Coliseum College Prep Academy (CCPA) is a public OUSD high school located in East Oakland at 66th and International. Coaches include: Mx. Brassey, Ms. Arnetta, and Carlos Romo. Mentors include: Benjamin Hernandez and Kevin from UC Berkeley.

What worked

- **A PiE student alum** (Ms. A) helped coach the CCPA team. (CCPA has previously participated in PiE before the COVID-19 pandemic.)
- **UC Berkeley mentors** (Ben and Kevin) were extremely helpful and came to practice twice a week!

Logistics



What worked

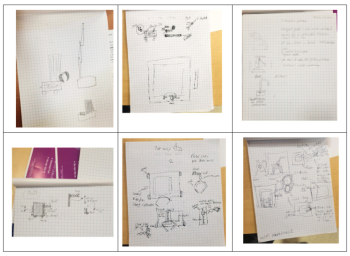
- **PiE team** was very responsive and helpful over email and Discord.
- **Transportation:** CCPA coach had access to a 7-passenger truck to transport a small group of students to off-campus events.

Challenges

- **Scheduling:** OUSD held a district-wide invitational tournament on March 16th (at the beginning of the PiE season) so the team was focused on our previous robot and this event, and did not have bandwidth to join to the March 4th PiE season kickoff.
- **Scheduling:** We lost 2 weeks of practice (Mar 27-Apr 7) because CCPA Spring Break was the week after UC Berkeley Spring Break.
- **Permission slips** coordination (4 permission slips per student) would have been easier to coordinate if we received them all at the same time at the beginning of the season: Liability (paper), Consent release (paper), Cogito (online), and Badge form (online).
- **OUSD laptops** work only on OUSD wifi, so we did not have an easy solution for using computers at off-campus events like the Scrimmage at UC Berkeley and the Final Competition at Lawrence Hall of Science.

Robot hardware

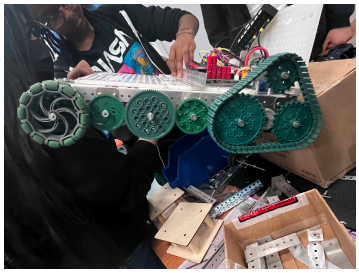
Design



Overview

- After watching the “Carnival Celebration” game over video, several team members sketched ideas and presented them to UC Berkeley mentors via Zoom during the “Design Review” event. View the PDF here.

Drivetrain



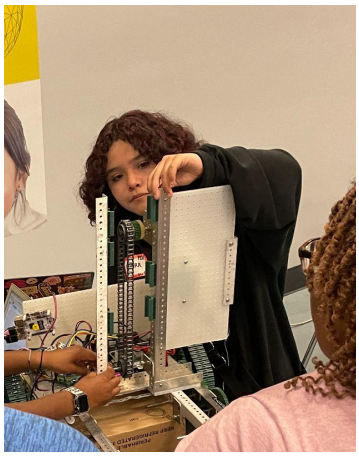
Overview

- The Team designed the drivetrain to allow move aross the field as much as possible, with the back of the drivetrain will allow the robot to move through the field as best as possibly and with some of the mini games being required for us to move up a ramp or move objects around or to even turn the drivetrain we designed will might be able to come across the challenges other teams might face, we also used a different type of wheelchair to allow our robot to have a slightly easier time turning around when we need it to.

Challenges

- A challenge our team has faced while building the drivetrain is coming up with the design for it so our team won’t have issues on the field.
- Another challenge we faced as well while building the drivetrain is making sure everyone is connected and tightly so we don’t have a problem midway through a match.
- A final challenge we had was when we loosened up the collars our gears had fallen apart completely so we had to fix that issue.

Lift mechanism



Overview

- To lift up and down for games like the green buttons and food court, we designed a lift mechanism that goes up and down.

Challenges

- We wanted a lift that reached down to the floor so we cut off part of our frame, and this made our base less stable and strong. We undid that.
- The motor is actually too powerful for the mechanism because the chain is made of plastic and sometimes it snaps and breaks!

Scissor arm

Overview

- The team designed an ambitious scissor style arm to fit into the initial size requirement box, but then extend based on input from the gamepad. Challenges for this design included choosing materials that were strong enough to support the weight of the arm itself, and programming a motor to extend the arm.

Challenges

- Way too complicated! Carlos (our mechanical engineering mentor) devised a way to build this, but without complete understanding the rest of the team had difficulty continuing to build with this component.

Grasping claw

Overview

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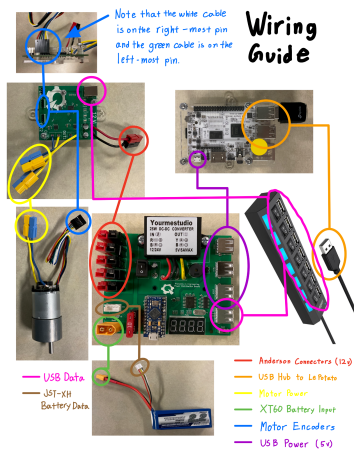
Challenges

- This piece was originally built using proprietary fasteners so it was hard to take apart when we needed to change the old servo to a new servo.
- We didn't know how to program the servo at first, since it's different from a regular motor.

Electronics



Overview

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Challenges

- No one on the team (except the UC Berkeley mentors) really understood what all the PiE components were, and what all the ports were for. We wanted to read documentation in narrative form.
- **Wiring:** Wiring diagram was difficult to understand.
- **Router:** Frequently lost connection to the robot and were not 100% clear on the reset sequence, resulting in some lost time and confusion.
- **Router:** At one point we tried resetting the router using the button on the square and there were no instructions for setting it up again, so we had to wait for assistance from the PiE team.
- **Battery:** At one point we were trying to plug in a new battery and it started smoking and got really hot in a student's hands.

Robot software

Code challenges

```
# Carnival Celebration" costs $25 per adult
# Full House: 3 adults and 2 children, or
adult_tix = 25
child_tix = 10
adults = 3
children = 3
total_cost = 60
# Three of a Kind: 3 adults = $50
# Date Night: 2 adults = $40
# Single Mom: 1 adult and 1 child = $30


def total_cost(adults, children):
  if adults == 2 and children == 0:
    return 40
  if adults == 1 and children == 1:
    return 30
  if adults == 3 and children == 0:
    return 50
```

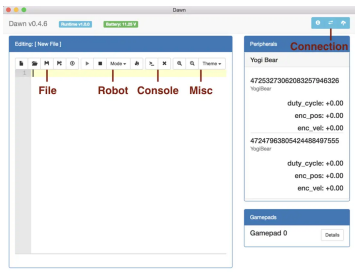
Overview

- We used Replit so we could see what each other were doing.
- We depended heavily on Kevin, our UC Berkeley mentor.

Challenges

- **Language:** Some students were brand new to the Python programming language.
- **Process:** The team working on coding challenges did not turn in the assignment following the instructions ("*Go to gradescope.com and sign up as a student. The course entry code is BPJRZZ and the school is UC Berkeley*").
- **Process:** We solved most of the challenges but did not successfully turn in the assignment.

Robot code



Overview

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Challenges

- **Collaboration:** We could not find the code from the previous CCPA PiE team so we lost that point of reference – but we used the "pioneers" documentation on GitHub to get started.

	● **Collaboration:** Students have never used git or version control so we did not use it, resulting in some students overwriting other students' files and losing "code that works". ● **Python:** No one on the team understood what 'async' was doing. ● **Pimulator:** No one understood how to use Pimulator unless the UC Berkeley mentors helped them directly. ● **Dawn** sometimes would not save files, so we had to copy code, save the file in another application, and restart Dawn to upload new code to the robot. ● **Collaboration:** Robot moved only backwards in autonomous mode (so we put it in the playing field backwards) but when the game started we learned that someone fixed the code and the robot backed into a wall and could not get 10 points by leaving the starting square.

End-of-season reflections

Operations

- At the beginning of the year we should build a simple base robot that just drives.
- Every team member should be assigned to a specific team.

Mechanical team

- **Responsibilities:**
  - Participate in sketching ideas at the beginning of the season.
  - Participate in design reviews and give oral presentations.
  - Record pictures and videos of each step of the mechanical engineering process.
- **Rules:**
  - **"Student hands only"**
    Adults should only help with things like giving advice, or performing high-risk tasks like cutting metal or welding.
  - **"Keep a notebook"**
    People working on the robot must use a journal to keep track of work. Before you begin working, you need to read the last entry. Before you finish working, you must log some notes in the notebook.

Software team

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Crossover team

- They should know both things equally so they can act as a substitute when needed.