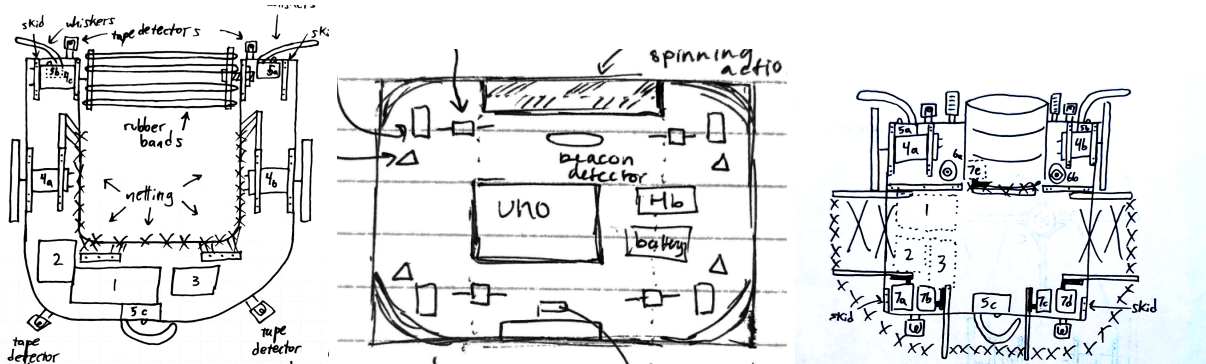# Lab Notebook

ECE118 Final Project: Jinsung P., Rohan P., Shreya S.

Meeting 5/7 - 5:30PM-7:30PM

- Coordinated and chose three main designs for checkoff with TA. Decided on *Rohan Idea 1*, *Shreya Idea 1*, and *Rohan Idea 3*. Got checked off by TA Kevin for Project Check 1.

- We decided that the first idea would be most feasible, and TA Kevin suggested having two back bumpers instead of 1, as well as refining our beacon detector system and perhaps dedicating more time to navigating the field to dump the balls near the end of the 2 minute round.
- Rohan started designing initial drive base to test wheel placement and drive motor choice (RS-385s).

Between Meetings:

- 5/7: 7:30-9:00PM - Rohan laser-cut and assembled drive base with remote control dESC. Video: 📄 5/7 Drive Test.mp4 . From testing, wheel Center to Center distance provides manageable turning speed, but wheels slipped (exceeded static friction) even at slow accelerations.

Meeting 5/8 - 8:30PM-10:00PM

- To-Do:
    - Go over ideas for presentation tomorrow
    - Go over schedule for next 5 weeks
    - Go over robot base and motors
    - Start budget listing
- Get 2 wheels from amazon
- Retrieve motors from ewaste printer
- Decide on roles

- After looking at the arena, we decided that we need a mechanism to open the trap door
  - Rohan Person
    - Primary: Programming, Secondary: Mechanical
  - Shreya Sinha
    - Primary: electrical, hardware / Secondary: programming
  - Jinsung Park
    - Primary: electrical, hardware / Secondary: programming
- Primary form of communication - Discord
- For scheduling and coordination, we created a spreadsheet with timeline

Between Meetings:

- 5/9: 1:07-1:15PM - Presented Rohan Idea 1 and Rohan Idea 3 to Elkaim and class. Verified that obstacle would be 11" wide, guaranteeing that one of the front bump sensors would hit it first. From review of previous classmates' ideas, integration of sensors is integral and should be undertaken immediately. Rohan completed the basic Block Diagram 🔲 Block Diagram , and started filling out the BOM 🟩 Mech BOM

Meeting 5/9 - 7:00PM-12:00PM

- Shreya and Jin worked on recreating the track wire detector and was able to get good detection from about 3 inches away from the track wire. Unfortunately, it must be held at a specific angle for optimal detection. Will need to test orientation on the actual base of the robot. Will attempt to solder the next day and see if more gain is needed (currently at about 400).

Between Meetings:

- 5/10: 6:00PM-8:30PM - Completed Beacon Detector Schematic
  📄 Beacon Detector schematic.png
- 5/12 - 5/13: Shreya completed the track wire detector, due to the impedance of the board, the range seems to have increased a bit to around 4-5 inches. Max voltage is about 3.65V, may be due to DC offset, another team suggested having an RC filter to remove the offset, but since that would involve desoldering components we voted to just keep the current track wire.
- To-Do (Shreya)
  - need to add LED / comparator (can be on breadboard) to track wire for checkoff
  - solder up voltage regulator (go to bels and grab another perfboard) update: perfboard acquired
  - create events / services for the track wire, bumper, tape detector, motors (?)
- 5/15
  - Laser cut new design with smaller roller

- - ○ Start implementation for various services on MPLab
    - ○ Learn how to work the switches. Struggled with reading the datasheet for the switch. We are using 1185RE8 and it turns out we don't need the datasheet at all. Its kinda self explanatory
- 5/16: Shreya worked on creating the service for the track wire. It works ok, however due to the fact that the output from the track wire is very noisy (max value when the track wire is not placed next to the inductor is 1023, the values change to random but below 1023 when the track wire is brought close such as 834, 542, 0, etc.). The values cannot seem to stay constant. A possible solution may be to solder a RC filter to the output of the first gain stage before the second gain stage to get rid of the DC bias and any other noise. As a result, the service spams events which might negatively impact our state machine. I attempted to add a moving 20 point filter to the code and although this appeared to work when the service timer didn't come into play, the length of the timer ticks affects how much the events are spammed (200 ms spams less vs 5 ms).

- 5/17: Shreya worked on testing the motors and trying to see what commands would make the motor run. One of the biggest problems we always encountered was that not grounding the UNO to the same ground used by the motor causes issues (Note: always ground the UNO, double check port connections, and make sure to initialize evey single header file used!!). The motor is connected to the H-bridge through the two output pins. We used ENA, IN1 and IN2 for the motor (this one will be used for the combiner). I used the pwm pin for ENA, and then set the frequency to 1000, and set the duty cycle for that pin. Then I set two separate pins as outputs and set them to alternate values (0 and 1 or 1 and 0). This allowed the motor to run. I also created a function for the motor (pretty much copied off the Roach code) which will change the motor speed to a new one.

- 5/18: Shreya worked on testing the RC Servo that was given to us from BELS. One of the biggest issues was figuring out what pulse width would result in a 90 degree angle output since we need the servo arm to lock into position (at 90 degrees) to have the gate open. It turns out the within the RC Servo header file, the max and min pulse were set at 1000 and 2000 respectively. This resulted in the servo only being able to go 45 degrees on both sides from the middle. Changing the min and max to 500 and 2400 respectively allowed the servo to move in it's full 180 degree range of motion. From there changing the pulse from 500 to 1500 allowed the servo arm to move 90 degrees. One thing found through trial and error was that there needs to be a bit of a delay between each rc set pulse time command or else the servo would not move. We referenced some of the delays used in the roach code and found that delaying by the MOTOR_TIME worked for testing purposes.

- 5/20: University is having a protest blocking out both East and West entrance so our progress was temporarily halted. With the progression stunted, we had a bit of time to relax and catch up on sleep. Shreya had created a template for the ir sensor and Jinsung took over the duty to implement the rest of the service. What needs to be done here is completing the state machine and connecting the hardware components to the

UNO. As we had worked on our code independently, putting it all together will serve as a challenge.

- 5/24: We attempted to put all the sensors together in the state machine and have it running on the ground. Big chunk of the time was wasted on figuring out why the events were not triggering a state change. Turns out that we were posting bumper events to bumper events. Well you might be thinking why that would be wrong. Normally this is the right way to do it. This is the right way to test your events. But in the case that you have a state machine, you have to also post to the state machine (in this case, topHSM.c). After figuring that out, we had an issue where the uno32 would cut off power and start flickering. This turned out to be an issue in loose wire. We were testing with a battery and the wires were not properly connected through the switch we were using. The switch acted as an intermediary between the battery and the uno, it was a crucial part of what turns on and off the machine. Then, we ran into trouble where the robot would not turn on with 9.9v even while connected to power, 9.9 power source or battery. Something is likely wrong with the connections. What I found to work the best was just wait a bit or shake the droid til it started working again. Wack I know, but it worked.

- Move the front ir sensors to be angled so that it is slightly facing forward. Have rohan redesign the front and back bumpers so that we have MDF covering a wider area. Angle the front so that it captures more balls. And make sure to remove tattletatle which is the service that outputs state changes because printing slows down the state change.

Meeting 5/7 - 11:40AM-1:30PM

- 5/7 Competition date. Our IR sensors busted in the morning so we had to quickly find a replacement. It worked fine in the end. We went second and competed against another team that hasn't received min spec. Both of the robots went out of bounds almost immediately, however our robot managed to collect 2 balls while the opposing team only collected one. This had us win by default. In the second round, we competed against the team that had a check off already and we lost pretty quickly.

Between Meetings:

- Once the competition was over, we had a 2 day rest break then got back to work. It was mostly Shreya fixing up the state machine since that was her role. I tried to help as much as I could but she refused any help so I let her be for the duration and tried to catch up on other duties.

List of teams:
Cris Vasquez • Carol Sanders
Ishan Madan • Yafi Thai • Peter Le
Dana Jeffs • Khanh Tran • Josh Kushner
Nghia Pham • Zac Kaner • Eugene Chen
Anirudh Iyer • Laura Ortiz • Danny Sabin
Daniel Au • Jaspreet Singh • Elijah Clancy
Samuel Si • Karla Vazquez • Zachary Bang
Charlotte Reiter • Ryan Taylor • Aaron Ye
Liz Villa • Rafael Delwart • Aaryan Redkar
Jinsung Park • Rohan Person • Shreya Sinha
Matthew Eng • Aarush Bannerjee • Duc Lam
Cole Schreiner • James Huang • Qingyuan Cao
Andrew Ton That • Andrew Xu • Andre Acacio
Caitlin Bonesio • Cooper Cantrell • Max Meyers
Christian Hernandez • Aidan Doshier • Derrick Lai
Ashton Coons • Nick Korshak • Justin Karnsomjet
Liam Asayag • Reed Warren • Ramsey Mogannam
Aleida Diaz-Roque • Karan Humpal • Jovanni Shen
Dylan Ford • Christopher McLeod • Marlon Brewer
Vanessa Tsui • Julio Quiroga Galan • Ian Calimquim
Teresa Begley • Jon Sheng • Miguel Robles Hernandez
Jesus Castro Garcia • Benjamin Goldblatt • Caden Grace Jacobs

Tutors:
Sean Cheng • Isaac Espinosa • David Evanko • Nikolas Gibson • Kevin Jiang

TAs:
Jack Lin • Leo Lin • Jerret Schlosser • Kunal Shah • Aadhav Sivakumar

Professor:
Gabriel Hugh Elkaim

Meeting X/X - X:XXPM-X:XXPM ← **Do not Delete, Template**

- Lorem Ipsum