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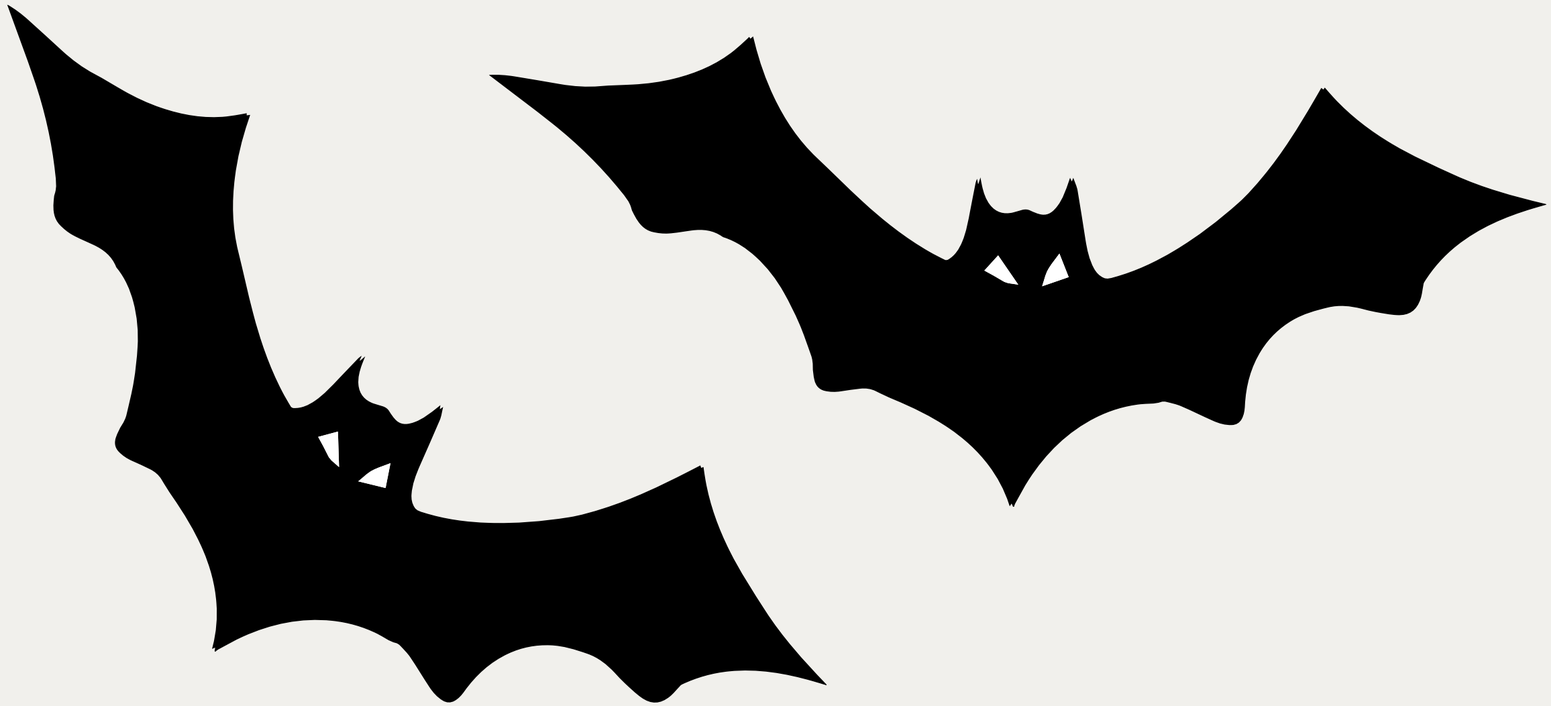

LAW-ABIDING BATMOBILE

PRESENTATION

MAE ECE 148 SU25 TEAM 4

2025

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TEAM MEMBERS

KARAN HUMPAL - ECE
BURHANUDDIN MAMUJEE - MAE
AVERY WU - ROBOTICS
ELIZABETH DAM - ECE

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OVERVIEW

OUR PROJECT IS THE START OF AN AUTONOMOUS BATMOBILE.
THREE MAIN FEATURES: (MUST HAVES)

- STOP SIGN DETECTOR (OAK-D-LITE)
- COLOR DETECTOR (OAK-D-LITE)
- OBSTACLE AVOIDANCE (LIDAR)

NICES TO HAVES:

- STOP SIGN DETECTION RUNNING ALONGSIDE LANE DETECTION
- HAVING ALL THREE FEATURES WORKING ALONGSIDE EACH OTHER

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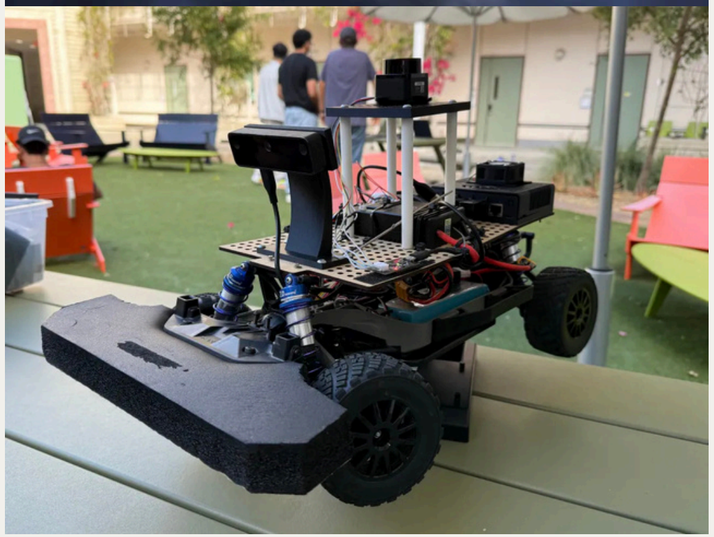
OUTLINE OF OUR ROS2 LAYOUT

Three Main Python Files Per Feature:

- A Constant Speed file
  - Creates a VESC value that goes at a constant speed
  - Publishes the values to constant_cmd
- Python file
  - Computes VESC values and sends the values
  - Publishes to their respective topics
- Arbiter
  - Subscribes to constant_cmd and the other topics that send VESC values
  - Determines whether to use the constant speed or the other VESC values
  - Publishes the VESC values to the topic cmd_vel



STOP SIGN DETECTOR

- STOPS FOR 3 SECONDS WHEN IT DETECTS THE STOP SIGN AND THEN CONTINUES
- USED A MODEL FROM ROBOFLOW UNIVERSE AND TUNED THE CODE TO WORK WITH ROS2
- TROUBLESHOOTING
  - CREATED TEST FILES TO DEBUG
  - RAN FILES INDIVIDUALLY
  - SLOWLY BUILT UP TO THE FULL STOP SIGN DETECTOR
  - ROBOFLOW NEEDS THE IMAGES FROM THE CAMERA DIRECTLY
    - WOULD NEED ANOTHER CAMERA RUNNING THE LANE DETECTION IN ORDER FOR STOP SIGN AND LANE DETECTION TO WORK TOGETHER
  - HARDWARE ISSUES
    - OUR DC-DC CONVERTER WAS BROKEN FOR THE ENTIRETY OF THE CLASS BUT WE DID NOT REALIZE UNTIL WEEK 3/4
      - CAUSED OUR JETSON TO NOT RECEIVE ENOUGH POWER AND WOULD SHUT OFF RANDOMLY

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COLOR DETECTOR

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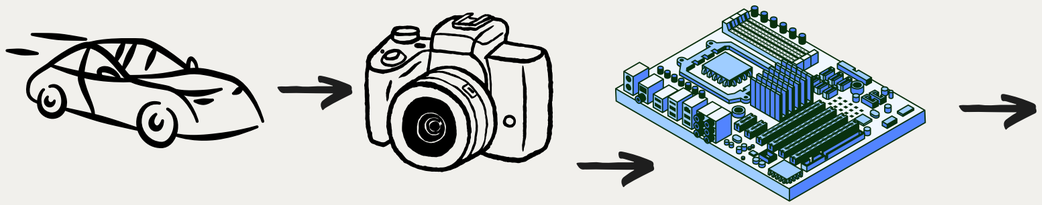
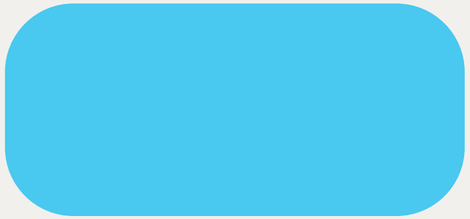
USED OPENCV TO FILTER OUT THE GREEN AND BLUE



→ **SPEEDS UP ON GREEN (JOKER)**



→ **SLOWS DOWN ON BLUE (CIVILIAN)**

→ **STOPS ON RED**

Troubleshooting

- **Realized we needed a way to stop the car besides Ctrl-C in the terminal → added a red detector**
- **Attempted to subscribe to the camera topic but failed and decided to use the camera directly in the color detector file**
  - **if given more time → sat down and tried to figure out in case in the future we wanted to try to use lane detection with it**

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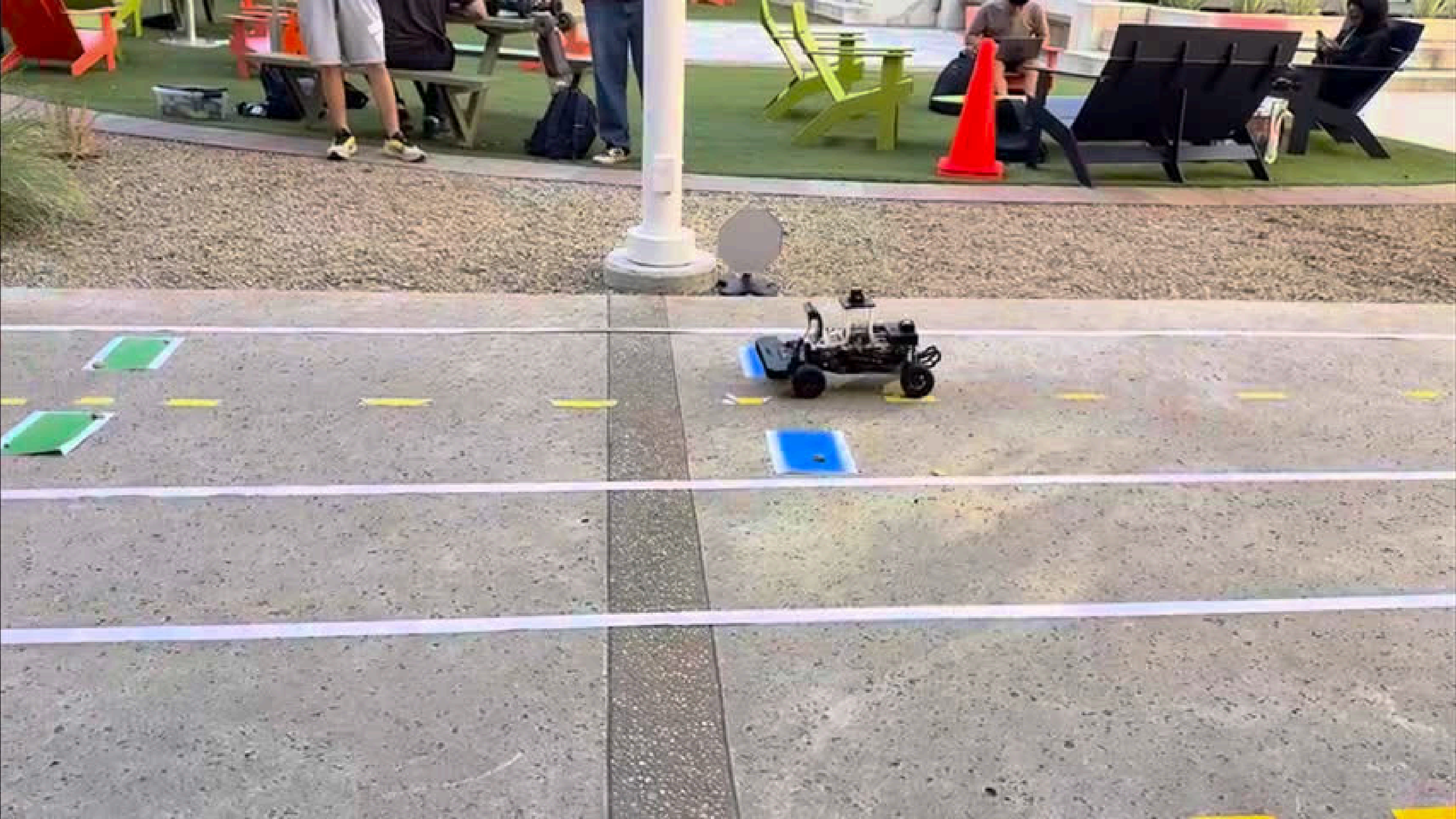
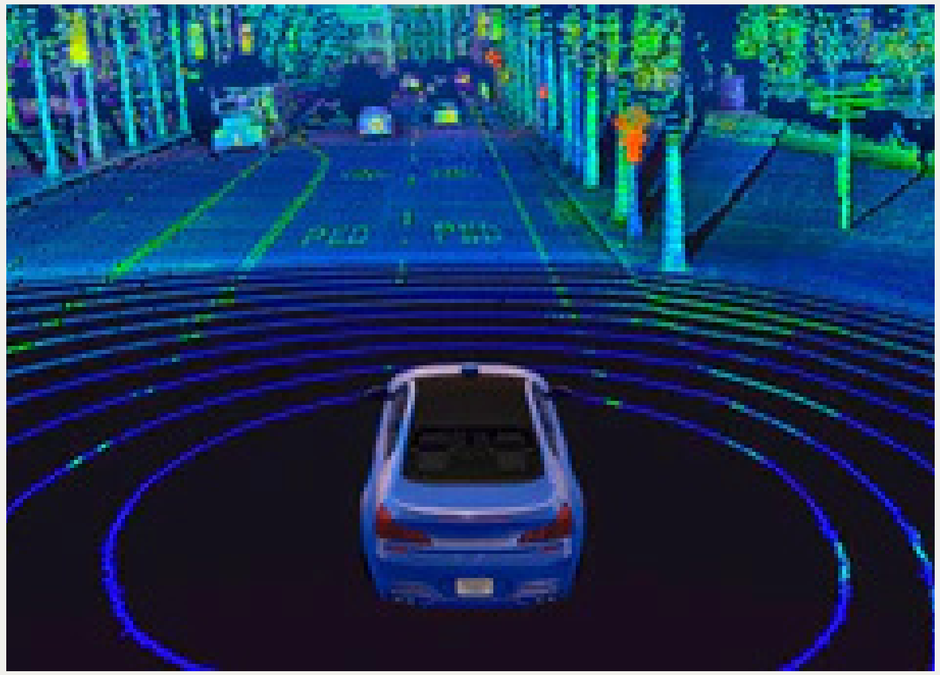


OBSTACLE AVOIDER

- USES LIDAR TO DETECT OBSTACLES AND THEN AVOIDS THEM
- USED LIDAR SETUP FROM UCSD_ROBOCAR_HUB2
- TROUBLESHOOTING
  - TRIAL AND ERROR WITH FIGURING OUT THE DISTANCE THE LIDAR WOULD CONSIDER AN OBSTACLE



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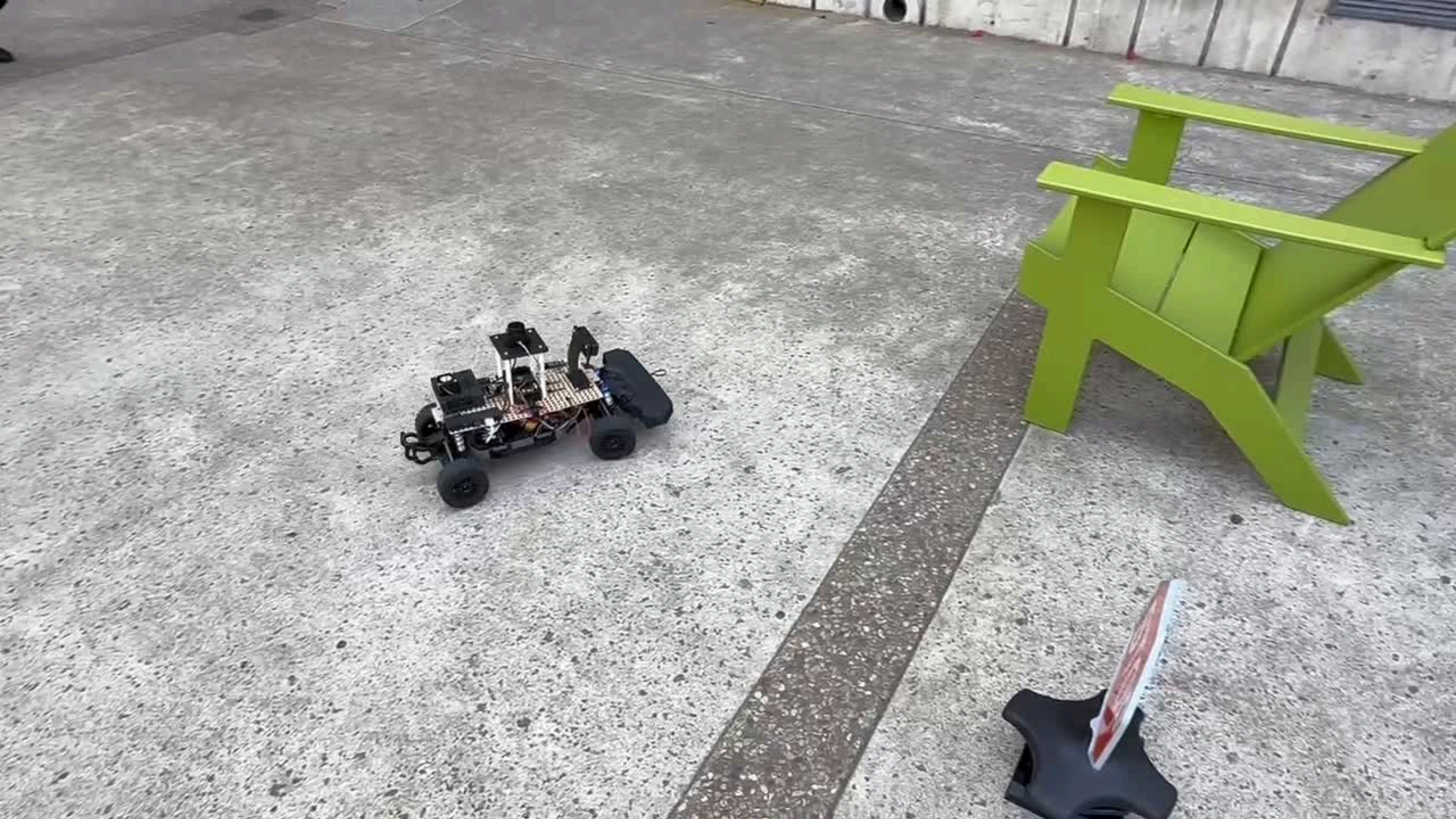
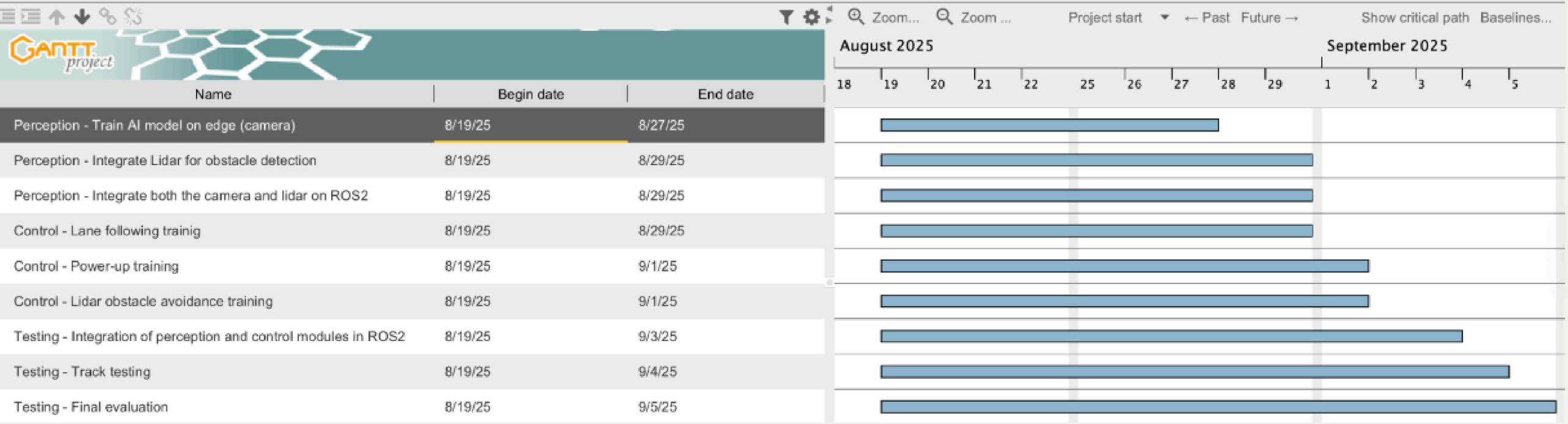
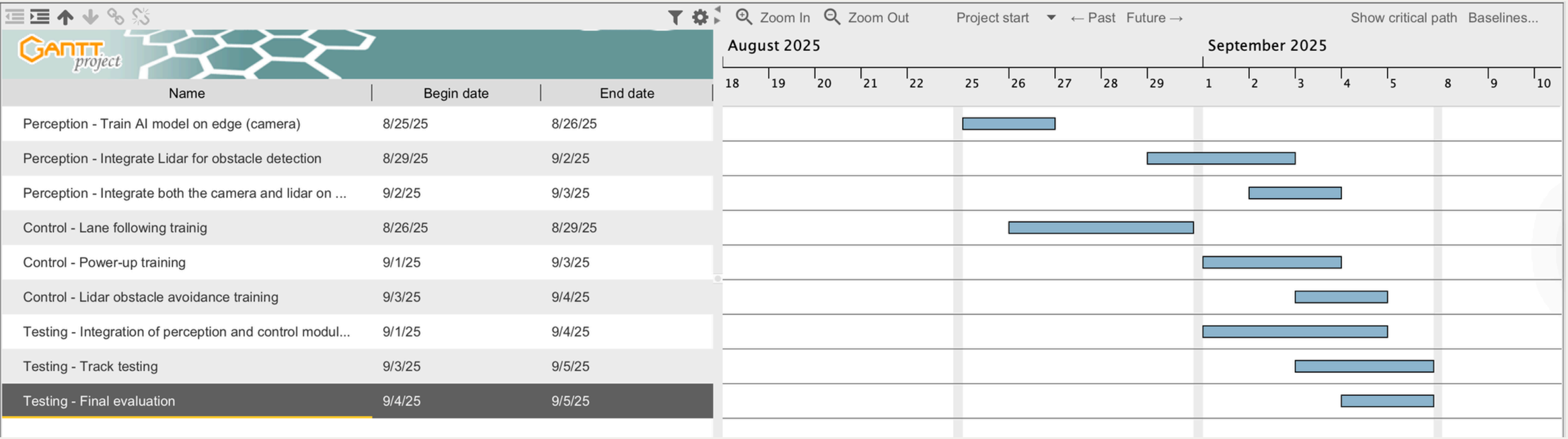


PREVIOUS GANTT CHART



Name	Begin date	End date
Perception - Train AI model on edge (camera)	8/19/25	8/27/25
Perception - Integrate Lidar for obstacle detection	8/19/25	8/29/25
Perception - Integrate both the camera and lidar on ROS2	8/19/25	8/29/25
Control - Lane following trainig	8/19/25	8/29/25
Control - Power-up training	8/19/25	9/1/25
Control - Lidar obstacle avoidance training	8/19/25	9/1/25
Testing - Integration of perception and control modules in ROS2	8/19/25	9/3/25
Testing - Track testing	8/19/25	9/4/25
Testing - Final evaluation	8/19/25	9/5/25

UPDATED GANTT CHART



Name	Begin date	End date
Perception - Train AI model on edge (camera)	8/25/25	8/26/25
Perception - Integrate Lidar for obstacle detection	8/29/25	9/2/25
Perception - Integrate both the camera and lidar on ...	9/2/25	9/3/25
Control - Lane following trainig	8/26/25	8/29/25
Control - Power-up training	9/1/25	9/3/25
Control - Lidar obstacle avoidance training	9/3/25	9/4/25
Testing - Integration of perception and control modul...	9/1/25	9/4/25
Testing - Track testing	9/3/25	9/5/25
Testing - Final evaluation	9/4/25	9/5/25

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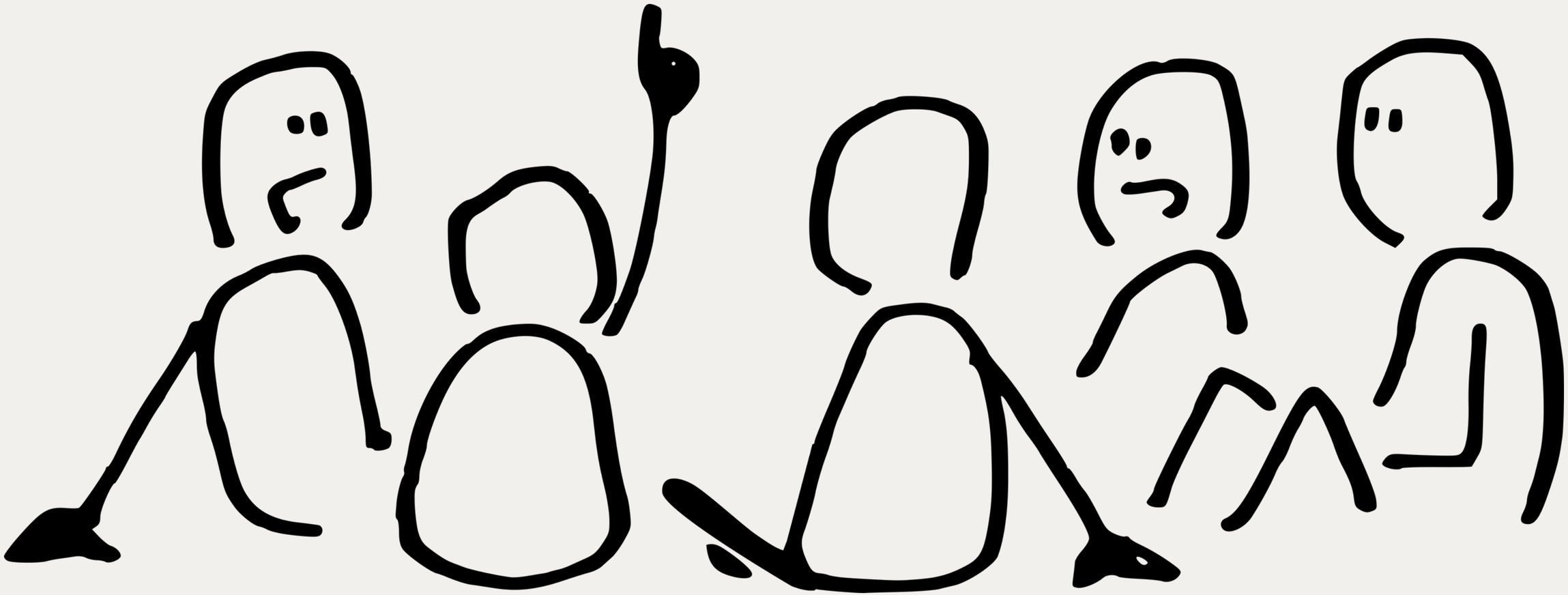
IF WE HAD ANOTHER WEEK



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THANK YOU!