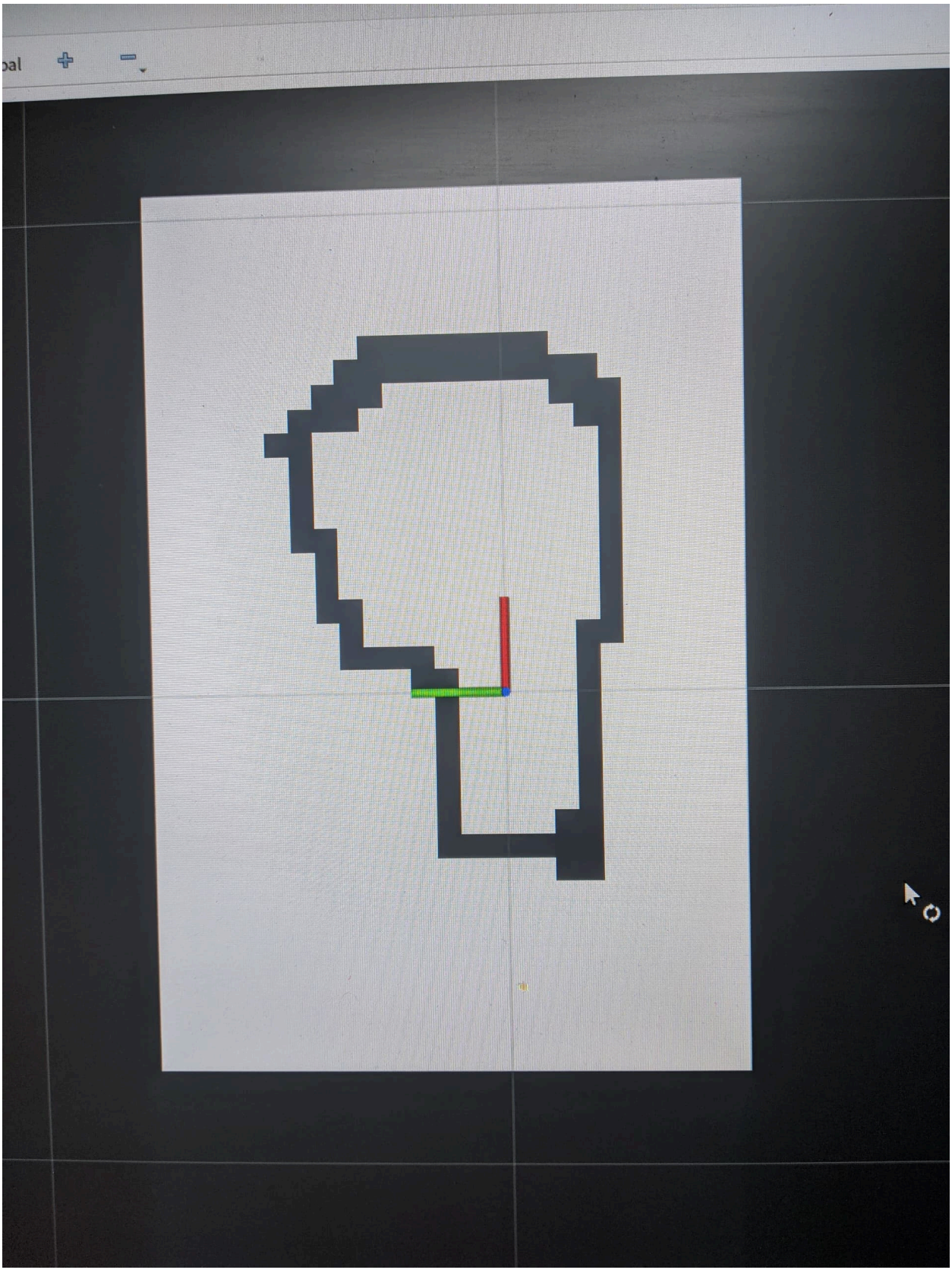
SLAM Problems

SLAM Mapping

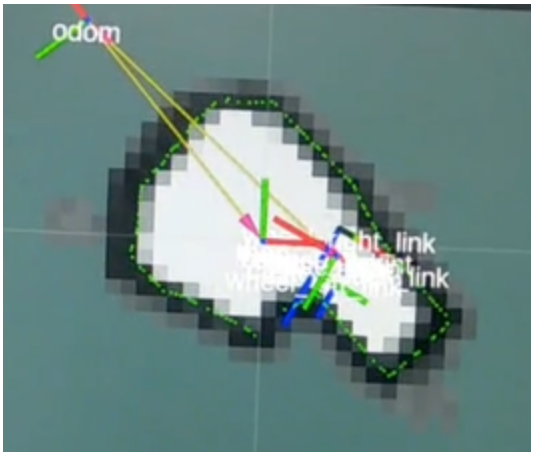
A simple environment is created using cardboard:

Then the SLAM node is run to map the environment. The bot is controlled using the keyboard to move around and detect walls as shown in Video 1. The following image shows the map generated:

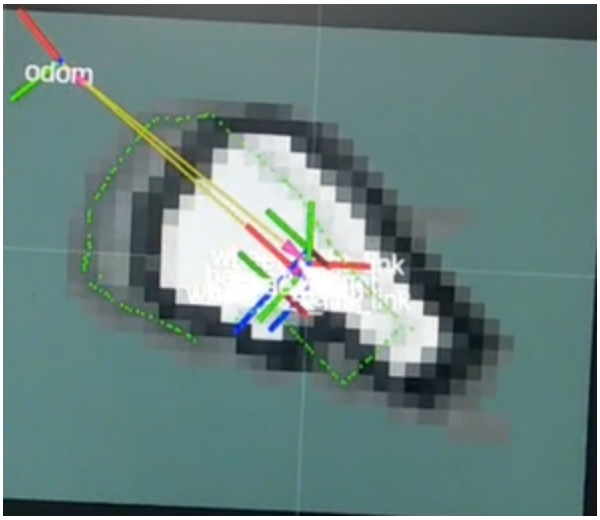


Issues while doing SLAM

- During the mapping of the SLAM, the reference point of the robot suddenly shifts. This causes problems because the previously mapped walls get overlapped with new detections as the reference point has shifted.
- This first image shows accurate positioning and mapping. The green dots show the walls currently being detected while the black pixels represent the previously detected walls. At present both of these overlap, showing that it is accurate.



- However the reference point suddenly shifts, and the green dots don’t align with the previously detected walls anymore, (due to change it reference co-ordinates). After the shift, the LiDAR keeps reading new data which is now overlapped onto the previous data. The shifting of this reference point is random and unpredictable. Video 2 shows a demonstration.



Navigation

- The first step of navigation is to set the starting point of the robot on the map.
- If the green dots align with the map, it shows the positioning has been done successfully. This can be seen in Video 3, where after drawing the line on Cartographer, the green dots show up aligning with the map underneath. This shows that the initial positioning is accurate.

Issues

- While the initial positioning works accurately, when trying to do navigation, the position of the bot on the map remains static. This can be seen in Video 4 and Video 5. When the bot starts moving, it’s position does not update, which results in the green dots losing alignment with the actual map.
- This indicates that either the sensor data of the bot is not being read properly, or there is an issue with the readings itself. However, the former is the more likely case since the sensor data works perfectly initially.

Simulation

- All of the issues discussed are likely due to hardware issues. Either the hardware is faulty, or it requires very careful tuning and calibration. If we run a simulation of a similar environment, everything runs smoothly as can be seen in the Simulation.mp4 video

- The video also shows placing a new object to block the path of the bot. The bot is able to find a new path around this object to reach its destination.