STATUS REPORT – Will Wu

Writer	Will Wu
Status Update Period	Week of 02/26/23 - 03/04/23
Professor	Dr. Dorothy Wang

Accomplishments for the week of (02/13/23-02/19/23)

- *System Development in ROS2 is well underway*
    1. The task of implementing a RPM sensor note is dedicated to Onza. I helped her familiarize herself with the build environment and my IMU node. I also provided her with a starting direction: ROS2 services. She seemed to be making progress.
- *PiCar system design and simulation*
    1. We designed the error function of the PID controller to regulate engine speed and steering angle. Both quantities are calculated based on x-speed, y-speed, and yaw rate.
        1. The PID controller we designed regulate speed, and is therefore a "velocity controller". Our design is very expandable, as we can easily add extra layers of PID controller outside of the velocity loop to control more parameters such as position. This technique follows the principle of cascaded PID design.
    2. To verify our error function, we attempt to finish our PiCar model and simulation in MATLAB and Simulink. We found new literature online, but the physics model is quite challenging to implement. The MATLAB implementation may take some time.
    3. I met with professor Yiannis Kantaros to discuss potential navigation system design for the PiCar. His suggested that we can use light poles around the track as "landmarks" and implement landmark-based navigation.
        1. Our general plan becomes clear: we will start with an GPS+IMU fusion Kalman Filter, and extend to add any visual/LiDAR elements.
        2. We chose a suitable GPS module for purchase.
- *Payton completed the third iteration of the Picar shell*
    1. The second iteration turned was a lot better than the first, though there still exists some issues.
    2. Based on the second iteration, we printed a third iteration with better tooled screw holes, tailored screw and wire cutouts, and new sizing that fits the LiDar and the Pi

Plan for next week (03/05/23-03/11/23)

- Continue MATLAB simulation to verify PID design
- Implement PID controller as ROS nodes if successful
- Continue designing and implementing Kalman filters
- Assist Onza with RPM node
- Conduct literature survey of GPS+IMU fusion algorithms

Topic Outline/ Progress toward deliverables

I. Implement ROS2 sensor nodes for Encoder **Scheduled to complete by 03/10/23**
II. PID Controller, linear estimator and angular estimator design. 15% done; ongoing: **2/24/23 - 3/9/23**
III. ROS2 implementation. 10% done; ongoing: **to complete by 3/20/23**
IV. Testing **Scheduled: 3/20/23 – 3/27/23**
V. Pre-SLAM navigation **Scheduled 3/20/23 – 3/27/23**
VI. SLAM study **Scheduled 3/20/23 – 4/27/23**

Issues

- Our SD card snapped. We have to reinstall the system on a new SD card. I have made

it my priority to make a system setup/install script and backup system images, so that we can quickly recover from similar situations in the future.