STATUS REPORT – Will Wu

Writer	Will Wu
Status Update Period	Week of 02/13/23 - 02/19/23
Professor	Dr. Dorothy Wang

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

- *Finished formal proposal*
    1. *Wrote the proposed technical approach section and feasibility section with preliminary results*
    2. *Compiled IMU and RPM sensor data into presentable graphs*
- *Converted IMU sensor script into ROS2 node*
    1. *Set up ROS2 workspace and build environment locally, results pushed to github*
    2. *Progressed into chapter 3 of textbook "Concise introduction to ROS2"*
    3. *Packaged previous IMU script into python wrapper class, specified ROS2 message for raw sensor reading*
- *Investigated torque measuring and motor modeling*
    1. *Found equations regarding motor torque output (cross product between motor speed and torque equals power)*
    2. *Investigated several ways of measuring/estimating motor torque (via measuring the power output of motor, whether electrical or mechanical)*
- *Conducted further literature survey on Kalman filtering*
    1. *Read relevant chapters from textbook "Feedback Systems" by K.J Astrom*
    2. *Investigated potential process models for Kalman filters (double integrator, linearized vehicle dynamics model)*

Plan for next week (02/20/23-02/26/23)

- Convert current sensor scripts into ROS2 nodes, publishing to relevant topics
    1. IMU
    2) Encoder
- Start Kalman filter design and verification via MATLAB
- Obtain sensor statistics, including sensor noise mean, variance, covariance, and standard deviation

Topic Outline/ Progress toward deliverables

I. Implement ROS2 sensor nodes for IMU and Encoder **Scheduled to complete by 2/26/23**
II. PID Controller, linear estimator and angular estimator design **Scheduled 2/27/23 - 3/9/23**
III. Starting ROS implementation **Scheduled 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

- Motor torque is a challenge to measure and estimate. There exists limited data on the Traxxs motor we are using. Though it is possible to measure the speed and estimate power through voltage-current measurements, the final reading would not be accurate given motor efficiency is far from 100%
    1. we decided to move away from entirely model-based controller and start implementing a PID controller. The existing partial model will still be useful for estimator design
- We are given the task of redesigning the top housing of the Picar. The current mesh file for the part turned out to be hard to modify.

1. We started a remodeling process for the part, spearheaded by Payton