STATUS REPORT – Will Wu

Writer	Will Wu (with some sections by Onja and Payton)
Status Update Period	Week of 01/29/23 - 02/04/23
Professor	Dr. Dorothy Wang

Accomplishments for the week of (01/30/23-02/05/23)

- Interfaced with onboard accelerometer through I2C bus and collected preliminary data
  - Read the official datasheet of MPU6050 Accelerometer for sensor configuration information. Record relevant configuration (e.g sensor configuration register addresses, configuration parameters, etc)
  - Configured accelerometer and gyroscope to sample at 1 kHz; sampled for 5 seconds to collect sensor statistical noise signature. We observed that the IMU suffers from statistical noises that follow a Gaussian distribution. Relevant statistical analysis were then conducted to determine the mean bias and covariance of the noise distribution
- Implemented preliminary LiDAR point-cloud scan, generated polar point cloud map using matplotlib
- Implemented motor control test program. Based on the motor start-up sequence provided by the instructor, the test program configures and arms the ESC and outputs user-directed pwm values to drive the motor.
- Added hall-effect sensor and magnet to the PiCar gear box for RPM sensor reading.
  - Implemented hall-effect sensor test program to detect magnet trigger through digital input
  - Designed moving-average filter algorithm for RPM sensor firmware
- Conducted literature survey on vSLAM (visual Simultaneous Localization and Mapping) algorithms for the autonomous driving task
- Note: Unlike Raspbian OS, Ubuntu has relevant permission restrictions regarding program privileges when accessing onboard buses and GPIO pins. During our testing and implementation, we identified and configured the system privileges accordingly. A notable example was the i2C bus. We had to configure proper user access to i2c port *dev/i2c-1* accordingly.

Plan for next week (01/28/23-02/03/23) (same as team)

- Conduct system identification experiments to find physical properties of the system (yawing moment of inertia, motor transfer function and wheel rolling friction constant)
- Complete sensor interfacing; program and test RPM sensor firmware
- Complete and submit our formal proposal.

Topic Outline/ Progress toward deliverables (same as team)

I. Continue the simulation on the Pi car (through 25% completion) **Scheduled to complete by 02/17/23**
II. Finish conducting system identification experiments **Scheduled to complete by 02/17/23**
III. Finish the formal proposal (30% complete) **Scheduled to complete by 02/12/23**
IV. Implement a PID controller, complementary filter and possibly a Kalman Filter **Scheduled to complete by 2/26/23**
V. Controller, linear estimator and angular estimator coding **Scheduled 2/27/23 - 3/9/23**
VI. Starting ROS implementation **Scheduled 2/27/23 - 3/20/23**
VII. Testing **Scheduled: 3/20/23 – 3/27/23**
VIII. Pre-SLAM navigation **Scheduled 3/20/23 – 3/27/23**
IX. SLAM study **Scheduled 3/20/23 – 4/27/23**

Issues

- The wires connecting our encoder to the PiHat got caught into the gears and are shredded. We need new ones.
- Confusion with the schematics posted on canvas led to connecting the PiHat to ESC 6V power supply, wiping all data on system SD card
  - We had to reconfigure the system from scratch. Luckily, our extensive journal and version tracking system (git) contained timely backups for us to reset the system
  - We plan to record backup system images in the future, so we have bootable system images to retreat to if similar situations were to happen again