Team: vehnicate

Members: Sai Siddharth S.E, Fahim, Pragya Sekar, Sowmiya

Programming challenge 1: Autonomous Disaster Management Rover challenge

Objective: To simulate the movement of a rover (physical) by collecting odometry data and communicating with a server. The challenge also requires us to use an API calling system to retrieve data of the battery percentage based on which the rover is to move.

Our setup:

- We decided to simulate the maneuvering of the vehicle in real life instead of a simulation.
- The vehicle is built out of a rough chassis and a lego based steering system controlled by a servo motor. We use two DC motors to drive the rear wheels of the rover.
- The OBU of the vehicle includes a:
  1. raspberry pi zero w for processing and communication of data.
  2. Arduino Uno with a combination of L293D motor driver to control the servo and DC motors.
  3. A MPU6050 i.e., an accelerometer and a gyroscope to measure the telemetry of the vehicle for self-localization and tracking.
- The calibration of the accelerometer was done by orienting the vehicle in various orientations along the three different axes and thereby using line of best fit to compute values of “b and c” such that:

  Calibrated acceleration = (measured acceleration) * b + c
- The gyroscope calibration was fairly a simple one that computed the offsets by averaging 5000 values of the sensor.
- We established connection between raspberry pi and THINGSBOARD.io via MQTT protocol. With this, we now wirelessly transmit the calibrated accelerometer and gyroscope. The graph of the same is now exported to a website that our team built, a link to which has been attached.

Team: vehnicate

Our working:

In accordance with the problem statement given, our working is as described below:

- The rover autonomously maneuvers through a terrain (auditorium floor). This stage of our development was able to meet our expectations- smooth motion execution (a smooth curve) and a fairly straight path with the steering and On-Board IMU.
- For the controlling of the rover, we have used;
  Stanley Controller for lateral control (steering system), and PID Controller for longitudinal control (for speed regulation)
- As the problem requires, the bot is supposed to start charging from 5% and stop at 80% during which its stationary. And the communication with the server (MQTT to thingsboard) stops as the battery drops below 10%. The battery percentage was retrieved from the API calling system suggested.
- Our designed system can navigate through terrains with less human intervention thereby making it apt for disaster management. Also, limited usage of multiple sensors makes it computationally cheaper. The sensor we used- mpu6050 is a highly durable one and can withstand harsh climatic conditions.

How we stand out:

- The IMU gives us with constant insights on the vehicle's driving behavior and a lot of jerks in the system would mean a highly grumpy terrain thereby giving us a head start in perhaps even mapping the terrain of exploration.
- Our strong desire towards a hardware simulation of the problem showcases our team's invaluable creativity and dedication towards solving real life problems.

Conclusion:

Our purpose of the project extends far beyond the hackathon with an intention to prove the reliability of the IMU sensor used. IMU systems as simple as these could greatly aide in deriving powerful & meaningful conclusions regarding the driving behavior of drivers and help detect road irregularities.

We consider this as our stepping step towards solving one of the nations's biggest problems- India's toxic driving attitude!

Team: vehnicate

A professional analysis states that a strong penalty system would solve nearly half of all the driving nuisances we face every passing day!

Its impossible for the Government to monitor the movement of every wrong doing. And this is where our team, vehnicate steps in. We work towards vehicle acquisition and crafting a valuable ecosystem for vehicles. For this, we begin with mounting telemetric On Board Units (OBUs) that track literally every movement of the ego vehicle involved.

This not only lets the government structure a better penalty system, but also create positivity. Think about it; if one Is to be punished for every wrong driving act, why shouldn't one be rewarded for every positive act? When one drives with patience- waits for pedestrians, drives with lesser honking and so much more. We not only want to reduce negativity but also help drive positivity!

Therefore, the cash prize if won would move towards the RnD of the OBU to be mounted on a potential ideal client!