

Team Name: sdmay24-31

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Report Period: Sept 18 - Oct 09

## Summary of Progress

### 1. Lidar Research (cont from last period)

- a. Explored the difference between Lidars
  - i. Solid State and Mechanical Lidar.
  - ii. 360-degree Lidar with 40-degree Lidar, considering longer-range capabilities.
- b. Conducted hands-on testing using the Livox mid-40 Lidar, Livox software, live Lidar readings, and previously recorded Lidar data.
  - i. Adjusted various settings:
    1. frame time
    2. color settings
    3. point size
    4. playback speed
    5. orientation.
- c. Tested the Pylas library with the recording of Lidar data.
- d. Lidar specifications
  - i. Created a Lidar specification sheet for comparing multiple Lidar models.
  - ii. Identified the most important Lidar specifications, including range, points per second (PPS), field of view (FOV), and frame rate (for 360-degree rotations).
  - iii. Explored Lidar data and familiarized ourselves with the software.
  - iv. Researched the use of Lidar as a vehicle detection system for moving vehicles.

### 2. Developed Requirements of Project

- a. Met with Ahmed Nazar to help develop these requirements
- b. Identified problem statement
  - i. Issues contributing to our statement:
    1. Lack of standardization in developing lidar sensors.
    2. Difficulty in creating an object classification training model due to data discrepancies.
    3. Poor cross-compatibility in lidar data.
  - ii. Problem statement: The challenge lies in establishing industry-standard protocols for lidar sensor development, leading to difficulties in building a reliable object classification training model due to data inconsistencies,

ultimately hindering cross-compatibility. Additionally, there is a need to create an open-source dataset for ISU to use as a reliable data source.

- c. Identified Requirements and Constraints
  - i. No specific budget constraints as equipment is available.
  - ii. Data privacy considerations in gathering data.
  - iii. Adherence to engineering standards and agile development practices.
  - iv. Multiple sensors and time constraints are to be managed.
  - v. Need a diverse dataset.

### 3. Developed Project Plan

- a. Tasks and timelines
  - i. for the rest of the semester:
    1. Week 1&2 Lidar Options
    2. Week 3 : ML overview
    3. Week 4&5 : Messing with ML
    4. Week 6-8: Data collection and data labeling
    5. Week 9&10: System Design
  - ii. Identified Project timeline
    1. Collect data - 60h
    2. Develop Model - 100h
    3. Label Data set - 70h
    4. Train model - 70h
    5. Check model - 90h

### 4. Machine Learning Research

- a. Machine learning basics
  - i. Machine learning crash course from Ahmed.
  - ii. Recognized the importance of parameters, weights, neurons, etc
  - iii. Built an understanding of different best-fit applications for Machine Learning:
    1. Linear Regression
    2. Logarithmic
    3. Re-Lu
    4. Leaky Re-Lu
  - iv. Different Types of Neural Networks
    1. Deep reinforcement learning
    2. convolutional
    3. Generative adversarial network

### 5. Explored Tools to be utilized

- a. MATLAB livox toolbox
  - i. Use manual labels first to determine the test accuracy
  - ii. Used due to OpenCV not working for computer vision
- b. OpenPyLivox
  - i. Used for extracting data

- ii. Better for communication between sensor and device