Progress Report 1

**Overall Project Specifications:**

Team Budget Tesla proposes a solution to this issue: an autonomous system that would enable the transfer of people around campus, specifically targeted towards those for whom travel is more difficult and time-consuming.

We plan on refurbishing a golf cart. Sensors and data processing will be added onboard to provide obstacle avoidance and self-driving capabilities. If we successfully implement our project, we will be able to provide a faster method of daytime transportation for people on campus. This will significantly improve the experience of impaired-mobility students on campus, potentially saving hours of travel time per student.

There should be a variability in the pickup and destination locations implemented by the system, but these locations can be limited to the general Stockton campus of University of the Pacific. All locations must be connected by a paved road that our vehicle can safely drive on. It should handle multiple location pickup and drop-off requests with a remote calling system and a queuing system, to allow all passengers to arrive as promptly and happily as possible. The accuracy of the cart will drop off and pick up at the paved road closest to the main entrance of the location, within 10 meters from the front entrance of all specified locations. Each named building should have at least one such point, with some (such as the University Center) having multiple for convenience. The cart should be able to aptly adapt to changes in campus geography, such as detours, removing or adding points, and other occasions.

**Block Diagram:**

Diagram

Description automatically generated

**Figure 1: Level 1 Functional Decomposition**

This block diagram above is an overall view of the system and what it should do. We should use the information given from the student about pick up and drop off location, power from the charger and golf cart batteries, and the data the sensors detect to provide transportation to the students.

This next block diagram depicts the sensor module which is what I have been focusing on and will continue to improve this semester.

Diagram

Description automatically generated

**Figure 2: Sensor Controller Subsystem**

The goal of my subsystem is to have enough computer vision/sensor data to detect obstacles to avoid them and navigate the campus correctly. This will be extremely important for the cart to drive around without injuring any pedestrians or bikers or even passengers. I will also be working on the algorithms for the cart to follow a straight line along campus, so we can be efficient in getting across the school and following paths.

**Current State:**

Currently, we have chosen a camera and a radar sensor that we can use on our car for detecting obstacles and pathways. This could always change, but the current choices for our radar and camera are the OmniPreSense OPS241-B-F-M-RP short range radar, and an Arducam IMX219 Wide Angle Camera which works directly with our Jetson Nano minicomputer. These sensors will give our cart enough information to detect objects in front of itself and be able to identify them if our object identification system is running correctly. This has been simulated on Matlab with their self-driving simulation toolkits as seen below.

Chart

Description automatically generated with medium confidence

**Figure 3: Bird’s Eye View Simulation**

The system for making sure the cart drives in a straight line has not been developed, but I am currently researching methods to implement this. Current idea is to path out campus for our cart and then implement a PID algorithm that will help the cart correct if it strays from the path on accident.

My plan for next week is to research radar sensors to see if there are any better options for less money to better fit the budget, and to start theorizing how I can implement the algorithm for straight driving around campus.

**Task Allocation:**

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| **Team Member** | **Tasks to Complete** | **Due Date** |
| All | Start of Next Semester | 1/18/2022 |
| Beau | Test/simulate radar sensor for functionality | 1/25/2022 |
| Michael | Ubuntu environment proof-of-concept, tested on Jetson | 1/25/2022 |
| Oscar, Davis, Beau | Implement Microcontrollers for Sensors | 2/15/2022 |
| Davis | Implementation for Mini-Computer Setup | 2/22/2022 |
| Hemad, Oscar | Throttle completed | 2/28/2022 |
| Michael | Scheduling and pathfinding implemented | 2/28/2022 |
| Davis | Training Data Set for NN Training Completed | 3/1/2022 |
| Michael, Beau | Micro- and Macro-navigation implemented | 3/15/2022 |
| Oscar | Construct Step Down Voltage Circuit | 3/22/2022 |
| Hemad | H bridge completed | 3/22/2022 |
| Davis | Image Processing Algorithms Completed | 3/22/2022 |
| Michael | Decision-making | 4/1/2022 |
| All | Software environment complete | 4/4/2022 |
| All | System Put Together with All Components | 4/4/2022 |
| All | Full System Testing Complete | 4/18/2022 |
| All | Finals Begin | 5/5/2022 |