**Senior Project Justification Fall 2021**

**Project Autonomous Wheelchair**

**Team Members:** Max Bronson, Denny Mannakulathil, and Oscar Montealegre

**Project Description:** Using the previously constructed Smart Wheelchair this project will implement SLAM protocols in order to achieve point to point autonomous navigation.

**Project Selection:**

1. Structure of Mechanism

The chassis of the drone will need to have sufficient tensile strength in rotor shafts, distributed equally, to support maximum possible payload. Additionally, the rotor shafts will need adequate torsion strength for the max torque possibly generated by the motors. Furthermore, the airframe in general will need proper structural integrity for the co-axial torsion, bearing stress, and moments induced.

1. Sensors

The sensors that will be used are: infrared sensor from a Microsoft Kinect, LiDAR scanner, and a video camera. The infrared sensors will assist in obstacle avoidance. The LiDAR will determine the distance traveled by using lazers. A camera will be attached to the wheelchair and is incorporated to the end-effector in order that the drone will know where to pick up the load.

1. Actuators

In order for the drone to have the strength and ability to fly with a small payload, it will require motors with a strong torque to weight ratio.

1. Computer System

This project will require the Arduino101 as well as a flight controller. The flight controller is necessary to control the motors of the drone. The Arduino101 will be used for the ultrasonic sensors. The readings from the flight controller will be connected as outputs for the Arduino in order for the drone to autonomously react to the given situation. The project will also use a microcontroller called NodeMCU that emits wifi signals. This will be used for indoor navigation via wifi triangulation.

**Specifications and Requirements**

1. Clear definition of system specifications

Exact parameters are still being evaluated for feasibility and practicality. The drone will require a DC battery in order for every component to operate. The motors will require enough power to lift the drone and package and carry it to the proper location. On board sensors will be used for the navigation, such as the ultrasonic sensors and the wifi microcontrollers. They will be reading data from transmitters in the environment. An on-board controller will manage the control systems for the aerodynamics.

1. Clear definition of technical requirements

This drone will have the capability to transport a package autonomously from a starting location to a designated location while avoiding any obstacles in its path.

1. Clear definition of minimum success criteria

The minimum success criteria is that the drone will lift off, navigate to a designated area, and land autonomously while implementing obstacle avoidance.

**Required Quality & Work**

1. Technical coverage, merit, learning, etc.

The technical areas that will be covered are mechanical and electrical design, obstacle avoidance, and path planning.

1. What engineering works are involved? It should cover analysis, simulation, construction, and test.

*Design*: For mechanical the drone frame will need to be designed and manufactured. It will require a Finite Element Analysis for a structural analysis. This test will confirm if the drone is strong enough to fly and hold a small payload.

*Electrical and Programming*: This will require various tests in order to determine the proper safe distances for the obstacle avoidance. The path planning portion of this project will require simulations and tests in order to determine the most optimal route to deliver the package.

*Simulations*: Simulate different possible environments that would have uniform threats to avoid, (i.e. if a factory occasionally has humans walking throughout the environment, have the drones know whether they should travel 3’ or 8’ off the ground; have a drone avoid a section of an environment if large moving parts have become active.)

**Feasibility Test**

The project will be completed in a semester. The budget will be ~$700 for this project, and team members will be self-funding. Technical resources including mentoring are James Hudak, Flavio Albieri, Dr. Adeel Khalid, IEEE membership, and the KSU Library.