Functional Specification

for the

Mail Delivery Robot

Version 1

Date: 01/28/2025

Sponsored by: Dr. Logan Porter

Designed by: Talaria Robotics

ESET 420 Section 502

TEXAS A&M UNIVERSITY
Engineering

1. **Design**
    1.1. Able to hold a combined 15 pounds of Mail
        1.1.1. No large or heavy packages
        1.1.2. All folders will be letter size or smaller
    1.2. Mail will be secured
        1.2.1. Mail does not fall out during typical movement
    1.3. Clean and organized design
        1.3.1. All cables will be secured
        1.3.2. Faculty Advisor will approve of final design
        1.3.3. All buttons and touchscreen options are clearly labeled
    1.4. Robot size
        1.4.1. Robot will fit through an average door frame
            1.4.1.1. Robot size will not exceed 28 inches
    1.5. Driving method
        1.5.1. Robot will have enough traction to avoid slipping on tile and carpet
        1.5.2. Tank treads are preferred
    1.6. Motors
        1.6.1. A minimum of two motors
        1.6.2. Motors will be controlled by a motor driver
        1.6.3. Motors will be related to encoders
        1.6.4. Motors will be able to run under the maximum mail load
2. **Set Up**
    2.1. Robot will start in the same position every run
    2.2. User will ensure that the system is adequately charged prior to starting
        2.2.1. Batteries should be above 20%
    2.3. Robot will travel a minimum of 1 stop, not including the mail room
    2.4. Normal Operation
        2.4.1. User will load robot with mail before selecting the desired rooms
        2.4.2. Robot will navigate to desired location while avoiding obstacles
        2.4.3. Robot must wait for end user to instruct it before continuing it's path
3. **Autonomous Navigation**
    3.1. Indoor navigation only
        3.1.1. Testing will occur on the first floor of Fermier Hall.
    3.2. Mapping
        3.2.1. Map will be preloaded
        3.2.2. Route will be programmable
        3.2.3. The user will have the ability to select any combination of the listed rooms
    3.3. Obstacle Avoidance
        3.3.1. Robot will avoid static and dynamic obstacles
            3.3.1.1. Robot will stop if an object is within 6 inches
            3.3.1.2. Robot will attempt to navigate around if an object is more than 6 inches away
        3.3.2. Obstacle avoidance sensor will not be a physical detection method (e.g. whiskers or bumpers)
            3.3.2.1. LiDAR is preferred

4. Touchscreen

4.1. Touchscreen will be visible at all times
4.2. Touchscreen will be larger than 5 inches
4.3. Touchscreen is reactive when touched

5. Power

5.1. Power supply will be supplied using portable batteries
    5.1.1. Batteries used for any module in the system must meet the following criteria:
        5.1.1.1. Sufficiently power all components
        5.1.1.2. Provide one hour of non-continuous operation per day
    5.1.2. Preferred 3.7V Lithium Ion (Li-Ion)
5.2. Batteries must be rechargeable

6. Communication

6.1. Raspberry Pis will be connected using Ethernet or another stable form of communication
6.2. Robot will not communicate with any technology not attached to the mobile system

7. Reports

7.1. An up to date Google drive will be shared with all stakeholders and include:
    7.1.1. Mechanical Concept Drawings
    7.1.2. Schematic Drafts
    7.1.3. Software Documentation
    7.1.4. Test Plans
    7.1.5. Critical Design Review
    7.1.6. Final Technical Report
7.2. Up to date code can be found on the GitHub
    7.2.1. Organization display name will be Talaria Robotics
7.3. Robot will be completed by the Final Technical Presentation
    7.3.1. Robot will be at the Engineering Project Showcase