

# Letter Shredder: Automatic Mail Sorting System

## TEAM MEMBERS:

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## PROBLEM

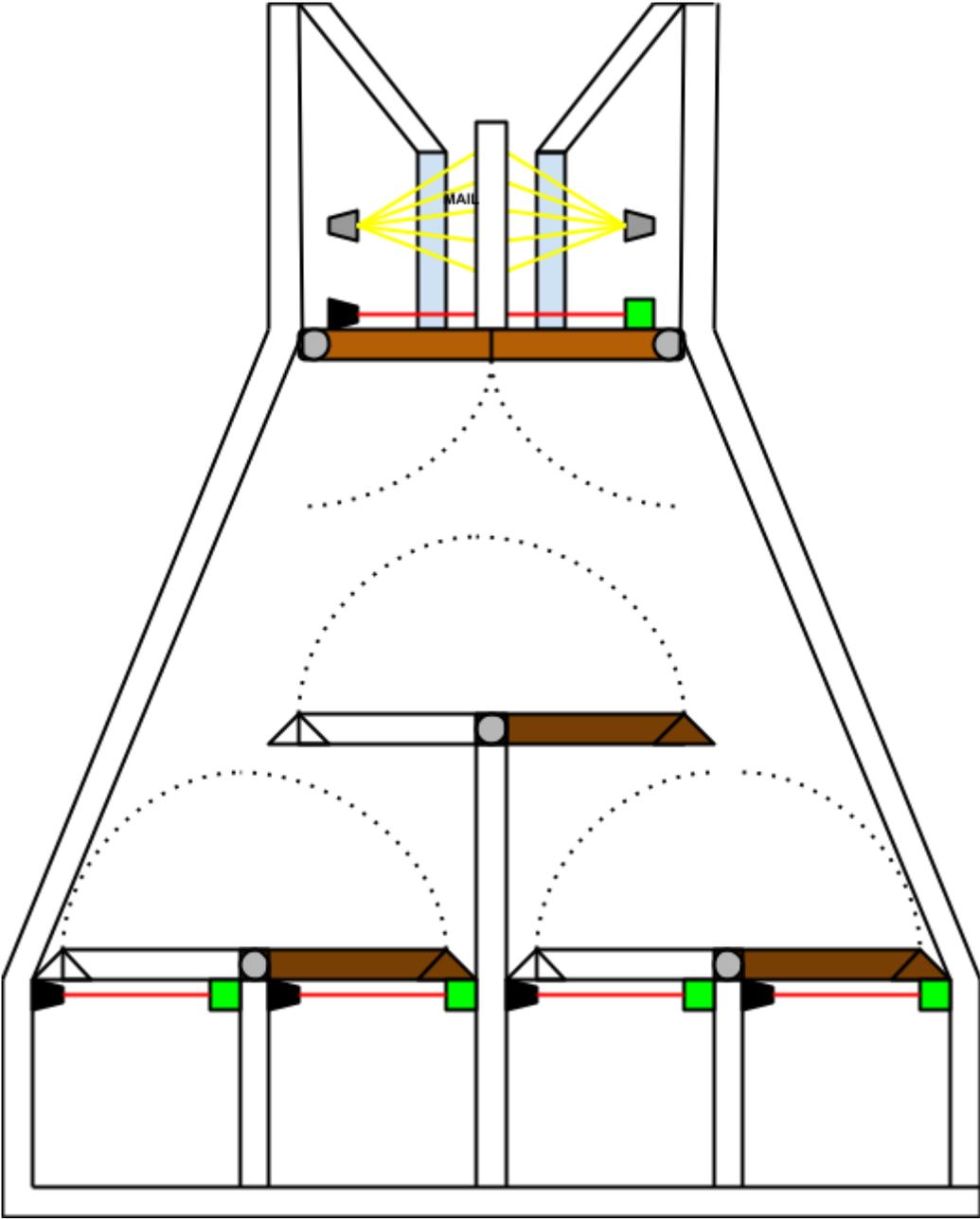
It is common for many residents to encounter mail that does not belong to them from prior tenants. The mail may contain personal information about that tenant that could risk security threats and negative legal implications. There are also many occasions where tenants currently living in apartments get unwanted mail from senders they would like to blacklist, or from advertisers.

## SOLUTION

We propose a mail sorter and shredder that would organize mail based on the names of the tenants and the senders that are allowed/blacklisted from the mail system. Names on the allowlist are sorted into the respective bins. Blacklisted names are sent to the shredder.

This would be done by scanning the mail, extracting the necessary information from the labels of the mail, and comparing all features to determine bin placement.

# VISUAL AID

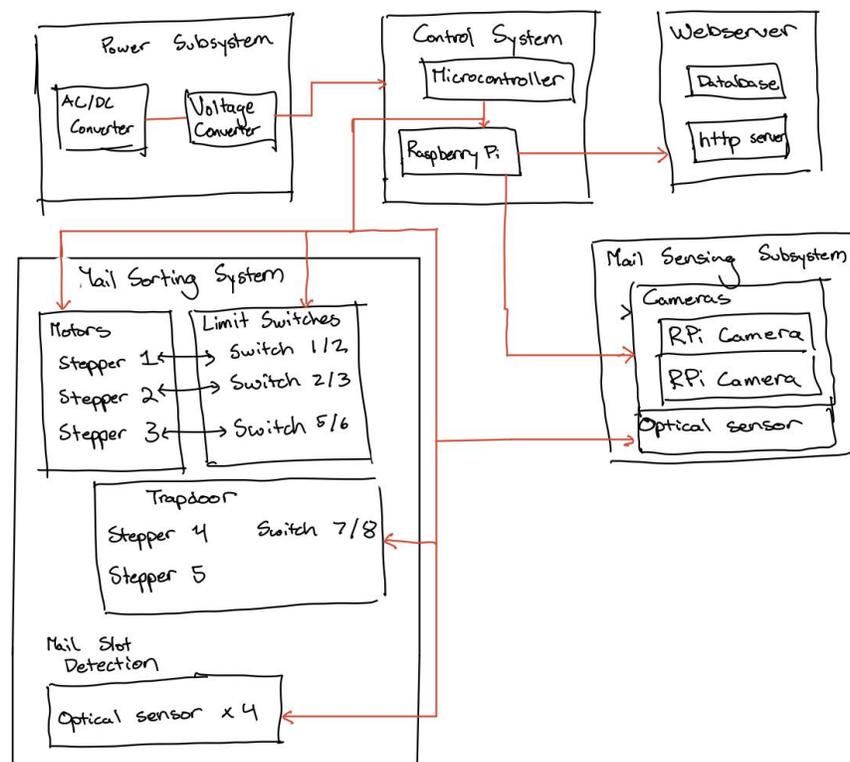


# HIGH-LEVEL REQUIREMENTS LIST

- Mail sorter can read mail and correctly sort into mailboxes based on the necessary information extracted like addresses/names from images of mail.
- Mail sorter settings can be set remotely
- Mail sorter can dispose of mail that doesn't fit the requirements necessary for any of the mailboxes

## DESIGN

### Block Diagram



## **SUBSYSTEM 1: MAIL RECOGNITION/DETECTOR**

This component will consist of an optical switch connected to the main control unit that will determine if mail is placed properly in the scanner. It will also contain 2 cameras and light sources to capture images of both sides of the mail.

### **Requirements:**

Two standard definition cameras and lighting sources should capture an image given a control signal and send the data from these cameras to the main control unit for processing.

The optical sensor must be capable of detecting when mail has entered the scanning peripheral, and send the appropriate signal to the control unit.

### **Tolerance Analysis:**

The main issue that may arise from this subsystem is the accuracy of the image to text converter. We may have to rely on pre-trained parameters from prior research to determine the letters and numbers hand written on mail items accurately.

## **SUBSYSTEM 2: CONTROL UNIT**

Controls the image capturing of the camera based on the optical switch, and runs an OCR to determine the sender and receiver from the printed or handwritten text. It will then compare the data to names/aliases within a local database to determine the destination of the mail being processed. It will also host the web server that can allow the host to append or change the database externally. Further, it will send control signals to different electric motors in the organization system.

### **Requirements:**

The raspberry pi will be the main source of control signals for the entire system. It should be able to load and store the data coming from the cameras and optical subsystem and send the appropriate signals to these systems for camera capturing and motor controls. Based on the name and references from the database, it should create an operational code for the motors controlling the direction faced by the paddles in the mail sorting system.

The raspberry pi should host a webserver that will interact with this database to update the names of the users that are meant to receive the mail along with the destinations in terms of the mailbox number. It should also be able to update and modify the blacklisted senders for each of the users dynamically to allow user control for mail.

## **SUBSYSTEM 3: MAIL SORTING SYSTEM**

This is the physical system that controls the directional movement of the documents such that it reaches the intended destination.

### **Requirements:**

This subsystem will consist of multiple paddles along with a dropoff chute for the mail once it has been scanned. The main requirement of the motor dropoff is that it only releases the mail once it has been successfully scanned, and when the paddles are in the precise orientation that allows the mail to enter its respective box. The paddles must allow for consistent routing to the appropriate boxes, even under a significant load.

### **Tolerance:**

This subsystem may fail mechanically due to the physical limitations of the materials used to construct the sorter. If there are any unwanted gaps in the system for the mail to fall into the wrong chute, it may diminish the use of our system. This can be mitigated through design choices and calibration of the motors controlling the paddles/latches. We will also have to run tests for the optimal timing of the mail release and paddle movement.

## **SUBSYSTEM 4: POWER SUBSYSTEM**

This is the subsystem that will provide the power for the entire project.

### **Requirements:**

This subsystem must be able to take in power from an AC to DC converter connected to an outlet. The voltage and energy provided from this converter must be enough to provide stable power to all the components, along with the appropriate voltages needed by any of the devices.

## **ETHICS AND SAFETY**

We believe that this project is fairly ethical, safe to the public and is beneficial for everyone involved. Referencing the IEEE Code of Ethics, our project would comply with all of the requirements, however, we can see some possible violations if this project is carried out as intended. The first foreseeable issue comes into play when unauthorized users try to access the residents' private data from our database such as name, address, and the photos of the mail received. This could be a possible violation of the IEEE Code of Ethics Section I-1. We strive for our project to be non-discriminatory, lawful, and well-cited. Overall, we seek to create a product that can be efficient and helpful for mail industry workers.