



UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN

Automatic Mail Sorter

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Problem

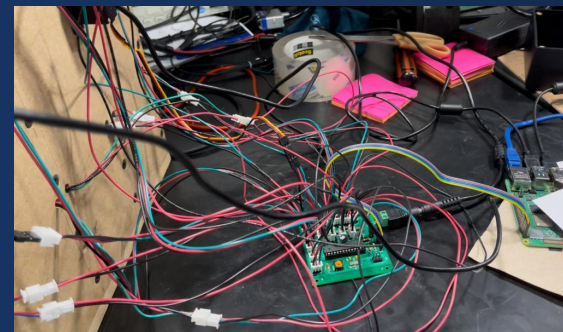
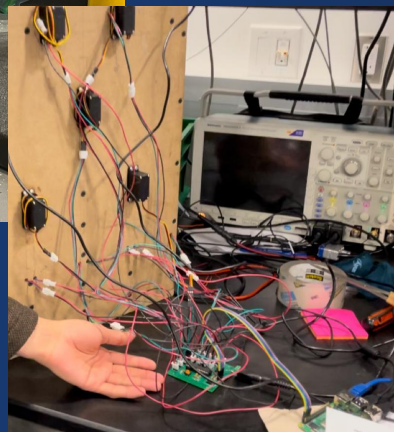
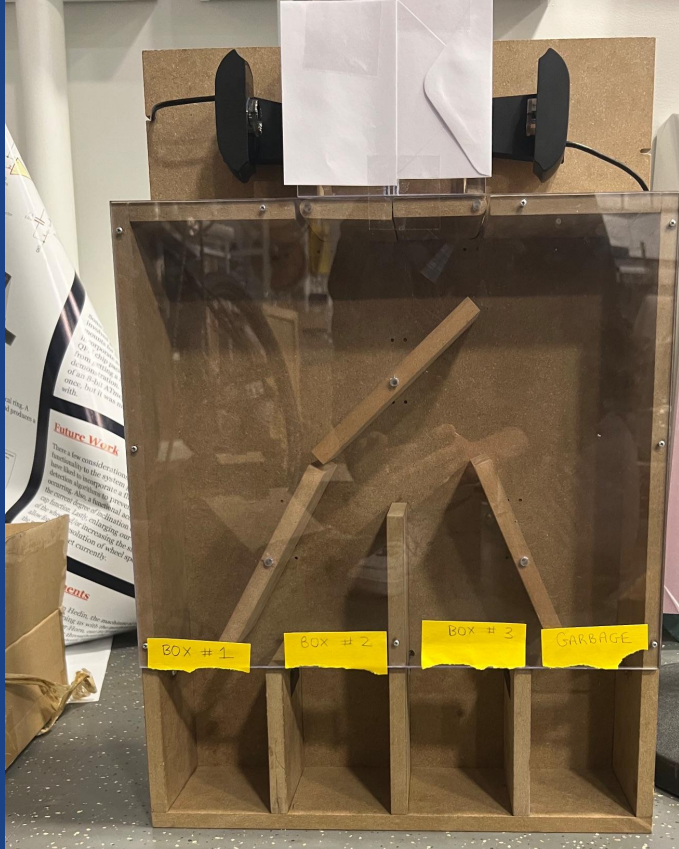
It is common for many residents to encounter mail that does not belong to them from prior tenants.

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.

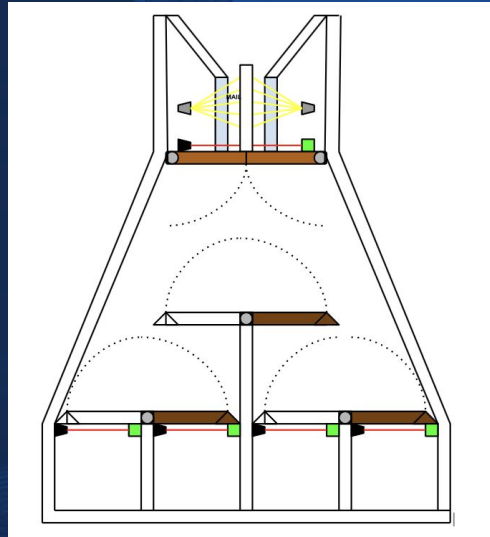
Our Solution

- Two Cameras to read Addresses and Names on the Mail.
- Paddles to guide mail to correct destination
- Raspberry pi and ATmega to process images, and flip paddles

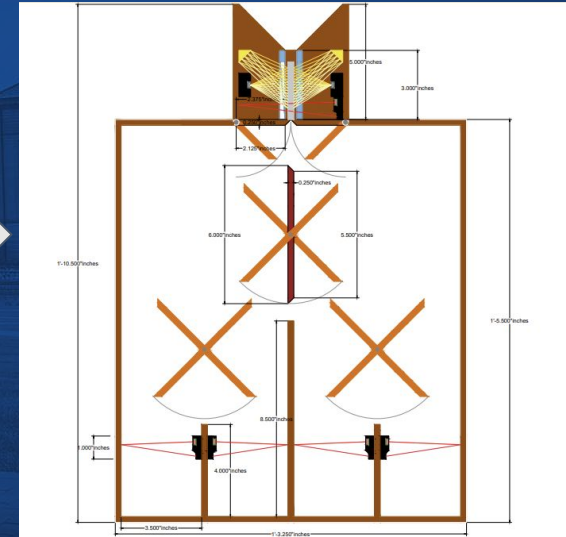


Original Project

- Included a shredder
- Stepper motors instead of servo
- Able to detect handwritten text
- Included an additional power unit



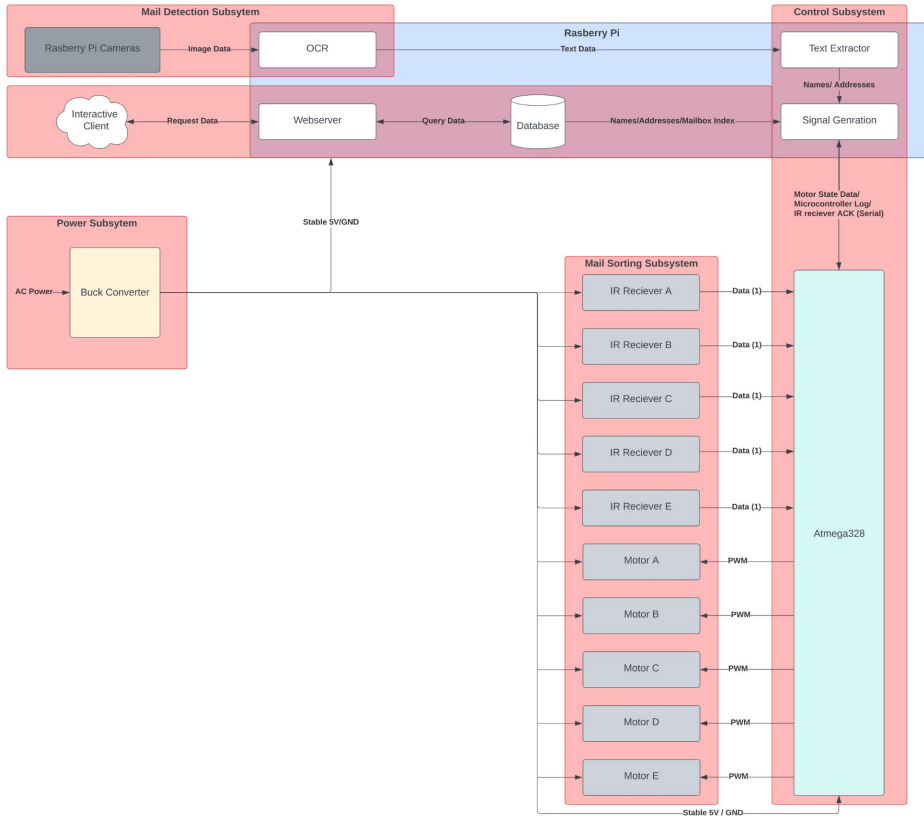
Proposal Layout



Design Document Layout

General Project Requirements

- **Mail sorter is able to correctly extract names from the mail, with a character accuracy of 90%, the printed names on the cards.**
- **Mail Sorter hosts a web server that provides a user interface for changing the name-based filter settings of the OCR software and stores the preferred filter settings on the raspberry pi.**
- **Mail sorter, once determining a slot to place the mail in, is able to physically guide mail through the system with an 80% accuracy. - (8/10 mail succeeds)**

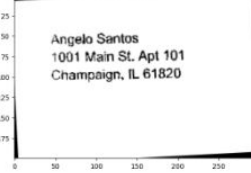
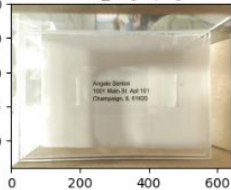
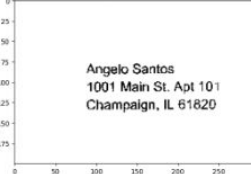


Subsystems:

- Mail Detection
- Mail Sorting
- Control
- Power

Requirements:

- Text recognition from the OCR module should produce the correct text from the mail 85 +/- 5% of the time.

		Angelo Santos 1001 Main St. Apt 101 Champaign, IL 61820
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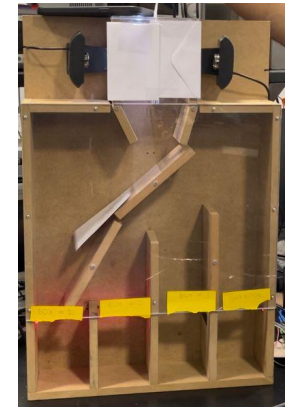
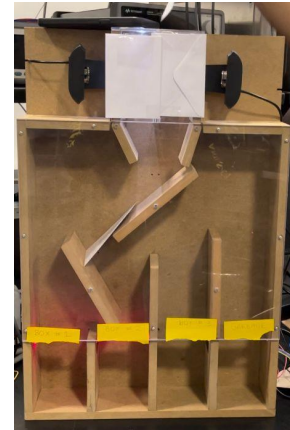
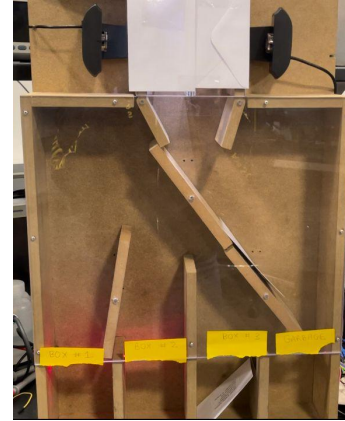
Characters: 313

Characters Wrong: 14

OCR Letter Accuracy: 95.5%

Requirements:

- The motor drop off only releases the mail once it has been successfully scanned.
- The paddles are in the precise orientation that allows the mail to enter its respective box.
- The mail should remain in the slot if the prior mail has not yet reached its destination.



Requirements:

- The Raspberry Pi should host a webserver.
- Able to update, add or delete the names of the users that are meant to receive the mail.
- The web server should also be able to update, add or delete the blacklisted senders for each of the mailboxes.

Residents

Index	Name	Address	Apartment	Box#	
{{ resident[0] }}	{{ resident[1] }}	{{ resident[2] }}	{{ resident[3] }}	{{ resident[4] }}	<input type="button" value="Remove Resident"/>

Add Resident

Name:

Address:

Apartment:

Box#:

Residents Webpage

Blacklist

Index	Name	Box 1	Box 2	Box 3	
{{ black[0] }}	{{ black[1] }}	{{ black[2] }}	{{ black[3] }}	{{ black[4] }}	<input type="button" value="Remove BlackList"/>

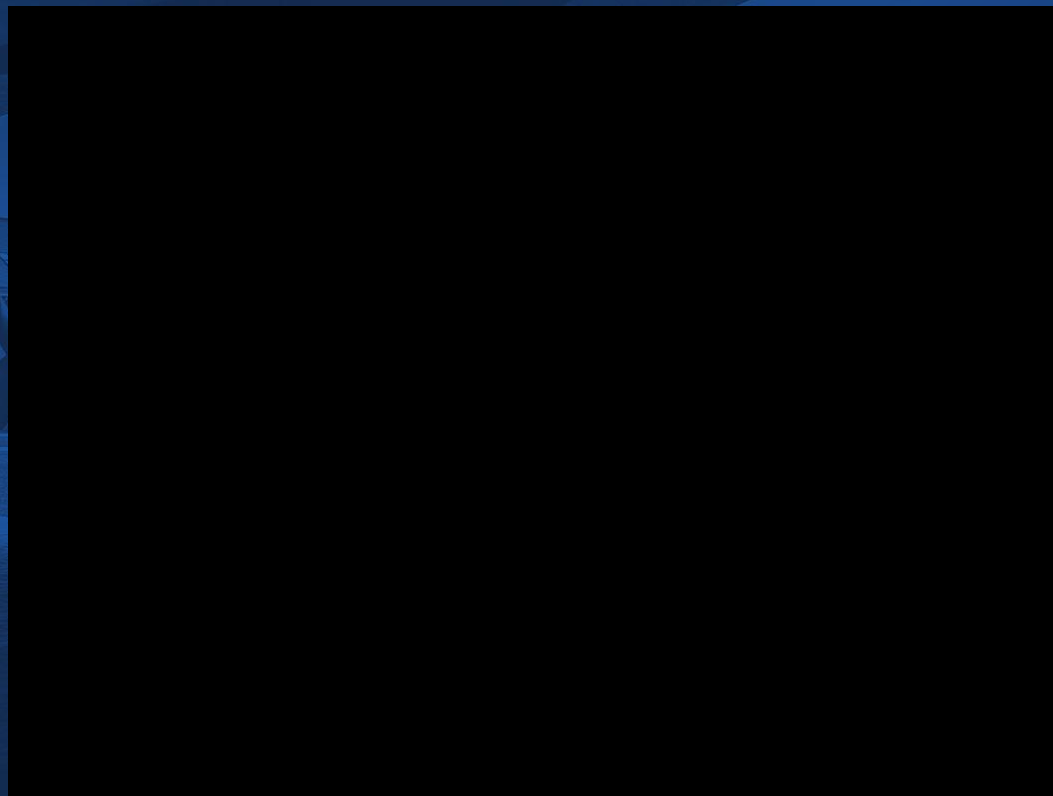
Add BlackList

Name: Box1: Box2: Box3:

Blacklist Webpage



Video



Successes:

- Able to achieve all of our goals and high-level requirements.
- Working PCB with minimal modifications
- Functional Computer Vision system capable of interpreting text in any orientation

Challenges:

- Lighting in entry mail slot
- Cropping camera image to extract text
- Communication between raspberry pi and ATmega.
- Mistakes in PCB CAD design
- Exact # of Components
- Broken Components

Conclusion

What we learned:

- PCB Design Process
- Image Recognition
- Motor Control and Design
- CAD
- Communication between different hardware
- Web Server design
- Database management

Do differently:

- Computer Vision Systems need bright and consistent light.
- Verify and test hardware design early.

Further Work

- **Detect Handwritten text**
- **Fully incorporate wiring onto PCB**
- **Add Lighting to Camera Area**
- **Increase speed of Character Recognition**



Thank You!

Questions?



The Grainger College of Engineering

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