Package Deposit Box
Group 2

According to Security.org 17% of Americans have had their package stolen in the past 3 months. Package thieves collectively took of over $8 billion in merchandise in the past year. Package theft has become a trending means of making illegal money due to the vulnerable delivery standards that exist today. Packages are often left unattended in front of private residences or even worsts apartment buildings. An interesting solution to this issue is a package deposit box. Let's explore why this is needed, how it'll be implemented and how it'll benefit the greater community.

The escalating incidents of package theft highlight a critical need for a secure package delivery standard. Individuals facing the loss of packages endure not just the immediate inconvenience of missing essential items, but also the emotional distress associated with the theft of personal property. The implications extend beyond the individual. Businesses offering buyer protection bear the financial burden while those that don't, risk hurting consumer trust and tarnishing their brand reputation. Current preventive measures such as mandatory signatures often prove bothersome for both consumers and delivery personnel. Similarly while security cameras may document theft they do little to prevent it. Given the limitations of these reactive strategies it's clear that adopting a more proactive approach is essential to significantly mitigate the issue of package theft.

The allure of theft prevention lies in its feasibility are at the forefront. The proposed system employs a dual-level structure: a deposit area for incoming packages and a secure storage compartment beneath. In the deposit zone a frame is outfitted with a camera, light, and motion sensor. The arrival of a package triggers the motion sensor activating the light and camera. The camera then authenticates the item verifying

its status as a package and recording relevant details like sender information and recipient identity. Following this verification a photograph of the package is captured just before it descends into the secure storage area. Upon doing so an email containing an NFC code and the package's image is dispatched to the recipient. Upon retrieval the recipient uses their smartphone and the provided NFC code to unlock the safe ensuring exclusive access. This streamlined process effectively deters potential thieves whether their intent is premeditated or opportunistic by restricting access solely to authorized individuals.

The range of parties that benefit from this delivery standard extends from individuals to businesses and delivery services. Individuals can be at ease knowing their package will not be susceptible to theft or damage due to external elements. This furthers customer trust and satisfaction which positively impacts businesses and delivery services. Businesses will see a massive reduction in reports of lost, stolen or damaged goods which will inherently reduce the cost of buyer protection by way of refund. With customer satisfaction growing the sentiment to buy more will become stronger improving customer flow for businesses. This also has a positive impact on delivery services because there will be more efficiency in package drop offs and a reduction in multiple delivery attempts. This idea provides a comprehensive solution addressing the needs of all parties involved.

In conclusion the package deposit box system presents a unique solution to the pervasive problem of package theft. This introduces a new standard of security and reliability in the realm of e commerce and other industries adjacent to mailing. This innovative technology provides a layer of insurance for consumers, businesses and delivery services. With respect to the statistics provided earlier it is believed that this implementation can massively drive down probability of theft and potentially save billions in cost for buyer protection.

System Overview

- Database: Database must be created storing details of user information

Functional Requirements

- Letter Detection and Verification: Ability to detect letters, recognise the address of the receptor and determine the concerned box.
- Engine sorting algorithm: directs the letter to the box linked to it and throws it there.
- Trap Door: Send signal to more allowing letters to be dropped.

- Notification and Communication: Alerts must be sent to recipients of letter upon letter is detected by camera.
- Connection Status: Must have indicators for microcontrollers connection to the internet.
- User Interface: Mobile UI must be designed for ease of use
- Database: Database must have residents' information, history logs, recipient details, sender details etc.

Non Functional Requirements

- Performance: System must be smooth and timely when detecting letters and authenticating/interacting with users.

- Readability: System should be user friendly and provide fail-safe mechanisms.
- Maintainability: There must be very clear and easy to identify gaps for system improvements, ease of identifying troubleshoot procedures and smooth maintenance

Hardware Requirements

Motion Sensor: PIR motion sensor will be used to detect package and trigger camera + lighting system

- Specifications: Block Time: 2.5s (Default), Delay Time: 0.5-200s

Camera: Mini camera will be used to capture image of package and process label

- Specifications: Sensor Type: Omni Vision OV5647 5MP, Still Picture Resolution: 2592 x 1944, Video: 1080p @ 30fps, 720p @ 60fps, Compatible with Raspberry PI

Lighting System: LED will provide adequate illumination for the camera to capture clear images

- Specifications: LED Number: 24, Compatible with Raspberry PI

NFC Reader/Writer: NFC Forum Type 4 will communicate with recipient device for authentication

- Specifications: Frequency Range: 13.56MHz, Communication Standard: NFC, Read Distance: 10cm, Communication Interface Support: I2C, SPI, UART

Lock Mechanism: Physically secures storage using barrel lock and motor

- Specifications: Lock: 2mm Barrel Lock, Motor: 3V + 15000 RPM

Microcontroller: Raspberry Pi will serve as central processing unit coordinating all other hardware devices

- Specifications: CPU Architecture: Quad Core Cortex-A72 64bit, Core Speed: 1GHz, RAM: 512MB, Controller Features: Wifi, Bluetooth

Power Supply: Hard wired power supply will provided power to all electrical components

- Specifications: Barrel Type: Micro USB, Input: AC 100-240V, Output: 5V 3A Max, Cable Length: 6ft

Connectivity Module: Wifi adapter will facilitate comms to internet sending notifications and updates

- Specifications: 802.11 Protocol

Physical Frame: Wooden frame will encase all components providing adequate protection from elements

- Specification: Wood: Sheathing Plywood

Connections

Motion Sensor to Microcontroller

- The motion sensor is wired to a GPIO pin on the microcontroller
- It will operate on HIGH/LOW signals so when motion is detected a high signal will be output to the microcontroller for further processing

Camera to Microcontroller

- Camera will be connected to Raspberry PI using camera serial interface (CSI)
- When signaled by microcontroller after motion sensor signal camera begins capture sequence sending image back to microcontroller for further processing

Lighting System to Microcontroller

- Lighting system will connect to Microcontroller through GPIO pin
- Microcontroller will send signal to power lights when camera is activated

Lock Mechanism to Microcontroller

- Microcontroller will send signal to engage or disengage lock based on validation of NFC data

Power Supply to All components

- Power supply will be connected to microcontroller which is typically equipped with power supply management circuit to coordinate power distribution to peripherals and other devices

Connectivity Module Integrated into Microcontroller

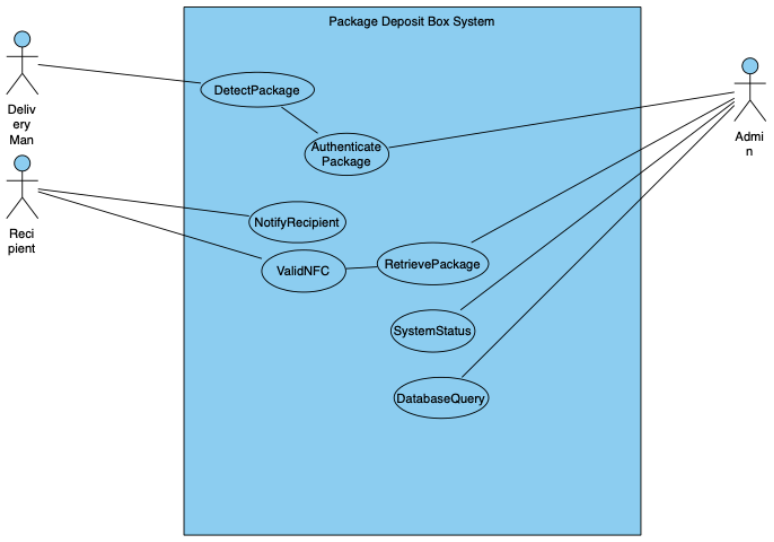
- Network interface will be integrated into microcontroller with purpose of sending image and messages from microcontroller to phone

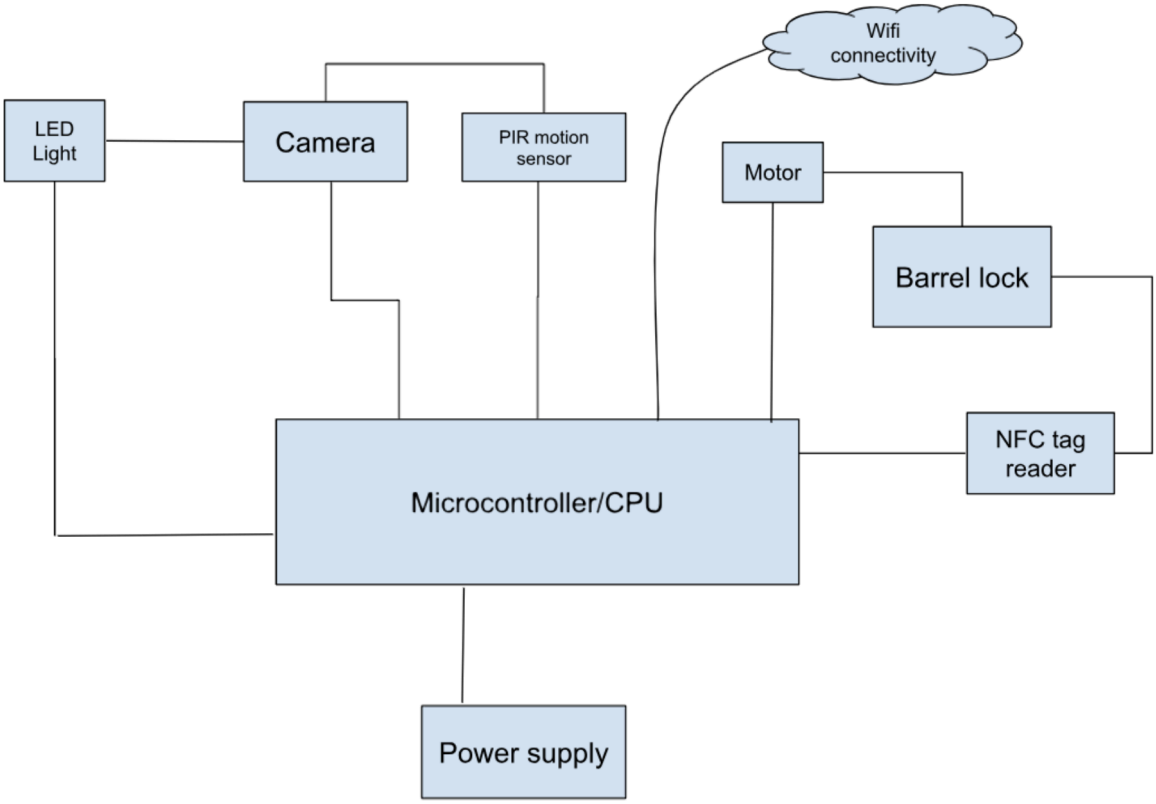
Structural Housing

- Will act as independent architecture housing all electronic devices and providing structure for protection and mechanical movements like trap door

Hardware Architecture:

Use cases:




Wifi
connectivity
LED
Light
Camera
PIR motion
sensor
Motor
Barrel lock
NFC tag
reader
Microcontroller/CPU
Power supply