

Mail Gobbler 9000

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Postal security is an escalating concurrent concern that reflects our increasing reliance on postal services. Growing dependencies on postal packages correlate to a greater demand in safe package reception. This call is answered by the Mail Gobbler 9000 (MG9K). The MG9K is an ergonomic smart dropbox that fortifies postal security through an authenticated locking mechanism. Barcodes for expected packages are preloaded by the user via a dedicated mobile application. Matching barcode scans of incoming packages unlock the dropbox, to prevent theft and tampering. Various quality of life features are included, such as its dedicated mobile application for communication, remote unlocking, historic data logs, and live delivery notifications. Beyond these features, the MG9K shines as a low-cost power efficient smart dropbox that fills a niche amongst its expensive superfluous competitors.

I. INTRODUCTION

Through the years, online shopping has grown, stemming from its convenient and efficient nature. Resultantly the fall of retail giants (i.e. JcPenney, Sears, Lord & Taylor, etc.) has been titled the “retail apocalypse” as numerous retail chains close business and file for bankruptcy[4]. Empty husks of these stores remain as physical shopping locations grow scarce, usurped by digital platforms such as Amazon and Ebay. From clothes, appliances, toiletries, and even groceries, any and all products are now available online. Further bolstered by social distancing practices as a result of the COVID Pandemic, dependencies on e-commerce have then led to an influx of online shopping and in turn waves of packages being shipped. Packages do not only provide means of merchandise delivery, but also allow for gifting between friends and family, maintenance of remote learning/work systems, ease of sales returns, and otherwise provides an essential facet for our daily operations. The alarm for postal security rings now more than ever, so that we may receive packages securely and prevent theft.

A. Significance

Last year, “C+R Research” asked 2,000 consumers about their experiences with package theft along with their preventive measures [1]. 59% of respondents reported that they receive a package on a weekly basis. From Figure 1, respondents’ reports of stolen packages increased from 36% in 2019 to 43% in 2020. Also, many victims (64% of them) stated that they’ve had packages stolen more than once. Although the transportation of packages is secured by respective postal agencies the hand-off phase is played in part by the receiver. Thus, action among the receiver is essential.

Package Theft:
2019 vs. 2020



Figure 1: Package Theft Percentage in the years 2019-2020 taken from “2020 Package Theft Statistics Report.” C+R Research, www.crrresearch.com/blog/2020-package-theft-statistics-report#:~:text=Package%20Theft%20Victims,package%20theft%20more%20than%20once.

“C+R Research” queried consumers regarding their theft prevention practices. Polls revealed that respondents are now changing their online shopping pattern opting for options like store pickups (24%), staying home for deliveries (64%) or installing surveillance cameras (23%). A smart dropbox solution relieves the user of these roundabout means that force consumers to adjust their schedules and accommodate for deliveries. Rather than observing theft (cameras), a smart drop box provides physical fortification that prevents, rather than reacts.

B. Context and Competing Solutions in Marketplace

A smart dropbox is not a novel concept. Many companies have fiddled with the idea, and placed their designs out to market.

For example, Eufy SmartDrop Mailbox is a kickstarter campaign for a smart mailbox, with a starting MSRP of \$299. [2]. Their product encompasses a carbon steel box with advanced technological features such as a built-in camera with two way audio, motion detection, a keypad lock, and built-in Alexa/Google support. These furnishes are eye catching to the consumer, but provide many inessential functions that are reflected in its price point. For example, they upsell their two way audio feature as a means of communicating with the delivering postal worker. However in practice, instances where the courier has trouble would unlikely overlap with timeframes where the user is free and available for communication. Otherwise, the user may also come to the door and help the personnel physically. Their dropbox utilizes an access code means of unlocking, where couriers must input digits produced by the mobile app that the user includes on their shipping address. Albeit secure, this access code handoff may be tedious and confusing. This kickstarter was announced the same month as our proposal. We differentiate by appealing to a different audience. By opting for a simpler system with fewer peripheral functionalities, we produce a dedicated postal security system that is straightforward, while being both low cost and power efficient compared to superfluous competitors. The MG9K focuses on barcode authentication, where couriers can scan the delivery tracking label to verify their identity and then place the packages within a locked compartment. Any additional features are built upon the basic hardware and

software for the authentication, which avoids costs in circuitry and waste in power consumption. Our simple design is aimed to keep the system modular, and avoid overlap with other common home security systems such as smart doorbells or surveillance cameras.

Parcel Wirx utilizes a lock called BoxLock and is another smart dropbox option that uses scanners and barcode authentication. [3] However the scanner is not built into the physical box, but is an exterior lock itself. The lock is a steel shackle and works as follows. The mailman must press a power button and manipulate the scanner on the lock to read the barcode. This comes with its own concerns. Their system trusts that the mailman properly replaces the lock after delivery. Mechanically, a stand-alone lock may be weak and susceptible to being cut. Our product has the solenoid lock lodged inside the mailbox along with circuitries being integrated interiorly, which allows the box to be as physically sturdy as desired based upon the physical box that encompasses it. Circuitry is hidden to avoid tampering.

To reiterate, competing solutions do exist. However, the MG9K is designed to fill the inefficiencies of other systems and shine as a low-cost low-power alternative to other smart dropboxes.

D. System Requirements and Specifications

Table 1: Requirements and Specifications

Requirements	Specification	Value
Performance	Wake-up Response	<1 sec
	Authentication and Unlocking	<5 sec
	Grace Period	Upon unlocking, gives a grace period of 2 min. for delivery
	Extended Battery Life	12V battery, est. 90 days
	Round Clock Operation	LED allows for night time illumination.
Security	Data Security	The user must sign up and log in via AWS Cognito, whose roles and privileges are limited. Data is stored in AWS DynamoDB, secured behind their services with limited

C. Societal Impacts

As our project aims to deter package theft and enable secure package reception, it affects parties involved in the process. Online shoppers with fears of theft can secure their deliveries with the MG9K, without needing to dedicate their time on expectant delivery estimates. Consumers who rely on measures such as video footage of thieves may opt to utilizing the MG9K, as a cheap addition to their security framework. The MG9K simply provides barcode authentication and physical fortification, and thus does not overlap with video security systems and instead builds upon a preventive rather than reactive approach. Missing packages become a hassle with issues like refunds, repurchasing and waiting for another delivery, or even a company not believing that the package is missing. Our mailbox is designed to be a full deterrent. It offers peace and mind to the online shopper, knowing that their package will be safe until they arrive home. We have focused on the receiving part, but now lets review impacts on the delivering party. As the MG9K relies on the tracking ID already provided by postal services, there is no change to their current mechanics. The courier can intuitively scan their already present barcode without the need of learning complex additional steps or memorizing pin numbers. By having a simple system, the constituencies can easily learn its mechanics.

		write privileges to only backend account credentials.
	Hardware	Circuitry is hidden inside the dropbox to prevent tampering by attackers
Convenience	Mobile App	Stable mobile app with full functionality
	Unlocking Alternatives	Remote unlocking via App and physical backdoor.
	Envelope Compartment	Compartment for envelopes with arrival notification
	Wireless Set Up	No external wires or connections.
	Dimensions	24" height x 15.4" length x 24" width

II. DESIGN

A. Overview

The MG9K is designed to be low power and low cost, yet still provide enough functionality to receive packages safely and deter malicious thieves. The cornerstone of the system is a barcode authentication process. Users upload tracking ID's via

