



Advancements in Parcel Security: A Smart Monitoring Approach

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Abstract. The Internet of Thing (IoT) refers to a network that uses the internet to link numerous devices. IoT helps to send data between devices, track, and self-monitoring gadgets. Furthermore, IoT is a future trend that has transformed traditional lifestyles into high-tech tools. Smart cities, smart homes, pollution management, energy savings, smart transportation, and smart industries are examples of IoTs development. Many important research studies and investigations have been conducted to improve technology through IoT. Recently, IoT plays an important role in smart security. Smart Security makes use of a variety of IoT-enabled items to enable consumers to remotely monitor and manage the security of their stuff. These systems can control the monitoring in and everywhere. Therefore, Smart Parcel Security and Monitoring System need to be developed as smart security system. Various types of components were used to create a whole system of this developed product such esp32-cam and esp8266. Esp32- cam used as monitoring system from web server on chrome or Mozilla. Meanwhile, esp8266 board was used as the brain of the system. Blynk applications was used to receive notifications of the arrival of the packages, control the smart lock and sanitizer of the mailbox. This system able to reduce the loss of consumers packages and save their time and energy to check the mailbox only from the palm of their hands.

Keywords: Smart Parcel, Smart Monitoring System, Tenement Residence

1.0 Introduction

The COVID-19 pandemic has increased the E-commerce growth in Malaysia [1]. Malaysian shoppers are gradually switching from physical shopping to online shopping. The fear on contacting COVID-19 through cash and visiting physical stores is one of the factors of the increasing on using online shopping in Malaysia [2]. In addition, online shopping is preferable as it saves more time and energy to explore various brands. However, due to the outbreak, the number of internet shopper consumers increased gradually which has contributed to the problem to delivery packages security, especially when the packages were placed at the public area without security [3]. Not

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just that, there are incidents where a scammer stealing information's from the delivery packages of the victims [4]. Furthermore, due to COVID-19, the virus can be transmitted through delivery packages [5].

Therefore, to cater to this problem, the idea of Smart Parcel Security and Monitoring System is proposed to make an improvement of the current Smart Postbox with more efficiency in monitoring the packages through camera, locking the postbox through Blynk App, alerting the owner about their delivered packages and finally it comes with an automatic sanitizer spray to sanitize the delivered packaging. Smart Parcel Security and Monitoring System is based on the smart anti-theft mailbox that is already available in the market. However, in the market, most of the anti-theft mailbox does not come out with IoTs features [6]. The anti-theft postbox is more to the unique design of the postbox to make it difficult for the packages to be stolen. Even if there are smart mailboxes available on the market, the features only come with sensors to detect the delivered packages in the postbox [7]. Therefore, by innovatively combining the current smart postbox with new features from this project, it will create a far more advanced product for the future Internet of Things technology. All will be combined and applied to this project to create a smart parcel security and monitoring box. Covid-19 pandemic has impacted the society lives around the globe on many aspects and one of them is e-commerce. Due to lockdown that occurred to decrease the spread of COVID-19, almost all shops, restaurants, schools, shopping malls, and public transportation are closed [8].

Although, the growth of e-commerce has increased rapidly ever since [9]. However, the increases in home deliveries have led to more opportunities for theft. Mainly, this occurs in resident areas such as service apartments and condominiums. While the number of people in every apartment increased during quarantine, this does not guarantee the guardianship of the delivered packages due to daily routine interrupted which cause the packages to be left unattended for a long period of time or forgotten [10]. For example, people are working from home, taking care of their children for online schooling, and entertaining themselves with social media to pass the time. Other than that, the parcel packages also can be stolen even though it was kept safely in an old classic post box [11]. Besides that, there is an act of scam where scammers stole owners' information from delivery packages covers such as names, address, and the mobile phone number of the victims [12].

Furthermore, due to the concerns over potential contamination of COVID-19 from the mail or packages, some people delay its packages for hours or even days [13]. The local health commission warns that citizens who touched the parcel need to undergo COVID-19 test [14]. Professor Kim Woo-Joo, an infectious disease expert at Korea University Guro Hospital states that the virus could also survive on a bubble wrap surface. The virus can survive for 24 hours on cardboard and over three days on hard surfaces like stainless steel [4]. However, due to speedy deliveries, the spreading of COVID-19 increased because the packages do not sit for a long period of time [15]. Therefore, in this study, the Smart Parcel Security and Monitoring Box system were designed to secure the delivery packaging. The significance of this system is to reduce the number of stolen packages from the mailbox. Thus, it will ease the owner in their daily life while using this system. The system can easily be monitored and secured from the palm of their hand. Other than that, this product will reduce the spreading of COVID-19 from the contaminated packages [16]. Therefore, the owner does not have

to worry about contaminated packages and secures the health of the owners and their families. Furthermore, the scope of this project focuses on the creating of a smart post box device that only be applied on residents' areas like apartments and condominiums. Some apartments that do not require an elevator cause their residents to leave their packages for a long period of time in their post box due to disturbed daily routines. In addition, the security of the delivered packages is low. The limitations of this project are the system created is not suitable for link or cluster houses due to the easy assessable of the owner to retrieve their package is high.

2.0 Methodology

2.1 System Architecture

The smart parcel security and monitoring system was developed by integrating between hardware device, software development and video streaming server. The mailbox is attached with sensors which are able to send notifications, detect the present of the delivered mail, monitor the mailbox from inside and outside using camera, sanitize the delivered packages and lock/unlock the mailbox through Blynk App.

2.2 Hardware Device

The hardware device used in this system consists of IoT microcontroller unit (MCU), push button, servo motor, ESP32-CAM, Micro Submersible Water Pump Dc 3v-5v and relay module. The main hardware used in this system is IoT MCU. This MCU is a processor that supports processing data and can run software. NodeMCU is an open source IoT platform that uses LUA programming language that is designed for ESP8266 WIFI chip. The NodeMCU is provided along with ESP8266 which is an integrated chip where it was employed to connect with WIFI protocol. In addition, it is also able to run its application with sensors device. Besides that, it also comes with features such as GPIO, PWM and ADC. It has applications that are featured with WIFI, analog pin, digital pin, and communication interface. NodeMCU pin able to read inputs such as pushbuttons, light on a sensor and converts them into outputs such as turning LED on, sound on speaker and receive notifications. In this research work, NodeMCU was used as the brain of the system. It was used to connect the hardware such as servo motor and push button through Wi-Fi and connect to Blynk App as remote control. Blynk consists of widgets that can be applied and used for its specific device. By using this application, the hardware of this project can be executed and controlled from mobile phone at any time with the connection of Wi-Fi network.

2.3 Software Development

Software in IoT is very important as it provides data collection, real time analytics and executes the device to undergo its specific task [17]. Without software, the IoT system will not be able to work. The software that will be used in this project is Arduino IDE and Blynk. Arduino IDE (Integrated Development Environment) software is used to develop a program code known as sketch while Blynk is a platform for mobile application that can be used to control Arduino or IoTs system such as open an LED light, control the servo motor, and open the front house gate.

2.4 Video Streaming Serve

Video streaming server is a web that can be opened on web browsers such as Chrome or Mozilla. After the coding for Camera Streaming has been uploaded, a local IP Address is displayed on the Serial Monitor. The link will lead to a web page where all the camera settings appeared on the left side. At the bottom, there is an option “Start Streaming”. The video settings can be changed based on our preferences.

3.0 Results and Discussion

The Smart Parcel Security and Monitoring System is designed to help users who live in tenement houses to secure their delivered packaging from being stolen. This will help them more as all the mailbox systems can be controlled through the phone. Figure 1a and Figure 1b show all the systems that were used in this developed project. Firstly, is the water pump widget. The widget used is the button widget. The mode of the button is “PUSH”. When the button is pressed, the water pump will be activated. When the button is released, the water pump will stop. The water pump was used as a sanitizer spray for the delivered packaging. For this project, water was used to represent sanitizer liquid. Secondly, is the servo slide. The slider was used to rotate the servo motor. When the slide value is 0, the mailbox is in unlocked mode. When the slide value is 180, the mailbox is in unlocked mode. The slide determines the position of the servo motor rotating. Thirdly, the notification button was used. The notification button was used as an output when the push button is pressed. It will come out a notification “Mailman Arrived”. Thus, the owner will alert about the arrival of the packaging.

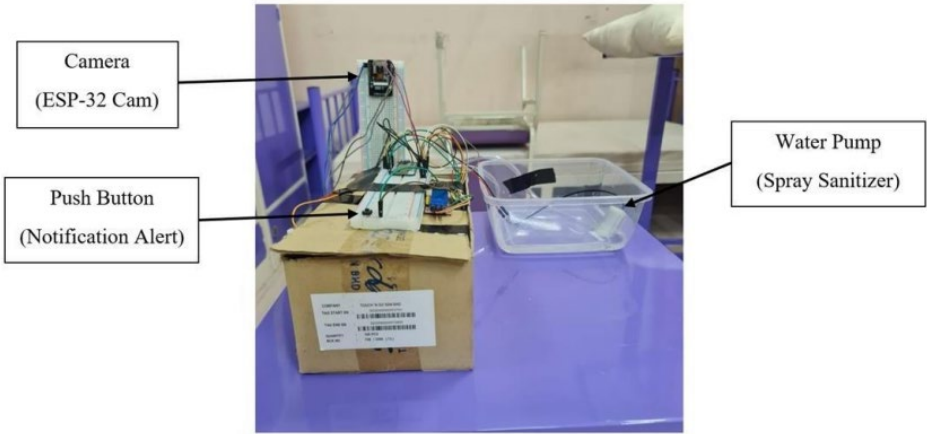


Fig 1a. Complete system of Smart Mailbox

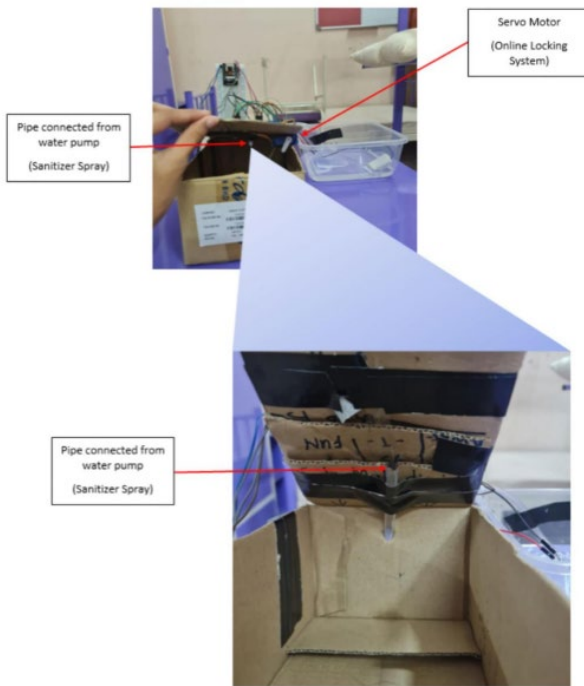


Fig. 1b. Inside view of the Smart Mailbox

3.1 Input of the system

Input is when the system receives a signal from the hardware [lee]. In this study, the input is the pressed push button as shown in Figure 2. When the push button is pressed, an electric circuit is completed. This causes the data pin to be connected to GND. The current flows through the push button to GND causing the voltage of the push button pin drops to GND and read as 0. As soon as the systems detect the pressed push button, from the programming software, the notification of “Mailman Arrived” will appear on Blynk to alert the owner about the arrival of the mailman. When the push button is released, the electric circuit is incomplete. This causes the data pin to be disconnected to GND. The current does not flow causing the voltage of the push button pin maintained at 5V, thus, it is.

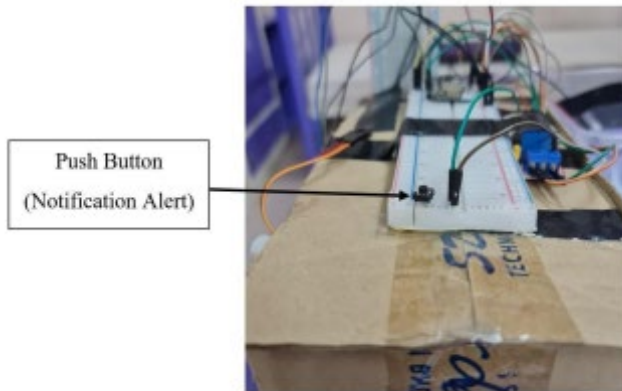
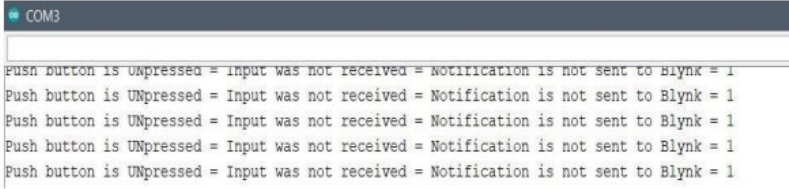


Fig. 2. The push button on the completed system

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COM3
Push button is pressed = input was received = Notification is sent to Blynk = 0
Push button is pressed = Input was received = Notification is sent to Blynk = 0
Push button is pressed = Input was received = Notification is sent to Blynk = 0
Push button is pressed = Input was received = Notification is sent to Blynk = 0
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Fig. 2a. The output on the serial monitors when the push button is pressed.



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COM3
Push button is Unpressed = Input was not received = Notification is not sent to Blynk = 1
Push button is Unpressed = Input was not received = Notification is not sent to Blynk = 1
Push button is Unpressed = Input was not received = Notification is not sent to Blynk = 1
Push button is Unpressed = Input was not received = Notification is not sent to Blynk = 1
Push button is Unpressed = Input was not received = Notification is not sent to Blynk = 1

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Fig. 2b. The output on the serial monitors when the push button is unpressed.

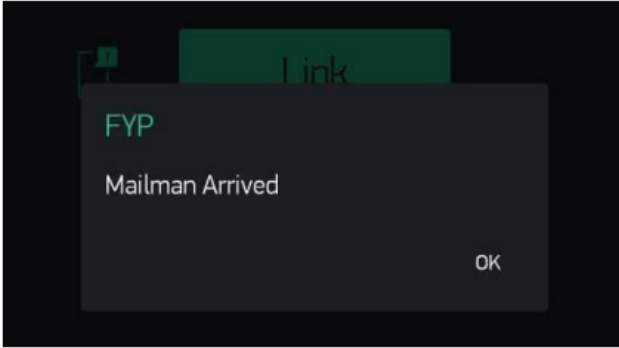


Fig 2c. The notification (Output) when the push button is pressed.

3.2 Output of the System

Output is data that was sent by the system. In this work, there are three output components which are the water pump, servo motor, and the E SP32 Cam.

3.3 Control the Servo Motor Via Blynk Application

The Servo motor is controlled by the slider widget on the Blynk app. In this project, the servo motor acts as an online lock to secure the mailbox from the Blynk app. On the Blynk app, the slider widget allows the servo motor to rotate within the range from 0° to 180° .

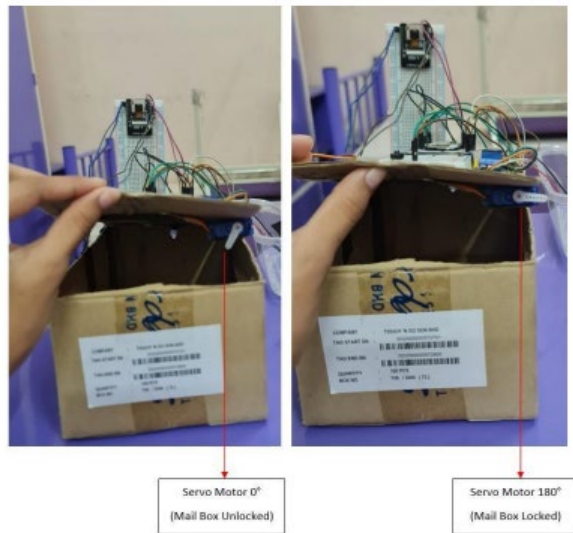


Fig 3. The position of the servo motor at 0° to 180° respectively.

3.4 Control the Water Pump Via Blynk Application

In this study, the water pump will act as a sanitizer spray for the delivered packaging. The water pump was controlled from Blynk [12]. On the Blynk application, the button widget controlled the water pump. The output of the water pump is GP15. It is made with push mode (Fig 4).



Fig 4. The location of the spray sanitizer system and Water Pump button widget when it is turned on and off.

3.5 Control the Video Streaming Via Web Browser

Video streaming can be controlled on web browsers such as Chrome whether on a phone or laptop. The IP address received from the serial monitor and was copied & web on any web browser. The IP address will lead to a web browser as it was shown in Figure 5. On the web browser, there is a video setting that allows the users to set their preferences to the settings such as resolution, brightness, face detection, and recognition, special effect, contrast, saturation, quality, and more.



Fig 5. The output on the serial monitors video streaming via phone

3.6 The Operation of Blynk System

The Smart Parcel Security and Monitoring System is designed to help users who live in a tenement house area to secure their delivered packaging from being stolen. This benefited them as all the mailbox system can be controlled through a phone. Figure 1 shows all the systems that were used in this developed system. Firstly, is the water pump widget. The widget used is the button widget. The mode of the button is “PUSH”. When the button is pressed, the water pump will be activated. When the button is released, the water pump will stop. The water pump was used as a sanitizer spray for the delivered packaging. For this project, water was used to represent sanitizer liquid. Secondly, is the servo slide. The slider was used to rotate the servo motor. When the slide value is 0, the mailbox is in unlocked mode. When the slide value is 180, the mailbox is in unlocked mode. The slide determines the position of the servo motor rotating. Thirdly, the notification button was used. The notification button was used as an output when the push button is pressed. It will come out a notification “Mailman Arrived”. Thus, the owner will alert about the arrival of the packaging.

4.0 Conclusion

In conclusion, the developed Smart Parcel Security and Monitoring System may help more people in securing their packaging. The main difference between this developed smart mailbox and smart mailbox available in markets is, this mailbox can control many features from phone while the existing mailbox can only receive notification from phone. The more features that can be controlled through a phone, the more helpful the developed project is. This smart mailbox can receive notifications, monitor camera, lock, and activate sanitizer spray from phone. This is what makes this developed project unique.

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