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Smart Mailbox Using Raspberry Pi

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I. OBJECTIVES

A. To directly deliver packages without any intention and personal presence of a person.
B. Safe and secure to collect and get notified via e-mail and SMS.
C. To offer 24/7 services to deliver packages.

II. INTRODUCTION

The increase in popularity of commercial transactions for purchase of various products is steadily increasing eventually, this sets up a problem where the recipient don't have the time to take the delivery / the recipient may not be available on that specific date or time. This issue arises an interest to find new innovative ways of delivery in today's scenario, hence automation presents a new trend. (Home automation is a network of hardware, communication, electronic interface that work to integrate everyday devices with one another. Each device has sensors and is connected through WiFi, so toy can manage them from your smartphone whether you're at home or miles away). One of the significant solution is the concept of smart mailbox. Smart mailbox serves as a significant solution in reviewing packages in the future where all the deliveries are notified to the recipient.

The solution provides possibility to get accurate data about the time of delivery which offers 24/7 services to deliver packages with or in the absence of the recipient and also to track delivered goods in real time. It will also prove helpful in scarcely populated areas, office workers / people left house for any emergency.

III. LITERATURE SURVEY

Sunny Yang **[1]** proposed a multinational smart mailbox with in built video, audio, temperature, control systems, telephone communication capability.This proves an easiest way of delivery for both the recipient and the third party carrier, as the carrier need not have to wait to get the receipt signed in- person by the recipient.

Robert Hanna **[2]** presented a transmitting mechanism for ensuring the delivery of packages in the smart mailbox, which sends signals and also senses the opening and closing of mailbox when the packages are delivered in the mailbox.

Ziemianski et al. **[3]** presented an alert system attached with the mailbox which detects the presence of delivery. The alert system proves useful where in the recipient is remotely located.

Shuai Jiang **[4]** proposed a package receiving device which includes a sensor configured to obtain package identifying matches and to secure the package until authorized retrieval is determined.

Stanislava Turska et al. **[5]** proposed an application of smart mailbox which is designed for delivering packages/parcels. The most important benefit of the solution is the increased comfort of the shipment received by the recipient and simplifying the work and efficiency of the third party carrier for delivering packages.

Geng **[6]** proposed a smart mailbox which consist of unlocking code input device for inputting an unlocking code to unlock the mailbox, which is used for sending/receiving mail automatically. It also provides intelligent monitoring so that the mail can be handed over safely.

Inorder to facilitate work and efficiency of the third party carrier and to provide ease for the recipient, I proposed a methodology of replacing the traditional mailbox with a more secured, peculiar and personalized smart mailbox which is electronically accessed by the recipient which offers services all the time irrespective of the personal presence of the person proves as a convenient and reliable way of delivery of packages.

IV. PROPOSED WORK WITH METHODOLOGY :

In our proposed methodology, the primary function of smart mail box is to detect the delivery of parcels/ packages being received. The design of a smart mailbox includes a web application which runs on Raspberry Pi microcomputer. The smart mailbox also comprises of PIR motion sensor which readily senses the packages being delivered and Raspberry Pi camera module captures the images the same respectively. The Raspberry Pi is solely connected to home WiFi network and the software application runs within the hardware specification. The data that has been collected as yet, is stored in the database and notifies to the recipient via email. The notification can also be received via SMS, even if the recipient is remotely located/ with no internet access.

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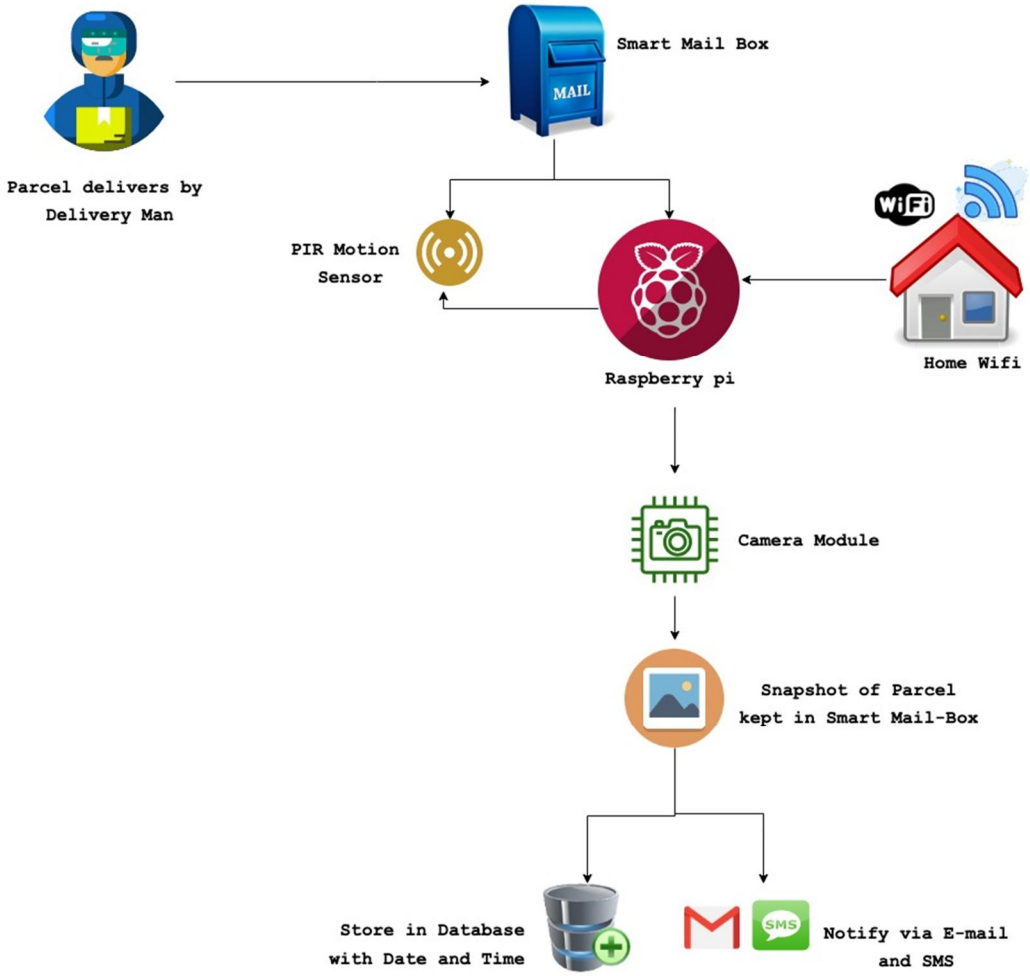


Figure 1.1 : Diagram of the Proposed Model - Smart Mail Box

The above diagram represents the workflow of the proposed model – Smart Mail Box. This model contains the following:

V. HARDWARE DEVICE

A. Raspberry PI 3

The Raspberry Pi 3 Model B+ is the powerful credit-card sized single board computer . The latest Raspberry Pi 3 Model B+ has a faster 64-bit 1.4GHz quad core processor, 1GB of RAM, faster dual-band 802.11 b/g/n/ac wireless LAN, Bluetooth 4.2, and significantly faster 300Mbit/s ethernet. It provides a 40-pin GPIO connector for physical interfacing projects.

B. PIR Motion Sensor

PIR sensors, referred as, "Passive Infrared" or "IR motion" sensors, enable you to sense motion. Everything emits a small amount of infrared radiation, and the hotter something is, the more radiation is emitted. PIR sensors are able to detect a change in IR levels of their detection zone (e.g. when a human enters a room) and hence sense motion.

C. Raspberry Pi Camera Module

The Raspberry Pi Camera Module v2 is a high quality 8 megapixel Sony IMX219 image sensor custom designed add-on board for the Raspberry Pi, featuring a fixed focus lens. It's capable of 3280 x 2464 pixel static images, and also supports 1080p30, 720p60 and 640x480p90 video.It attaches to the Raspberry Pi via one of the small sockets on the board's upper surface and uses the dedicated CSi interface, designed especially for interfacing to cameras.

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VI. SOFTWARE

The software design computes of program in python environment, database and user interface. The python program ensures the normal functioning of the components respectively .The database provides the storage medium for the data collected of the parcels delivered. These data are processed into relative information which is displayed on graphical user interface and notifies the recipient via email/SMS. The graphic user interface has the characteristic feature to update the status of the parcel. As soon as we collect the parcel, the status will be updated as picked up. Incase the recipient hasn't collect the parcel within 24 hrs from the time of delivery, the recipient will again get a remainder of the parcels delivered via SMS / E-mail.

VII. IMPLEMENTATION

In our proposed model, the primary function of smart mail box is to detect the presence of parcels / packages being received. The design of a smart mailbox includes a web application which runs on Raspberry Pi microcomputer. The smart mailbox also comprises of PIR motion sensor and Raspberry Pi camera module which senses the packages promptly and captures the images of the packages received respectively .The Raspberry Pi is solely connected to home WiFi network and the software application runs within the hardware specification's. The data that has been collected as yet, is stored in the database and notifies to the recipient via e-mail. The graphical user interface has the feature to update the status of the parcel. As soon as the parcel has been collected, the status will change over and would be updated as picked up. If incase the recipient failed to collect the parcel within 24hrs from the time of delivery, the recipient will be remainded about the delivery again via email. The notification can also be received via SMS, even if the recipient is remotely located or with no internet access.

VIII. EXPECTED OUTCOMES/RESULT

The main aim of the proposal is to provide a cost effective smart mailbox that would be useful in the future. The smart mailbox is split up into two parts . First, the hardware part which constitute its physical design, for storing and retrieving the parcels and selection of the suitable components that will provide smart function of the mailbox. Next, is the software part that provides logical design which determine specific informations of the packages being received.

IX. APPLICATION

A. Save time for the consumers.
B. Useful to deliver the packages 24/7.
C. Useful to provide accurate date and time of delivery
D. Trouble free for both the recipient and the delivery man.
E. Safe, secured and convenient mode of delivery.
F. Useful for employees and elderly people.

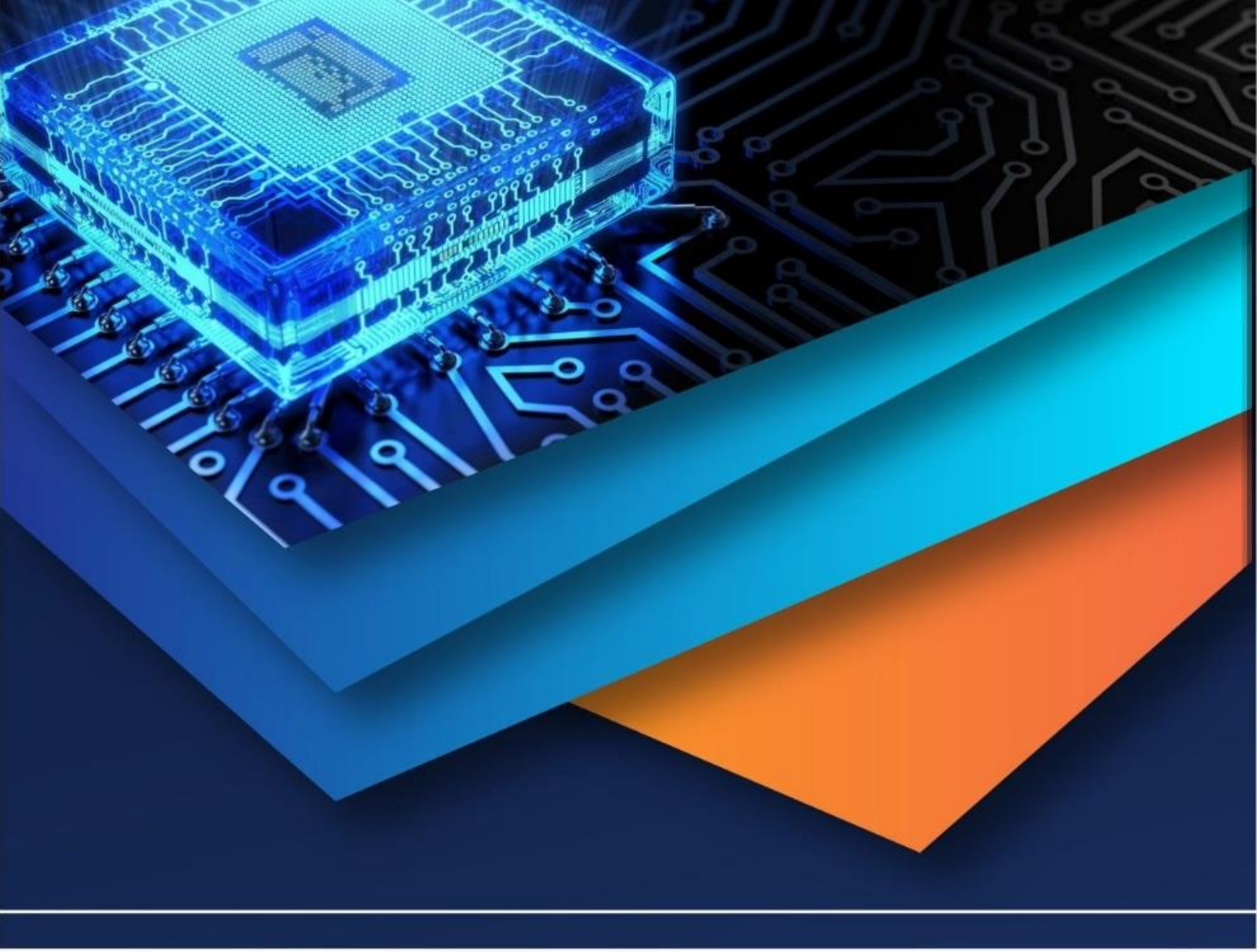
X. CONCLUSION

This paper has been focused on replacing a traditional mailbox with a smart mailbox. The solution aims at providing 24/7 services which ensures hands-on purchases on time. It also provides streamlined delivery operations which increases the efficiency of the postal workers, making it trouble-free for both the recipient and also the person who delivers it. The proposed solution permits the recipient to know the details and assurance of the packages being delivered at the doorstep, whether the person is nearby or miles away. Thus, the proposal manifest intelligent monitoring, which proves helpful of delivering packages in a more secured, environment and personalised manner in the future.

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