Smart Electronic Pigeon Hole System

Seah Kah Hean¹, Mohd Nazmi Mohd Nasir¹, Muhammad Faiz Muhammad Asri Nandan¹, Mohamad Syafiq Abd Rahman¹, Nurul Hanim Shafiqah Sidik¹, Muzammil Jusoh¹, Mohamed Nasrun Osman¹, Hasilza Abdul Rahim¹, Thennarasan Sabapathy¹, Mohd Najib Mohd Yasin², Ainur Fasihah Mohd Fazilah¹

Bioelectromagnetics Research Groups (BioEM), ¹School of Computer and Communication Engineering, ²School of Microelectronic Engineering, Universiti Malaysia Perlis (UniMAP), Pauh Putra, 02600 Arau, Perlis, Malaysia

muzammil@unimap.edu.my, nasrun@unimap.edu.my

Abstract. Throughout this modernization world, the demands on Internet of Things keep increasing. Most mailbox or pigeon holé are designed with poor efficiency system and commonly suffer from some possible flaws such as manually checking the letter by the user. The main problem of this project is to improve the existing pigeon hole system. In the case of staff at School of Computer and Communication System, Universiti Malaysia Perlis, each academic staff has been allocated a pigeon hole for any letters or memos from within or inter faculty. Unfortunately, the current conventional pigeon hole system is unable to inform and notify the staff on any urgent letter and this lead to significant delay in responding the letter. The main weakness of the current system is that staffs need to check their respective pigeon hole every day. However, due to the routine commitment or unforeseen circumstances the pigeon hole cannot be possibly checked every day. Hence, to fulfill this requirement, this project named as Smart Electronic Pigeon Hole System is introduced in order to make the pigeon hole more efficient. The purpose of this project is to design a smart electronic pigeon hole system with some detecting sensors such as infrared and ultrasonic sensors. Wi-Fi module acts as a tool to communicate via email between pigeonhole’s system and its owner. Arduino board is used to be programmed in such a way to process the sensors when detecting the upcoming document or letters and to continuously check the status of capacity of the pigeon hole. This project work with the administrative staff, who collected the documents from the post center, will entered and select the designated number of the pigeon hole users. Infrared sensors, located at the front, will detect the upcoming documents or letters. Ultrasonic sensor will detect the fullness of the letter in the pigeon hole. When there is arriving of document or letters, the user will get the notification email. The user will also get the warning notification email when their pigeon hole is full with documents. Red LED will light on when the capacity of the pigeon hole is full. The sensor will continually sense the condition of the pigeon hole as long as the system is activated. This project is suitable for the staff or the apartment residents as it has the capability to alert the user when there is a letter to prevent the urgent letter’s being ignored.
1. Introduction

Pigeon hole is a small compartment for filling letters or mail. Pigeon hole also known as a message box or internal mail system and commonly used for communication in organizations, workplace and education institutes. Documents and messages are placed in a person’s pigeon hole for them to collect. Each staff in most big organization has his/her own pigeon hole to receive any important letter or memo related to the official duty. Commonly pigeon hole used by the lecturers or staff in a university but however residents in some place or regular people who work in an office are also regular user of pigeon hole or others might called it as mail box. In order to receive an important document without worrying it will be lost or stolen, it must be able to alert the owner. The pigeon holes with notification system acts like a pigeon hole but it is different from normal pigeon holes that are sold in the market.

Although there is lots of expensive pigeon hole in the market still, it is not guaranteed that it will satisfy most of the customer’s needs. With the aid of the technology that will be incorporated into the pigeon hole, this will improve and expand lot of functions and also reduced problems that most users will encounter such as forget to collect the important documents.

In the case of staff at School of Computer and Communication System, Universiti Malaysia Perlis, each academic staff has been allocated a pigeon hole for any letters or memos from within or inter faculty. Unfortunately, the current conventional pigeon hole system is unable to inform and notify the staff on any urgent letter and this lead to significant delay in responding the letter. The main weakness of the current system is that staffs need to check their respective pigeon hole every day. However, due to the routine commitment or unforeseen circumstances the pigeon hole cannot be possibly checked every day. In order to overcome this problem, the Pigeon Hole with Notification System is introduced as an innovation from conventional pigeon hole to notify user through email. The notification email is included the information such as status of the capacity of pigeon hole.

When any documents are put into the pigeon hole, it will send a notification email to inform the user that it has received some documents. If the pigeon hole is filled up with tons of documents, the pigeon hole will send a notification email to the user that it cannot receives mails and documents anymore unless the user clear up the documents inside it. At the same time, a red led at the top of pigeon hole will also light on, to show that the pigeon hole is full.

The internet of things, or IoT, is a system of interrelated computing devices mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human to human or human-to-computer interaction. A thing in the internet of things can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or manmade object that can be assigned an IP address and is able to transfer data over a network. Increasingly, organizations in a variety of industries are using IoT to operate more efficiently, better understand customers to deliver enhanced customer service, improve decision-making and increase the value of the business.

An IoT ecosystem consists of web-enabled smart devices that use embedded processors, sensors and communication hardware to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analyzed or analyzed locally. Sometimes, these devices communicate with other related devices and act on the information
they get from one another. The devices do most of the work without human intervention, although people can interact with the devices -- for instance, to set them up, give them instructions or access the data.

Blynk is a platform with IOS and Android apps to control Arduino, Raspberry Pi and the likes over the internet. It is a digital dashboard where you can build a graphic interface for your project by simply dragging widgets. Blynk also works over USB. This means you can linker with the app by connecting it to your laptop or desktop while waiting for some internet shield to arrive.

2. Methodology
   A. Proposed System Block Diagram
   Figure 1 shows the system block diagram of proposed work it major constituent of it are:
   - **LCD**: Display “Enter no. mailbox”.
   - **Keypad**: Act as input, used to input the pigeon hole number of the user
   - **Infrared Sensor**: Act as input. IR sensor will detect and consequently send a notification emails to inform the user that it has received some documents.
   - **Ultrasonic Sensor**: Act as input. Its detect the capacity of the pigeon hole.
   - **Wi-Fi Module**: Wi-Fi module will send a notification via email to the owner of pigeon hole when their pigeon hole’s full.
   - **White and Red LED**: Indicate the status of pigeon hole either its full or not.
   - **Blynk Apps**: Notify the user whenever there is arriving of documents or when the pigeon hole is full

![System Block Diagram](image)

**Figure 1. System block diagram**

   B. System Flow Chart
   Figure 2 depicts overall system flow chart. Firstly, the LCD will display “Enter no. mailbox”. The user need to enter the number of mailbox by using keypad. After the number of mailbox has been inputted, the chosen number will show up on the LCD. Then, there was a delay of 10 seconds for the mail to be inserted into the pigeon hole. If no mail is detected by the IR sensor, “No letter input” will show up and it will loop back to entering the number of mailbox. If the letter reaches the capacity of ultrasonic that set by the admin, red LED will turn on and an email will be sent to the owner of the pigeon. While white LED will turn on if unreached the capacity set by ultrasonic sensor.
3. Result and Discussion

Pigeon Hole with Notification System is a project that will ease the user of a pigeon hole by sending notification whenever a mail is inserted into their respective pigeon hole and also to notify the maximum capacity of the pigeon hole by the mean of an email. The system is built with an Arduino Mega as its main processing unit and a Node MCU and both of these devices communicate through serial communication.

![Figure 2. Overall system flow chart](image1)

![Figure 3. Connection of Arduino with input and output](image2)
Figure 3 shows the connection of Arduino Mega with the input and output such as LED, Keypad, IR sensors, Ultrasonic sensors, Node MCU and also LCD.

![Image](image1.png)

**Figure 4.** LCD displays “Enter no. mailbox”

For Figure 4, the LCD will display “Enter no. mailbox” to indicate for the admin to enter the number of mailbox which the mail will be inserted. After the number of mailbox has been inputted through the keypad, the chosen number will show up on the LCD. Then, there was a delay of 10 seconds for the mail to be inserted into the pigeon hole. If no mail is detected by the IR sensor, “No letter input” will show up and it will loop back to entering the number of mailbox.

![Image](image2.png)

**Figure 5.** IR sensor and ultrasonic sensor
Figure 6. Illustration of the location of IR sensor and ultrasonic sensor

Figure 5 and Figure 6 show the connection of IR Sensor and Ultrasonic Sensor. The IR sensor is located at the door of the pigeon hole. This is to detect the insertion of mail into the pigeon hole. After every single new insertion, an email notification will be sent to the respective pigeon hole owner to notify that there is a new letter for the owner. Next, the ultrasonic sensor is located on the middle top of the pigeon hole. This is to detect the capacity of the pigeon hole. When it reaches the maximum capacity, it will notify the owner through the mean of an email that the pigeon hole is full and the owner needs to clear it as soon as possible.

Figure 7. White LED turns ON

Figure 8. Red LED turn ON and LCD display "Mailbox is full"
For the LED condition, whenever there is space for another mail, and the ultrasonic sensor is not triggered, the white LED will turn on as shown in Figure 7. If the ultrasonic sensor is triggered, the red LED will then turn on to indicate the pigeon hole is full as in Figure 8. Whenever the maximum capacity has been reached, the admin cannot select that particular mailbox anymore. If the admin chooses to do so, the LCD will display “The mailbox is full” and “Enter no. mailbox” again.

**Figure 9.** Notification for infrared sensor

**Figure 10.** Notification for ultrasonic sensor

Figure 9 shows the email notification that has been sent to the pigeon hole owner whenever the IR sensor detects a new mail. Meanwhile, Figure 10 depicts the email notification when the ultrasonic sensor detects the capacity of the pigeon hole that was filled with tons of documents.

4. Conclusion

In a conclusion, the “Smart Electronic Pigeon Hole System” has been designed and tested successfully. It has been developed by integrated features of all the hardware and software components used. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Thus, the Smart Pigeon Hole System has been designed and tested successfully. The system has been tested to function automatically. Thus, the functionality of the entire system has been tested thoroughly and it is said to function successfully. The users of the pigeon hole (lecturers/workers) at SCCE office does not need to carry out manual checking anymore. The users also will not forget to retrieve their mails as they have been notifying via email about mail availability. The users also notified whenever their pigeon holes were fully occupied and does not have any space for mails anymore.
5. Future Work

Even though the overall project is well functioning and work successfully, there is a room of improvement to make the project better. In the future work, the project will be improved by considering the following:

- Adding another sensor that is able to accurately display the number mail received, as well as the ability to distinguish unwanted mails from important letters.
- Find other software that can run the email function automatically without the need of additional work force of supervision.
- By using a touch sensor, the system can be turn of when need to be used and turn off after the user finish using it.
- By using weight sensor, the system will have better range of detection for incoming objects, including small parcel
- Link smartphones to our sensors so that a simple glance can be advanced to a simple text message or an application notification.
- Provide efficient indicator for LED such as red, amber and green displayed at the top of the pigeon hole. Each lighted LED indicates the amount of mails inside the pigeon hole, with green representing the presence of a mail, amber meaning that the pigeon hole is half full and red meaning that it is fully filled.
- To provide security system such as implementing simple lock system with motor, so only open up when the user key in the correct password and for avoiding missing documents or letters.
- By using more advanced microcontroller or processor, the system can be scale up to provide service for more users.
- Monitoring via apps.
- Database system can be implement and the admin able to change the owner of pigeon hole without needing to change the whole coding.

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