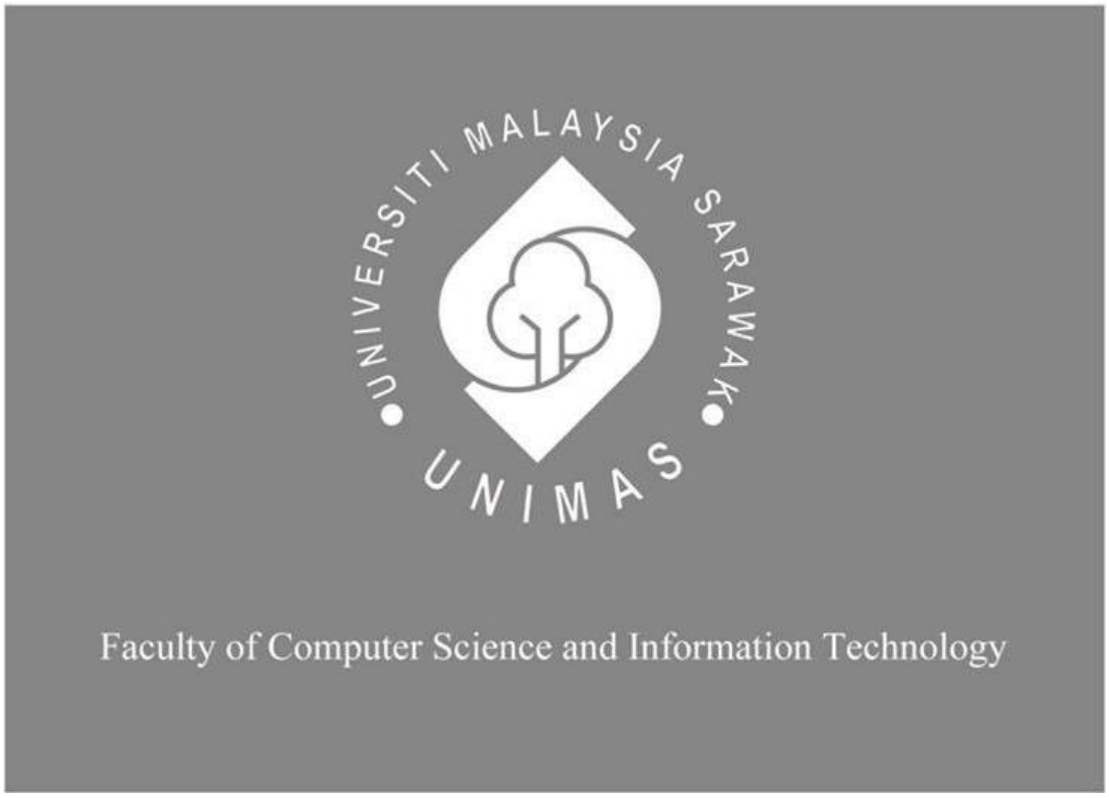


# *IoT-based Pigeon Hole System for FCSIT Lecturer*

**Nur Aiereen binti Alazam**

Bachelor of Computer Science with Honours (Multimedia Computing)

2019

*IoT-based Pigeon Hole System for FCSIT Lecturer*

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## ABSTRACT

This thesis was born out of an idea to make the current student assignment submission to be easier especially for the lecturer. Nowadays, the pigeon hole is one of the important mediums for lecturer and students who need to send the assignment or document. With this pigeon hole box, students do not have to interrupt with lecturer for only to submit the assignments unless students need to consult with the lecturer if there is something important to discuss. However, sometimes the lecturers are too busy and doesn't have much time to check the pigeon hole every day or time. In fact, some lecturer's room are quite far from their pigeon hole box. So, modern technology is now able to overcome this problem by upgrading the system to facilitate lecturer's checking their pigeon hole box. This project will help the lecturer to make sure they know if their pigeon hole boxes contains any assignment or document sent by students by displaying on lecturer's device using the Blynk application. As the lecturers may have to handle multiple courses at one time, this system will display the number of assignments according to the courses sent by the student through the lecturer's device.

# ABSTRAK

Tesis ini diilhamkan daripada idea untuk membuat proses pengahantaran tugasan pelajar lebih mudah terutamanya untuk pensyarah. Pada masa kini, ‘pigeon hole’ merupakan salah satu medium yang penting untuk pensyarah dan juga pelajar yang ingin menghantar tugasan atau dokumen. Dengan adanya kotak ‘pigeon hole’ ini, pelajar tidak perlu untuk mengganggu pensyarah hanya untuk menghantar tugasan melainkan pelajar perlu berbincang dengan pensyarah jika terdapat sesuatu yang penting sahaja. Walaubagaimanapun, kadang-kadang pensyarah terlalu sibuk dan tiada masa untuk memeriksa ‘pigeon hole’ setiap hari atau setiap masa. Malah, sesetengah bilik pensyarah agak jauh dengan kotak ‘pigeon hole’ mereka. Jadi, teknologi moden masa kini mampu mengatasi masalah ini dengan menaik taraf sistem untuk memudahkan pensyarah memeriksa kotak ‘pigeon hole’ mereka. Projek ini akan membantu pensyarah untuk memastikan mereka mengetahui jika kotak ‘pigeon hole’ mereka terdapat tugasan atau dokumen yang dihantar oleh pelajar dengan memaparkan melalui telefon pensyarah menggunakan aplikasi Blynk. Disebabkan seorang pensyarah mungkin mengurus lebih daripada satu kos pelajaran dalam satu masa, sistem ini akan memaparkan jumlah tugasan atau dokumen yang dihantar oleh pelajar melalui telefon pensyarah.

**TABLE OF CONTENTS**

**LIST OF FIGURES**

**LIST OF TABLES**

# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

Nowadays, the pigeon hole box becomes an important medium for the lecturer and the students. The function of the pigeon hole box is for the lecturers to check and collect documents and the assignments from the students. With this pigeon hole box, students do not have to interfere with the lecturer only to submit the assignments unless students need to consult with the lecturer if there is important issue to discuss. The method of pigeon hole box has not been updated where most lecturers still need to take the assignments from the pigeon hole box manually and need to separate the assignments according to the lecturers' teaching courses.

Internet of things common definition is defining as: Internet of things (IoT) is a network of physical objects. The internet is not only a network of computers, but it has evolved into a network of device of all type and sizes , vehicles, smart phones, home appliances, toys, cameras, medical instruments and industrial systems, animals, people, buildings, all connected ,all communicating & sharing information based on stipulated protocols in order to achieve smart reorganizations, positioning, tracing, safe & control & even personal real time online monitoring, online upgrade, process control & administration (Vermesan, O., & Friess, P. , 2013). The internet of things (IoT) has gained its popularity for the past decade, this is due to the broadband internet and sensor is become more widely available and thus the cost is decreasing. As a result, more and more everyday objects can be connected to the internet these days. These objects are being created with wireless fidelity (Wi-Fi) capabilities and sensors built into them, which allow real-time data communication between these objects without human involvement. In this project, the pigeon hole box will be implemented with the Internet of Things (IoT) where sensors in the pigeon hole box will count the assignments submitted according the type of courses. From the detection of the sensor, the lecturers will be notified then with the numbers of documents received for different courses.

## 1.2 Problem Statement

As the pigeon hole box is very important for both students and the lecturers, several problems have been identified in this project. First and foremost, the checking system. Currently, the lecturers need to check the pigeon hole manually regularly by themselves on the submission of assignments. Next on the list, as one lecturer has only one pigeon hole box and may have to handle multiple courses at one time, lecturers may misplace some assignments to other courses when separated them. Lastly, if the lecturers forgot the assignments inside the pigeonhole, the assignments will remain there till the lecturer check for the pigeon hole box again. Thus, the IoT-based Pigeon Hole for UNIMAS Lecturer is designed to improve and overcome the inconvenient method where lecturers don't need to check the pigeon hole box regularly and will be notified with the count on the submission of assignments submitted by students.

## 1.3 Aims and Objectives

The main objectives for this project are:

- To analyze the existing IoT based pigeon hole box monitoring system.
- To design and implement the IoT based pigeon hole box monitoring system.
- To evaluate the performance of IoT based pigeon hole box monitoring system.

## 1.4 Scope

This project will be completed within these scopes:

- The Faculty of Computer Science and Information Technology(FCSIT) is the first place to apply the application of IoT-based Pigeon Hole.
- The lecturer will be notified with the Blynk Application upon the assignments submitted by students.
- Required a scanning method, in which each assignment must be scanned one by one for the sensor to detect the assignment.
- Required standard UNIMAS cover page with the QR Code only for each assignment.
- This IoT-based Pigeon Hole is for the assignments in the size of A4 paper only. It will not function for parcel detection.

## 1.5 Brief Methodologies

System development methodologies play a vital part in developing the system. The basic purpose of these methodologies is to structure, plan and control the process of development so it can be a smooth system development.

Rapid Application Development (RAD) methodology is chosen as the base framework for this project. RAD is selected for its abilities to providing quicker development and higher quality results than other software development methodologies. The main objective of this methodology is to accelerate the entire system development process. This modified development method contains three phases which are analysis, prototyping and testing. The prototyping phases will be divided into two phases which are user design and construction. This prototyping phase will be repeated over and over until the user confirms that the product meets all requirements.


*Figure 1.1: Rapid Application Development for IoT-based Pigeon Hole*

Following sections shows the activities done on each phase :

**Requirement Planning :**

The requirement planning process involves the user identifying the problems in the current system – pigeon hole box system to get an in-depth understanding required for a new IoT-based pigeon hole box system. Besides that, the author needs to plan a project schedule with its milestones for developing the system.

**Prototyping :**

Prototyping is an iterative phase involving development, demonstrating and refinement process. Based on the requirements, the author will design and develop the prototype of the system based on user's interest such as designing the system interface and architecture. For this prototyping phase, it will be divided into two parts which are user design and construction. This phase is repeated until the results of the refinement are accepted by user. The prototype will be demonstrated to users to gain feedback and then refine the model accordingly. This phase is iterative.

**Testing :**

Lastly, the testing phase takes place which involves the author to completely test and examine the system to make sure it meets the requirement and objective of the system.

## 1.6 Significance of Project

There are a few other existing systems for pigeon hole box system. However, there are still flaws and problems occurred in that system. This proposed IoT-based pigeon hole is significant because:

- The existing system only counts the number of assignments inserted in the pigeon hole box.
- The proposed system will detect and count the number of assignments according to the courses of assignments inserted into the pigeon hole.

## 1.7 Project Schedule

This project for Final Year Project 1 which involves until Chapter 3 begins on 23rd September 2019 and is expected to finish on 12th December 2019 which comes to a total of 80 days. Below are the project schedule and Gantt Chart for this project. Figure 1.2 and Figure 1.3 below show the schedule for this project.

| Task | Duration (Day | Start Date | End Date |
|---|---|---|---|
| **IoT-based Pigeon Hole for UNIMAS Lecturer** | **80** | **23/9/2019** | **12/12/2019** |
| | | | |
| **Brief Project Proposal** | **6** | **23/9/2019** | **29/9/2019** |
| **Project Proposal** | **20** | **29/9/2019** | **19/10/2019** |
| Research on project | 8 | 29/9/2019 | 7/10/2019 |
| Identifying objectives and project scopes | 4 | 8/10/2019 | 12/10/2019 |
| Determine methodology | 8 | 12/10/2019 | 20/10/2019 |
| **Chapter 1: Introduction** | **6** | **20/10/2019** | **26/10/2019** |
| Finalise project proposal | 6 | 20/10/2019 | 26/10/2019 |
| **Chapter 2: Literature Review** | **21** | **26/10/2019** | **16/11/2019** |
| Gathering journal and informations on existing syst | 13 | 26/10/2019 | 8/11/2019 |
| Analysis information and documentations | 8 | 8/11/2019 | 16/11/2019 |
| **Chapter 3: Requirement Analysis and Design** | **18** | **17/11/2019** | **5/12/2019** |
| Collect all requirements | 2 | 17/11/2019 | 19/11/2019 |
| Create ERD and DFD | 5 | 19/11/2019 | 24/11/2019 |
| Basic design of system | 11 | 24/11/2019 | 5/12/2019 |
| **Submissions of Final Year Project 1** | **7** | **5/12/2019** | **12/12/2019** |
| **Submissions of Proposed/Revised Structure** | **5** | **11/2/2020** | **17/2/2020** |
| **Submissions of First Draft Chapter 4** | **25** | **18/2/2020** | **23/3/2020** |
| **Submissions of First Draft Chapter 5 and 6** | **10** | **24/3/2020** | **6/4/2020** |
| **Submissions of First Draft FYP2 Full Report & Paper** | **64** | **7/4/2020** | **5/7/2020** |
| **Submissions of Full Report, Source Code and Paper** | **9** | **6/7/2020** | **15/7/2020** |
| **Submissions of Final Full Report, Source Code and Paper** | **1** | **15/8/2020** | **15/8/2020** |

*Figure 1.2: Project Schedule for FYP 1 and FYP 2*

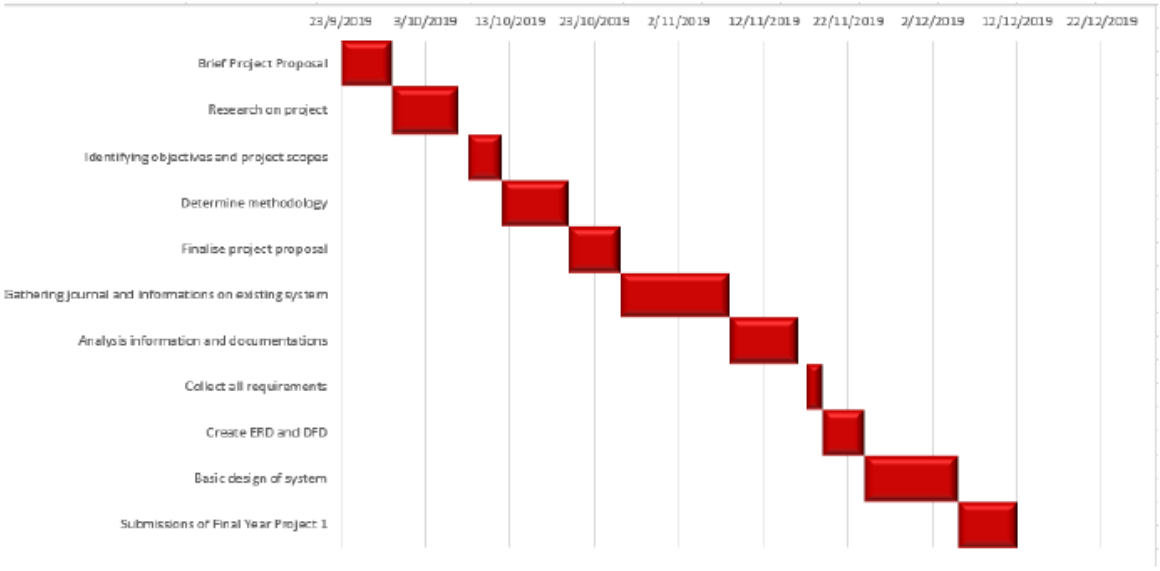


*Figure 1.3: Project Schedule Gantt Chart for FYP*

## 1.8 Expected Outcome

At the end of this project, an IoT-based Pigeon Hole system is designed and developed for FCSIT lecturers where the system will be able to automate itself with the use of sensor that tracks and count the sum assignments of specific course submitted into the lecturer's pigeon hole and notified them through the Blynk.

## 1.9 Project Outline

### 1.9.1 Chapter 1: Introduction

Chapter one is the introduction of the project. It explains the project's overview, problem statement, scope, objectives, significant of the project and the expected outcome once of the project.

### 1.9.2 Chapter 2: Literature Review

Chapter two is the discussion of literature review. In this chapter, researches are done to review and make comparison between the existing system and the proposed system. The advantages of the proposed system over the existing ones also, will be determined and discussed in this chapter.

### 1.9.3 Chapter 3: Methodology

Chapter three describes the methodology chosen for developing this project. This chapter explain the phases and details of the development process in order to come out with a clear idea of workflow on developing the system.

### 1.9.4 Chapter 4: System Implementation

Chapter four is all about the project outcome. The explanation of development and implementation of the system will be done.

### 1.9.5 Chapter 5: Evaluation and Testing

Chapter five is all about how the project be tested and evaluated for final fixing. The result of the testing will be explained in this part of the project.

### 1.9.6 Chapter 6: Conclusion and Future Work

Chapter six is the conclusion of this project. It will discuss on the project findings and brief on future work that can be done with this project. The system also, will be evaluated whether it met its objective.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

This chapter discuss on the literature review on existing system with similar functionality and process to the proposed system. A comprehensive analysis will be discussed in depth regarding towards the system strengths, weakness and features of those system. The IoT-based pigeon hole box system is designed with a several key points taken as a subject studied for this research. There are several sources that have been identified as a resource for this literature review, such as books, thesis, journals and websites. The 4 existing systems that are similar to the proposed system are Real Time Mailbox Alert System via SMS or Email, Smart Mailbox, GSM-Based Notification System for Electronic Pigeon Hole and Arduino Based Mail Notifier System. Based on the study, a comparison is done between existing systems and proposed system to identify problem that occurred in existing system and ways to overcome them regarding towards project goal. Apart from that, this chapter also discuss about the tools and technology that will be used for the development of the proposed system.

## 2.2 Review Existing System

In this section, four existing systems that similar to proposed system are reviewed based on their methods of counting and notify user upon the arriving documents and the feature design of the system. This is so to understands the basic process of how each existing system works. Not just that, it also aims to analyse the user interface features on existing system that can be added to the proposed system.

### 2.2.1 Real Time Mailbox Alert System via SMS or Email

The system is introduced by Subramaniam et.al (2007) where the system is designed by sending a short messaging system or email to alert and notify the users about important new mails reaching their mailbox. As Figure 2.1 below shows, the programmable logic controller, interface module and the GSM modem can be incorporated by using linking the user's mailbox with quick messaging system or email facilities and this enables the users to be notified whenever a new mail is delivered. When mails delivered into the user's mailbox, the system will automatically generate an alert by sending a short message system or email.

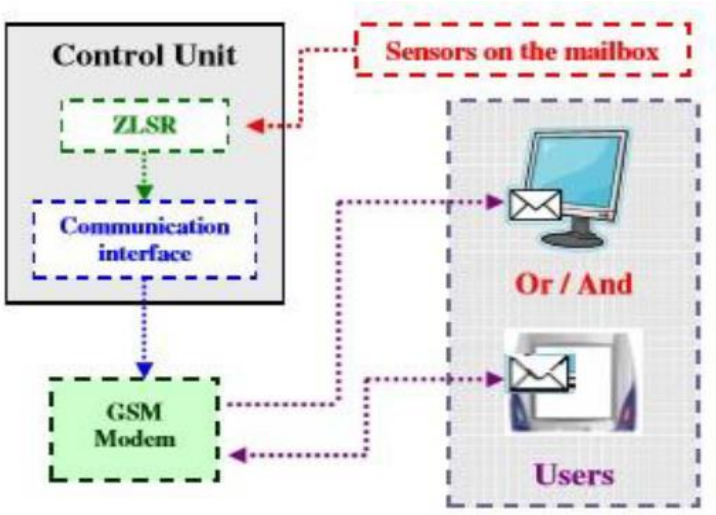


*Figure 2.1: The real time MASYS block diagram*

Besides that, the user is capable of checking their mailbox status by sending a SMS to the system and control system will reply base on the latest status of the mailbox to the user. This project is very effective and conventional method because user can always be alert of important mails that received because of the high confidentiality and official letters are increasing as a corresponding tool globally. The system is used to send a reminder to the users if the mails are not collected for a length of time and also to reset the system once the mails are collected.

### 2.2.2 Smart Mailbox

Smart Mailbox (Hassan, 2018) as shown in Figure 2.2 is a hardware system in Finland where it manages the mail inside the box itself. It is designed with sensor equipped inside to detect all the mail that goes in and from the sensor it will send the information into the panel display inside the house to notify the resident about the mail availability.

*Figure 2.2: Smart Mailbox in Finland*

With this functionality, the resident will know that they got mail inside the box. Unlike the traditional one, the residents need to check the mailbox regularly. When the mail taken out, the sensor will read the mailbox as empty and reset the information send into the LCD panel display. For this Smart Mailbox, there are several hurdles to overtake. The biggest challenge is to make a product that is both cost efficient and robust. Besides that, the battery performance in cold weather. As we know, low temperature slows down the chemical reactions happening inside the battery cells. The temperature in Finland can drop as low as -30 degrees Celsius in winter which can drain any normal chemical battery.

### 2.2.3 GSM-Based Notification System for Electronic Pigeon Hole

Smart GSM mailbox (Abd Wahab et al., 2010) main objective is to detect the presence of a letter into the mailbox. It is for reducing the risk of losing important letter. The Smart GSM Mailbox has two approaches to detect the letter; first approach is buzzer attached to the mailbox as the notification. When the infrared sensor detects the mail, the buzzer will go off and keep buzzing according to the set point given. As we can see from Figure 2.3, the LED also acts this way, which they were light up when the sensor detected the mail.

*Figure 2.3: GSM Mailbox's LCD Panel*

The second approach used the GSM module to send SMS to the user. When the infrared sensor detects the mail, GSM module will send SMS to the resident phone. The messaging setting is coded inside the PIC microchip. The sensor identifies approaching mail and number of mail dependent upon the figuring in the procedure. The information from the sensor is sent to the PIC and changed over from simple to advanced indicator. Consistent with the information motion from the circuit that was manufacture, the information is sent to the collector.

Before the letter inserted into the mailbox, the LED turn GREEN to show that the mailbox is empty. After the letter has been inserted into the mailbox, the LED turned on to the RED to inform the letter is inside the mailbox. The buzzer produces sound after few moments or GSM will send a message to the user to inform the incoming mail.

### 2.2.4 ARDUINO BASED MAIL NOTIFIER SYSTEM

A simple mail alert system (Kapoor, Sharma, Singh, & Sutradhar, 2018) is built in this project using simple and cheap wireless communication tools. The purpose of the project is to inform the user of a message whenever he or she receives a mail in their mailbox.

The main sensor used for detecting the mail is the photo resistor or LDR. Most of mailboxes are open and shut type i.e. a small door must be open, and the mail must be placed inside the box. If we place the LDR on the inside of that small door, it receives light only when the door is opened to insert a mail. As the LDR senses the changes in the ambient lighting (by changing its resistance accordingly), it can differentiate between a door – open scenario and a door – close scenario. The system will be installed outside the homes in the post letter box and as soon as the mail is inserted inside the box the owner will receive a mail as “MAIL MAIL MAIL MAIL MAIL”

## 2.3 Comparison Between Proposed and Existing Systems

Below is the comparison between the existing systems and the proposed system based on their selected methods and features.

*Table 2.1: Comparison between Existing System and Proposed System*

| Systems / Features | Similar Existing Systems | | | | Proposed Systems |
|---|---|---|---|---|---|
| | **Real Time Mailbox Alert System** | **Smart Mailbox** | **GSM-Based Notification System for Electronic Pigeon Hole** | **Arduino Based Mail Notifier System** | **IoT-based Pigeon Hole for UNIMAS Lecturer** |
| **Incoming Mail Notification** | Yes | Yes | Yes | Yes | Yes |
| **Type of Notification** | SMS/Email | LCD Display Panel | SMS, LCD Display Panel and LED Light | Email | Blynk |
| **Range of Notification Alert** | As long as connected to WIFI | As long as connected to WIFI | As long as connected to WIFI | As long as connected to WIFI | As long as connected to WIFI |
| **Type of Sensor** | Infrared Sensor | Gyroscope sensor | Infrared sensor | Photo resistor/ LDR | 2k2ohm resistor |
| **Main Function** | Notify user upon the arriving items. | Notify user upon the arriving items. | Notify user upon the arriving items. | Notify user upon the arriving items. | Notify user upon the arriving items. |
| **Other Special Functions** | None. | None. | RFID for open the door. | None. | Count the numbers of documents arrived according the courses. |