



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**PIGEON HOLE NOTIFICATION SYSTEM BY USING
ETHERNET TECHNOLOGY**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Telecommunications) With Honours

by

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DECLARATION

I hereby, declared this report entitled “Pigeon Hole Notification System by Using Ethernet Technology” is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Telecommunication) with Honours. The member of the supervisory is as follow:

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(EN ABDUL HALIM BIN DAHALAN)

ABSTRAK

Pada tahun 1800-an, revolusi perindustrian telah memperkenalkan dunia mengenai proses pembuatan, komunikasi, pembangunan dan pengangkutan. Hasil dari perkembangan pesat pada ketika itu, telah membawa kemajuan kepada masyarakat sejagat khususnya dalam bidang elektronik. Seperti mana yang kita saksikan, terdapat pelbagai perkhidmatan atau kaedah yang dapat membantu manusia dalam memudahkan aktiviti harian mereka. Ketika waktu itu juga, telah diperkenalkan sistem notifikasi untuk kotak mel yang ditempatkan di pejabat bagi menguruskan pengurusan dengan lebih sistematik. Kotak mel yang dinotifikasikan melalui ethernet adalah satu cara yang dapat memudahkan pengguna di masa kini. Ia akan membolehkan pemilik untuk diberitahu bila-bila masa dan di mana sahaja melalui penerimaan E-mail.

ABSTRACT

In the 1800s, the industrial revolution has introduced the world about manufacturing processes, communications, construction and transport. The result of the rapid development at that time, it has brought many progresses to society, particularly in the field of electronics. As we have seen, there are various services or methods that can help people to simplify their daily activities. During that time, a notification system has been introduced which the mail box is placed in the office to manage in a more systematic management. Pigeon Hole is notified via Ethernet is one way that may help users in the present. It will allow the owners to be notified anytime and anywhere via E - mail reception.

DEDICATION

To my beloved parents, Ahmad Bin Yusof, for supporting and encouraging me to believe in myself and Radziah Bt Ismail, a strong and gentle soul who taught me to trust in Allah and every hard work that so much could be done with little.

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LIST ABBREVIATIONS, SYMBOL AND NOMENCLATURES

LAN	Local Area Network
PCB	Printed Circuit board
LCD	Liquid Crystal Display
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
IP	Internet Protocol
RFID	Radio frequency Identification
GPS	Global Positioning System
GSM	Global System for Mobile Communication
IOT	Internet of Things
SMTP	Simple Mail Transfer Protocol
IMAP	Internet Message Access Protocol
SSL	Secure Sockets Layer
TSL	Transport Layer Security

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter will explain about the project background including the problem statements, objectives and the project scope. The main purpose of this chapter is to explain the structure of the project, which is to make sure the objectives are achieved with flying colours.

1.1 Project Background

A wireless sensor network (WSN) consists of a set of autonomous devices called sensor nodes, equipped with short-range wireless interfaces and hardware for monitoring environmental parameters such as humidity, pressure and temperature [1]. Throughout this technology era, pigeon hole has become the most essential part for keeping or storing any types of document mainly in offices, school and university. In the late 1700s, the first pigeon hole was existed with the most basic features. Throughout the years, the pigeon hole has invented into more extra features. The additional features are closed box, security pin, liquid crystal display (LCD). In this project, a wired communication has been chosen as a medium to transmit and receive data from the sensor. Basically, the operation of the pigeon hole is whenever there is document inserted into the pigeon hole, a push button will be triggered and will send the information to a microcontroller. We use Arduino Mega to program the coding that will receive and transmit data from sensor to emails of the user. This is a more efficient way compares to notify through SMS and LCD.

1.2 Problem Statement

However, the pigeon hole is not yet invented to notify the user automatically. Usually, the user herself must check the box frequently to ensure any emergency documents. Thus, this is helpful for a busy career, especially lecturers and managers. In order to notify the user there are two ways wireless or non-wireless. Basically, user spent more time on checking their boxes frequently, thereby the invention of pigeon hole is more efficient and user friendly. As we go through our day with a full-time internet access, we can literally check e-mail sent from the pigeon hole. This can avoid any overlooked documents, especially when we are out of town. Wireless refers to communication without using any wire attached, for example, satellite, Bluetooth, infrared, microwave and Wi-Fi. Meanwhile, wired communication requires wire-base communication technology to transmit data where Ethernet is the most popular usage for wired communication. Wired communication can be classified to fibre optics and Ethernet LAN connection. Waveguides is one of the wired medium due to its high power application.

1.3 Objectives

The main objectives are :

1. To develop an efficient pigeon hole notification system for users based on Ethernet technology or wired network.
2. To understand how the notification system works as required, which is notified by using e-mail of users.
3. To compare the protocols involved in incoming and outgoing mail server for Gmail and yahoo.

1.4 Project Scope

The project scope, we have divided into two processes. The first one to undergo is software. As we use Arduino Mega 2560 as our devices to interface the three main components which are 4x4 keypad membrane, Ethernet Arduino board and LCD screen. Under software process, there are another two sections which assigned for this project. Thus, we must create a coding to combine the three phases to make it works.

Hardware Simulation

Arduino is another autotyping open source with many new inventions that comes out with many extra features. Arduino is chosen due to the easier programming with any types of projects for beginners. It also can be run on Windows, Mac and Linux which will be easier for me to handle it. Besides coding, circuit design is one of the elements that must be created. It can be designed by using software named Proteus or Fritzing. For this project, it is preferred to use Fritzing because the ease of using it is easy to understand. Fritzing has three simulations design available, there are hardware, schematic and PCB design. Before proceeding to coding, the circuit should be correctly connected. In the circuit, there are four stages of designing; power supply, keypad, Arduino Mega and Arduino Ethernet Shield. After finishing designing the circuit, we may proceed to create coding, but it is important to note that every pin used in microcontroller must be declared according to the design. This is to avoid any errors during compiling the file. When the coding has finished, it must have compile to check errors and warnings.

Programming Software

Software used to write the coding is Arduino Integrated Development Environment (IDE). The IDE can be used to write the sketches of the project, multiple files can be added, third-party hardware can be involved, various of libraries can be used for complex level. Troubleshooting is also available to help the user on what to do if the coding doesn't work properly. After completing the programming for IDE, it will be proceeded to create database in order to differentiate the user. The second process is hardware. When the simulation of coding is working successfully, the hardware process will be interfacing the devices according to the design.

1.5 Project Significant

This project is significant on protecting documents when is the user herself will be notified through her email despite keeping up to date with any document that is inserted into the pigeon hole. Moreover, since the smartphone has taken over world's management this project will prove that the usage of email for notification system is convenient for letting the user know of the progress in and out of the box. It is also handed on notifying the user on which identification number is sending document into the pigeon hole. Thus, users can access their email anytime they want in addition, it can prevent any carelessness on any emergency documents. This project especially can build the student's integrity to always be punctual especially on handling assignments. On top of that, this is mainly to save manpower, cost and time despite of the location of pigeon hole is far from the user.

1.6 Summary

A wired notification system of pigeon hole by using Ethernet technology will provide the fastest and efficient way to make sure the user is always being up to date by using their e-mail. Data is obtained from data keyed in by user located outside the pigeon hole, before entering the paper the user must keyed in his or her matrix card number and by pressing * simultaneously with inserting document, it will send data to lecturer. The keypad button attached outside of the pigeon hole will give input to the Arduino Mega in the microcontroller. The program that has been set up will continues transmitting the information to notify the user through e-mail.

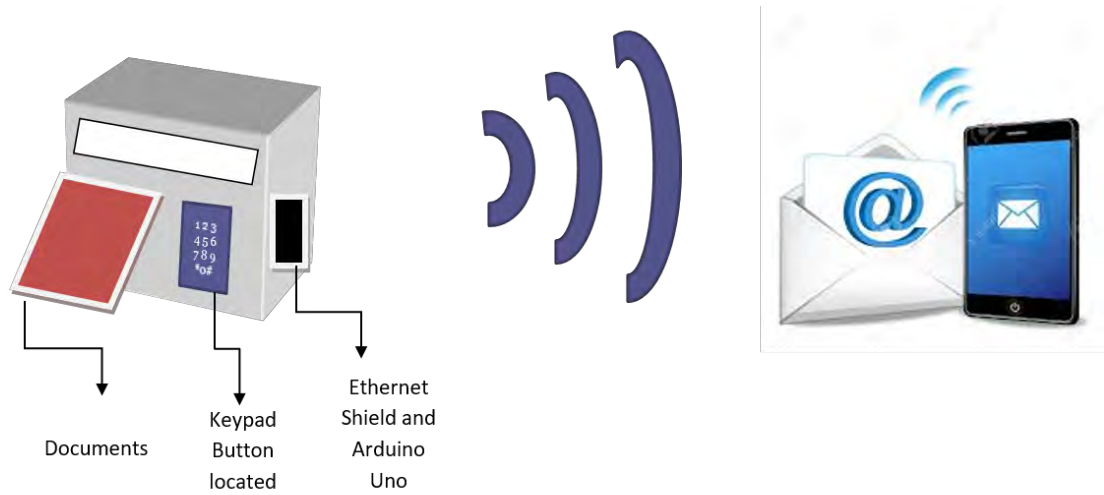


Figure 1.6: An illustration of the Pigeon Hole Notification System by Using Ethernet Technology

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will explain on how the project is being conducted. The main purpose is to help students in obtaining the information regarding the project. Each information can be earned from many types of resources, for example journal, thesis, book, internet and article as well. The studies conducted will give an input or idea to students for instance, which types of hardware and software involve, comparison between devices, what can be improved by the project and significantly to avoid any plagiarism on the other's project. Moreover, this chapter will specify and solve issues encountered during designing.

2.1 Notification System Application

The most essential element in the web based notice board application is the communication method used to communicate or to remotely control the main device on notice board. They're a two method to approach this communication which using wireless and non-wireless. Although the wired notification system was taken over the technology in the early of development of notice board automation system, nowadays the Ethernet technology has become main communication system which requires proper planning and construction works for efficient and clean design. For each wireless and non-wireless medium, it has their own advantages and disadvantages that makes it valuable until now. The aspects that mostly consumer has been looking for being the security, cost savings, flexibility and power consumption. Next, every consumer or user must be looking forward on maximizing their communication

network performance while maintaining the reliability and secured data transmission. The table below is showing the comparison between wireless and non-wireless communication.

Table 2.1 : Comparison between Wireless and Non-wireless technology

	Wireless	Non-wireless
Security	Lower security	Higher security
Data transmission	Slower (Radio waves)	Faster (Wired ; Ethernet)
Cost	Low cost that there are no cables needed.	A bit expensive depending on the length of wire and the copper material inside.
Installation	Easy installation	Difficult installation since there is hubs and switches involved.

2.1.1 Wi-Fi

Wireless Fidelity or known as Wi-Fi is a technology that uses radio waves on transmitting and receiving information or power between points. (Andrea Goldsmith, 2015) explained that spectrum allocation for existing system has its own frequency spectrum. The frequency spectrum for wireless communication services is in the range of 2.305GHz to 2.36GHz. This shows that Wi-Fi device that is going to use is suitable for the communication system. Wi-Fi is less secure than wired connections, such as Ethernet, precisely because an intruder does not need a physical connection.[20]

2.1.2 Ethernet

Ethernet is one of the mostly used Local Area Network (LAN) technology. It refers to units of transmission, packets and frames. Ethernet was originally designed to run over a coaxial-cable. As time passing by, Ethernet now is evolved to higher transmission speed and changes in frame contents. It is divided to two types of network topology; star and bus topology. Each topology has their own advantages and disadvantages.

Table 2.1.2 : Comparison performance between Start and Bus topology

	Star	Bus
Performance	Failure of one node doesn't affect the whole system.	Failure of one node affects the whole system.
Cost	Higher	Lower
Ease of troubleshoot	Easy, since it can easily detect which nodes are affected	Hard to detect, since the whole network should proper shutdown to find the damages node.

Ethernet shield is easier to handle than Wi-fi module. This is because the pins on the Ethernet can be directly connected to Arduino. Meanwhile, wi-fi module needs to be configured each pin that is attached on the Arduino board. But, in order to connect Ethernet to internet connection, it is a must to connect Ethernet shield where TCP/IP is attached on it and configure the step by step layer[23]. The layers mentioned are physical, data link, network and transport layer. Mohana, 2015 said that all Ethernet devices requires two unique identifying addresses which are an IP address and MAC address. Meanwhile, on the data link layer it is to determine who is allowed to access the media at

one time. The unique MAC address is a must have in building the network with Arduino board. Thus, the unique IP address is important in the network layer to forward packets through routers.

Moreover, the table below shows the differences between the maximum speed can be achieved for both Ethernet and wi-fi. The speed of the Ethernet connection depends on the types of cable used.

Table 2.1.2 : Comparison network speed between Wi-fi and Ethernet connection

	Wi-fi	Ethernet
Speed	Since new standards were introduced which are 802.11ac and 802.11n has offered maximum speeds of 866.7Mb/s and 150Mb/s respectively.	By using CAT-6 cable, the maximum speed could have achieved is 10Gb/s. Again, the maximum speed depends on type of cable used because CAT-5e cable could achieved up to 1Gb/s.

Moving on to latency of both systems, Wi-fi's latency can be check using any application on the internet for instance www.speedtest.net where it provides the speed for download and upload so as the ping command. Ethernet's latency connection can be checked using command prompt and ping the router's IP address. The Ethernet connection might not experience with any wireless interference, but it will have faced signal degradation which can be eliminated and avoided.

2.2 Wireless Notification System by using ZigBee

From the previous table, it is clearly noted that wired connection has now own a lot of improvement. Nevertheless, in this project a wireless connection has been chosen due to the limitation of cost. There are lots of medium that can be used under wireless connection for example ZigBee, Raspberry Pi and Arduino. Each control unit has their own limitation and ability. ZigBee is a newly developing protocol for wireless sensor networks have become the most attraction technique in research and commercial domain because open standard, low cost and low power characteristic. ZigBee has its own benefit which it is suitable for system environments that demand on less power consumption and lower data-rates requirement (Devi, August, 2012). ZigBee has its own benefit which it is suitable and lower data-rates requirement.

The main advantage of ZigBee over other wireless module is the range covered by ZigBee. ZigBee has been widely used in any application and used in many applications, for example, in wirelessly controlling robots or any other specifics in wide range coverage application. It can act as a transmitter and receiver functionality.

2.3 Wireless Notification System by using Raspberry Pi

On the other hand, the micro controlling can be implemented by using Raspberry Pi. Raspberry pi is one of control unit devices that come out with Wi-fi modules attached for their new products. It has two main types of raspberry pi that are model A and B. With some improvements in terms of number of ports, Ethernet and Wi-Fi module and increases of power consumption, it has developed in such advanced way until the new version of A+ and B+ took over the electronics industry due to its specifications.

Table 2.3 : Comparison specification of Raspberry Pi products.

	Raspberry Pi 1 (B+)	Raspberry Pi 2 (B)	Raspberry Pi 3
CPU	Arm11	Cortex A7	4x Arm Cortex A-53
Ethernet	Yes	Yes	Yes
Wi-Fi and Bluetooth	No	No	Yes
Power Consumption	Least efficient	Fewer efficient	Most efficient

From the table, it can be concluded that the latest version of Raspberry pi which is the third version is the optimum among the other products issued by the company. In order to apply the unit control into the wireless notification system, it is the most convenient since the existence of Wi-Fi and Bluetooth has already been installed in the new version. Hence, it can cut more cost saving despite the power consumption in Raspberry pi 3 is higher compared to Raspberry pi 2.