SMART PIGEONHOLE SYSTEM BY SENDING NOTIFICATION THROUGH SHORT MESSAGGING SYSTEM

NAZARIAH BINTI ABDULLAH

CA12012

FACULTY OF COMPUTER SYSTEMS & SOFTWARE ENGINEERING (FSKKP)

UNIVERSITI MALAYSIA PAHANG

2015

UNIVERSITI MALAYSIA PAHANG

BORANG PENGESAHAN STATUS TESIS

JUDUL: <u>SMART PIGEONHOLE BY SENDING NOTIFICATION THROUGH SHORT MESSAGGING SYSTEM</u>

SESI PENGAJIAN: <u>SEMESTER 2 SESI 2014/2015</u>

SAYA <u>NAZARIAH BINTI ABDULLAH</u>

Mengakumembenarkantesis/laporan PSM inidisimpan di PerpustakaanUniversiti Malaysia Pahang dengansyarat-syaratkegunaansepertiberikut:

1. Tesis/LaporanadalahhakmilikUniversiti Malaysia Pahang.
2. PerpustakaanUniversiti Malaysia Pahang dibenarkanmembuatsalinanuntuk
3. tujuanpengajiansahaja.
4. Perpustakaandibenarkanmembuatsalinantesisinisebagaibahanpertukaranantara
5. institutpengajiantinggi.
6. **Silatandakan (√)

☐ SULIT (Mengandungimaklumat yang berdarjahkeselamatanatau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972) *

☐ TERHAD (Mengandungimaklumat TERHAD yang telahditentukan olehorganisasi/badan di manapenyelidikandijalankan) *

☐ TIDAK TERHAD

DisahkanOleh

……………………………………………………

Alamattetap: ………………………… Penyelia:…………………………………..

Tarikh: …………………………………. Tarikh:……………………………………

*Silalampirkansuratdaripadapihakberkuasa/organisasiberkenaandenganmenyatakanseka lisebabdantempohtesis/laporaniniperludikelaskansebagai SULIT atau TERHAD.

SUPERVISOR DECLARATION

I hereby declare that I have read this thesis and in my opinion this thesis/report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Computer Science (Computer System and Networking)

Signature:……………………………………………………

Name of candidate: Nazariah Binti Abdullah.

Date: 20 May 2015.

STUDENT DECLARATION

I declare that this thesis entitle "Smart Pigeonhole System by Sending Notification through Short Messaging System" is the result of my own research except as cited in the references. The thesis has not been accepted for any bachelor and is not concurrently submitted in candidature of any others bachelor.

Signature:……………………………………………………

Name of candidate: Nazariah Binti Abdullah.

Date: 20 May 2015.

ACKNOWLEDGEMENTS

Alhamdulillah, thanks to Allah because with His grant, I get finish my project. In this project, many people were involved until this project done. I have got a lot of experience and new knowledge to finish this project. This system will not accomplish with prosperously, without their auxiliary and support.

To my beloved father and mother, who always there for me no matter how difficult life it is and heir encouragement and financial support toward to achievement of my success.

To Encik Syahrulanuar BinNgah as my supervisor, thank you for your guides, advices and support to ensure this project is finish and accomplish all requirements needed.

Last but not least, thanks to all my fellow friends, all faculty members, seniors and juniors, for kindness, cooperation moral support and valuable opinion by sharing the idea during the progress of the project. May Allah bless the very all of you.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF DIAGRAM

LIST OF ABBREVIATION

SMS- Short Massaging System

IR sensor- Infrared Sensor

GSM- Global System for Mobile communication.

EXECUTIVE SUMMARY

Smart pigeonhole system dengan menghantar peringatan melalui system pesanan ringkas adalah sistem yang diwujudkan bagi memudahkan penghuni untuk mendapat pesanan ringkas melalui telefon jika surat masuk kedalam peti. Sistem ini membolehkan penghuni untuk menjimatkan masa mereka daripada selalu memeriksa kewujudan surat didalam peti surat mereka jika penghuni tinggal di bangunan yang tinggi. Di dalam proses pembuatan system ini, suatu kaedah yang dinamakan system kitaran hayat pembangunan telah digunakan bagi mengumpul maklumat. System ini mempunyai lima fasa iaitu fasa perancangan, analisis, pelaksanaan, mereka bentuk dan pengujian. Sistem ini sangatlah penting bagi memastikan mutu produk dan memastikan pejalanan dalam pelaksanaan projek sentiasa berjalan lancar. Sistem ini dibina dengan menggunakan beberapa komponen antaranya sensor infra merah, ultrasonic sensor dan arduino yun. Sensor infra merah digunakan untuk mengesan kehadiran surat yang masuk ke dalam peti manakala sensor ultrasonic digunakan untuk mengesan paras kepenuhan peti surat. Jika paras surat didalam peti melebihi paras yang disetkan maka penghuni akan menerima pesanan bahawa peti surat didalam keadaaan penuh dan meminta agar penghuni mengambil surat mereka dalam keadaan segera. Kesimpulannya, system ini amat berguna kepada penghuni bagi memudahkan mereka mendapat peringatan tentang surat yang sampai ke dalam peti surat mereka.

EXECUTIVE SUMMARY

Smart pigeonhole system by sending notification through short messaging system is a system that have been built for resident to get a notification about arriving mail through short messaging system in their phone. This system allows residents to save their time rather than always check the existence of the letter in their mailbox if residents living in high buildings. During development of this system, a method called the system development life cycle was used to gather information. This system has five phases: namely, planning, analysis, implementation, design and testing. This system is essential to ensure product quality and ensure a trip in the implementation of projects always run smoothly. The system is constructed using several components including infrared sensors, ultrasonic sensors and arduino yun. Infrared sensors used to detect the presence of the mail into the box while the ultrasonic sensor is used to detect the level of fullness of the mailbox. If the level is above a letter in the set, the residents will receive a message in order that the whole situation and asked that residents take their mail in circumstances immediately. In conclusion, this system is very useful to residents to enable them to get a warning about the mail that came into their mailbox.

CHAPTER 1

INTRODUCTION

1.1)   Introduction

The Smart Pigeon Hole is a hardware system that operates by using Arduino Yun mainboard, Temboo account and with Adjustable Infrared Sensor that will inform the user about the mail that arrived in the pigeonhole. When the letters cross the Adjustable Infrared sensor's alignment, it will send a trigger to the Arduino Yun mainboard. It does operate by sending Short Messaging System (SMS) to inform the user about the arriving mail. This system is more efficient. It's very useful because this system will send the SMS without any credit charges to the user because this system used Temboo's API system.

Besides that, it also sends alert if the user's pigeonhole is full. This system will send a notification to a user to take out the letter. This part will be using a digital sensor that can detect the range in the pigeonhole. All the notification's process was programmed in the Arduino IDE platform, and it will be uploaded to the Arduino Yun mainboard that act as a web server to operate the entire sensor. This might be an interesting device and helpful product.

1.2) Problem Statements

There are the several problems that have been identity in this project. This problem statement will be the core statements in replacing the existing pigeonhole mailbox system which are:

i) Manually checking system.

Every day, the user needs to check at their pigeonhole, either they got mail or not. If the pigeonhole is far from the user than it is difficult to them to check regularly and sometimes they forgot the important mail inside

ii) Waste time.

If the user's pigeon hole is far from the user place then, it might take a little time to collect their mail. If they are waiting for important mail, they might check the pigeon hole regularly. It is frustrated if they come from the high floor and looking from their mail, but the mail is not there yet.

iii) Inconvenience

If the users forgot the mail inside the pigeonhole, the mail will be there as long as the users remember to check it. It will lead to inconveniency if the mail is an urgent one.

1.3) Objective

The main purpose of the Smart Pigeonhole is to improve the manual checking system to the digital way by sending notification about the mail arrived to the user through a short messaging system. There are several objectives that will be the goal that need to achieve:

- To build a pigeonhole programmed response by using suitable device and software.
- To reduce energy and time use in mailbox checking.
- To give an alert to a user if the pigeonhole is full and informs to collect the mail.

1.4) Scope.

i)   The User. (pigeonhole owner)

When using this system, users do not have to check their mail regularly. The checking process will be covered by the system, and the user just has to wait for the notification to arrive.

ii)   This project acts as a mail alert only.

This Smart Pigeonhole System is for the mail alerts only. It will not function for parcel detection.

iii)   Send a text message to notify the user.

This system will send text messages to a user about the mail arrive, and it is also will send a message to notify a user if their pigeonhole is full. The users still need manually to take the mail from the pigeonhole.

1.5) Material's Outline.

This project consists of six chapters:

Chapter 1 consists of the overall overview about of the project. In this chapter, the problem statement will be stated. After that, the objective and scope will be defined by refer to the problem statement. The scope must be stated clearly in this chapter.

Chapter 2 consists of literature review about the existing system. The enhancement of the existing system will be proposed. This chapter also will simply brief about the current system that will be developed.

Chapter 3 consists of research methodology that will be used in developing this project. This chapter will explain about the planning, analysis and design phase. This chapter will explain more about the device and equipment that will be used during developing process.

Chapter 4 consists of implementation and maintenance of the project. This chapter will explain about the steps of developing process and programming codes that have been used.

Chapter 5 is discussions about the result and the output from the project. In this chapter also will discuss about project enhancement and suggestion to make the system more useful in the future.

Chapter 6 is the last chapter that will conclude all the chapters.

CHAPTER 2

LITERATURE REVIEW

2.1) **Introduction of the Relationship between the Existing Project and the Current Project.**

In developing the current system, some researchers are required. This is to get some information and to find what the existing system can do and to know the weakness. From the weakness, some enhancement can be done to make the project more effective in solve the user's problem.

2.2) Existing System Review

There are three systems that have been chosen during this research. There are GSM Smart Mailbox, Smart Mailbox using alert system and lastly notifications system for pigeonhole using online telegram messenger.

2.2.1) GSM Smart Mailbox

Smart GSM mailbox main objective is to detect the presence of a letter into the mailbox. It is for reducing the risk of losing important letter. The uses of the PIC Microcontroller 16F877A act as the main device for the mailbox. It controls all the minor devices such as buzzer, LCD display and also LED. All minor devices function will be programmed in PIC 16F877A. Another main device use for this mailbox is GSM. It functions as SMS sender to inform the presence of a letter to the resident. This way, resident will be alert to the letter exists.

The Smart GSM Mailbox has two approaches; first approach is buzzer attached to the mailbox as the notification. The output is the 5v buzzer for the infrared sensor input. The LCD panel display will display 0 SMS if the switch toggle is pressed, and it will trigger and activate the buzzer mode. When the infrared sensor detects the mail, the buzzer will go off and keep buzzing according to the set point given. The LED also acts this way, which they were light up when the sensor detected the mail.

Figure 2.1: GSM Mailbox's LCD Panel.

The second approach used the GSM module to send SMS to the user. This GSM technology is use 7. 5v for power it up and frequency range from 900-1800 MHz's. When SMS mode is active, which is when SMS=1, the GSM module will be activated. 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 code is tending to minimize and simplify a thing for the user and the user itself can set the profile for the mailbox number.

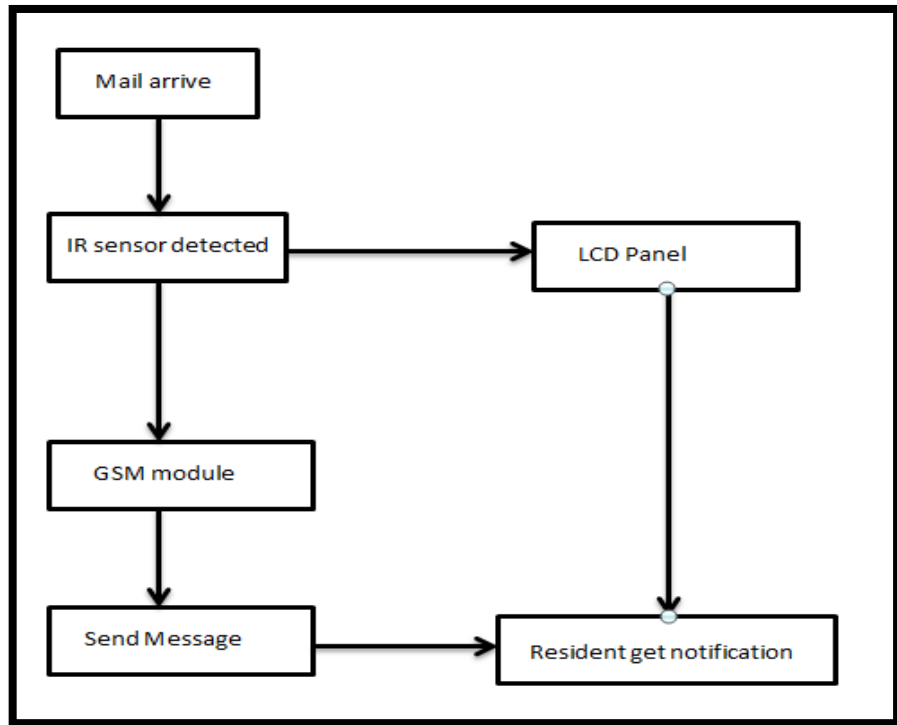**Figure 2.2: General flow of system.**

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.

Figure 2.3: GSM mailbox inner side.

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.

2.2.2) Smart Mailbox

Smart Mailbox is a hardware system managing 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 resident about the mail availability.

With this functionality, the resident will know that 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 wipe the information send into the panel display.
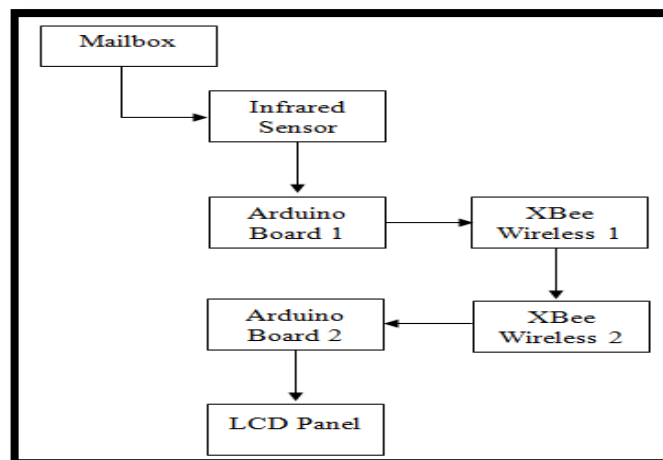

Figure 2.4: general flow of the system.

9

This system used two arduino board and two XBee wireless shields that placed in two locations. Arduino board 1 and Xbee wireless one shield is placed in the mailbox, and the ones are placed in the house with the LCD panel. The system works when the mail arrived, the IR sensor will detect the mail. After that, it will send triggered to the Arduino 1 board.

The arduino one board has been programmed to send triggered to XBee 1 wireless shield in the mailbox. After that, XBee 1 shield will transfer the information about incoming mail to XBee 2 wireless shield in the house. To connect XBee 1 and XBee2, strong wireless connection is very important to avoid the connection problems.

XBee2 got the information and sends the information to arduino two boards to be displayed in LCD panel. The LCD panel will show the message to the residents. Below is the workflow of the system.
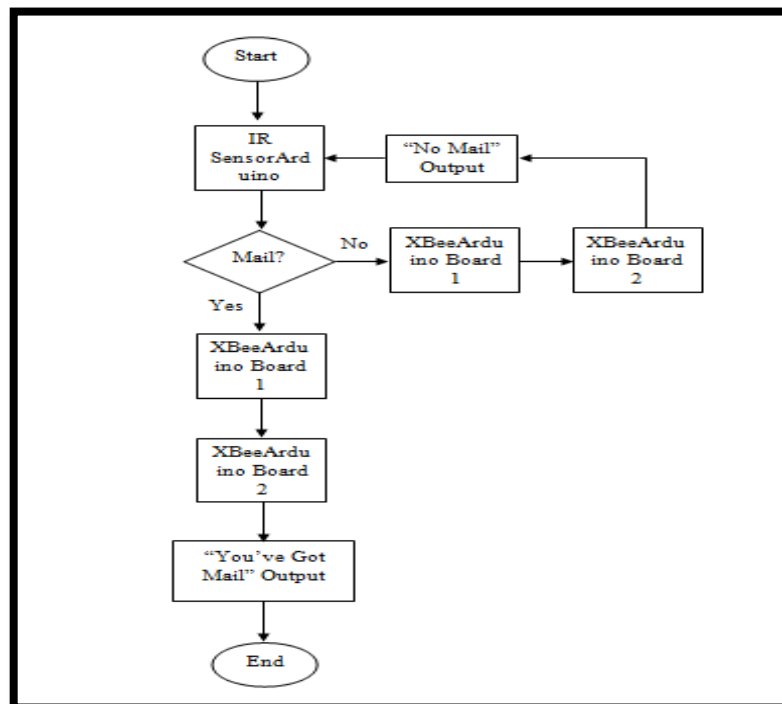
Figure 2.5: Smart Mailbox workflow.

2.2.3) Notification system for pigeonhole using online Telegram messenger.

Figure 2.6: General System Flow.

First of all, the raspberry pi will start the systems and entire IR sensors, and ultrasonic sensor's device will trigger automatically. When any presents of mail are detected or the pigeonhole volume reached certain level, system will generate Telegram Messenger message and send to the Pigeonhole owner via Telegram Messenger account.

2.3) Propose System.

The propose system is Smart Pigeonhole using Short Messenger System. This system is a hardware that operates by using Arduino Yun, infrared sensor and adjustable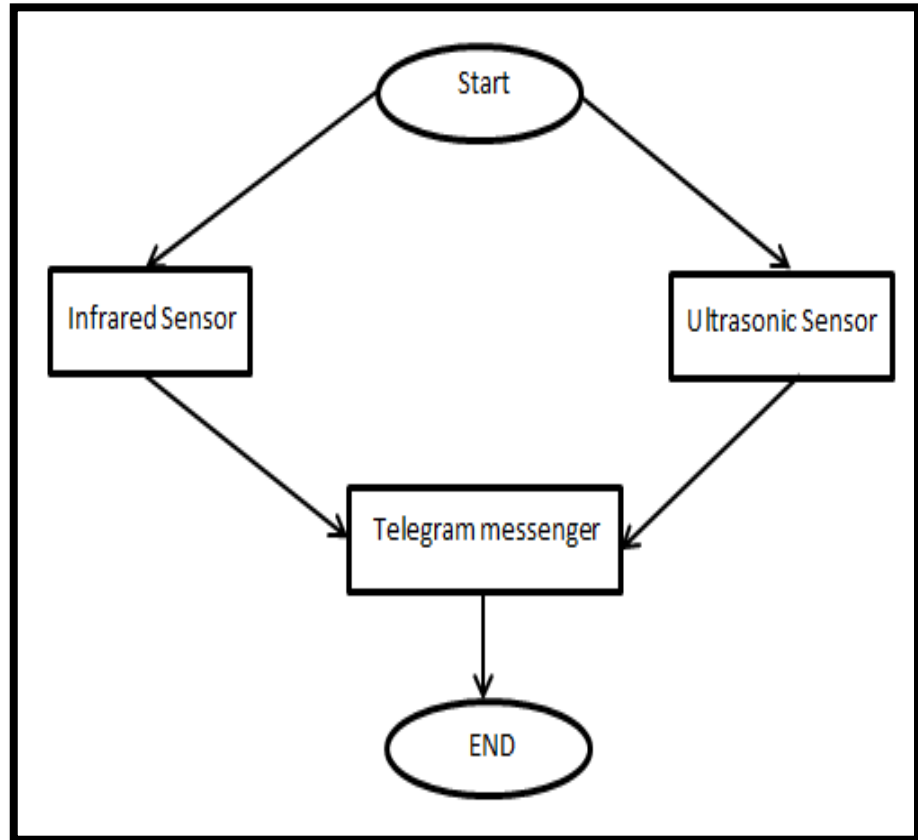 sensor that will inform the user about mail that got into the pigeonhole. Every mail who got into the pigeonhole will give a phone alert by sending text message to the user.

The system will design by using IR sensor that acts as a detector to detect the mails that arrive. The IR sensor is placed on the top of the mailbox. It must locate in the good position to make sure it can detect the mail arrive accurately in every time the mailman inserts the mail. This sensor is an adjustable sensor. User can adjust the transmitter and receiver. It will be mounted to the board and will be connected with the arduino yun board.

Ultrasonic sensor is a second sensor that acts as the range detector. This sensor also will be used for this system to detect certain level of fullness. When the pigeonhole is full, the ultrasonic sensor will send warning to a user to take out the mail through a short messaging system.
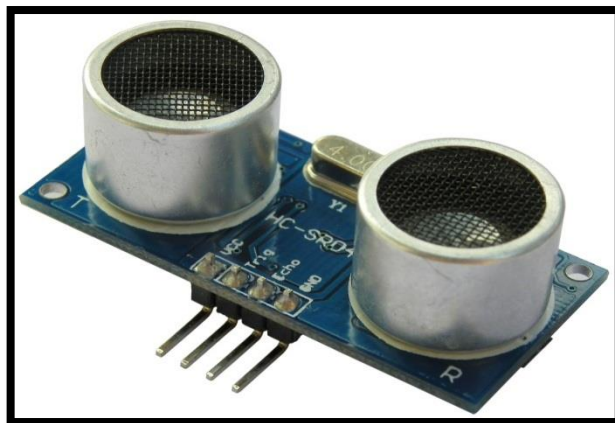

Figure 2.7: Ultrasonic sensor interfaces.

In the yun programming, user can use C++ language to setup the programming code. The programming code will be uploaded into the yun by using Arduino 1.6.1 software platform. Yun only works with arduino platform 1.5.4 version and above. This software is open source; user can easily download through the internet. Every component that connected to the arduino will not function as long as they not program in the arduino software.

On yun board also have some types of pin, for example, analog pin, digital input/output pins, USB connection, a power jack, reset button and so on. We must connect the component in the correct pin. If the component is not connected in the appropriate pin, it will not function properly.

General system work flow.
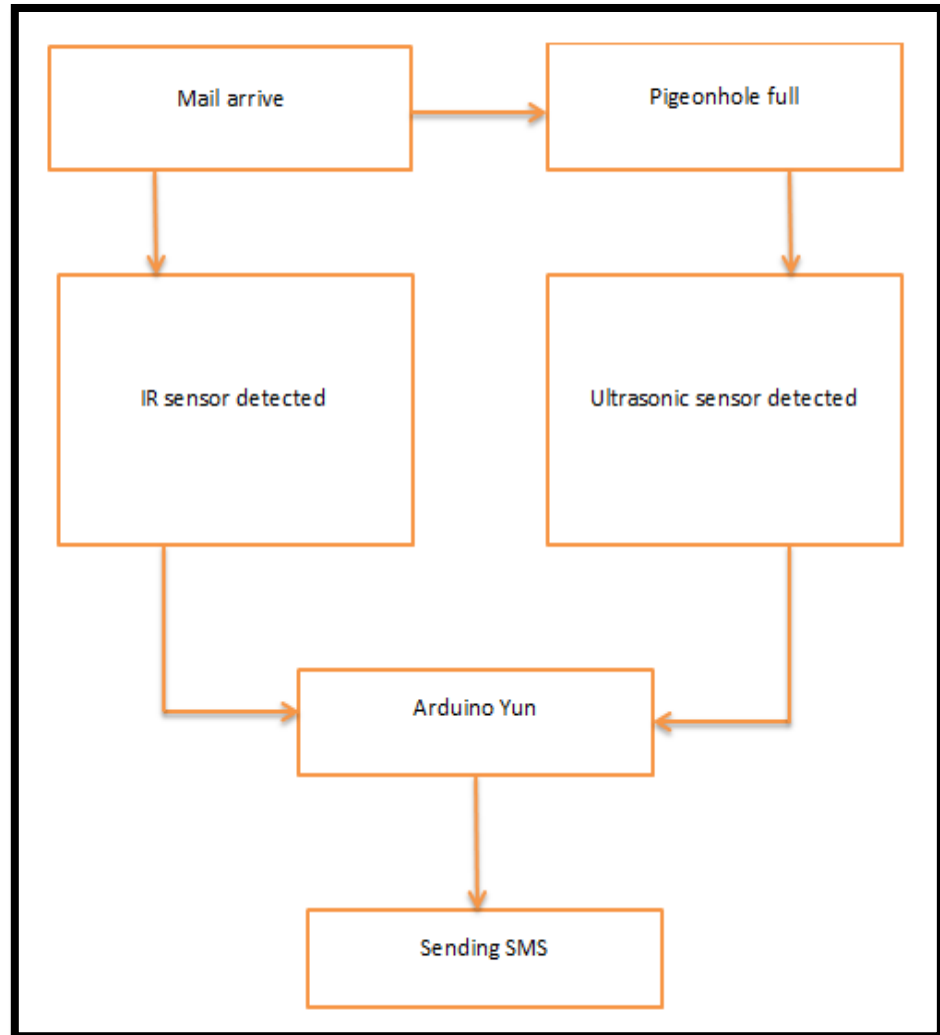
Diagram 2.1: General flow of the system.

Once the mails arrive, the IR sensor will detect, and it will send a signal to the arduino yun to proceed. Arduino yun will connect to WiFi to get a connection with Temboo account. Once yun is connected it will send notification to the user. It is same when the pigeonhole is full. The ultrasonic sensor will detect the distance and send a signal to yun board. And yun will send warning message to the user.
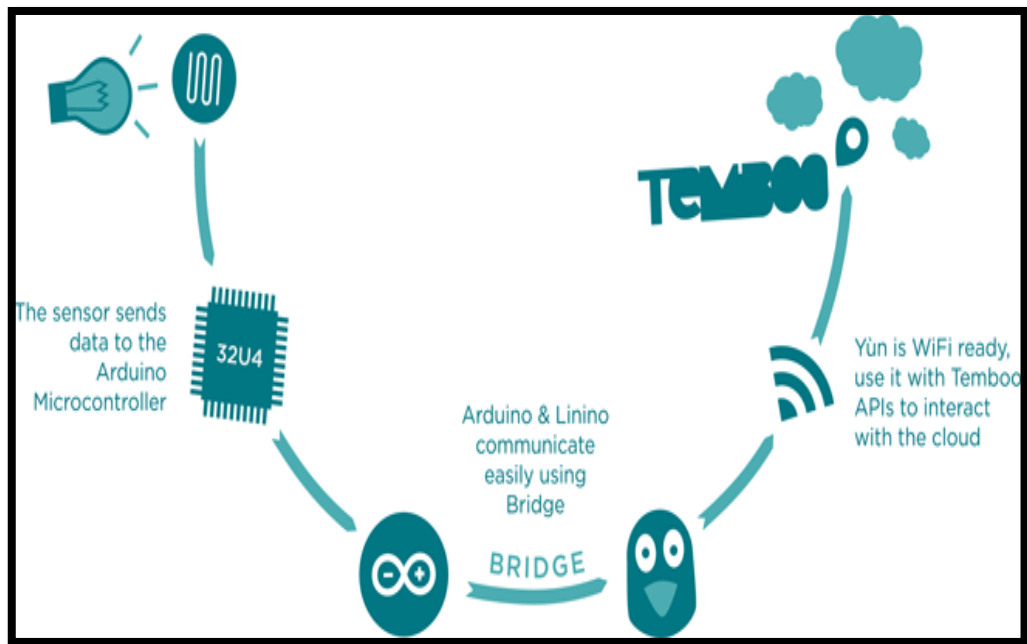
Figure 2.8: Connecting to internet services with Temboo.

The yún has a number of built-in capabilities for networking, but some of the most exciting aspects are working with other online platforms. Arduino has partnered with <u>Temboo</u> to make connecting to user favorite services easy as possible. Temboo provides normalized access to 100+ APIs from a single point of contact allowing a user to mix and match data coming from multiple platforms (for example, example Twitter, Facebook, Foursquare but even FedEx or PayPal).There are a number of examples in the *File > Examples > Bridge > Temboo* folder, these are a great place to get started working with your Yún in the cloud.

2.4) Existing system and its limitation.

There is summarization of the existing system. This table will show the strength and the weakness of the existing system and purpose system.

Table 2.1: Existing system feature comparison with this project.

	Current system	GSM smart mailbox	Smart mailbox	Pigeonhole telegram	Smart pigeonhole SMS alert.
Notification sensitivity	No	Yes	Yes	Yes	Yes
Types of notification	None	SMS notification	LCD display panel	Telegram messenger notification	SMS notification
Range of notification	None	Anywhere with Telco signal	100meter	Anywhere with internet	Anywhere with Telco signal
Credit charges	None	Yes	None	Yes	No
Type of sensor	None	Ir sensor	Light sensor	Ultrasonic sensor & IR sensor	Ultrasonic sensor & IR sensor
Device needed	None	GSM shield/ arduino uno	XBee wifi shield, Arduino uno	Rasberry pi	Arduino yun
Connection medium for	None	Use sim card	WiFi connection	WiFi connection	WiFi connection

device					+ Telco signal
System price	Free	Rm400	Rm390	Rm 340	Rm350

CHAPTER 3

METHODOLOGY

3.1) Introduction

The method that will be used in developing this project is System Development Life Cycle (SDLC). SDLC provided the alternative model that focuses more on planning, analysis, design, implementation and testing phase. The implementation and maintenance phase will be covered in chapter 4.
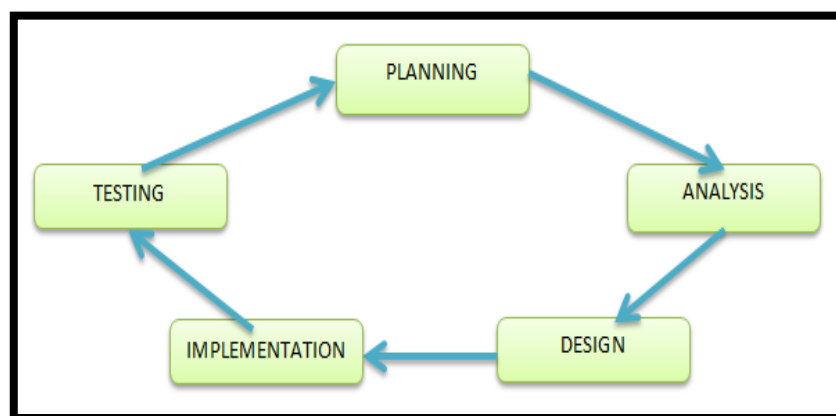

Diagram 3.1 Software Development Life Cycle (SDLC) model.

The Smart Pigeon Hole system development involves research on the usage of Arduino Yun Mainboard. This project will allow a resident to know the letter that arrived through the SMS on their phone. This chapter will present the proposed framework for Smart Pigeon Hole System by discussing details about the planning and analysis of this system and will show about the flow through this system. Lastly, will be discussing about the architecture design of the system.

3.2) Planning

Planning phase started with identifies the problem, the objective of the system, the scopes that will be covered under this system and the equipment that will be used while developing the system. This is to make sure the system will have a good flow and planning. To develop the system, there are very important to know which device and software that will be used.

It is important to identify and search more about the equipment before the developing process. While developing this system, the device that will be used is Arduino Yun, Adjustable Infrared Sensor and the software that we will use are Arduino 1.0.5. The table below shows the summarization of planning that will consider during developing process.

Table 3.1: Summarization of Planning Process.

Goals	Strategy	Required Actions	User
Allow the residents get the notification about the arrived mail via SMS.	Using devices like Arduino Yun, Adjustable Infrared Sensor, ultrasonic sensor and Arduino 1.0.5 software.	Mounting process, connect the cables or wired together, searching a suitable programming tools, survey price for the device required.	The Resident

All the devices are selected by their function, for example; Adjustable Infrared Sensor will be used to detect the incoming letter and Arduino Yun will be used as a web server, and it also will provide Wifi connection. This will be explained more details in analysis phase. In planning process, budget in developing this system also is included in this phase. In the planning, this system will not exceed RM400. There are some details about the price of the device.

Table 3.2: Budget planning for hardware needed.

Name of device	Number of unit	Price
Arduino Yun	1	RM265.00
Adjustable Infrared Sensor	1	RM 26.00
Ultrasonic Sensor HR-SR04	1	RM13.00
Pigeonhole	1	RM15.00
Total		RM 319.00

The device like Arduino Yun and Adjustable Infrared Sensor is easy to buy in Cytron's website. The pigeonhole is easy to get it in the hardware shop. All the devices will be a primary hardware and very helped in developing the system. The price has been set by the seller, and it can't be negotiated.

3.3) Analysis of hardware components.

The analysis is happened through the Internet and the pass year project. All the information will be used to produce a good performance from the device. For information, this project is more about the knowledge about the programming technique and mounting technique that will be covered some electricity knowledge. This is much interesting and more adventure in developing process soon.

In this phase, it is important to know more about the device that will be used. In planning phase, the device will be used is Adjustable Infrared Sensor and Arduino Yun board. There are some steps where the developer needs to know before it is proceeded to developing phase. This process is very important to make sure the developing process going smooth and to avoid the loss. Some of the thing that needs to analyses are like:

- How to connect the arduino yun board and adjustable infrared sensor.(Mounting technique)

- How arduino yun and adjustable infrared sensor works. (The voltage needed, the structure of the board, the facilities that they have, how it will be placed and etc).

- The suitable code and command that will be needed.

- Any additional or backup device that will be used.

All the technique will be applied during developing process. It is important to make sure all the devices and equipment will work properly. The wrong analysis will give a bad effect for the project. For example, the arduino board will not function if the voltage needed is not enough and the board also can damage if the voltage is over the limit. It will give a major loss because the price of the board is expensive among the other equipment. The Adjustable Infrared Sensor also a sensitive device. It is easily broken by over limit voltage. So it is important to know the right technique to mount it.

There are some analyses of the products that will be used. The future sub's topic will give more information and explanation about the equipment.

3.3.1) Analysis of Arduino Yun Mainboard.

Arduino yun is the main component in developing process. The board has built in Ethernet and Wifi support. Yun runs Linux based system on-a-chip, and its take care of the networking tasks. The Yun makes it easier to connect to cloud-based services from the Arduino platform. This board no need to used additional shield for WiFi connection like other's arduino board. The processor whom Yun's run is ATmega32u4, which includes 8-bit CPU, 16MHz clock speed, 2.5KB SRAM and 32KB flash storage.

Figure 3.1: The interface of Arduino Yun Mainboard.

Besides that, Yun also has micro-SD-card slot and provides 20 digital input/output pins. So, it is can be used to connect a device like sensor that used digital pin. Besides digital pins, 12 analog inputs pin and 7 PMW output pins also are provided by Yun. For information, the analog pins will be used to connect Adjustable Infrared Sensor. There are more descriptions about analog and digital pin:

Digital pin:

- Digital pins can be used as INPUT or OUTPUT via the pinMode(), digitalRead(), and digitalWrite() commands.
- As a default there are sets as INPUT.
- Digital pins are easy to understand because there only have two modes. There are ON or OFF mode.
- When the pin is configured as an input, ON mode is known as HIGH (5V) and OFF mode is known as LOW (0V).
- For example, in programming logic, when the switch is OPEN, the mode is HIGH and when the switch is CLOSED the state changed to LOW.

```
pinMode(3, INPUT);
pinMode(13,OUTOUT);

if ( digitalRead(3) == HIGH  ) { // Button not pushed
      digitalWrite(13, LOW )      // Turn off the LED
} else {                                      // Button is pushed
      digitalWrite(13,HIGH)       // Turn on the LED
}
```

Figure 3.2: the example of digital pin's programming code.

Analog Pin:

- Analog pins support 10-bit analog to digital conversion using analogRead() function.

- Analog pin is always an input, but those pin also function as digital input/output.

- Analog pin is suitable to read variable sensor such as light sensitive sensor or a potentiometer.

- Most of the analog pins can be used as digital pins.

- Analog pins understand that zero volt (0V) as a binary 0 and five volt (5V) as a binary 1.

Yun board also is a built-in micro USB connection and three reset buttons. There is Linux Reboot Button, Arduino reboot and Wifi reset button. This board provide USB communication, eliminating the need for a secondary processor. This will allow the board to connected computer as a mouse and keyboard.
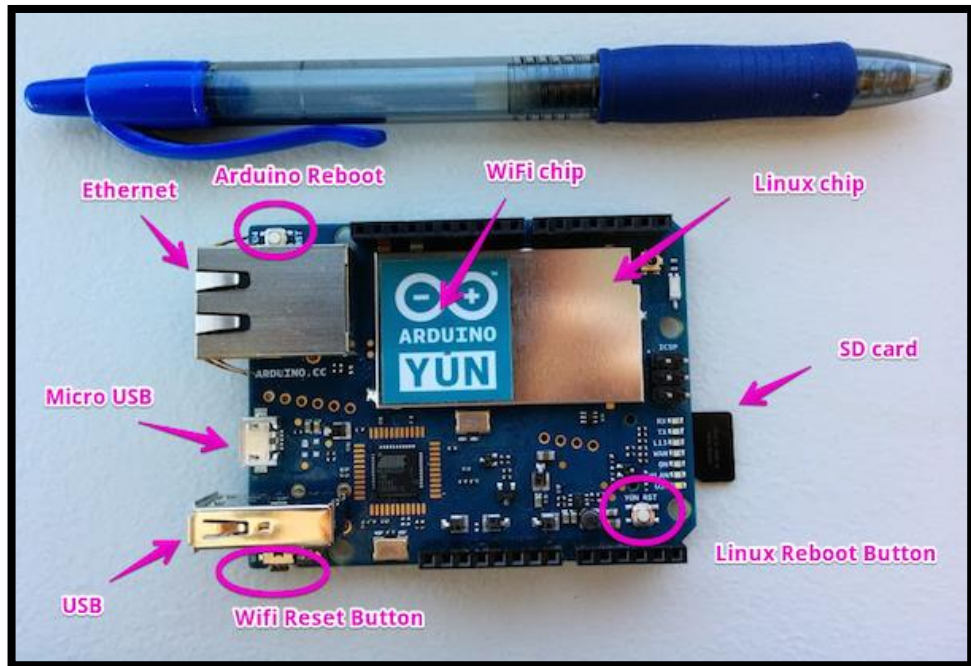
Figure 3.3: Arduino Yun's components.

Table 3.3: Summarization of arduino yun device.

Microcontroller	ATmega32u4
Wifi	IEEE 802.11b/g/n
Ethernet	IEEE 802.3 10/100Mbit/s
Processor	Linux microprocessor (Atheros AR9331)
USB type-A	2.0 host
Card Reader	Micro-SD
Operating Voltage	5V
Digital I/O pins	20 pins
Analog Input	12 pins
PMW channels	7 pins
RAM	64 MB DDR2

Flash Memory	16MB
Length	73mm
Width	53mm
Weight	32g

3.3.2) Analysis of Adjustable Infrared Sensor

Adjustable Infrared Sensor is one of the important devices that will be use during developing process. This sensor was chosen by their ability to detect a range between 3cm to 80cm. User can adjust the sensing range, but it will tell the user the amount of infrared it detects. This sensor is small, easy to use and inexpensive. User can buy it in price below then RM30.

Figure 3.4: Interface of Adjustable Infrared Sensor.

There are some specifications of Adjustable Infrared Sensor:

Table 3.4: Adjustable Infrared Sensor's specification

Model NO	E18-D80NK-N
Sensing range	3-80 cm (adjustable)
Supply voltage	DC5V
Load current	100mA
Diameter , Length	18mm, 45mm
Material	Plastic
Pin out	Red: +5V, Yellow: Signal, Green: Ground
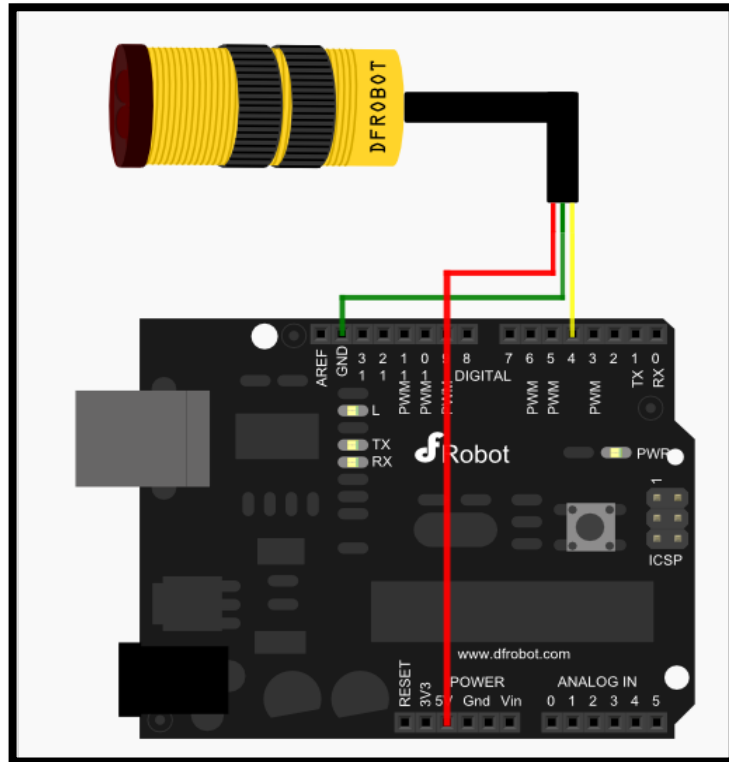
Figure 3.5: Example of adjustable infrared sensor's connection.

This sensor is one of the great infrared sensors. It can be used in many ways, for example, at automation machine, machine robot for obstacle detecting. The implementations of modulated IR signal immune the sensor to the interferences caused by the normal light of a light bulb or the sun light.

Figure 3.6: Adjustable infrared sensor's part.

Verification of alignment and functionality:

- Open the moveable partition. Direct line of sight between the transmitter and receiver must be available.
- It powered the transmitter and makes sure a green LED should be lit. If the green LED is powered then, the transmitting is happen.
- Adjust the transmitter and receiver until they are aligned. There are some manners of the LED function:
- Amber – indicates that the unit is properly aligned, and a strong signal is being received.
- Amber and Red – receiver is partially misaligned and may not function properly.
- Red – receiver is misaligned and will not function properly.

- No LED – receiver is completely misaligned and will not function properly.
- Once the units are aligned, close the partition to verify the LED on the receiver turns off.
- Open the partition and verify LED on the receiver turns on and is Amber.
- Tighten loose screws and check that the LED on the receiver is still Amber.

3.3.3) Analysis of Ultrasonic sensor HR-SR04.

The HC-SR04 ultrasonic sensor use's sonars to determine distance of an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It can detect a range from 2cm to 400 cm or 1" to 13 feet. It operation is not affected by sunlight or black material like Sharp rangefinders are although acoustically soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module.

During this project ultrasonic will function as detection's equipment. It will detect the range between the mail and the top of the mailbox. It will send a signal to tell the user that the mailbox is full. In the code, we will declare the range that will be detected by the sensor before its send a notification.

Table 3.5: The features of the ultrasonic sensor HR-SR04.

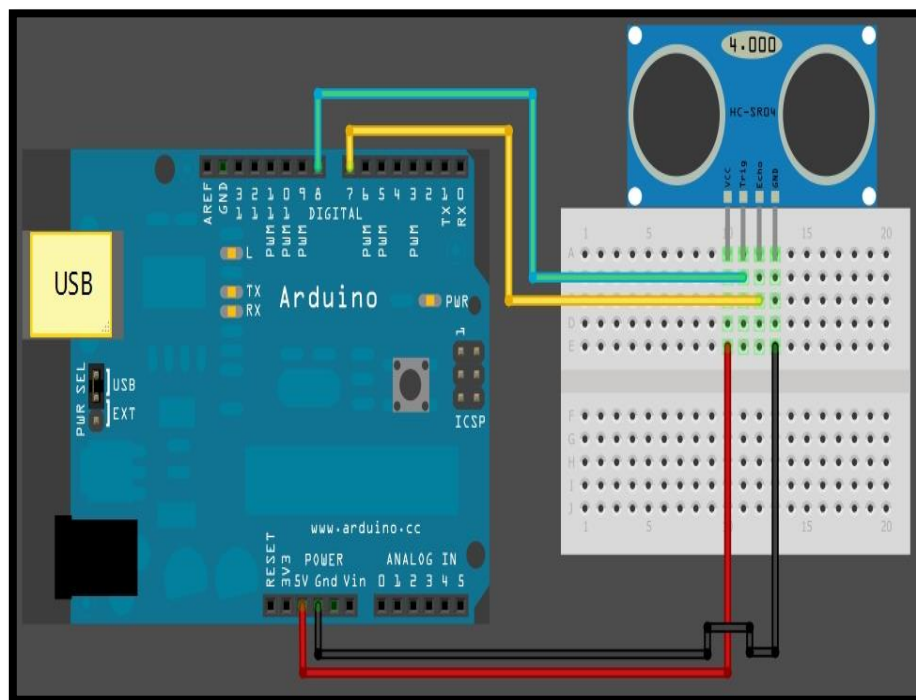| Power Supply needed	5v
Quiescent Current	<2mA
Working Current	15mA
Effectual Angel	<15°
Ranging distance	2cm-400cm/1-13ft
Resolution	0.3cm
Measuring angle	30 degrees
No of pins	4 pins
Pins type	Vcc, Trig, Echo, GND

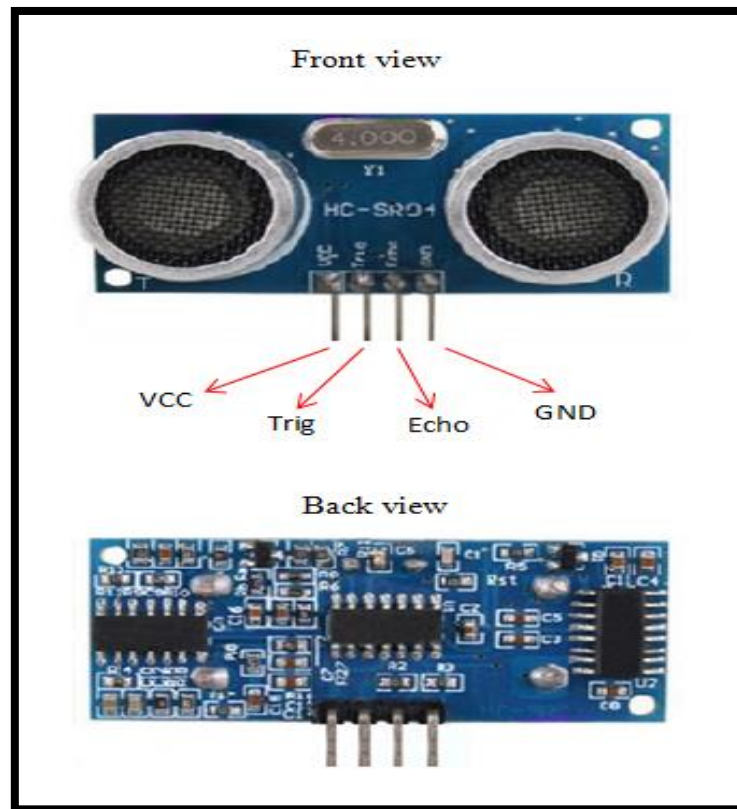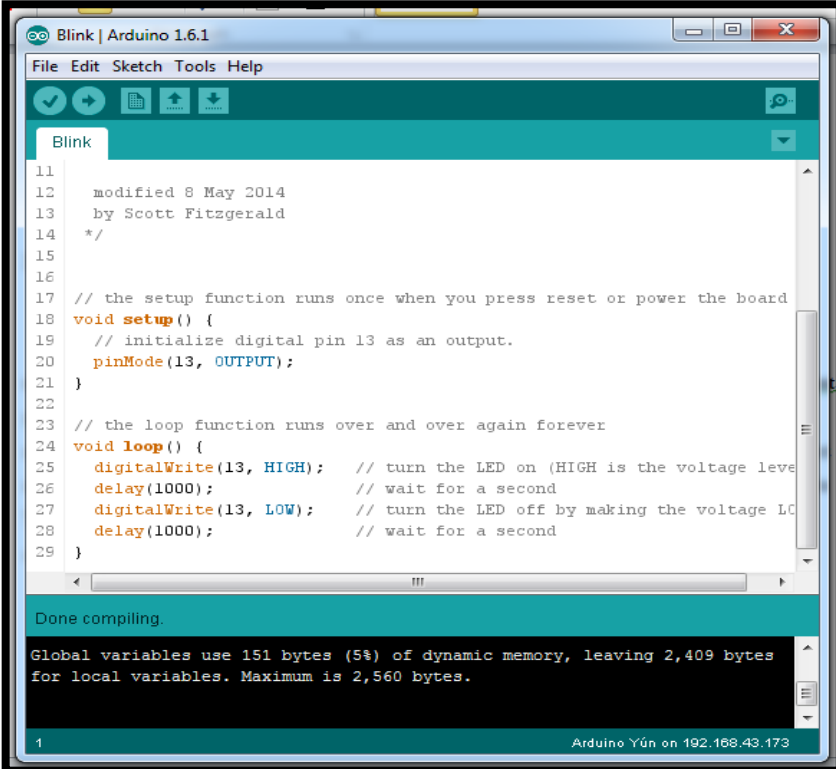**Figure 3.7: The example of ultrasonic sensor HR-SR04's schematics.**

Figure 3.8: Front and back view of the ultrasonic sensor HR-SR04

Pins description:

- VCC : +5V direct current
- Trig :Trigger (INPUT pin)
- Echo : Echo (OUTPUT pin)
- GND : GND

3.4) Analysis of software components.

This part will describe more about major software components that will be used during developing proses. In developing this project Arduino 1.6.1 and Temboo have been used. Arduino 1.6.1 is used to write all the programming code. Arduino Yun is only compatible with Arduino 1.5.0 platform and above. All the programming code that connected to the sensor is programmed in Arduino 1.6.1 platform and will be uploaded to arduino yun board.

Figure 3.9: Example of arduino 1.6.1 platform.

Arduino software is open-source software. User can easily download the software from arduino website. The arduino platform supported C programming language. User can write the code and compile the code easily. This software can be used by many types of arduino and user also can choose the types of Arduino board in the tool's bar.
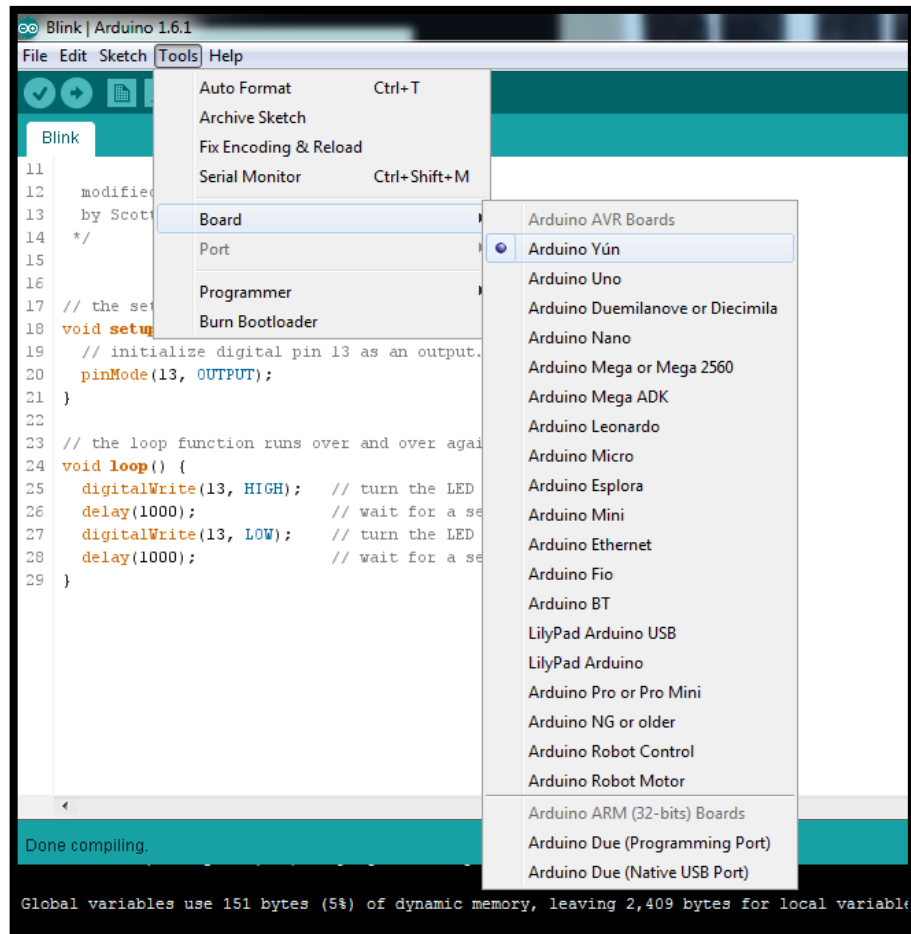

Figure 3.10: Types of arduino board that can be supported using arduino software.

The code that has been written into the arduino software can be verified and uploaded to the arduino board.

3.5) General Design of Smart Pigeon Hole Operation

This system was built by using simple embedded system and Temboo messenger. This system aims to help pigeonhole user to get notification about the present of mail. When the mail arrives, there are two sensors will detect the mail. First sensor is adjustable IR sensor. Once the mail is inserted into pigeonhole the IR sensor will detect and send a signal to Yun board. Yun will generate programmed code and send a signal to Temboo. Before that, Yun board must already connect to Wifi to make sure it can connect Temboo account.
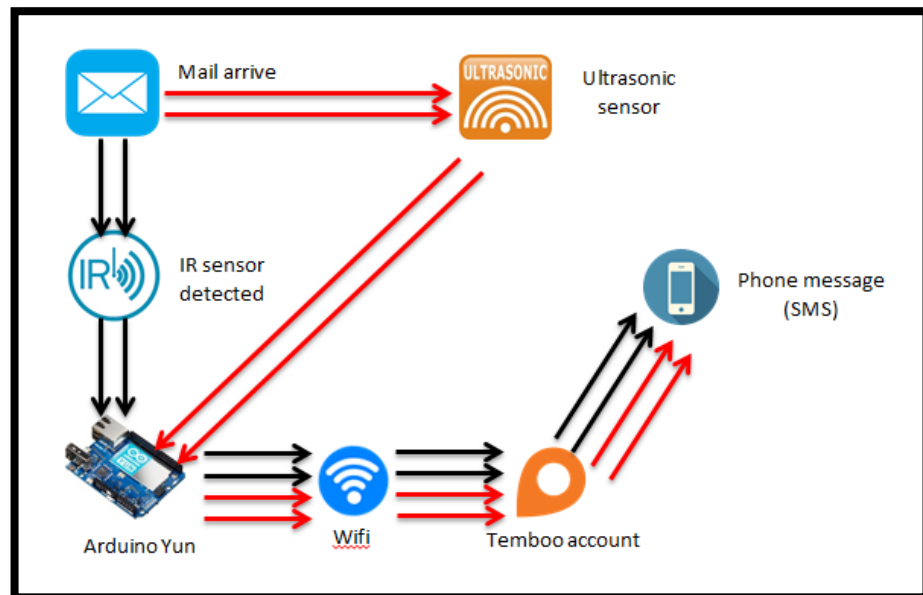

Figure 3.11: General architecture design.

3.6) Hardware and Software Requirement

In the process to develop this system, some hardware and software are needed to use during the developing process.

Table 3.6: Hardware requirement.

No	Name	Quantity	Purpose
1	Laptop / Computer	1	Research, development, documentation
2	Printer	1	Printing thesis
3	Hard disk	1	Data backup
4	Compact disk (CD)	1	Data backup
5	Arduino Yun	1	Microcontroller to control whole system
6	Ultrasonic Sensor HR-SR04	1	To detect range.
7	Adjustable IR sensor	1	Detection system
8	Smart Phone	1	SMS receiver

Table 3.7: Software requirement.

No	Name	Purpose
1	Microsoft Window 7	Operating System
2	Adobe Photoshop CS4	Edit picture
4	Arduino 1.6.1	To run the programming code
5	Microsoft Office Visio 2007	Draw diagram
6	Microsoft Office Word	Documentation
7	Microsoft Power Point	Presentation
8	Chrome	Web browser for research

CHAPTER 4

IMPLEMENTATION

4.1) Introduction
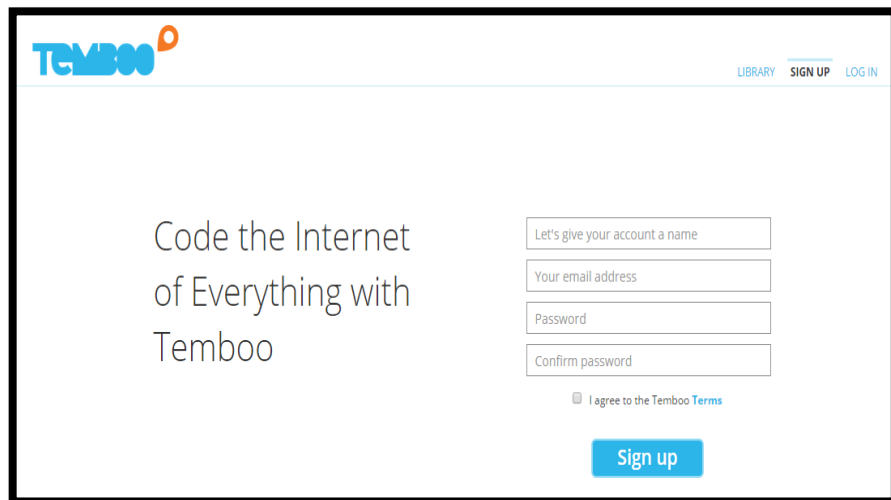
Implementation is an essential part in the strategic planning process, and organizations that develop strategic plans must expect to include a process for applying the plan. This chapter will explain more about developing process step by step. This chapter will begin by introducing to a user how to create Temboo account until the system is completely developed.

4.2) Developing process.

There are several steps that will be required in developing this project, which is:

4.2.1) Creating Temboo account.

The first step will begin by creating the Temboo account. Arduino Yun is a special platform that cans easily interact with web-based services that powered by Temboo. To get a Temboo account user need to sign up the account by register their account name, email address and password.

Figure 4.1: Sign up pages for Temboo.

After sign up Temboo's account user will be provided with 500 credits from Temboo that allow a user to use it to run their project free of charge after the credits reach the limit. User can advertise the Temboo pages to another friend to get more credits. Each person that registered the Temboo's account via advertisement that user made, the credits will increase 500 per persons. User can easily view their credit's balance by go to Temboo account link.
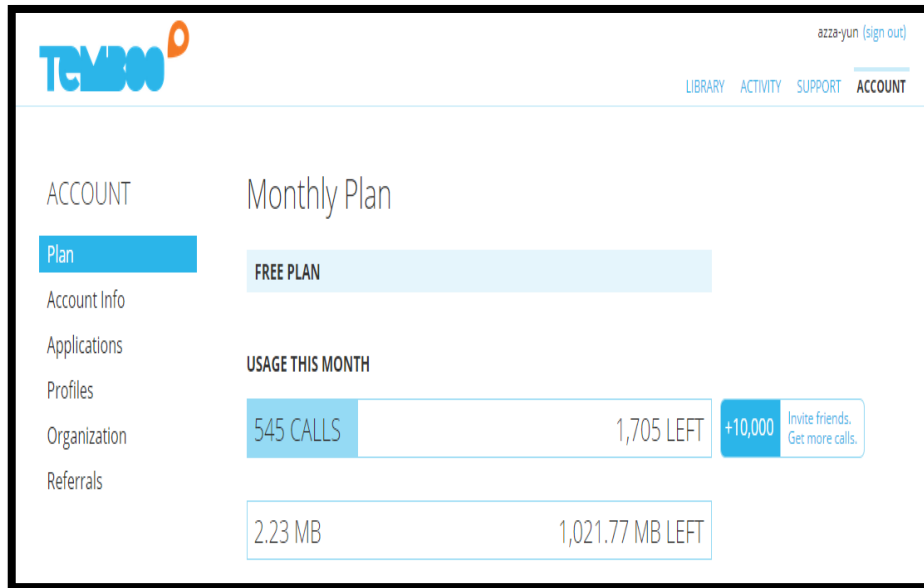
Figure 4.2: Temboo's credit information page.

4.2.2) Creating Twilio account.

Second step is creating Twilio account. Twilio is a cloud communication that allowed a user to make and receive phone calls and send and receive text messages using its web service APIs. Users need to sign up their accounts by registered their basic information in sign up pages.

Figure 4.3: Twilio's sign up pages.

After the user registered their account, Twilio will provide an account SID number and authentication token number that will be used in generating the messaging code. User also needs to set up their phone number, which will receive the message by Twilio account by go to Numbers > Verified Caller IDs.
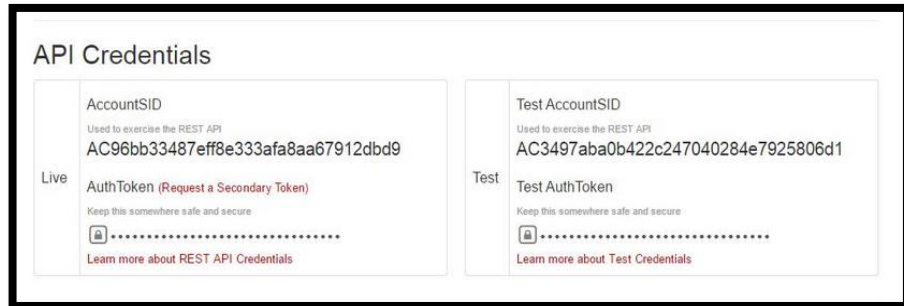

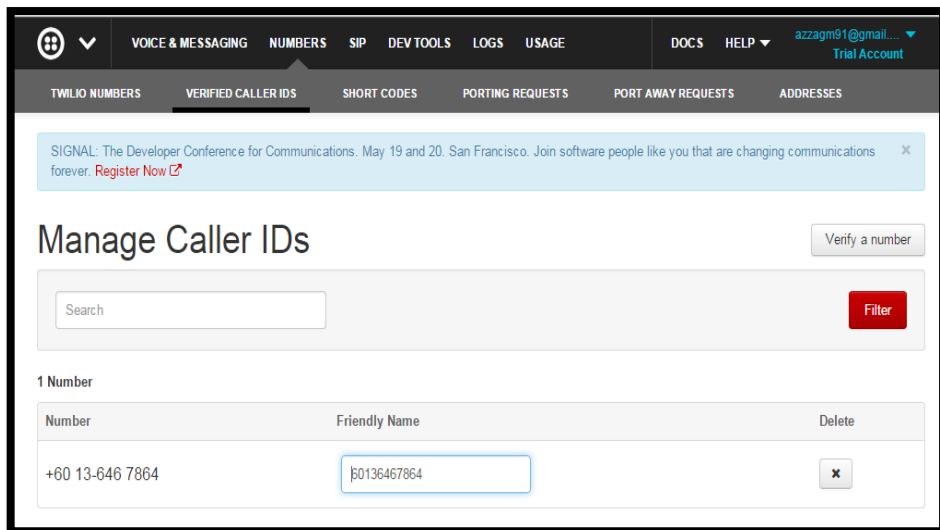**Figure 4.4: Example of SID number and authentication number by Twilio.**

Figure 4.5: Setup message receiver's phone number in Twilio.

User also can test their Twilio account even its works or not by clicking on the trial messaging link. If the account is valid user will get a message from Twilio.

4.2.3) Setup Wifi in arduino yun.

When the user first power on the Yun board, they need to connect the pc with arduino yun's wifi network that called as Arduino Yun-xxxxxx. After the wifi is connected users need to enter http://arduino.local website or enter 192.168.240.1 in address bar and login pages will appear. Users need to insert "arduino" as a password for first login.
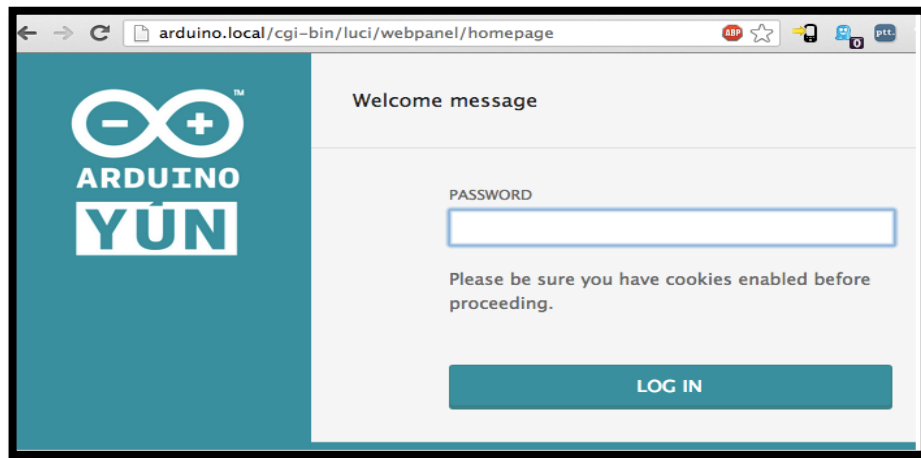

Figure 4.6: Arduino yun login pages.

After user login the pages the next page will appear to user and its show the information about the current network connection and user needs to configure their own WiFi by press the configuration button to proceed the next step..

Figure 4.7: Current network connections information in yun.

Figure 4.8: Yun board configuration pages.

While waiting for yun to be connected to the selected network users needs to connect their computer with the same network that connected to yun board. After that, users need to open the Arduino IDE and connect the IDE to yun's ip address that connected with the board by go to Tools > Port menu.

4.2.4) hardware setup.

As stated before, in developing this project two sensors will be used to detect the mail. There are adjustable infrared sensor and ultrasonic HR-SR04 sensor. These two sensors will be connected to the bread board and yun board. The adjustable infrared sensor has three wires that need to connect on the yun and bread board. The three wire needs to connect to 5v pin, pin number 4 and ground pin on arduino.
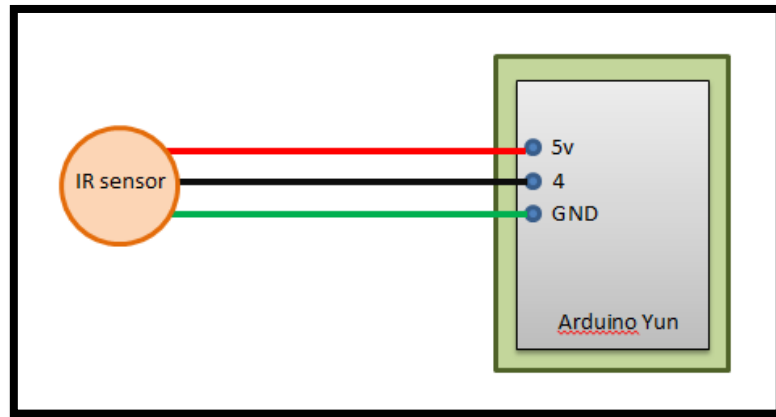
Diagram 4.1: Connected adjustable infrared sensor on yun board.

The connection between infrared sensor and the pin number must be same as initialization code when creating the code in arduino IDE platform.
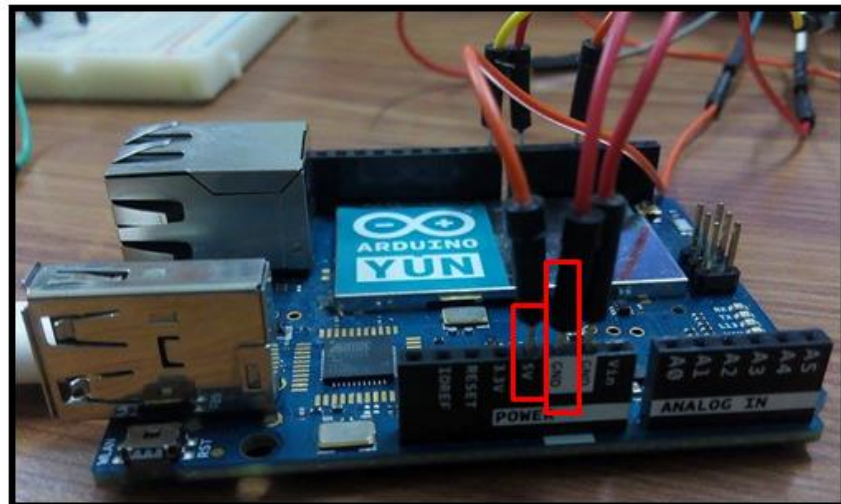
Figure 4.9: Pin connection on arduino yun board.

Next, test the connection. User can try uploaded the example code in the arduino IDE platform. If the light of infrared sensor is turned on, then the connection is successful. After that, user needs to connect the ultrasonic HR-SR04 sensor on the yun board. Ultrasonic sensor has four pins that need to connect to yun pin. VCC pin to 5v, echoPin to pin number 7, TrigPin to pin number 8 and GNDpin to GND pin.
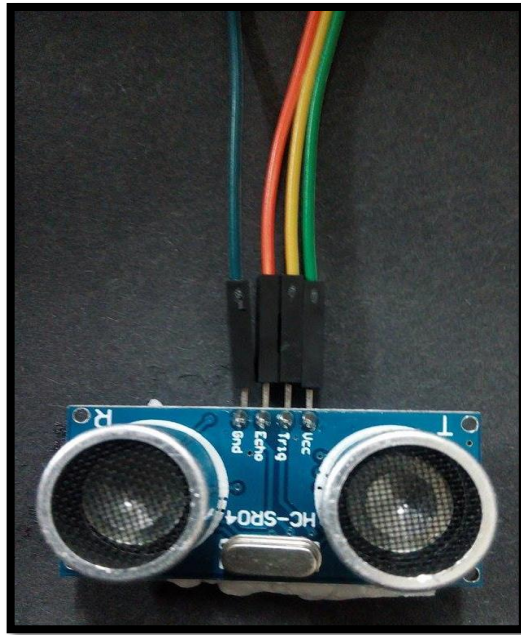
Figure 4.10: Ultrasonic HR-SR04 connection.

After the connection is well, try to upload example code to make sure the sensor is work. User can used example code in IDE platform. The pin connections also need to be same as the initialize code.


```
2   #include <Bridge.h>
3   #include <Temboo.h>
4   #include "TembooAccount.h"
5   #define echoPin 7 // Echo Pin
6   #define trigPin 8 // Trigger Pin
7   #define LEDPin 13 // Onboard LED
8
9   //declaration for ir sensor
```

Figure 4.11: Example of pin initialization of ultrasonic HR-SR04 sensor.

4.2.5) Generate SMS code.

The benefit of using Temboo account is user can simply generate their project code. User can login to Temboo account that has been created and go to Library and select Twilio as Chereo type to send message notification. After that, users need to insert account SID and authentication number that users get when the sign up to Twilio account before. Next, in the body field user can write any text message that they want to send and set up the sender phone number which is Twilio's phone number and receiver phone number. After that, press runs button. Users need to wait for a minute while the code is generated by Temboo.

Figure 4.12: Example of information that need to be fill before Temboo generate the code.

User can copy or download the code that provided by Temboo and need to modify the code base on sensor connection. The header code also is necessary to download it to make sure the code can connect to user's Temboo account..

Figure 4.13: Example of header code.

The code is successful when users get a message notification on their phone. The code also needs to modify by match the pin connection and modify the code based on the input and output of the hardware.

CHAPTER 5

RESULT AND DISCUSSION

5.1) Result and discussion.

This chapter will explain about the testing phase. The role of the test is detecting the errors and bugs found and will test on the system performance, structure and design. Next, it will also discuss about the benefits of using this project.

5.2) Testing.

In this part will show the criteria of checking list of the project. It is to make sure the system can run smoothly and reach the objective. There are areas and criteria of the checking process:

Table 5.1: Table of criteria of the checking process.

Testing criteria	Valid	Not valid
- Hardware installation (hardware can be mounting in correct way)		
- Performance testing (the system can give a good performance)		
- Programming testing (ensure the programming free from error)		
- Integration testing (ensure the system reach the objective)		

5.3) Expected result.

The Smart Pigeonhole System is had been built to easy the user to get a notification through short messaging system when the mail is arrived. It's had been developed by using some hardware and corporate with Temboo and Twilio web based system. As a result, user can easily get a notification whenever they go as long as their phone get telco signal without any credits charge.

5.4) Benefits of using smart pigeonhole system.

       The smart pigeonhole system give is very suitable to be used by everyone who wants to get notifications when the mails arrive. When using this system user do not have to manually check their mail every day. They only have to wait for the massage to notify them about the mail arrive. It's really helpful for them. Besides that, the benefit of using this smart pigeonhole system is it no credits charge. Every user can receive text message by free of charge. It is really saved.

CHAPTER 6

CONCLUSION

Smart Pigeonhole System by sending short messaging system is a system that provides help to pigeonhole owner. User can get a notification for every mail that comes in into their pigeonhole. The warning notification alert tells user to collect their mail when the pigeonhole is in full state. This system will be an advantage to user because it is free messaging system and help user who always busy in their daily work and activities.

References:

[1]   Suha Kayun. (2012) Gatech Smart Mailbox with Phidget, Arduino and
        Infrared Sensor, Inc.

[2]   Mohd Nasrul. (2013) Smart Mailbox Using Alert System with Arduino,
        Infrared Sensor and XBee shield.

[3]   Wichita State University. (2013) Wichita State University Smart Mailbox.

[4]   Mohamad Eliyass (2014). Pigeonhole Notification System by Utilizing
        Telegram Messenger.

[5]   Arduino Uno (2014), retrieved from:
        http://arduino.cc/en/Main/arduinoBoardUno

[6]   Arduino, Global System for Mobile communication shield (GSM shield)
        http://arduino.cc/en/Main/ArduinoGSMShield

[7]   Adjustable Infrared Sensor Information, retrieved from:
        http://www.v1.cytron.com.my/viewProduct.php?pcode=SN-E18-
        D80NK&name=Adjustable%20Infrared%20Sensor%20Switch

[8]   Sending SMS using Arduino Yun by Temboo, retrieved from:
        https://www.temboo.com/arduino/yun/send-sms

52

[9]   About Arduino Yun, retrived from:

        http://arduino.cc/en/Guide/ArduinoYun

[10]   Arduino WiFi (Getting Started), retrieved from:

        *https://www.twilio.com/blog/2015/02/arduino-wifi-getting-started-
        arduino-yun.html*

[11]   Checking WiFi Status with Arduino Yun, retrieved from:

        *http://www.instructables.com/id/Checking-you-wifi-status-with-Arduino-
        Yun/*

[12]   Serial Communication monitoring in Arduino Yun, retrieved from:

        *http://stackoverflow.com/questions/20681318/arduino-yun-serial-
        communication-not-working*

[13]   Arduino Yun Bridge [2013], retrieved from:

        http://jpmens.net/2013/09/23/understanding-arduino-yun-s-bridge/

[14]   Upgrade Yun System, retrieved from:

        http://arduino.cc/en/Tutorial/YunSysupgrade

[15]   WiFi-Ethernet- USB and shield for Arduino, retrieved from:

        *http://www.instructables.com/id/Linux-WiFi-Ethernet-USB-Shield-for-
        Arduino/*

[16]   Sending SMS with Temboo, retrived from:

https://learn.adafruit.com/downloads/pdf/sending-an-sms-with-temboo.pdf

[17]   Complete Guide for Ultrasonic Sensor, retrieved from:

http://randomnerdtutorials.com/complete-guide-for-ultrasonic-sensor-hc-sr04/

[18]   HR-SR04 Ultrasonic Sensor, retrieved from:

http://arduinobasics.blogspot.com/2012/11/arduinobasics-hc-sr04-ultrasonic-sensor.html

[19]   The power of Temboo connect to Yun [2013], retrieved from:

http://blog.arduino.cc/2013/09/11/the-power-of-temboo-connect-the-yun-to-100-apis/comment-page-1

APPENDIX A.

Gantt chart

ID	Task Name	Duration	Start	Finish
1	Analysis	7 days	Mon 9/2/15	Tue 17/2/15
2	waiting for confirmation from supervisor	7 days	Wed 18/2/15	Thu 26/2/15
3	buying arduino yun and infrared sensor	12 days	Fri 27/2/15	Mon 16/3/15
4	connect arduino yun to internet	4 days	Tue 17/3/15	Fri 20/3/15
5	mounting infrared sensor on arduino yun	3 days	Sat 21/3/15	Mon 23/3/15
6	buying ultrasonic sensor	4 days	Sun 22/3/15	Wed 25/3/15
7	mounting ultrasonic sensor	3 days	Thu 26/3/15	Mon 30/3/15
8	searching sms code	5 days	Tue 31/3/15	Mon 6/4/15
9	connecting arduino yun to Temboo account	2 days	Tue 7/4/15	Wed 8/4/15
10	generating sms code	4 days	Thu 9/4/15	Tue 14/4/15
11	connecting arduino yun to Twilio account	3 days	Wed 15/4/15	Fri 17/4/15
12	insert Temboo and Twilio code in arduino and compile	4 days	Sat 18/4/15	Wed 22/4/15
13	succesfull run the code and upload in arduino	1 day?	Wed 22/4/15	Wed 22/4/15
14	built pigeonhole prototype	2 days	Thu 23/4/15	Fri 24/4/15
15	testing the system	2 days	Sat 25/4/15	Mon 27/4/15
16	make some changes on system	3 days	Mon 27/4/15	Wed 29/4/15
17	updated report	26 days	Fri 10/4/15	Wed 13/5/15
18	designed poster	3 days	Thu 14/5/15	Mon 18/5/15
19	submit poster and report	2 days	Tue 19/5/15	Wed 20/5/15
20	report submission and confirmation	3 days	Thu 21/5/15	Sun 24/5/15
21	project presentation	3 days	Mon 25/6/15	Wed 27/5/15

Project: psm2 gant chart
Date: Sat 16/5/15

Task / Split / Progress / Milestone / Summary / Project Summary / External Tasks / External Milestone / Deadline

Page 1

55

User requirement letter

Smart Mail Development Project

13 February 2014

Nazariah Abdullah
Universiti Malaysia Pahang
Lebuhaya Tun Razak
26300 Gambang Kuantan
Pahang Darul Makmur

RE: SMDP Letter of Intent.

Dear Ms Nazariah:

I submit this Letter of Intent to notify that I, Mr.Syahrulanuar Bin Ngah intend to submit a proposal for the Smart Mail Development Project.

I would like to request a project development in order to help people to get a notification about the mail that arrive at their home. Besides, I want people to more alert and get a warning message when their pigeonhole is full.

The project should be able to use arduino board as the main platform and the use of sensor as detection components. Besides, this project should help people to minimize their cost when using this system.

I will be our main point of contact for the purposes of the SMDP process and can be reached at syahrulanuar@ump.edu.my

Thank you for this opportunity to participate in the SMDP and I wish you all the best.

Sincerely,

Syahrulanuar Bin Ngah

Senior Lecturer.