HOUSE MONITORING SYSTEM

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TECHNICAL SUBMITTED IN FULFILMENT OF THE DEGREE OF COMPUTER SCIENCE

FACULTY OF COMPUTER SYSTEM AND SOFTWARE ENGINEERING

2013

UNIVERSITI MALAYSIA PAHANG
BORANG PENGESAHAN STATUS TESIS

JUDUL: HOUSE MONITORING SYSTEM

SESI PENGAJIAN: 2012/2013

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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 & Networking)

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Date   : 3 June 2013

ACKOWLEDGEMENTS

Firstly, I am would like to express my high appreciation to my supervisor Dr. Mohamed Ariff Bin Ameedeen for his great ideas and invaluable guidance in making this project possible. I appreciate his hard work to guide me all the time when I face some constraint in progress work. I am also grateful for his guiding in writing good documentation and he often gives his suggestion and opinion in helping me to design the system flow. When I make mistakes, he will lead me back to the correct way in patient. Moreover, I would also very thankful to my academic advisor Miss Zalili Binti Musa, for her advice and believe in me during my studies in UMP.

Secondly, I want to thanks to other lecturers who helped me throughout this project. Your opinion and suggestion really helped me a lot to complete my project. Your different point of view gives me idea to make my project become better. And to all my friends, thank you for your supports. You support let me have the courage and confident to believe that I can do my best to complete this project.

Lastly, special thanks to my lovely family for their support and understanding towards the completion of my project. There are the one who always be there and let me feel warm when I feel stress and depressed in the process to make this project possible. I cannot find the appropriate words that could properly describe my appreciation for their devotion, support and faith in my ability to attain my goals.

Once again, I want to express my high appreciation to all the people that support me in order to let me have the confident to complete my project.

ABSTRACTS

This project reviews about the home monitoring system that would be able to solve one of the issues that we have nowadays that is house broken. In this project, we would look into advancing a new system that we will use the system to monitor the house surrounding and keep the house secure through just a mobile phone or laptop or it would just secure automatically. We would discuss about how we are going to advance the existing system through several ways and it may cheaper than the usual system. The technology that involved would relate in using the Wi-fi devices which we may control the devices remotely. Besides, we would also talk about efficient process that we may using when we are developing this project to make it error free. I have been using Modified Waterfall Model in developing my project. There are five phases in this model: Requirement Analysis, Design Phase, Implementation Phase, Testing Phase and Maintenance Phase. The Modified Waterfall Model is slightly different from the traditional waterfall. The Modified Waterfall Model has permission to fallback to previous phase in case there is any error. The examples of the designs are included in this report. Before the end of the report, I also have arranged a Gann Chart to help me in developing the project so that I would be able to finish my project in time.

ABSTRAK

Projek ini adalah mengenai pengajian tentang system pemantauan rumah yang boleh dijadikan sebagai salah satu penyelesaian masalah kecurian rumah. Dalam projek ini, kita akan memperlihatkan system pemantauan rumah supaya boleh dipermajukan lagi. Sistem ini akan dimajukan supaya berupaya memantau sekeliling rumah dan keselamatan rumah boleh dijaga sama ada menerusi mobil pintar atau computer riba dan juga boleh berfungsi berkunci secara tersendiri. Kita akan membincangkan bagaimana kita akan memajukan sistem pemantauan yang sedia ada pada hari ini melalui beberapa cara dan cara tersebut akan lebih menjimatkan kos. Sistem ini melibatkan teknologi wi-Fi supaya kita boleh mengawal sistem ini dari jarak jauh. Selain itu, kita akan membincangkan proses penghasilan produk secara berkesan supaya bebas daripada kesilapan. Saya akan mengunakan model ''Modified Waterfall'' dalam menghasilkan poduk projek saya. Model ini ada lima fasa , iaitu : Analisis Keperluan, Fasa Reka Bentuk, Fasa Pelaksanaan Ujian Fasa dan Fasa Penyelenggaraan. Model ini ada sedikit berbeza dengan model yang asal. Model ini mempunyai ruang supaya kita ulang balik ke fasa yang sebelum ini sekiranya terdapat kesilapan. Contoh rekaan telah dipaparkan dalam laporan ini.

TABLE OF CONTENT

Page

3.   CONCLUSION

LIST OF TABLES

LIST OF FIGURES

PART 1

INTRODUCTION

1.0 Introduction

1.1.1 Project Overview

During these days, we may be able to use remote control to control house and office appliances which includes stereo equipment, refrigerators, thermostats, washing machines, copiers, light switches, telephones, and factory equipment. It is the trend that appliances have been getting more computerized with more features. At the same time, it is becoming common for people to carry a smart phone that has better input output capabilities than the average home appliance, such as high-resolution screens, text-entry technologies, and speech capabilities.

Phones are likely to maintain this advantage over appliances, because improved hardware is a key differentiator between phones and is often marketed as an incentive to upgrade to a new phone. All phones also come with the ability to communicate over the cellular networks, and most have built-in short range communication capabilities, such as Bluetooth, that could allow them to communicate with and control appliances in their surrounding environment.

Phones are also personal devices, which allow them to provide interfaces that are personalized. We see future phones being the preferred mode of interaction with many appliances, because the phone is always available and can provide a better user interface with its improved hardware.

The aim of this project is to develop a house monitoring security system that we are be able to monitor the house surroundings, automatic lock and can be easily observe and manipulate by using windows phone. This development of house monitoring system where the security system will be stronger than the existing house alarm system. It may provide a more secure environment

to record down so that the owner still able to know though from far away by just using windows phone.

1.1.2 Background

Windows phone is a mobile operating system which being developed by Microsoft, launched in second half of 2010.Windows Phone having a user interface featuring its design language called Metro. The software is integrated with the third party services and Microsoft services, and sets minimum requirements for the hardware on which it runs. The home screen, called the "Start screen", is made up of "Live tiles" which would be the same with Window 8 live tiles. Users can add, rearrange, or remove tiles. Tiles are dynamic and update in real time. Tiles are links to applications, features, functions and individual items (such as contacts, web pages, applications or media items).

On June 20, 2012, Microsoft unveiled Windows Phone 8, a new generation of the operating system for release later in 2012. Windows Phone 8 will replace its previously Windows CE-based architecture with one based off the Windows NT kernel with many components shared with Windows 8, allowing applications to be easily ported between the two platforms.

As it shares much of its platform, Windows Phone 8 will support the running of managed code through a Common Language Runtime similar to that of the Windows operating system itself as opposed to the .NET Compact Framework. This, along with support for native C and C++ libraries, will allow some Windows programs to be easily ported to Windows Phone 8.

Nowadays there are many homes and offices use closed circuit television (CCTV) camera systems to monitor and record surveillance footage. Common uses include keeping an eye on individuals responsible for childcare, deterring thieves and making sure that employees are staying honest. The problem in the past was that these systems had to be monitored from somewhere on site.

Currently, there are many houses try to install the house security alarm system in order to prevent theft. The house security alarm system may notify the owner in case there is real theft happen. However, there is still weakness that house owners would not know immediately what happen though they are being notified. This is why the system is being developed so the owner will have clearer image about what happened using windows phone.

1.1.3 Problem Statement

We knew that there are some cases of theft still happening though some of them have their houses installed with house security house system. The theft may be also cause that the owner of the house was careless and forgot to lock their window or houses. Some of the may be already in the outstation but they just realized they forgot to lock their houses.

Besides, when we are inside or outside the house, we may always need to take few steps in order to go to the door and lock up the house. It might be a bit troublesome if the distance is more far away from the house. There may be cases happening if we are not able to lock up our doors in moment.

CCTV still very expensive nowadays as may be most of the residents still cannot afford to buy the CCTV system. Hence, their house may be in the risk to have theft to occur since their house does not have any device to help to monitor the surroundings. They would not be able to identify though there are strangers entering theirs houses. It is not easy to be noticeable too.

Therefore, we may try out an alternate way by develop a system which will be able to overcome these problem to make it the stronger system to prevent theft.

1.1.4 Objective

The objectives of the research are to:

1. Apply a remote control concept to the house monitoring system that the user will be able to secure own house environment using windows phone through Wifi or other wireless option.
2. Develop a hardware system due to sensor detection.
3. Apply a monitoring system to monitor the surrounding of the house.

1.1.5 Scope

The project is designed:

i. For the house owner who would want their house to be more secure and safe.
ii. To control the new house monitoring system using windows phone and laptop would be as back up.
iii. To enable the house environment and surroundings to be more secure and monitored for 24 hours every day.
iv. For the sight inside and outside the house would be clear to know by the house owner though the owner is in outstation.
v. There would be application be installed and security insurance in the house, on the windows phones and laptops.

1.2 Current System and Limitation

1.2.1. Introduction

During the research I found out that there are several works that are relate to my current project. There are alternative ways and technologies used in order to monitor the house. In this chapter we are going to look into the technologies and ways that have been developed to be function to monitor the house. We will be collecting a well-rounded opinion of all the researchers that have been part of the development of these alternative methods for developing a more advanced home monitoring system. The strength and weakness of all these monitoring systems will be discuss further on whether that kind of approach is a worthy consideration for the future.

1.2.2 Wireless Sensors for Home Monitoring

One of the works is about wireless sensors for home monitoring. The purpose of the system is to monitor the activities of a resident living independently to distinguish normal activity from unusual activity. The system is based on many sensors, the sensors are distributed around the home to collect data on activity in the home. The sensors have built-in transmitters which are used to transmit the collected data to a central monitoring system to collate all data and saved in a database according to predetermined time slots. The historical activity timelines as well as buffer times are stored in the database which used to distinguish the activities.

A wireless sensor is a sensing module which houses one or many transceiver nodes and base stations. It uses a wide range of RF communications techniques. Through software, the sensor may be configured to measure and monitor various physical parameters such as force, temperature, motion etc. Since the wireless sensors employ RF communication, a network of these sensors is considered as a "Wireless Sensor Network". The tasks performed by these wireless sensor networks include measuring the relevant quantities, monitoring and collecting data, assessing and evaluating the information, formulating meaningful user displays, and performing decision-making and alarm functions. The block diagram of a wireless sensor network is shown for monitoring of electrical appliances in a home [The sensing units (SUs) not only have the necessary transducers to monitor an electrical device, they also house the RF transceiver modules to communicate with the central controller unit (CCU). The data

communication on the wireless network may follow one of many industry standards or a proprietary protocol.

This project has reviewed different wireless sensors used for home monitoring especially to care elder people. The monitoring system is based on the integration of different sensors which has the capability of transmitting the data via wireless communication. The data are collated by a central processor which saves all data for processing as well as future use. The habit of the life-style of the person under care is stored in the system. The collected data are compared with the stored pattern and depending on the situation the actions are defined as unusual or abnormal. If the system detects any abnormal activity a warning or alarm message can be transmitted to the care-giver. The availability of low-cost wireless sensing system for this type of application has a great potential to save human life especially elder people.

1.2.3 Network based Home surveillance/ monitoring system

A home surveillance/monitoring system may include video cameras, terminals, sensors, actuators, and severs. More generally, such a system can be used for monitoring or controlling devices. Typically the network transfers data from sensors to a server, from which the user can request information. Similarly the user can send commands via the server to sensors and actuators to control devices. These systems are increasingly connected via a gateway (with firewall) to the internet. As a result home owners can both monitor their homes and control devices in their homes via the internet or other IP network. Surveillance systems based on IP networks have become mainstream products in recent years. Large numbers of images and other forms of data can be transmitted in real time through the intranet or internet. Moreover, the surveillance has gradually evolved from only the traditional security monitoring functions to become an intelligent management system.

A central requirement of our problem is to provide network connectivity *only* to authorized cameras. Additionally, we want to be able to dynamically add cameras (and other sensors) to the system, while also dealing with failures and decommissioning devices that were earlier been added to the network. These requirements mean that we need to dynamically discover new devices that are added to the network. After discovering a device we need a way

for the user to indicate if this device (whose identity must be authenticated in some way) should be authorized to utilize the network's services. After a device is authenticated and authorized we will need to assign the device an IP address and configure it appropriately. In addition, we will need to manage all of the devices that have been assigned addresses. This management includes configuring the device, controlling it, and sending/receiving IP packets to/from the device.

To protect these devices from being controlled by someone who is not authorized, we will have to examine how the device can authenticate and authorize communication from the router and server; and how the router can prevent traffic from attackers from reaching the cameras. There is an information security to provide secure communication requires ensuring data confidentiality, authentication of the sender, data integrity, and timeliness of delivery (both to ensure that the data is not too severely delayed and to ensure that it is not replayed).

1.2.4 Home Monitoring and Control System

This project addresses the first issue by allowing the home-owner to monitor their own system via the internet and to be notified of sensor tripping via email, thus eliminating the need for a professional monitoring service. The connection to the internet, obviously, facilitates the individual monitoring of the system, but it also addresses the second issue. By using Ethernet it is possible to connect to the "outside world" without a landline phone by using an existing high speed internet connection.

This project incorporates both hardware and software elements. The hardware includes a PIC with an embedded Ethernet controller as well as home monitoring sensors and a 110Vac relay that is used to turn a lamp off and on to act as a deterrent system. It also incorporates a web-based interface that will allow the user to monitor the status of each of the sensors in the home as well as enable and disable the monitoring system. It will also allow for the control of the lamp that is connected to the relay.

1.2.5 Home Monitoring System

The system is about to design a universal system that will allow access control, and monitor home vitals including temperature, carbon monoxide, smoke, power consumption, and door lock status. The data can be viewed from a touch screen QVGA encompassing the home monitoring device parameters.

In the project the unit must be able to wirelessly monitor temperature, CO, smoke, and door status. It must control a particular access location of a home via an RFID tag. All the data must be able to be displayed in one central location (QVGA).It also must be economical and fit within the team budget .House must be secure in case of a power outage. Base station must be able to collect data from multiple remote modules.

1.2.6 Building Home Monitoring Applications: From Design to Implementation into The Amigo Middleware

The goal of home monitoring applications is to monitor entities, that is, objects and people, inside the home environment. Typically, such an application acquires context information about entities from physical sensors, check monitoring criteria, and notify users according to predefined preferences. Various monitoring applications can be developed in an ambient home environment. As an example consider an object reminder application. This application prevents users from forgetting objects when leaving their home. Entity monitoring is another instance of the home monitoring class of applications. It consists of keeping close watch over people or objects inside the home.

The development of a home monitoring application requires many software components. First, entities must be tracked inside the home. Second, relevant criteria called monitoring rules must be checked. Finally, a user may need to be warned. Tracking entities inside the home requires the use of physical sensors [13]. Such location systems typically send events to notify applications of entities movements. However, these events are too generic and need some processing at the application level to match its requirements. For example, events providing Cartesian coordinates of entities have to be filtered if the application only needs to be notified of

area changes. Areas are defined by a cut-out of the monitoring space in hierarchical locations such as rooms or floors. Monitoring rules express constraints on entity locations. A monitoring rule is verified true when the monitoring entity enters a notification area (spatial location such as the kitchen) and some conditions (e.g., time of the day, location of the supervisor) become true. The notification of the supervisor does not require very specific software components. However, it requires specific support to retrieve user preferences (which notification system to use), to acquire some privacy context information (is the user alone?) and to find renderers close to the user location (service discovery).

Location systems rely on physical sensors such as tags and tag readers. Therefore, the size of a notification area depends on the accuracy of the tag readers deployed. These tags are either passive or active. Using passive tags requires the deployment of tag readers in each monitoring areas, increasing the number of software components to coordinate. In addition, passive tag readers are often embodied by gates installed at strategic places such as door frames, making the monitoring of an open area difficult. On the other hand, systems based on active tags such as Ubisense only require few readers to obtain the entity locations by triangulation. By providing a uniform location of entities by Cartesian coordinates, this system enables reuse of software components and the definition of arbitrary notification area. In the rest of this paper, we focus on systems based on active tags.

1.2.7 Conclusion

From the research that we have gathered so far on the four types of ways, it is clearly that all these type of authentication have its own advantages and limitations. However, it is clearly shown that the Network based Home surveillance/ monitoring system is the most common among all of them. The alternative like the system using the wireless sensors is rather rare and costly which requires extra tools or devices to perform it.

1.3 Methods of Approach

I will use Microsoft Windows Phone SDK 8.0 and Microsoft Visual Studio software to develop this system. Hardware that I will be using as the laptop, wireless IP camera, windows phone simulator, sensors and other electronic components.

1.4 Outline of Material Presented in Rest of Report

This technical report consists of 3 parts. The first part is explaining about the introduction, problem statement, objective and scope of the entire project. Meanwhile, review on previous work and current system and limitation are also cover in this part. This subsection briefly compared the existing system and proposed system. Besides, this part also contains the method of approach and scope and limitation,

In part two, the main focus is explaining about the methodology used to develop the system. This part will explain the used of Modified Waterfall Model (MWM). Last but not least, this part also discussed the user requirements, flow chart, diagrams and the method use for the whole development process.

The last part is about the conclusion of the technical report. This part will conclude and summarize the key important point for the entire project.

REPORT BODY

2.1 Methodology

The software development model that I would use in develop my application system is Modified Waterfall Model. Modified Waterfall Model is a software development methodology that actually exists as there are defects in the traditional waterfall model. The phases of the Modified Waterfall Model are similar to the traditional model which it contains:

    i.   Requirement Analysis Phase
    ii.   Design Phase
    iii.   Implementation Phase
    iv.   Testing Phase
    v.   Maintenance Phase

The figure below shows the process of Modified Waterfall Model.
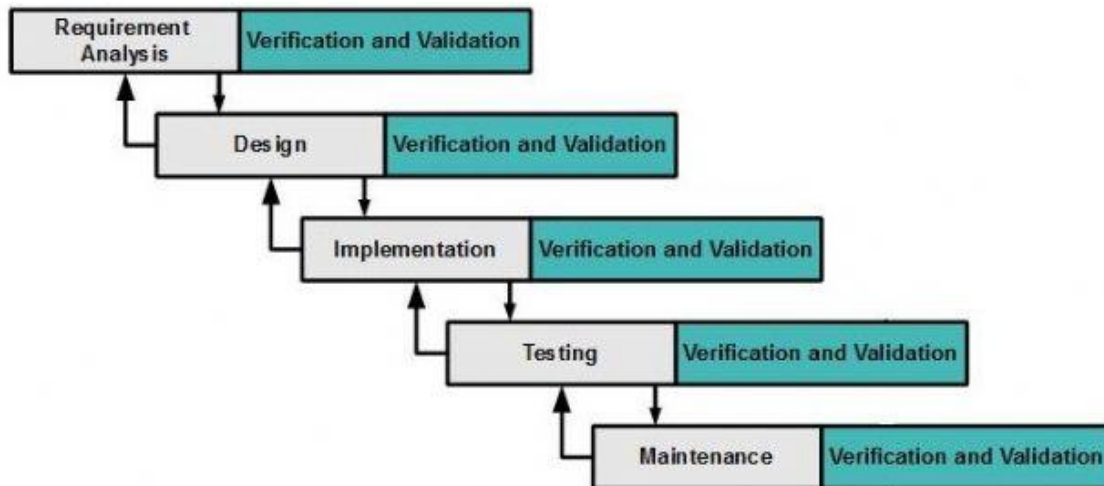
Figure 2.1.1: Modified Waterfall Model

Why Modified Waterfall Model is used?

The change in the modified model is that, the phases in modified waterfall model life are permitted to overlap. A number of tasks can function concurrently, which ensures that the defects in the software are removed in the development stage itself and the overhead cost of making changes to the system before implementation is saved.

The other advantages of using modified waterfall model are:

- Making changes to the basic design is possible
- Easier to rectify any errors introduced because of changes made
- Reduce oversight issues
- A verification and validation step has been added
- More relaxed approach to formal procedures, documents and reviews
- Reduces huge bundle of documents
- May helps to finish the product faster

2.2 User Requirement

2.2.1 Requirement Analysis

In this phase, I have taken the consideration of requirements from the user so that they would be included in my system. As we know there are issues that house are broken into by unknown people and there are also issues that theft are happening due to the carelessness of the house owner that they forgot to lock their doors and windows of the house. Hence, it comes out the idea that there may be the environment of the house should be video monitored all the time and there would be sensors notify whenever there is object comes near the house as the door and windows will be complete locked automatically to prevent anything goes into the house unless there is any verified user access. Besides, the user requires that the videos taken by monitoring camera should be able to view from the laptop and his windows phone. The laptop would be able to store the videos that have been taken. The windows would be able to access to the house system and unlock and lock the door whenever he prefer. In addition, there should be security purpose that the laptop would be able to lock down the application as if the windows phone which contains the house monitoring application being stolen.

2.2.1.1 UML Use Case Diagram

UML use case diagrams are used to describe the functionality of a particular system. The following shows the functionality of the user of the system.
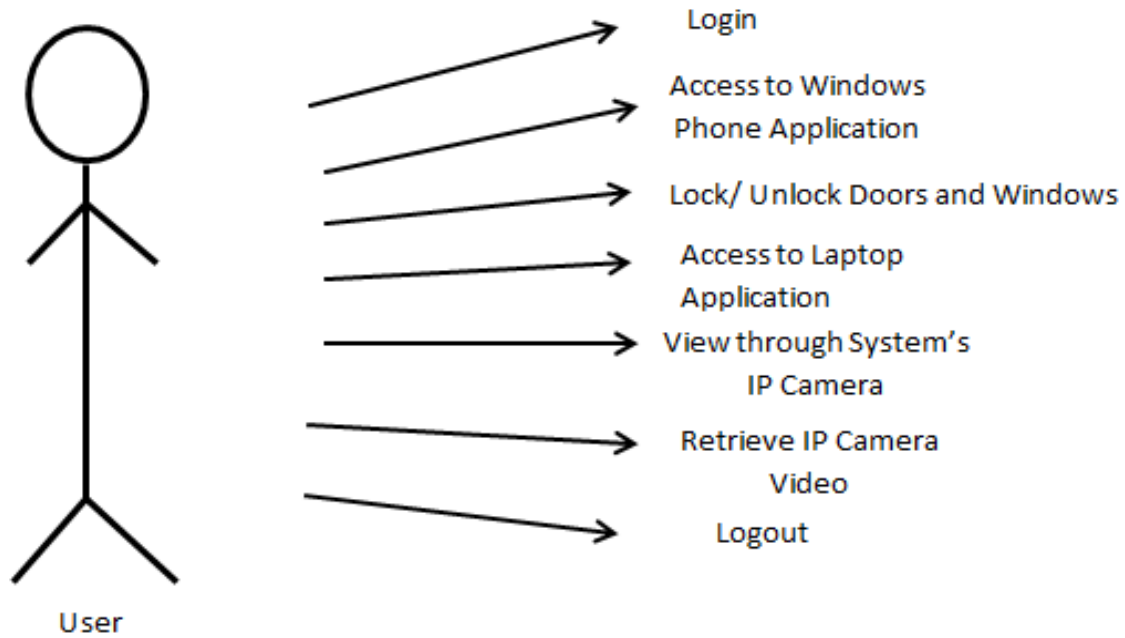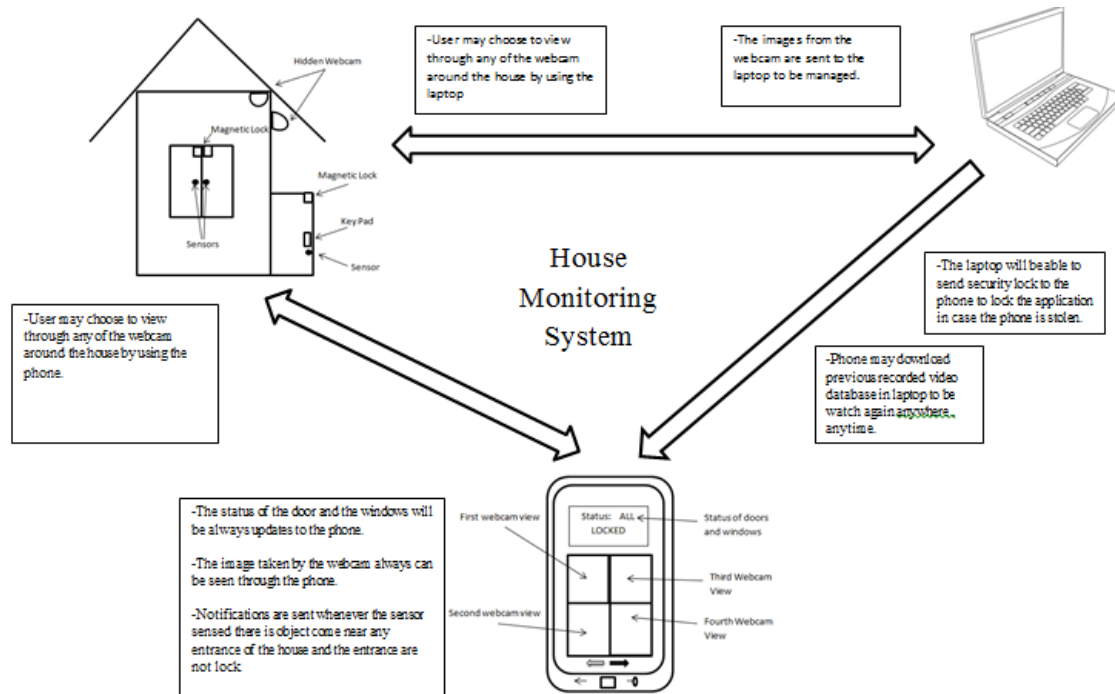

Figure 2.2.1.1: UML Use Case Diagram

2.3 Design Description

2.3.1 General Design of Whole System

Figure 2.3.1: The figures shows that the general flow of interactions between the house monitoring system and the 2 devices.

As we can observe from the figure above, the "House Monitoring System" will be involved the devices which will be installed in the house and mobile devices that can be taken away to anywhere. In generally, the devices in the system will be able to controllable by either the smart phone or from the laptop. The figure above is designed as a beginning idea how am I going to develop to the next step so that I may be able to fulfill my user requirement. I may clearly see that system would be able to control by smart phone in the form of application. As there is application, I may control the system from my laptop application too.

2.3.2 Flow Chart

A flow chart represents the flow of the activity that involves in a system. A flow chart is design so that we can look further inside to the application. The application provides private user usage only. Hence, the flow chart starts from the user to login.

The following **flow chart** will show how the system is going to works:
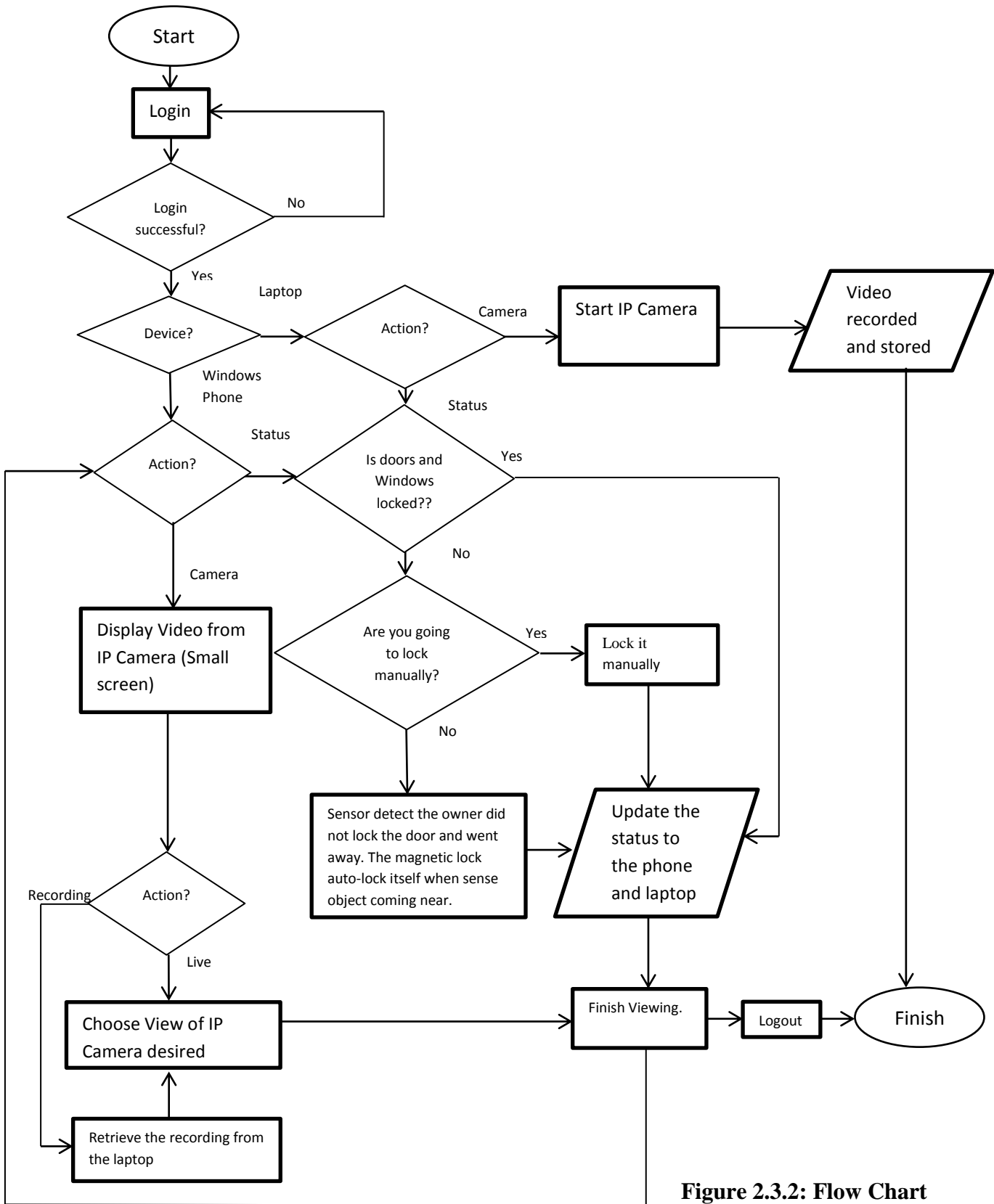
Figure 2.3.2: Flow Chart

The flow chart shows that we may be able to choose whether we can login to the windows phone or the laptop in order to access to the system. As we have login to the system, we may choose the path that to look into the status if the house or the video by the IP camera that is taken. If camera is chosen, it leads to the option to view the video taken live or that had been recorded. All the flow of these paths leads to the end devices which are the windows phone and the laptop.

2.3.3 System in the House
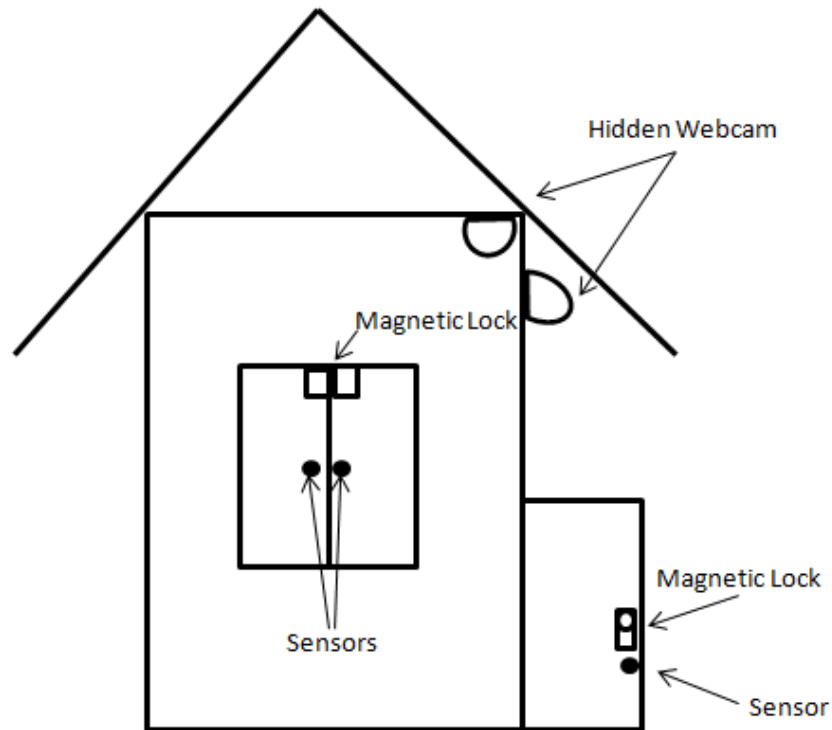
Figure 2.3.3.1: Devices installed in the house

The figure shows in this part of the project, the devices that are needed to be installed in the house to complete the system. This project will include numbers of wireless IP Cameras, 1 set of magnetic lock and numbers of sensors. The wireless IP Cameras are going to be installed on the top above the back door and front door for priority. This is to give an advantage that we may be able to see whoever person who is going to pass through the door. We may also see the surroundings in front and behind the house more clearly. The magnetic lock would be a big help that the door would close more firmly that before. It may transfer status whether the door is lock or not. The sensors are to installed being near to the lock so that any object or person who comes near would be detectable. The devices used in the system may be cheaper and secure than the normal system.

2.3.4 Windows Phone Application

As we know, an application to control the house monitoring system in the form of windows phone. The application would be created by using Microsoft Visual Studio 2010 and Microsoft Windows Phone SDK 7.1. The programming language that us in the coding is C #. The following are drafts and examples of the interface that we may see in the application.
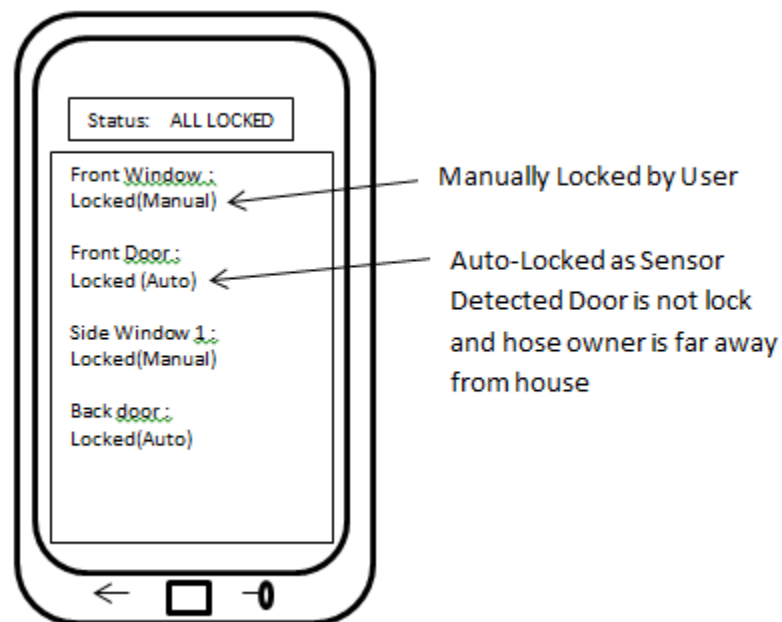
Figure2.3.4.1: Draft of the application Interface

This is the draft interface of status observing that we are going to develop. This draft may help us to understand the basic idea how we are going to develop our interface to make it perfect.
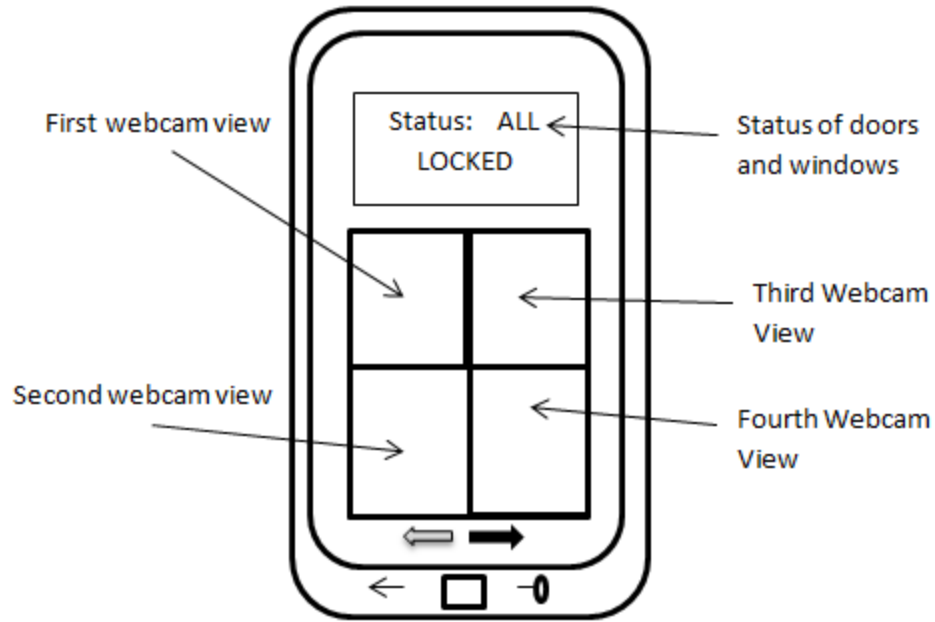
Figure 2.3.4.2: Draft of the windows application interface

This is the draft interface that we are going to design so that the video taken from the Wireless IP Camera can be view from here.

2.3.5 Camera View in Laptop

If in case the application in the windows phone momentarily cannot view through the IP Camera to observe the surroundings, the user may also be able to observe via the laptop. The web browser in the laptop will be also an alternative function that user can use the IE browser to view via the IP Camera or trigger the alarm on the IP Camera that have been set up.

2.3.6 Hardware and Software

The types of hardware and software that I used are listed as below:

Hardware:

Device	Specifications
IP Camera	**Avtech IP Camera(AVN80X)** **Network**
	Network Compression H.264 / MPEG4 / MJPEG
	Multiple Video 3 (H.264, MJPEG, MPEG4) Streaming(Encode Modes, IPS, Resolution)
	LAN Port YES
	LAN Speed 10/100 Based-T Ethernet
	Supported Protocols DDNS, PPPoE, DHCP, NTP, SNTP, TCP/IP, ICMP, SMTP, FTP, HTTP, RTP, RTSP, UPnP
	Frame Rate NTSC:30, PAL:25
	Number of Online Users 10
	Security Multiple user access levels with password
	Web management Web browsers, such as Internet Explorer, Mozilla Firefox, Google Chrome, Safari & Opera for single device access, or Free CMS software, Video Viewer, for up to 16 network cameras control simultaneously
	Camera
	Image Sensor 1/3" Live MOS image sensor
	Video Resolution SXGA, SXVGA, 720P, VGA, QVGA
	Min Illumination 0.1 Lux / F1.5, 0 Lux (LED ON)
	Shutter Speed 1 / 60 (1/50) to 1 / 100,000 sec.
	S/N Ratio More than 48dB (AGC off)
	Lens f3.8mm / F1.5
	Viewing Angle 75°
	White LED YES (1W, 10 meters)
	White Balance ATW
	AGC Auto
	IRIS Mode AES
	PIR Sensor Detection Range 76° wide angle with 5m long distance at 2m height (under 25°C)
	Micro SD Card Slot YES
	External Alarm I/O YES
	Microphone YES
	Speaker YES

	Power Source (±10%)　　　　5V / 2A Operating Temperature　　　0°C~40°C
Wireless Router	**TP-Link Wireless N Router (TL-MR3420)** Specifications : Interfaces – • 1 USB 2.0 Port for LTE/HSPA+/HSUPA/HSDPA/UMTS/EVDO USB Model • 1 10/100Mbps WAN Port, 4 10/100Mbps LAN Ports, support the auto-Negotiation and auto-MDI/MDIX Wireless Features - • Wireless Standards　　　IEEE 802.11b, IEEE 802.11g, IEEE 802.11n • Frequency　　　　　　　2.4-2.4835GHz • EIRP　　　　　　　　　<20dBm • Wireless Security　　　　Support 64/128 bit WEP, WPA-PSK/WPA2-PSK,
Electrical Components	• Donut Board (Big) 10x24cm • LED x 2 (represent magnetic lock) • SK40c • Lead • Female pin header • Male pin header • Resistor 0.5W 5% (1K1) x2 • 2510 PCB Connector 3 Ways (R/A) • PIR Sensor Module **Features:** • 5V to 20V operation voltage with <100uA current draw • Single bit output (digital) • Delay time adjustable • Compatible with all types of microcontroller • Small size makes it easy to conceal • Plug n Play feature • IC PIC18F4550 **Parameter:** • Pin Count: 40 • Program Memory (KB) 32 Flash • CPU Speed (MIPS): 12 RAM Bytes 2,048 • Data EEPROM (bytes): 256 • Digital Communication Peripherals: 1-A/E/USART, 1-MSSP(SPI/I2C)

	• Capture/Compare/PWM Peripherals: 1 CCP, 1 ECCP • Timers: 1 x 8-bit, 3 x 16-bit • ADC: 13 ch, 10-bit • Comparators: 2 • USB (ch, speed, compliance): 1, Full Speed, USB 2.0 • Operating Voltage Range (V): 2 to 5.5 • Enhanced 40 pins PIC Start-Up Kit
Laptop	**Dell N4010 14R** Display

Display

	Resolution	: 1366 x 768 pixels
	Display size	: 14.0 inches

Processor

	Processor speed	: 2270.0 MHz
	Processor type	: Intel Core i3

Memory

	Memory size	: 4000.0 MB

Storage

	Hard Drive Speed	: 5400 RPM
	Drives included	: 1.0
	Other storage	: -Memory Stick -SDHC Card -Picture Card
	Drive type	: Hard Disk Drive
	Drive size	: 500.0 GB

Storage Media

	Memory stick	: 1
	XD picture card	: 1

Ports and Connections

	Wireless connection	: 802.11 n
	Available Interfaces	: Bluetooth
	Slots	:- Memory Stick -SDHC Card - D-Picture Card
	SDHC Card or Secure Digital High Capacity (SDHC)	: 1
Other Features		
	Devices	: Built-In Microphone : Built-In Webcam
	Docking Station Port	: No

Table 2.3.6.1

Software:

Item	Specification
Microsoft Visual Studio 2012	Support Architecture: -32bit(x86) -64bit(x64) Hardware Requirement: -Computer that has a 1.6GHz or faster processor -1 GB (32 Bit) or 2 GB (64 Bit) RAM (Add 512 MB if running in a virtual machine) -3GB of available hard disk space - 5400 RPM hard disk drive -DirectX 9 capable video card running at 1024 x 768 or higher-resolution display -DVD-ROM Drive Programming Language Used : C#
Microsoft Windows Phone SDK 8.0	Support Architecture: -32bit(x86) -64bit(x64) Hardware Requirement :

	-Installation requires 4 GB of free disk space on the system drive. -3 GB RAM -Windows Phone Emulator requires a DirectX 10 or above capable graphics card with a WDDM 1.1 driver Programming Language Used :Visual Basic
Microsoft Window 7	Support Architecture: -32bit(x86) -64bit(x64) Hardware Requirement : -1 gigabyte (GB) RAM (32-bit) or 2 GB RAM (64-bit) -16 GB available hard disk space (32-bit) or 20 GB (64-bit) -DirectX 9 graphics device with WDDM 1.0 or higher driver

2.3.7 INSTALLATION GUIDE

2.3.7.1 Hardware Installation

SK40C

SK40C is another enhanced version of 40 pins PIC microcontroller startup kit. It is designed to offer an easy to start board for PIC MCU user. However, all interface and program should be developed by user. This board comes with basic element for user to begin project development. It offer plug and use features. This kit is designed to offer:
- Industrial grade PCB
- Every board is being fully tested before shipped to customer
- Compact, powerful, flexible and robust start-up platform
- Suitable for hobbyists and experts
- Save development and soldering time
- No extra components required for the PIC to function
- **All 33 I/O pins** are nicely labeled to avoid miss-connection by users
- **Connector for UIC00A/B** (low cost USB ICSP PIC Programmer) - simple and fast method to load program
- Fully compatible with SK40B
- No more frustrated work plugging PIC out and back for re-programming
- Perfectly fit for 40 pins **16F and PIC18F PIC**
- With UIC00A/B, program can be loaded in less than 5 seconds
- More convenient to use and it is smaller than SK40B.
- Maximum current is 0.5A.
- **Dimension:** 85mm x 55mm

  SK40C come with additional features:
- 2 x Programmable switch

- 2 x LED indicator
- Turn pin for crystal. User may use others crystal provided.
- LCD display (optional)
- UART communication
- USB on board.
- PICkit port which can be used with UIC-A and PICkit 3
- And all the necessities to eliminate users difficulty in using PI

BOARD LAYOUT (SK40C)
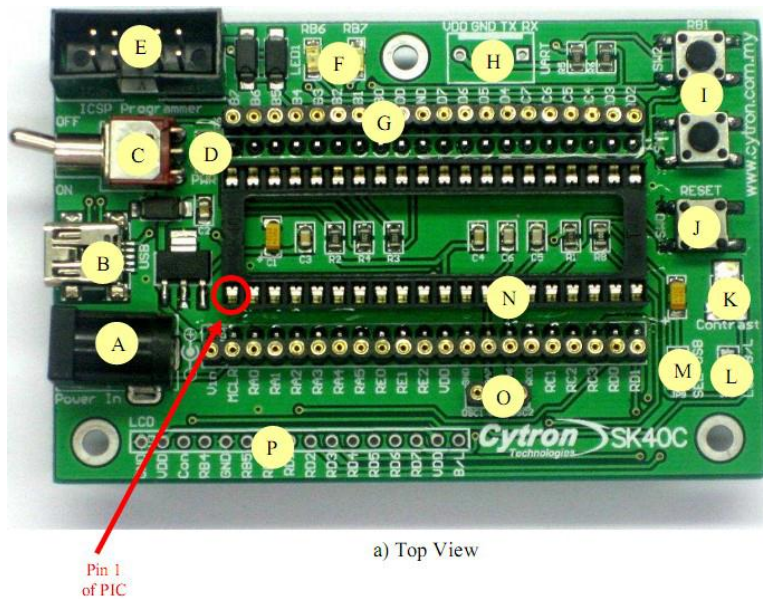
Figure 2.3.7.1.1: a) Top View
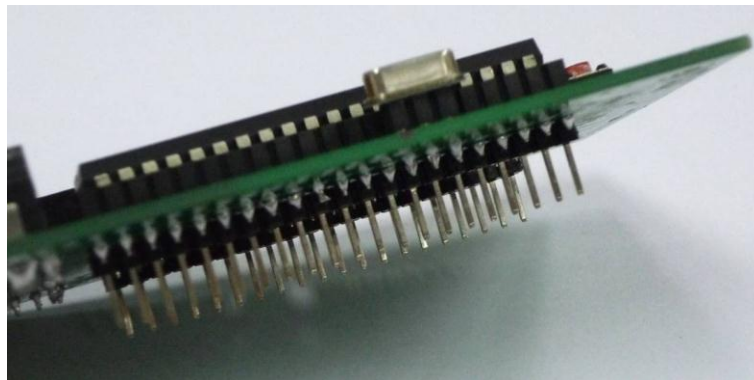
Figure 2.3.7.1.2: b) Side view
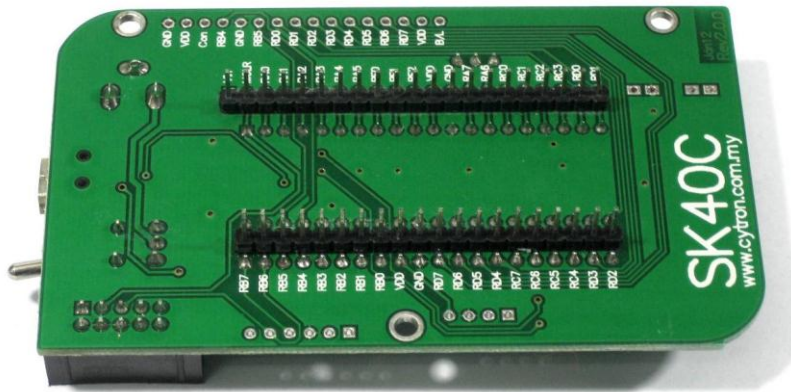
Figure 2.3.7.1.3: c) Bottom view

A – 2x5 box header for UIC00A/B, USB ICSP PIC Programmer.

B – JP10 port reserved for PICkit programmer. User may use PICkit 3 at this port to load program besides using UIC00B.

C – Reserved for UART communication. Tx and Rx pin of SK40C are connect to RC6 and RC7 respectively. Ensure PIC use have the correct UART pin (RC6 and RC7).

D – 2 LEDs (connected to RB6 and RB7) as active High output for PIC MCU. These LEDs are controllable from PIC MCU.

E – 40 pin IC socket for user to plug in any 40 pin PIC MCU (8 bit). It can either be 16F or 18F PIC. Of course the IC package should be PDIP. **Please ensure the first pin is at the top side.** Inside IC socket, there some electronics components, it include a 20MHz Crystal.

F – 2 x Push button connected to RB0 and RB1 of PIC MCU. This is extra input button for user. It can be programmed as input switch.

G – Push button with the function of Reset for PIC MCU.

H – 5K of trimmer to set LCD contrast.

I – JP9 is provided for USB. Connect this pin if users use USB port

J – JP8 is provided for LCD Backlight. LCD Display will have backlight if this pin is shorted.

K – Turn pin is provided for crystal. 20M Hz is default crystal provided in SK40C. However, the 20M Hz crystal can be removed and replace with other crystal. Just remove the crystal and put other crystal on turn pin without soldering.

L – Reserved for 2 x 16 LCD Display. User may solder 2x16 LCD display at this space if want to use it.

M – Consist of several line of header pin and turn pin. Header pin provide connector for user to solder SK40C to prototype board and use the I/O of PIC MCU. It is fully compatible between SK40B. Turn pin offer simple way to check voltage with multi-meter probe. 40 pins of PIC MCU except OSC (connected to crystal) are extended out to these pin. There is an extra pin on top of MCLR which is labeled as Vin, is connected to the input power.

N – DC power adaptor socket for user to plug in DC adaptor. The input voltage should be ranged from 7 to 15V.

O – USB connector for communication between devices and a host controller (usually personal computers). This function is only valid for certain model of PIC microcontroller.

Please refer to USB interface section. The power LED will light ON when the USB cable is connected.

P – Power indicator LED for on board. It will light ON as long as the input power is correctly connected.

Q - Toggle switch to On/Off the power supply from DC adaptor.

Figure 2.3.7.1.4:   PIC18F4550

The following are the pins that would be used to be function in the PIC :

No	Pin Name	Pin function	Connection
1	GND	Ground	GND
2	VDD	Positive supply for PIR Sensor	5V
3	RD5	Write data/Read data	Data output
4	RB2	Positive supply	5V
5	RB4	Positive Supply	5V
6	GND	Ground	Ground
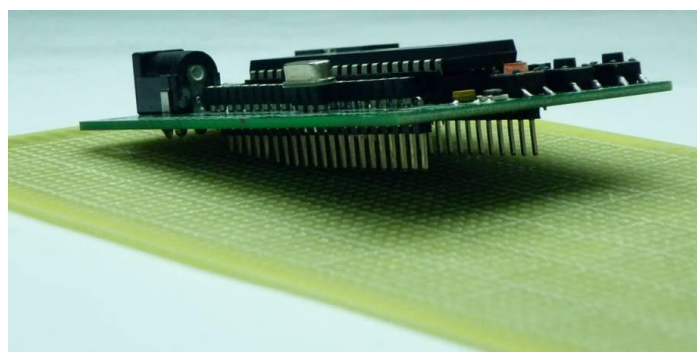
Figure 2.3.7.1.5: The SK40C with the PIC attached will be plug into the donut board

Plug the I/O pins of the Start-up Kit onto a donut board. Solder the pins onto the board to access the I/O.
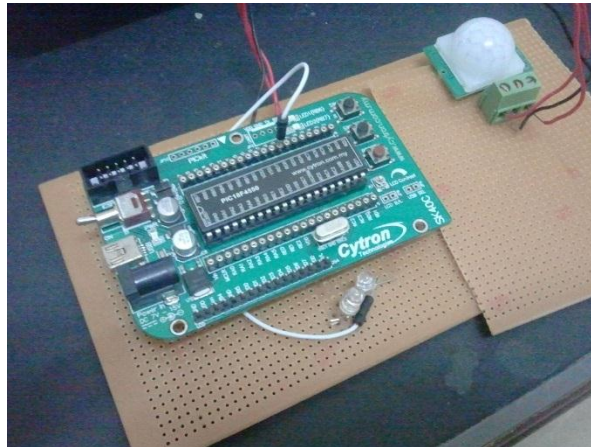
Figure 2.3.7.1.6: The SK40C is being shouldered and the IO is connected to another connector to the PIR Sensors

The figure above showing all the electronic components are shouldered including the LEDs, resistors, PIR Sensors and the 3-way connectors. There are two LEDs and resistors that have been used.

How to program the coding into PIC?
SK40C come with UIC00A/B ICSP USB programmer connector to offer simple way for downloading program.UIC00A/B ICSP programmer is very easy and save plenty of development time.

1. Loading Program Using UIC00A/B Programmer
Connect SK40C as shown in following figure.
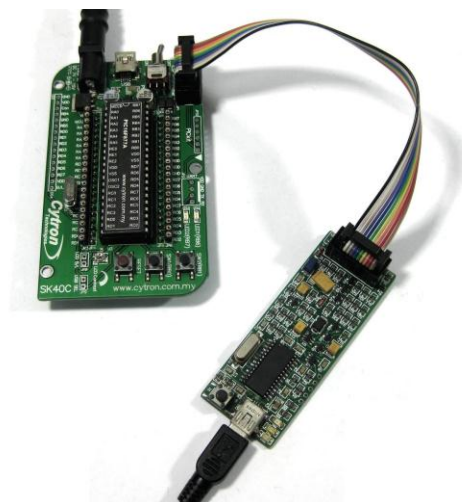
Figure 2.3.7.1.7: After plug in 40 pin PIC MCU (make sure the orientation is correct), SK40C should be powered by **DC adaptor**. Now, the hex code is ready to be loaded to SK40C.

Camera

Figure 2.3.7.1.8: The IP Camera that have been used is AVN80X.

Router

Figure 2.3.7.1.9: The router that have been use is TP-Link Router

The UTP cable is connected from the IP Camera to the router so that the streaming of the IP Camera can be broadcast through internal Wifi without access to internet.

2.3.7.2 Software Installation

2.3.7.2.1 MPLAB IDE & HI-TECH PICC

Please install MPLAB IDE and HI-TECH PICC Lite according to the following steps.
1. Please double click on the **Setup** to install MPLAB V8.70.
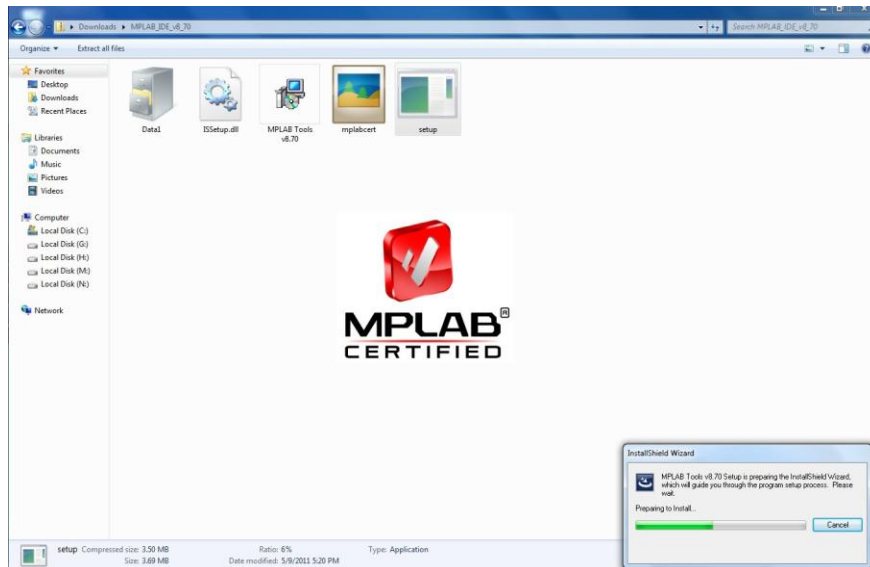
2. The Install Shield Wizard will pop out.

After all the directions shown in the welcome note (as in following diagram) is done, please click *Next>* for next step.
4. Please select *I accept the terms of the license agreement* if it is not selected in the diagram below, and click *Next>* after this.
5. Please select *Complete* for the setup type to install all program features, and click *Next>* to next step.

6. In the **Choose Destination Location**, user is recommended to use the default destination folder, which is *C:\Program Files\Microchip* or user is also free to select the other destination folder by using the *Browse...* button to browse to the desired destination folder. After that, click *Next>* for next step.

Please select *I accept the terms of the license agreement* if it is not selected in the diagram below, and click *Next>* after this.
8. Please select *I accept the terms of the license agreement* again for the window shown below, and click *Next>* after this.
9. Please click *Next>* for the diagram below.
10. Please wait for a while for the installation process shown in diagram below.
11. A window for *Question* will pop out, please click **YES** to proceed

12. Please click **Next** to Install HI-TECH C
13. Please select **I accept the terms of the license agreement if it is not selected in the diagram below,** and click **Next** to Install HITECH C.

15. Please select **Add to environment path** if it is not selected in the diagram below, and click **Next** to proceed.
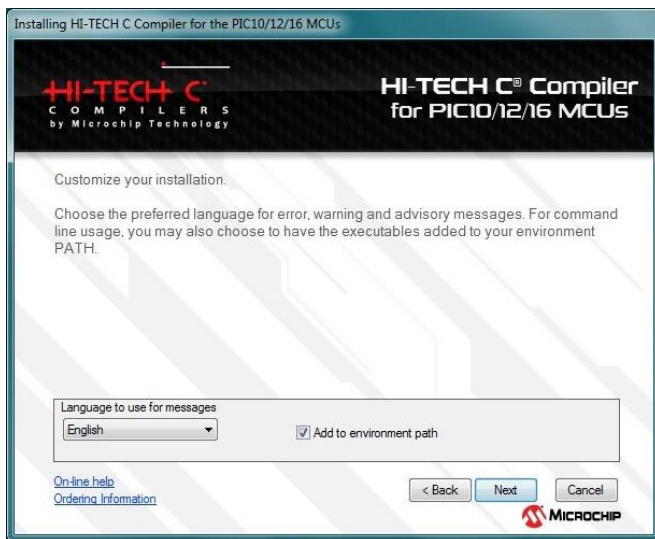
Please wait for the installation process to be completed.

17. Please click **Finish** after successfully installed the HI-TECH C.
18. The installation of MPLAB V8.70a is completed. Please click **Finish** to exit. User may need to restart the computer just after the installation or restart later.

CREATE PROJECT

After finished install the MPLAB IDE, we are going t show you how to create a project using it. There is just a few simple step to follow on how to create it.
Please follow the step below:
1. Go to to MENU BAR and click **Project > Project Wizard.**
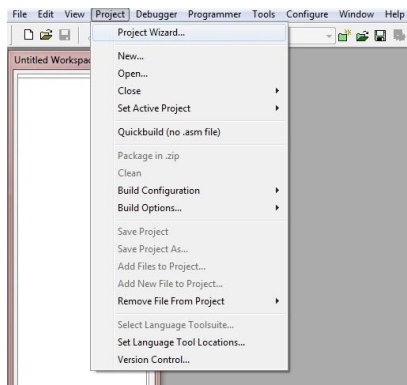
2. Click **Next>** . On the Device menu, choose **PIC16F887** because we are going to use this PIC MCU for coming project.
3. Choose **HI-TECH Universal Toolsuite** in Active Toolsuite. A **HI-TECH ANSI C Compiler** will show up in the Toolsuite Content.
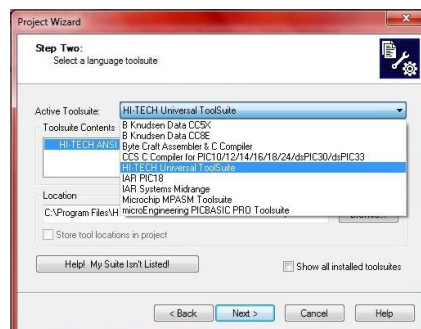
4. After that, choose a destination where the project you create to be save as. And also the project name. After that, click **NEXT>**.
5. In step 4, there are no existing file to be added so we can skip this step by just click **NEXT>.** After that, a project are created with the project name you added earlier.

2.3.7.2.2 PICKIT 2 SETUP

In here, we want our compiler to automatically send the .HEX file into our PIC MCU after compiler. There will be just only 4 step to do it. Please follow the instruction below:

1. Go to MENU BAR. **Programmer> Select Programmer> PICkit 2**.
2. Again, go to **Programmer> Setting**.
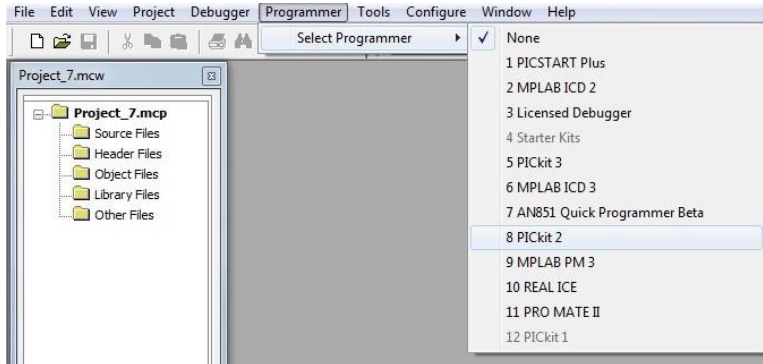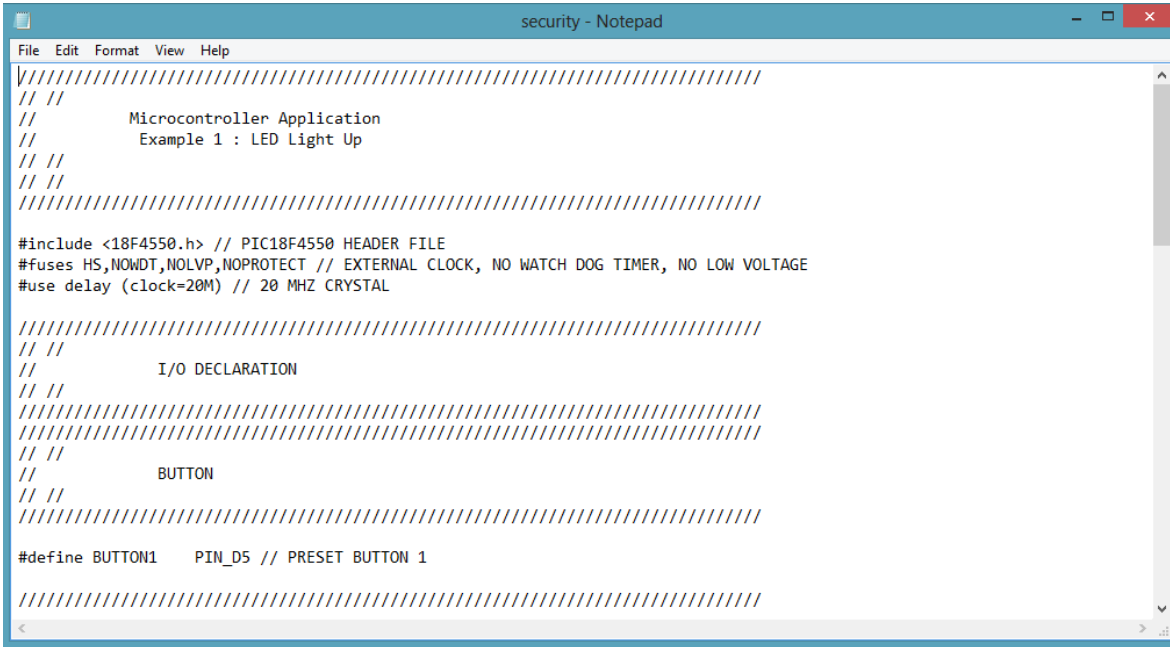
3. For **UIC00B**, please tick the box below.
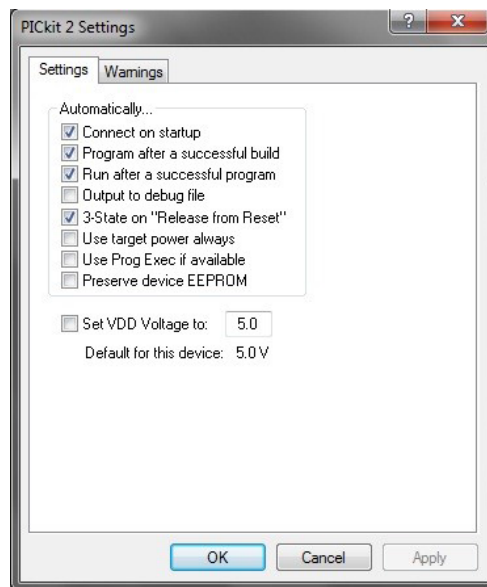
2.3.8 CODING CONFIGURATION AND APPLICATION DESIGN

Hardware (PIC Coding)

The following are the coding that have been designed to be compiled to .hex file and insert into PIC.

Figure 2.3.8.1: First part of PIC Coding

Figure 2.3.8.2: Second part of PIC Coding

```
// //
//              PORT INITIALIZE //
// //
///////////////////////////////////////////////////////////////////////

set_tris_d(0xFF); // SET ALL PORT D AS INPUT PORT
set_tris_a(0x00); // SET ALL PORT A AS OUTPUT PORT


///////////////////////////////////////////////////////////////////////
// //
//              MAIN PROGRAM //
// //
///////////////////////////////////////////////////////////////////////

while(TRUE) // always repeat program below

{
if(!input(Button1))
{
output_high(led1);
delay_ms(2000);
output_high(led2);

}
else
{
output_low(led1);
output_low(led2);
}
}
}
```

Figure 2.3.8.3: Third part of PIC Coding

Application (Design - xml, coding – VB)

Figure until Figure are the designs which designed by using Blender.
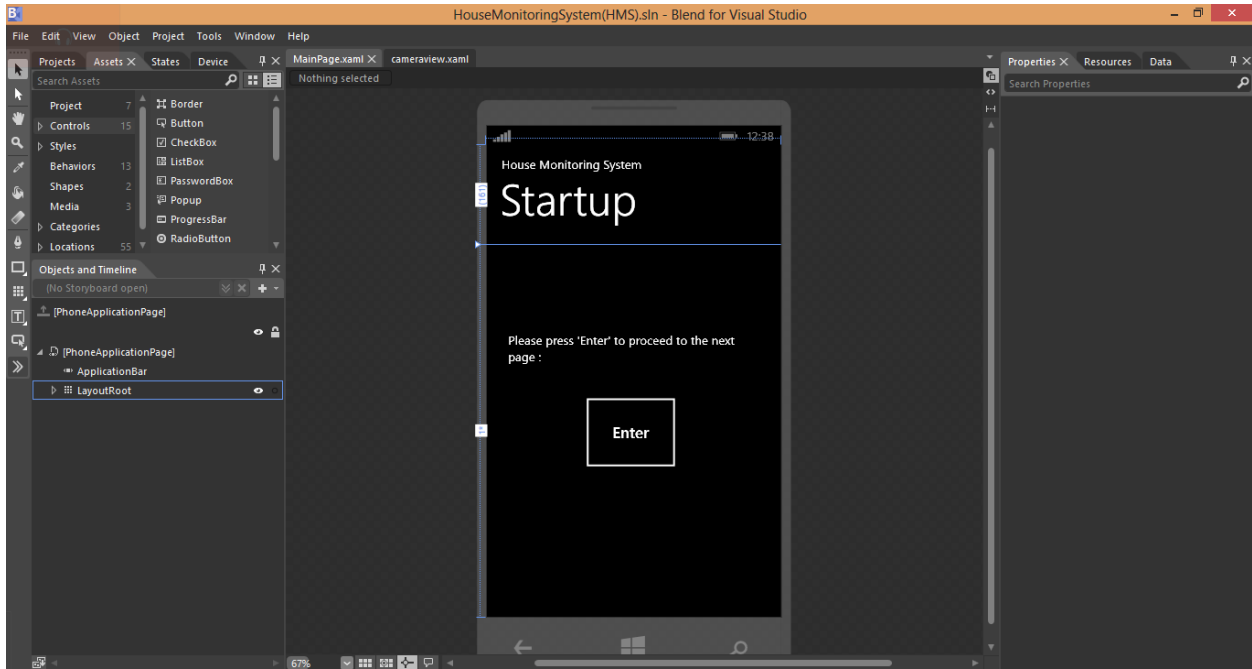
Figure 2.3.8.4: Startup interface Design with Blend
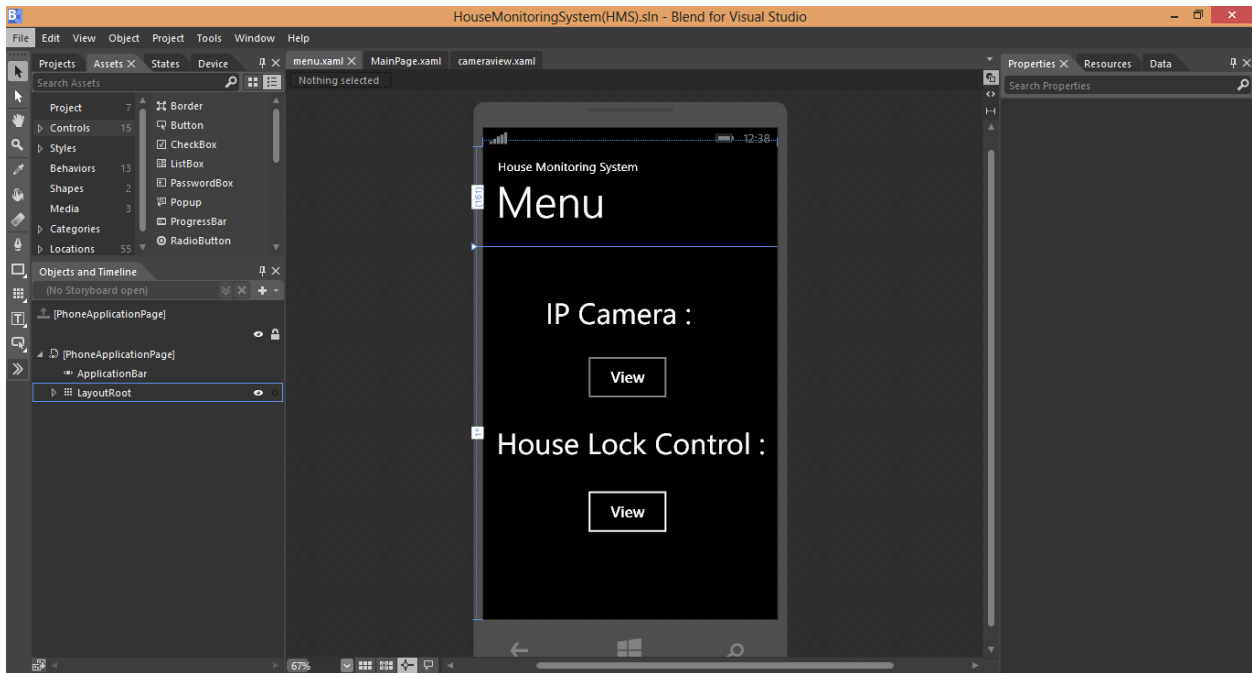
Figure 2.3.8.5: Menu interface Design with Blend
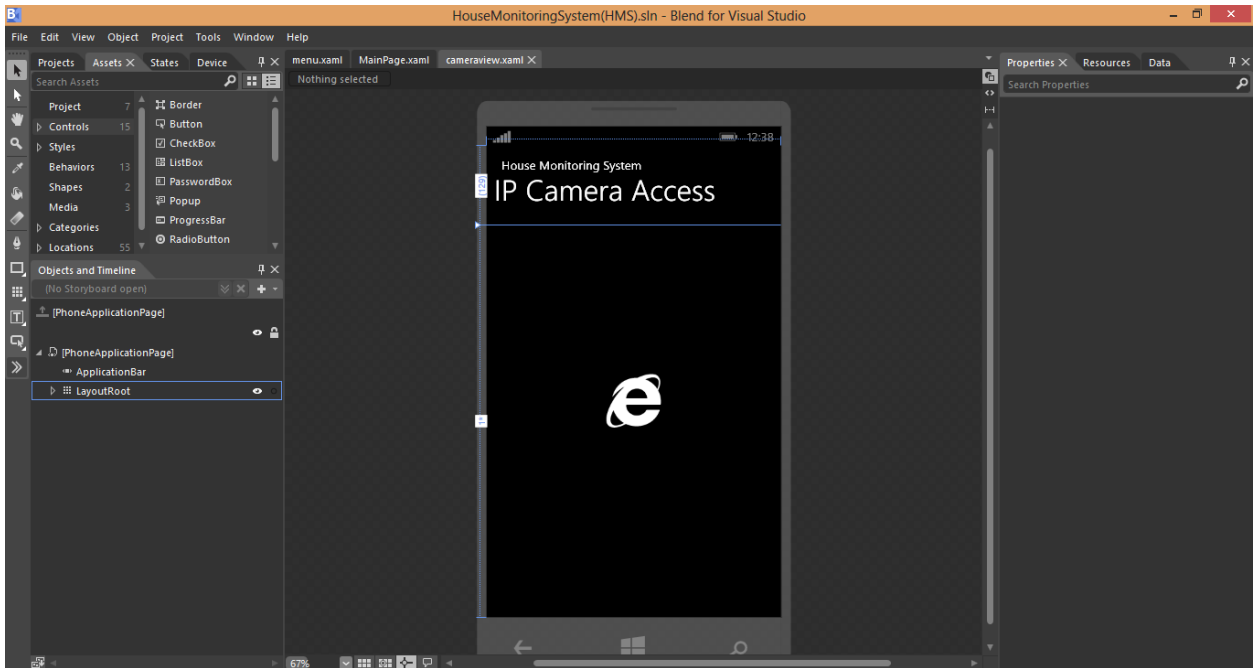
Figure 2.3.8.6: Camera Access Design wirh Blend
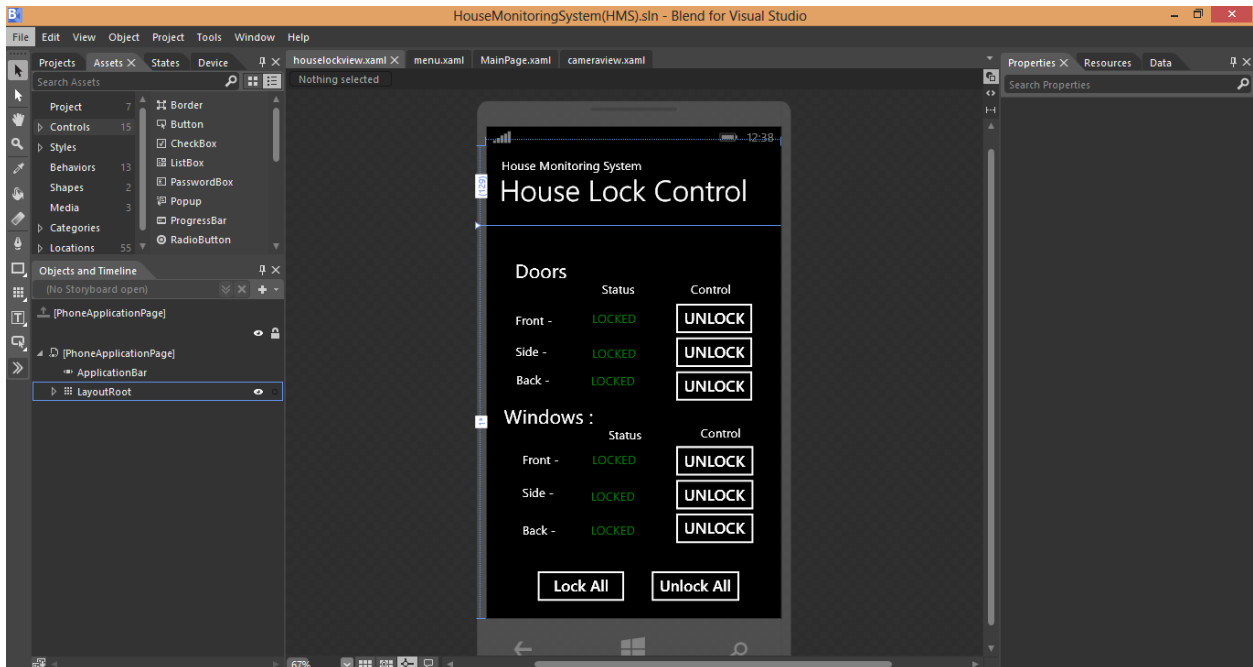
Figure 2.3.8.7: House Lock Control interface Design with Blend

The following are the .xaml coding and the VB coding that make the buttons and browsers to be able to function:

Figure 2.3.8.8: First some part of VB coding

Figure 2.3.8.9: Second some part of VB Coding

```
,0" TextWrapping="Wrap" Text="LOCKED" VerticalAlignment="Top" Grid.Column="1" Foreground="#FF008100"/>
,0,0" TextWrapping="Wrap" Text="LOCKED" VerticalAlignment="Top" Foreground="#FF008100" Grid.ColumnSpan="2"/>
,0,0" TextWrapping="Wrap" Text="LOCKED" VerticalAlignment="Top" Foreground="#FF008100" Grid.Row="1" Grid.Column="1"/>
17,0,0" TextWrapping="Wrap" Text="LOCKED" VerticalAlignment="Top" Foreground="#FF008100" Grid.Row="1" Grid.ColumnSpan="2"/>
72,0,0" TextWrapping="Wrap" Text="LOCKED" VerticalAlignment="Top" Foreground="#FF008100" Grid.Row="1" Grid.ColumnSpan="2"/>
n="125,115,0,0" VerticalAlignment="Top" Grid.Column="1" Click="Button_FrontDoor_Click" Width="148"/>
="125,170,0,0" VerticalAlignment="Top" Grid.Column="1" Click="Button_SideDoor_Click" Width="148"/>
="125,225,0,0" VerticalAlignment="Top" Grid.Column="1" Click="Button_BackDoor_Click" Width="148"/>
gin="125,38,0,0" VerticalAlignment="Top" Grid.Row="1" Grid.Column="1" Click="Button_FrontWindow_Click"/>
in="125,93,0,0" VerticalAlignment="Top" Grid.Row="1" Grid.Column="1" Click="Button_SideWindow_Click" Width="150"/>
in="125,148,0,0" VerticalAlignment="Top" Grid.Row="1" Grid.Column="1" Click="Button_BackWindow_Click"/>
="Wrap" Text="UNLOCKED" VerticalAlignment="Top" Foreground="#FFFF0011" Visibility="Collapsed"/>
="Wrap" Text="UNLOCKED" VerticalAlignment="Top" Foreground="#FFFF0011" Visibility="Collapsed"/>
="Wrap" Text="UNLOCKED" VerticalAlignment="Top" Foreground="#FFFF0011" Visibility="Collapsed"/>
="Wrap" Text="UNLOCKED" VerticalAlignment="Top" Foreground="#FFFF0011" Grid.Row="1" Visibility="Collapsed"/>
JNLOCKED" VerticalAlignment="Top" Foreground="#FFFF0011" Grid.Row="1" Grid.ColumnSpan="2" Visibility="Collapsed"/>
LOCKED" VerticalAlignment="Top" Foreground="#FFFF0011" Grid.Row="1" Grid.Column="1" Visibility="Collapsed"/>
nt="Left" Margin="125,115,0,0" VerticalAlignment="Top" Click="Button_FrontDoor2_Click" Width="148" Visibility="Collapsed"/>
="Left" Margin="125,170,0,0" VerticalAlignment="Top" Click="Button_SideDoor2_Click" Width="148" Visibility="Collapsed"/>
="Left" Margin="125,225,0,0" VerticalAlignment="Top" Click="Button_BackDoor2_Click" Width="148" Visibility="Collapsed"/>
nent="Left" Margin="125,38,0,0" VerticalAlignment="Top" Grid.Row="1" Click="Button_FrontWindow2_Click" Width="148" Visibility="Collapsed"/>
ent="Left" Margin="125,93,0,0" VerticalAlignment="Top" Grid.Row="1" Click="Button_SideWindow2_Click" Width="150" Visibility="Collapsed"/>
ent="Left" Margin="125,148,0,0" VerticalAlignment="Top" Grid.Row="1" Click="Button_BackWindow2_Click" Width="150" Visibility="Collapsed"/>
n="59,242,0,0" Grid.Row="1" VerticalAlignment="Top" Click="Button_LockAll_Click" Width="165" Grid.ColumnSpan="2"/>
argin="85,242,0,0" Grid.Row="1" VerticalAlignment="Top" Click="Button_UnlockAll_Click" Grid.Column="1"/>
3" TextWrapping="Wrap" VerticalAlignment="Top" Grid.ColumnSpan="2" Foreground="#FFB81111"/>
```

Figure2.3.8.10: Part of .xaml coding

2.4 Implementation Phases

<u>A) Application output</u>

This phase show the development of the application such as interface and hardware for the application are implement. The application based on the user requirement that gathered from the previous phase. Besides that, shows on how the system will behave and what function it will contain is necessary.

Figure 2.4.1: Startup interface in windows phone simulator

This is the startup page which will be appeared after the use trying to click on the application. User would require to touch on the enter to proceed to the next page
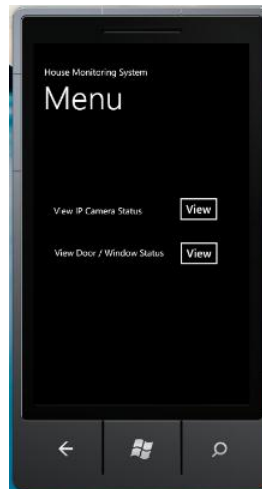
Figure 2.4.2: Menu interface in windows phone simulator

Figure 2.4.2 is the menu that we may choose to view the ip camera or we may choose to control the lock in the house
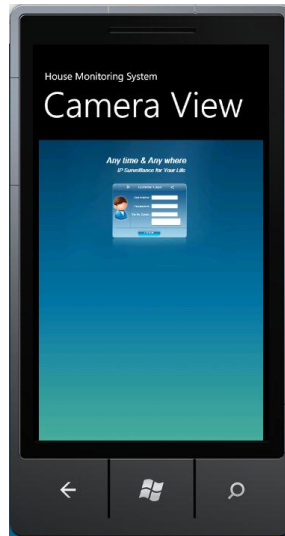
Figure 2.4.3: Camera View login interface in windows phone simulator

The figure shows the log in page after we have choose the Camere View button. User would require to login in terms of security to access to the ip camera.
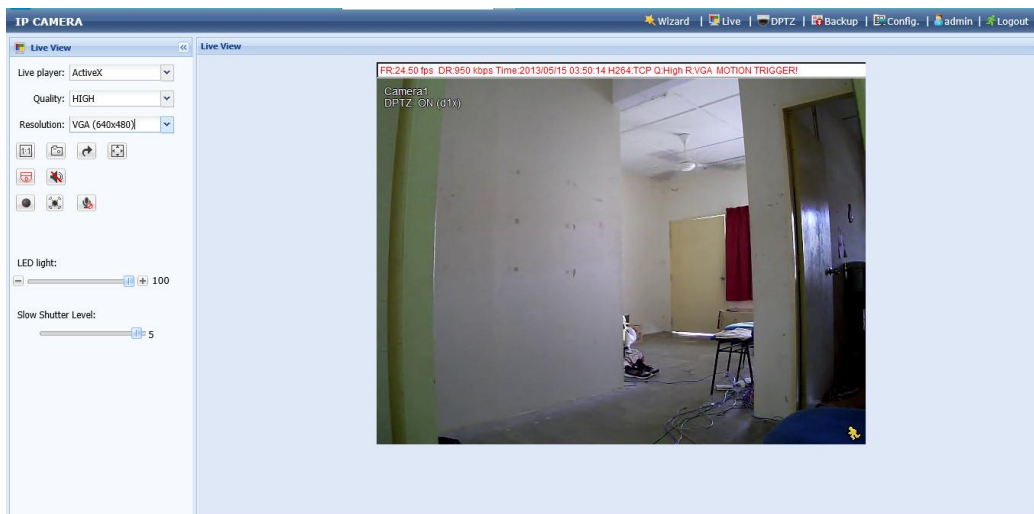
Figure 2.4.4: Access to Camera View Application

The figure shows the page after the user login. User will be able to observe the environment through the IP Camera via internal Wifi. User will be also be able to control the alarm in case there is any emergency.

Figure 2.4.5: Access to House Lock Control interface in windows phone simulator

The figure shows that the house control buttons to control the magnetic locks.

Figure 2.4.6: Access to House Lock Control interface in windows phone simulator

The figure shows that whenever there is any door unlock, there will be warning message to alert the user that the house is under risk.

Figure 2.4.7: Auto-lock functioning interface in windows phone simulator

Figure 2.4.7 shows that when PIR triggers as there is any object comes nearby, the doors and windows will be all automatically being locked themselves and the house is safe.

B) Hardware implementation
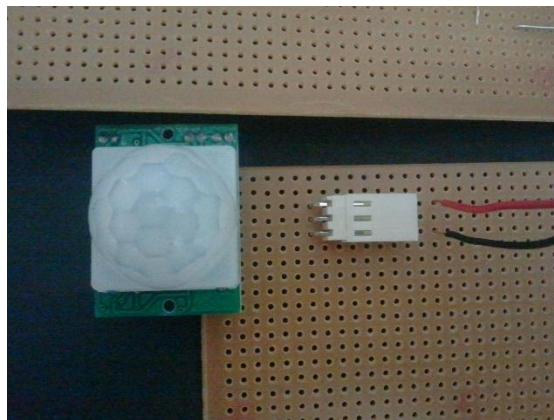
Figure 2.4.8: PIR Sensor

Figure 2.4.8 shows that the PIR is ready to detect any object that have infrared ray emission.
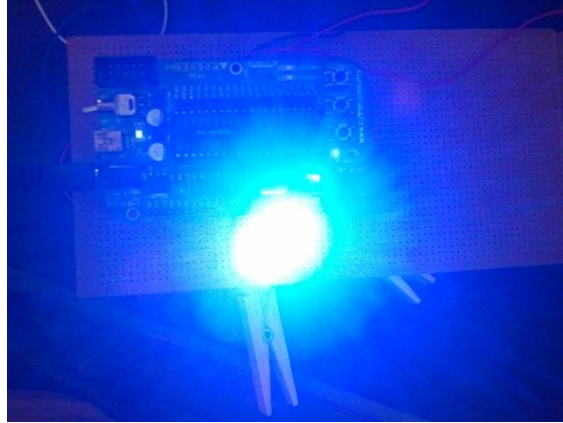
Figure 2.4.9: Result when PIR is triggered(LED lights up)

Figure 2.4.9 shows that the LED (represents the magnetic lock) lights up when the PIR detects infrared ray object and triggers.

2.5 Testing Plan

2.5.1 Testing Table

I would be going to have a table to record the result that I am going to test as soon as I have finished my devices and applications. The following would be the draft of table in order to test whether my system is fully works.

Devices/ Applications	Description	Expected Result	Actual Result	Remark
IP Camera	Ability to take video			
Sensors	Ability to detect object			
Magnetic Locker (Represented Using LED)	Ability to lock/unlock the door/window (LED lightup/not)			
Windows Phone	a) Ability to display IP Camera Videos			
	b) Ability to display the status			
Laptop	a)Ability to display IP Camera Videos			
	b)Ability to control IP Camera Videos			

Table 1: System Testing Table Draft

In case there are parts that are failed, the coding or algorithm need to recheck back again to identify the error. The devices are needed to be tested to make sure they are working.

2.5.3 Testing

Testing Table

I would be going to have a table to record the result that I am going to test as soon as I have finished my devices and applications. The following would be the draft of table in order to test whether my system is fully works.

Devices/ Applications	Description	Expected Result	Actual Result	Remark
IP Camera	Ability to take video	Yes	Yes	The environment is able to be view through the application via IP Camera
PIR Sensor	Ability to detect object	Yes	Yes	The sensor is able to detect the infrared object and triggers
Magnetic Locker (Represented Using LED)	Ability to lock/unlock the door/window (LED lightup/not)	Yes	Yes	The reaction of the LED depends on the reaction of the sensors
Windows Phone	a) Ability to display IP Camera Videos	Yes	Yes	In emulator, it might not successful as the emulator sometimes are not compactable with the requirement to run the streaming
	b) Ability to display the status	Yes	Yes (50%)	The status might not success to be displayed
Laptop	a)Ability to display IP Camera Videos	Yes	Yes	None
	b)Ability to control IP Camera Videos	Yes	Yes	None

Table 2: System Testing Table Summary

When there are parts that are failed, the coding or algorithm are rechecked back again to identify the error. The devices are needed to be tested until they are working.

2.6 Maintenance Phase

In maintenance phase, it must be fix the error of the application and make sure that no error will occur again. If there are any requests to change the system, then the developer should consider changing the system according to the new requirement. This process will be repeated until the developer and user satisfied with the changes. This is because achieve user requirement is important. In other words, new changes, correction, additions of the system may occur in this phase which the results will needs the documentation to be updated.

2.7 Findings

Since the system is implemented using Window 8 Professional, windows phone sdk emulator 7.1, Aztech IP Camera AVN80X, and the self-made demonstration board which contains PIR sensor and LED (which will be represent the magnetic lock that may be triggered), the outcome of the system display may not be the best.

During the development of the system, there are importance that there should be nice integration between the software and hardware. This is to enable us to guard our house though we are just using our mobile phone. Depends on current network data transfer, the streaming of the video may still delaying due to slow data transfer.

The control for locking the door/ windows may be delay as if the 3G network is being used. The auto-lock system for doors and windows may be efficient in case the user unable to lock in time.

3.0 Conclusion and recommendation

By developing this application, the house owner may not have to be worry about their house is in theft though they have forgotten to lock their doors and windows. Using this application, user may be able to watch their house through Wifi in windows phone and able to lock their house. They may be alert through the screen of the windows phone house lock control so they would have to lock back their house.

There are some constraint encountered when plan on the flow of the application. The original plan is to develop an application can be really controlled by house owner in further outstation and everything may be controlled through wifi. However, due to personal budget and limitation of certain field of knowledge, the application may contain LAN control and a bit of Wifi function.

There are several improvements in order to improve the functionality of the application. First, the user interface of the application can have more creative design which may more convenient for user to control and view through the IP camera. Second, we may try to improve that the IP Camera will be able to detect the face of the house owner to generate functions which will be more convenient to the house owner in future.

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APPENDICES

APPENDIX A

USER REQUIREMENT INTERVIEW LETTER

USER REQUIREMENT INTERVIEW

Interview Question:

Hi, I am here by to enhance a project which I named it, "House Monitoring System Using Windows Phone". The project is mainly about secure and guarding the house using a system and may going to be designed as your interests. May I know what requirements that you are interest to add into this house monitoring system that other than current basic system features that have been securing the house?

Answers: I would like to add in cameras so that I would be able to monitor my house surroundings. I would like to have sensors too so that I would be able to know in case there are anything come near my house. Besides, I hope that this system would also be able to be control by using my Windows Phone to make it more convenient for me.

Participated User's Name:

Signatures:

_____

APPENDIX B

GANTT CHART

	ⓘ	Task Mode	Task Name	Duration	Start	Finish	Predecessors
			⊟ Task Mode: Auto Scheduled	60d	Tue 18/9/12	Fri 10/5/13	
1	▦	⇉	Discuss and prepare Part1- Introduction	5 days	Tue 18/9/12	Sun 23/9/12	
2	▦	⇉	Writing Part1: 1.1	6 days	Mon 24/9/12	Mon 1/10/12	1FF
3		⇉	Submit Part1:1.1 and prepare Part1:1.2-1.6	3 days	Tue 2/10/12	Thu 4/10/12	2
4		⇉	Find article and journals	4 days	Fri 5/10/12	Wed 10/10/12	3
5	▦	⇉	Review on existing system	7 days	Fri 12/10/12	Sun 21/10/12	4
6		⇉	Submit Part1:1.2-1.6	1 day	Mon 22/10/12	Mon 22/10/12	5
7		⇉	Briefing of Part2- Report Body	3 days	Tue 23/10/12	Thu 25/10/12	6
8		⇉	Discussion and prepare of Part2-Report Body	22 days	Fri 26/10/12	Mon 26/11/12	7
9		⇉	Submit draft of Part2-Report Body	3 days	Tue 27/11/12	Thu 29/11/12	8
10		⇉	Submit Part2-Report Body	2 days	Fri 30/11/12	Mon 3/12/12	9
11		⇉	Submit draft of Technical Report of PSM1	3 days	Tue 4/12/12	Thu 6/12/12	10
12		⇉	Preparation for presentation PSM1	3 days	Fri 7/12/12	Tue 11/12/12	11
13	▦	⇉	Presentation of PSM1	1 day	Wed 12/12/12	Wed 12/12/12	12
14	▦	⇉	Preparation of PSM2	5 days	Thu 13/12/12	Wed 19/12/12	
15		⇉	Coding	60 days	Thu 20/12/12	Wed 13/3/13	14
16		⇉	Testing and Fix Coding	17 days	Thu 14/3/13	Fri 5/4/13	15
17		⇉	Implementation	7 days	Mon 8/4/13	Tue 16/4/13	16
18		⇉	Submit Report Documentation	1 day	Wed 17/4/13	Wed 17/4/13	17
19		⇉	Implementation and demo program	7 days	Thu 18/4/13	Fri 26/4/13	18
20		⇉	Complete and submit Technical report	5 days	Mon 29/4/13	Fri 3/5/13	19
21		⇉	Preparation of PSM2 Presentation	3 days	Mon 6/5/13	Wed 8/5/13	20
22		⇉	Presentation of PSM2	2 days	Thu 9/5/13	Fri 10/5/13	21
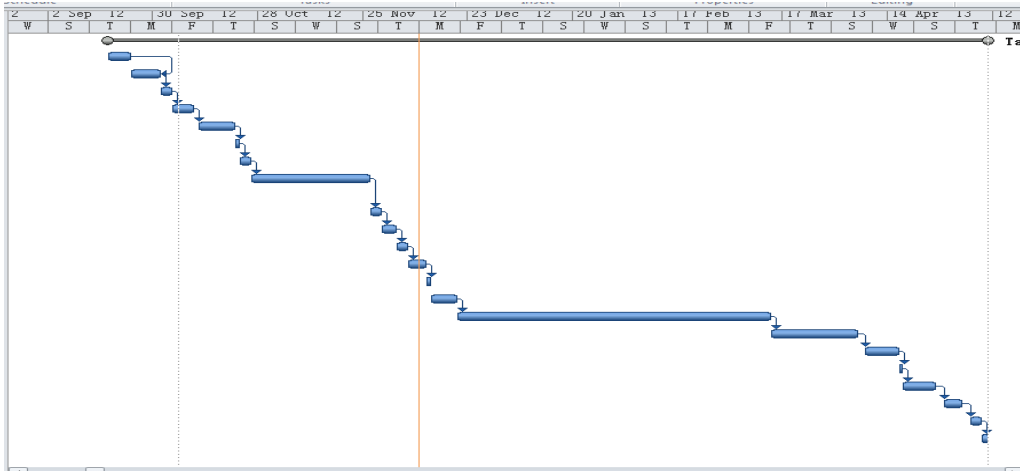
APPENDIX C

USER MANUAL/GUIDE

Step1:

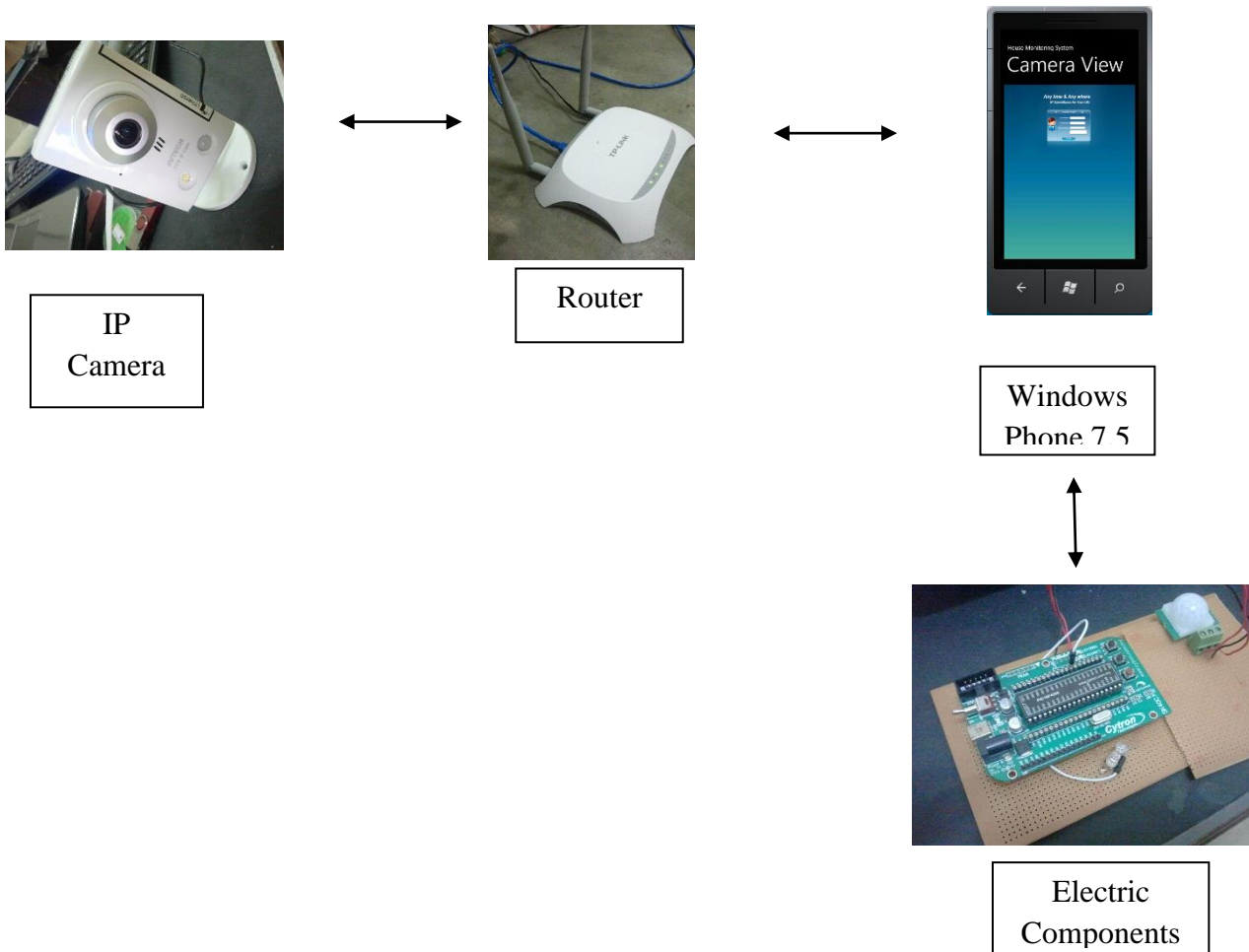Before start to use the application, user should prepare the list of tools that stated below.

Tools	Purpose
Windows Phone	• Use to run the application

Step 2:

Install the "House Monitoring System" in windows phone 7.5

Step 3:

Set up the tools that mentioned above as Figure below.

IP
Camera

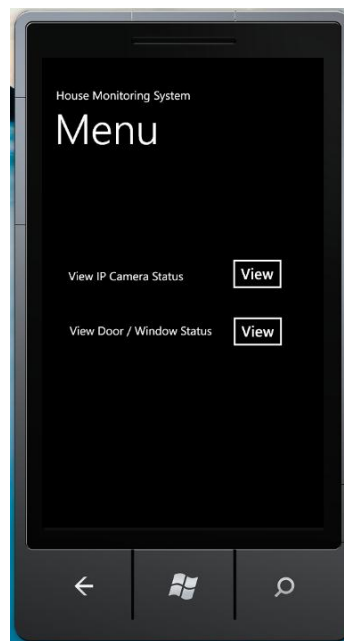Router

Windows
Phone 7.5

Electric
Components

Step3:

Run the application, enter to the startup page as below:

Touch the "Enter" to proceed to the Interface menu.

Interface Menu

Choose any two of the functions as you prefer.

Interface House Lock Control

Step 4:

- Unlock/Lock any doors/windows as you like

- Press "Lock All" to lock all the doors/windows

- Press "Unlock All" to unlock all the doors/windows