AUTOMATED HOUSE BY USING RASPBERRY PI

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ABSTRACT

Automated house, house automation or smart house is the same. Basically, this system will allow user or house owner to control or monitor their electrical appliance in their house while they are away. Automated House by Using Raspberry Pi is created by using Raspberry Pi as the central machine that connected to the board controller and this system is fully control via Short Message Service (SMS). No internet connection nor smartphone is needed as long there is a Global System for Mobile (GSM) network in order to access the system. This Automated House by Using Raspberry Pi is easy to use and affordable system that everyone can have it.

ABSTRAK

Rumah automatik, automasi rumah kediaman atau rumah pintar adalah sama. Pada asasnya, sistem ini akan membolehkan pengguna atau rumah pemilik untuk mengawal atau memantau perkakas elektrik mereka di dalam rumah mereka ketika mereka berada jauh. House automatik dengan Menggunakan Raspberry Pi dicipta dengan menggunakan Raspberry Pi sebagai mesin pusat yang disambungkan kepada pengawal lembaga dan sistem ini mengawal sepenuhnya melalui Perkhidmatan Pesanan Ringkas (SMS). Tiada sambungan internet mahupun telefon pintar diperlukan selagi ada Sistem Global untuk Mudah Alih (GSM) rangkaian untuk mengakses sistem. Ini House Automatik dengan Menggunakan Raspberry Pi adalah mudah untuk digunakan dan sistem berpatutan yang semua orang boleh memilikinya.

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CHAPTER 1

INTRODUCTION

1.1   INTRODUCTION AND MOTIVATION

This proposal is to propose an "Automated House by Using Raspberry Pi".

The first house light switch was invented in 1884 by John Henry Holmes. Since then, we have to use that switch to on or off lights in our house or other electrical appliance such as fan. So this proposal is to invent technology that can help people switch on or off their electrical appliance only by using their cellphone.

According to Oxford Dictionaries, automated is defined as a fully automated process while house is defined as a building for human habitation [1]. By having an automated house, we can conclude that every process happens in that house is fully automatic. Some believe that having an automated house can make our life much better and productive.

Raspberry Pi invented by Eben Upton. This small size single-board computer can do a lot of things that your desktop PC does. It can be connected to your monitor together with your keyboard and mouse [2]. This small board is mainly invented for educational purpose. Until now, there is two version of Raspberry Pi, called Model A and Model B. Thanks to the new Model B, Raspberry Pi now can be connected to the internet via Ethernet port.

With this technology approach, people can even switch on or off or monitor their electrical appliance when they are away from their house.

1.2   PROBLEM STATEMENT

When we are away from our house, whether on duty or having holiday, it is hard for us to monitor our house especially for the electrical appliance; light and fan. During festive holiday, we are advised not to switch on the light all the time.

So why we are not advisable to leave our house with the light switch on all the time? This kind of action could attract burglar to coming into our house. Of course we do not want this to be happen. Besides that, in term of cost, it is not a good practice as it will make our monthly electrical bill going up, just because we cannot control the electrical appliance during our holiday.

If we feel something not being switch off, we could not even know the real situation and cannot going back just to switch it off.

So people will buy or install additional device such as timer switch. But this kind of switch may have some disadvantages. One of the disadvantages are it only work with one profile. Means, we cannot set for several different timing. Normally this device allow up to one appliance.

1.3   OBJECTIVE

This proposal is submitted because:

1. To help people to monitor electrical appliance in their house.
2. To develop Automated House by using Raspberry Pi.
3. To explore the concept of using Raspberry Pi.

1.4   SCOPE

This project is develop by using Raspberry Pi. The target user are:

- House owner

    This project is mainly for house owner who need a device that can switch on or off remotely with their cellphone and at the same time, to monitor or to know the status of electrical appliance in their house. This will be a new experience for the house owner.

1.5   THESIS ORGANIZATION

This thesis will have total of six chapters ranging from chapter one until six. In chapter one, discussion is more on to introduction to this project which includes problem statement, objectives and scope of this project.

In chapter 2, literature review will be discuss. Discussion will be made about current system that exist, their advantages and disadvantages, and problems with current system.

For chapter 3, methodology chosen for this project will be discuss. The requirements for hardware and software also will be identify and discuss.

Chapter 4 is a design and implementation phase discussion. In this chapter, the project implementation will be shown including system flow, coding and developing process will be explained more detail.

Result and discussion will be show on chapter 5. Expected results and actual results will be in this chapter together with future enhancement to the project.

Chapter 6 is the final conclusion for this project. Conclusion will include methodology and literature review.

CHAPTER 2

LITERATURE REVIEW

2.1   INTRODUCTION

Automated House by Using Raspberry Pi (AHURaP) is a house that can be control and monitor by using mobile phone. Means that all electrical system such as light and fans can be switch on and off and also their activity can be monitor via mobile phone. This system is made to provide a house owner an easier way to monitor their house.

Malaysia, as a developing country, we need to catch up with the latest technology in order to standing right behind the developed country [3]. In developed country, smart house system is quite normal for their citizen. Information & Communication Technology sector is one way to contribute to the development of the country [2].

AHURaP is using Raspberry Pi, a credit card size computer together with Global System for Mobile Communication (GSM) module that will receive command given by house owner using Short Message Service (SMS). SMS is chosen because every phone support this service. It can be use anywhere if there is a telecommunication line. So, this project can be classify as a user friendly because everyone can learn quickly about the command needed.

2.2 OVERVIEW OF AUTOMATED HOUSE

2.2.1 WHAT IS AUTOMATED HOUSE?

Automated house is a system developed to control electrical appliances in our house such as light, fan, air-conditioning, security system, television and etc. [4]. Besides controlling our house, this system may also do monitoring job. For example monitor the temperature, current status of electrical appliance, closed-circuit television (CCTV) system and many more.

With the current technology, this system can be access through several ways; web-based, software, and smartphone application. This make automated house is easier to be use depending on our target of what we want to control, our budget, our type of system and so on [4]. This system will be integrated with our house electrical system.

2.2.2 THE HISTORY OF AUTOMATED HOUSE

In 1898, Nikola Tesla come out with an idea of controlling vessels and vehicle by using remote control. In 1966, there were a private project named "ECHO IV" run by an engineer, Jim Sutherland [1]. This project never been commercialized. During that time, everyone has the same idea that this system is not relevant as not every house equipped with an electricity.

Only on 20th century, every house has the electricity and began to accept the concept of automated house. Based on the research run by ABI Research, in 2012, in total of 1.5 million of automated house was install in United State (US) and they believe in could spark to 8 million in 2017.

2.3   BENEFITS OF AUTOMATED HOUSE

While we are away from home, of course we cannot what happens in our house. Have we turn off all light, switch off the air-conditioning, and turn off water heater before leave our house? How can we know the status if we in a car going to work and are u willing to return back to home just to switch it off? Of course not. But, by using this system, everything become handy. We can have a convenience experience and not to forget, this system could make sure our house feels safer.

It does not matter whether you use a tablet or smartphone in order to control the system, it is all the same. We still can know the status and condition of our house when we are away by using only one application that can control and monitor our house.

2.4   EXISTING SYSTEMS

Currently, many company was setup in order to develop and install this system into houses. Many studies and research has been done in order to improve the current system and this could give an advantage to the house owner as they will have many choices and types that they can choose.
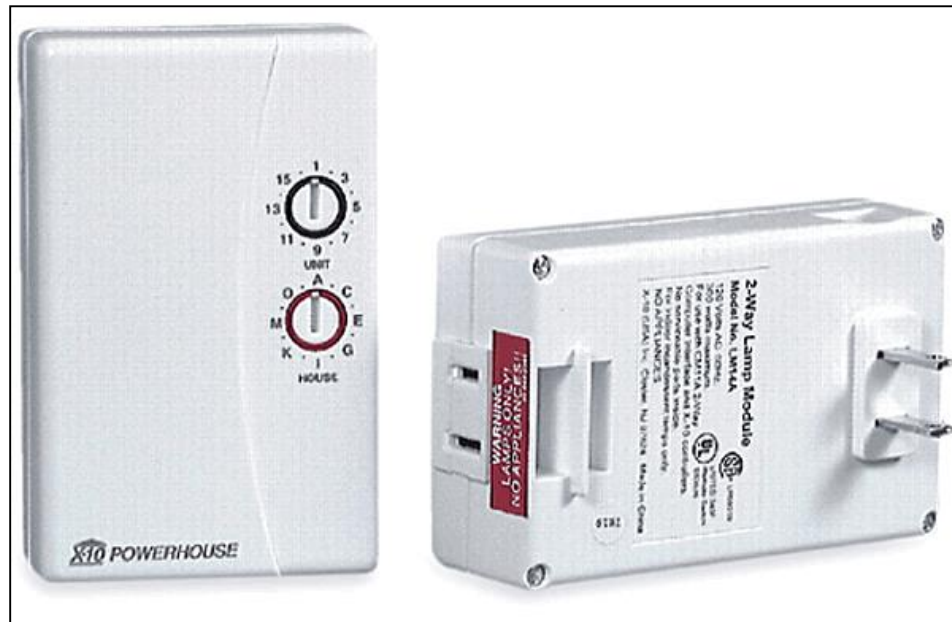
2.4.1 X10

Figure 2.1: X10 Lamp Module

This module will let us plug in our lamp into the module and plug in the module into the power outlet and lamp can be control by using this module. This module come with a keychain that can be used to turn on or off lamp remotely. It also can be controlled by using desktop if we want to control it in our house. An infrared module can be add in we want to control the lamp via remote control.

2.4.2 DOMO INTELLIGENT CONTROL (DIC)

This system offers us to monitor and control all electrical appliance from a central point. DIC can be access from all smartphone and tablets as it supports iOS/Android operating system. This system required an internet connection for user to be able to control the electrical appliance. DIC also can be programmed to suit our own preference; study, reading, night, morning, and party mode. Trigger system also been offered in this system for selected scenarios that can be found on the option.

2.5   PROBLEMS WITH CURRENT SYSTEM

Product produced by X10 is quite simple as it only can control on one electrical appliance at one time. Therefore if user wanted to control more than one appliance, they need to buy additional module and it could cost them. User also need to buy additional add on if they want to use different way to control the system, for example infrared module if they want to control the system using remote control. User are complaining on less functionality on X10.

For DIC, this system requires user to have an internet connection in order to control or monitor the house. For someone, at some time it could be difficult for them as not everyone have an internet connection on their smartphone or tablet as some tablet are only use Wi-Fi as their connection.

2.6   COMPARISON

Both have similar goal; to provide a convenience live style to house owner. But both have different way to interact with user. X10 provides a simple yet effective solution for the user to control lamp by using lamp module that can be control using keychain, remote control and desktop, while DIC provide a whole solution for house owner and user can access the system using smartphone or tablet. X10 is cheaper than DIC as it only control one module at one time.

2.7   CONCLUSION

Based on my observation, Raspberry Pi will be used as the central for this system as it is simple yet effective solution for us to have an economic solution or alternative to develop a new automated house system.

CHAPTER 3

METHODOLOGY

3.1   INTRODUCTION

In this chapter, the discussion is about methodology that will be use throughout this project development. Rapid Application Development (RAD) is used and it consists four phases; project initiation and planning, analysis, system design, and testing and debugging. It's very simple to understand and use. In RAD, during development process, customer will give some input and feedback that can be used to increase the quality of the project.

This project will consists both hardware and software. Raspberry Pi is the main hardware and will be connected to the relay and electrical appliance.

Below are several advantages comes with this model:
- Easy to use and understand
- Reduce overall project risk.
- Suitable for small and large project.
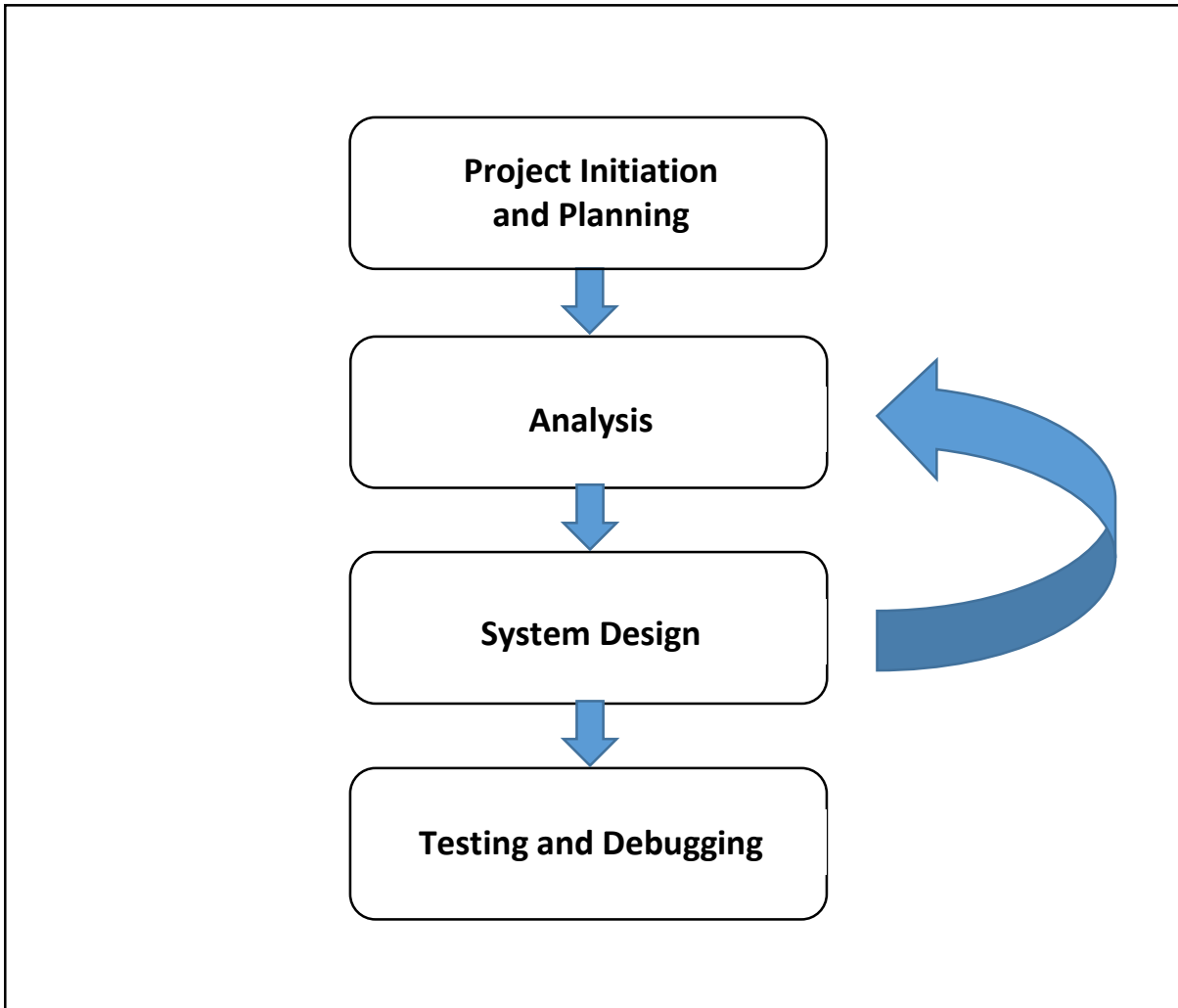- Increase quality of project.

Figure 3.1: RAD Cycle

3.2   PROJECT INITIATION AND PLANNING

This stage will be a meeting and discussion with potential customer and project developer, in order to know the requirement of this project and how to design the system. This discussion need to be carry on carefully in order to avoid misunderstanding during project development. During this stage, system developer will give the whole explanation to the potential customer.

3.3   ANALYSIS

This analysis phase will gather and define all the project requirement in a requirement specification document. It should be clear on what to develop by this time and the basic understanding about this project must be clearly understand. Automated House by Using Raspberry Pi is chosen because nowadays, everyone is talking about automated or smart house, even though the existing system may be very expensive to use. This kind of house is future proof and we are not going to eliminate the traditional method 100%, but this project is to improvise the traditional method. Yes we will still use all the traditional kind of switch when we still at home, but when we are away from home, this is when automated house system is being used.

The objective of this project need to be fix in order to make sure this project achieved the desired goals or else it will waste of energy, time and money. Need to keep in mind that this project may consume half of year in order to make it success. So, the objective of this project is to explore the concept of using Raspberry Pi itself, to develop an automated house and also help the house owner to monitor electrical appliance in their house.

Because of the some constraint available during this project development, project scope must be set. This project only have one target user which is house owner.

3.4   SYSTEM DESIGN

This design phase will defined all the functional and technical for this project. All the hardware and software that will be used must be set on this phase. So all the requirement set will be make sure to satisfy.

When starting this phase, in order to get the initial overview, we will start using the software. For this project, Raspbian will be used as operating system for Raspberry Pi and coding will be done on Leafpad, a notepad from Raspbian. Currently this software is a comprehensive for the designer that have many collection of tools that will help to create a variety of apps. This will be used to develop the interface and connect with the database. For this project, programming language that will be used is Python.

Figure 3.2 will show how the system will be done and how user will interact with it. By using this system, user will be able to control the electrical appliance.
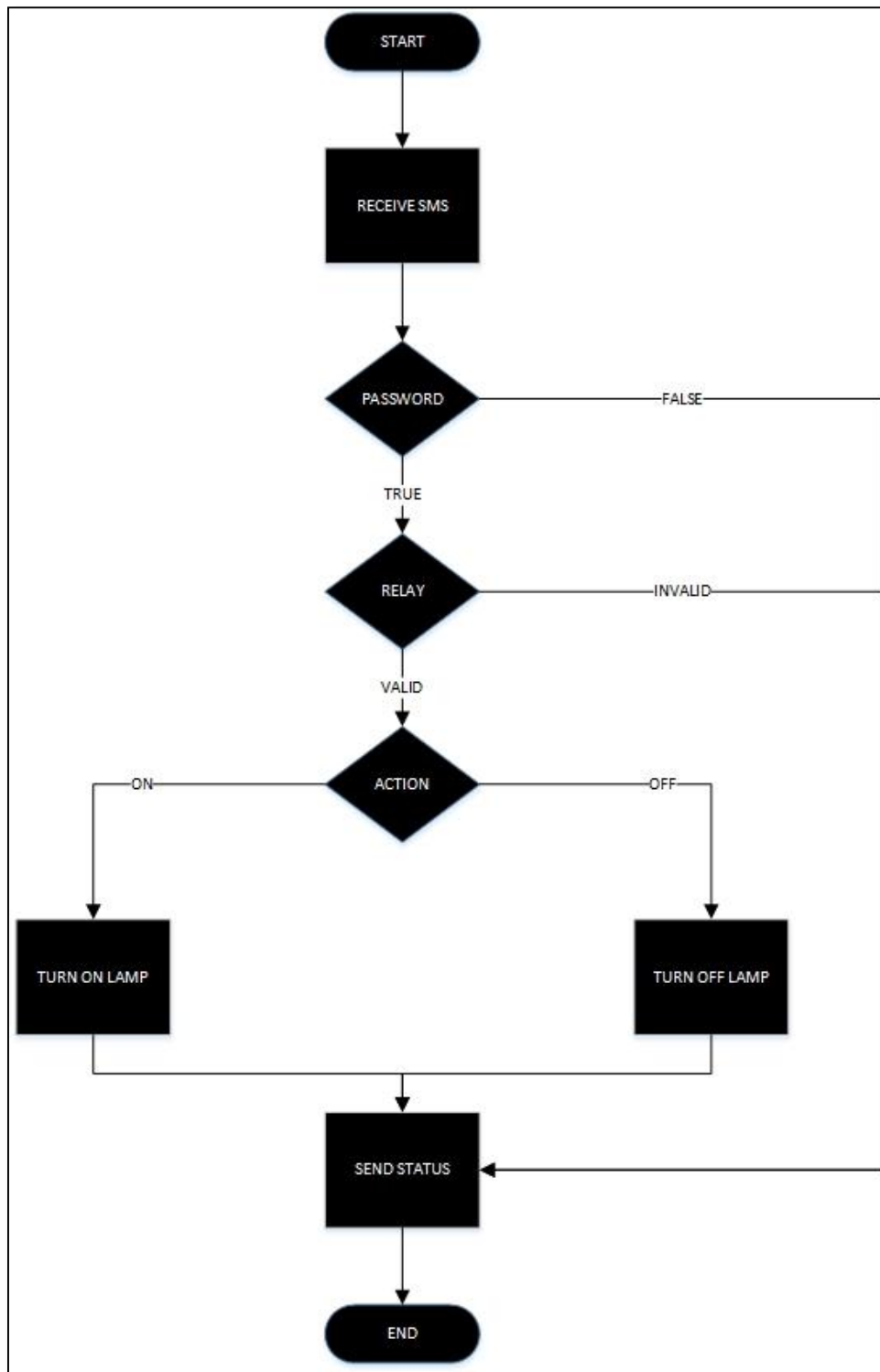
3.4.1 SYSTEM FLOW

Figure 3.2: System Flow

3.5   TESTING AND DEBUGGING

In this phase, all components must be ensured that they are error-free and meet all the requirement stated in the first step. There is one team called quality assurance team that will do several test cases in order to evaluate whether the product/project follow the requirement needed. Sometimes, this phase will also been called post implementation phase.

For this project, the software together with the Raspberry Pi need to be in correct order before it is going to the customer or house owner.

3.6 SOFTWARE AND HARDWARE REQUIRED

3.6.1 SOFTWARE

SOFTWARE	PURPOSE
Raspbian	Platform or OS for Raspberry Pi
Leafpad	Configure GPIO Port for the Raspberry Pi to be connected relay board
Microsoft Office	Documentation preparation
Foxit Reader	To read all the project related article
GSM Module API	Application needed by GSM Module to be connected with Raspberry Pi
Web Browser	To access the internet
Picocom	Access AT terminal from terminal.

Table 3.1: Software and Purposes