

Design and Development of a Wireless Controller Module  
(Smart Home Networking with Webcam CCTV Surveillance)

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For my lovely father and mother

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## ABSTRACT

Smart home networking with webcam CCTV surveillance is a wireless controller module of an embedded system. This project provides three important functions for home system which are controlling home appliances like lamps and fans, monitoring home surveillance and alert security as notification will be sent when sensor was detected an intruder. The different thing was implemented to this project by using a webcam to provide surveillance as a low cost CCTV. Wi-Fi has been used as the network medium as it will provide long range distance of controlling. Smart phone is used as a controller device since it became a requirement technology by people nowadays. The development of this system involved combination of three parts which are controller module, network system and controller device. For the controller device, an Android application has been developed by using MIT App Inventor for the purpose to make the system a user friendly. Router is the requirement for this system to establish the connection between the controller module and controller device. Besides that, Raspberry Pi B+ has been used as the controller module for this system. Then, the programming code is developed and it involved of a few types of languages such as JavaScript, Cascading Style Sheets (CSS) and HTML for developing web interface while Python programming is used for PIR sensor system. WebIOPi framework has been used to control GPIO and Motion framework is used to view video signal from camera. Ngrok software also has been applied to improve the connectivity. Smart home

networking with webcam CCTV surveillance is one of advance project because it provided the long range of remote control with enabling different networks to access on the system. However, the camera only can be viewed on light vision. Therefore, for the future improvement a lamp should be provided or a night vision sensor should be used to make the system function well in night vision.



## ABSTRAK

Rangkain rumah pintar dengan pengawasan CCTV webcam ialah modul pengawal tanpa wayar untuk sistem terbenam. Project ini telah menyediakan tiga fungsi penting untuk sistem rumah iaitu mengawal peralatan rumah seperti lampu dan kipas, pemantauan serta pengawasan rumah dan amaran keselamatan dimana mesej akan dihantar bila sensor telah mengesan sebarang penceroboh. Satu perbezaan telah diwujudkan dalam sistem ini iaitu menggunakan webcam sebagai alat untuk pengawasan yang murah. Wi-Fi telah digunakan sebagai medium rangkain kerana Wi-Fi akan menyediakan pengawalan untuk lingkungan jarak yang panjang. Telefon pintar telah digunakan sebagai alat pengawal memandangkan ia adalah satu keperluan teknologi untuk manusia zaman sekarang. Penghasilan sistem ini telah melibatkan gabungan tiga bahagian iaitu modul pengawal, sistem rangkaian dan alat pengawal. Untuk alat pengawal, satu aplikasi Android telah dihasilkan dengan menggunakan MIT App Inventor untuk tujuan membuatkan sistem ini lebih mesra pengguna. Router pula adalah satu keperluan untuk sistem ini menghasilkan sambungan diantara modul pengawal dan alat pengawal. Selain itu, Raspberry Pi B+ telah digunakan sebagai modul pengawal untuk sistem ini. Kemudian, kod program dihasilkan dengan melibatkan beberapa jenis bahasa seperti JavaScript, Cascading Style Sheets (CSS) dan HTML yang digunakan untuk menghasilkan permukaan web manakala program Python digunakan untuk sistem sensor PIR. Rangka kerja WebIOPi telah digunakan untuk mengawal pin GPIO dan

rangka kerja Motion digunakan untuk amaran video daripada kamera. Perisian Ngrok juga telah digunakan untuk meningkatkan sambungan. Rangkaian rumah pintar dengan pengawasan CCTV webcam adalah satu projek penambahbaikan kerana sistem ini telah menyediakan lingkungan yang panjang untuk kawalan jauh dengan perbezaan rangkaian untuk capai sistem ini. Walau bagaimana pun, kamera tidak boleh berfungsi pada waktu malam. Dengan itu, satu lampu perlu disediakan atau menggunakan sensor penglihatan malam untuk membuatkan sistem ini berfungsi pada waktu malam.

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## **CHAPTER 1**

### **INTRODUCTION**

This chapter will discuss briefly about the introduction of the project. It covered the background of the project, problem statement, objectives, scope of work and about report structure.

#### **1.1 Project Background**

Generally, this project is an embedded system design that functions as a controller. This controller will use android platform to develop the user interface software for controlling home appliances. Nowadays, because of the android development become as user friendly, it is interesting to apply it in home controller. This controller is a real-time controller, which is by using a wireless connection like Wi-Fi as a medium of the network. The home appliance like lamps, fans and camera CCTV will be controlled by using smart phones everywhere though users at the

office. By using Wi-Fi connection, user can control and check out their home condition in a wide range of distance. Moreover, this project will also use in helping the disable people and easier to control the home appliances. Raspberry Pi will be used as a module for this project. This system has mainly three components which are the android enabled user device, a Wi-Fi router having a good scalable range, and a raspberry pi board. This will improve the system popularity since there is no need for a wired connection. The instructions from the user will be transmitted through the Wi-Fi network. The raspberry pi board is configured according to the home system and it will enable the peripheral circuit as per user request.

## **1.2 Objectives**

- i. To design a home controller based on smart phone and Android application
- ii. To provide long distance remote access by using Wi-Fi as network medium
- iii. To monitor home surveillance with low cost CCTV and reduce power consumption
- iv. To provide remote accessing facilities in controlling home appliances which especially could help disabled & older people in their daily activities.

## **1.3 Problems Statement**

Nowadays, one of the more frightening and potentially dangerous crimes that can occur to a family is a home invasion robbery. A home invasion is when robbers force their way into an occupied home, apartment or hotel room to commit a robbery or other crimes. It is particularly frightening because it violates our private space and the one place that we think of as our sanctuary. In facts, due to working hours and unexpected jobs, people might not have time to check up their home condition. Sometimes, they forget to closed lamps or fans because of rushing to go work. This

project will help them to make sure their house in safe condition and also at the same time they can avoid in exceeding of electrical power usage.

Besides that, most people want a simple and easy life. Walking around to control the home appliance are trivial things for them. It is better to have a controller so that they can monitor the appliances from a long distance. But the important thing is we keep seeing the older peoples tired to walk or go up or down stairs just to turn off or turn on the home appliances examples like lamps and fans. From wasting their energy and afford by walking to control the home appliances, indeed this project will turn their difficulty into a convenient life. This project will help the people, especially the older and disabled people to control and monitor the home appliances from wirelessly.

#### **1.4 Scope of Work**

- Work performs in software and hardware.
- In software part, Android platform will be covered by using MIT App Inventor software and Raspbian OS will be used to configure the Raspberry Pi.
- Determine the connection between Android platform and controller via Wi-Fi.
- In hardware part, a raspberry Pi module will be used and circuits will be designed.
- Interfacing both software and hardware.
- Develop the prototype.

#### **1.5 Project Methodology**

This project is starting by reviewing on the previous projects. The information is analyzed and then tabulated the data in the form of a table. The critical review is done by analysis each paper and then comparing the getting information with the specification of the proposed project. Next, apply Android platform software

which is MIT App Inventor to develop User Interface (UI). Then, if the software has succeeded developed, go to the next process which is design the peripheral circuit. After that, the Raspberry Pi module needs to be configured so that the connection can be established. To configure the Raspberry Pi, the Raspbian OS software will be used. So, when the configuring part is done, the next process determines the connection between Android platform, controller and devices. Lastly, interfacing both software and hardware part and develop the suitable prototype.

## **1.6 Thesis Structure**

This thesis consists of five chapters. The following chapters are the outline of the implementation of this project.

Chapter I will discuss briefly the overview of this project such as introduction, objectives, problem statements, scope of work, and methodologies.

Chapter II contains the research and information about the project on several important concepts of smart home, Android application and software used in the study. Every facts and information, which found through journals or other references, will be gathered and compared and lastly the better methods have been chosen for the project.

Chapter III includes the details about designing and modelling the Android interface and wireless connection using Wi-Fi. All these methodologies that highlighted will be applied to get better performance.

Chapter IV describes more about the discussion and project findings. The result is then presented in figures and graphs. Simulation results, analysis, observation and discussion of the result will be described.

Chapter V discusses about the conclusion of the project and the future recommendations for the next generation.