UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DEVELOPMENT OF SURVEILLANCE SYSTEM USING RASPBERRY PI

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electronic Engineering Technology (Industrial Electronic) (Hons.)

by

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I hereby, declared this report entitled "Development of Surveillance System Using Raspberry Pi" is the results of my own research except as cited in references.

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APPROVAL

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

…………………………

(En. Ahmad Fairuz Bin Muhammad Amin)

ABSTRAK

Sistem pengawasan kamera telah wujud sejak tahun 1942 di Jerman. Para saintis Jerman telah menghasilkan televisyen litar tertutup atau cctv (closed circuit television) untuk memantau atau menyaksikan pelancaran roket V2. Pada hari ini kita dapat lihat bahawa teknologi televisyen litar tertutup ini makin berkembang dengan pesat mengikut peredaran masa. Hal ini terbukti apabila terdapat pelbagai jenis televisyen litar tertutup dan fungsi spesifik yang boleh didapati dengan mudah di kedai. Namun demikian, nilai yang ditawarkan oleh peniaga adalah tinggi dan tidak fleksibel kepada pengguna. Sistem pengawasan rumah dengan menggunakan televisyen litar tertutup sangat penting dalam gaya hidup hari ini bagi memastikan persekitaran yang selamat. Projek ini mencadangkan sebuah sistem dimana sensor sinaran inframerah pasif digunakan untuk mengesan kehadiran individu dan menghantar imej individu tersebut kepada pengguna melalui email. Pengguna juga dapat menonton secara live streaming keadaan sebenar melalui televisyen litar tertutup. Sistem pengawasan televisyen litar tertutup ini menggunakan Raspberry Pi 3 model B sebagai pengawal utama sistem. Sistem juga akan mengaktifkan penggera sekiranya sensor aktif. Sistem ini juga menggunakan motor servo dimana motor servo ini akan berputar sehingga 180 darjah untuk mengesan pergerakan individu tersebut. Apabila pengguna menerima email dari Raspberry Pi 3, pengguna telah dimaklumkan bahawa persikataran kediaman tidak selamat. Maka, dengan ini pengguna harus bertindak cepat dengan memaklumkan kepada pihak berkuasa bahawa kediaman telah diceroboh. Secara kesimpulannya, projek ini menawarkan sistem yang mudah dan berfaedah untuk digunakan kepada pengguna.

ABSTRACT

Camera surveillance system has been around since 1942 in Germany. The German scientist has produced closed-circuit television or CCTV (closed circuit television) to monitor or watch the launch of V2 rockets. Today we can see that the closed-circuit television technology is growing rapidly with time. This is the evident when there are multiple types of closed circuit television and a specific function that can be easily found in shops. However, the values offered by traders were high and inflexible to consumers. Home surveillance system by using closed circuit television is very important in today's lifestyle to ensure a safe environment. This project proposes a system in which the passive infrared radiation sensor is used to detect the presence of people and send individual images to users via email. Users can also watch live streaming the actual situation through closed circuit television. Closed-circuit television surveillance system is using the Raspberry Pi system 3 model B as the main controller. The system will also activate an alarm if the sensor is active. The system also uses the servo motor where it will rotate up to 180 degrees when detects any individual movement. When a user receives an email from the Raspberry Pi 3, the user has been informed that the residence environment unsafe. So, with these system consumers must act quickly to alert the authorities that the residence was invaded. In conclusion, this project offers a convenient and beneficial system to use for consumer.

DEDICATION

To my beloved parents, Abd Rahman Bin Yunus,
and Robiah Binti Matt

ACKNOWLEDGEMENT

Bismillahirrahmanirahim,

Alhamdulillah, thanks to Allah SWT, whom with His willing give me opportunity to complete this final year project which is title Development of Surveillance System using Raspberry Pi. This final year project would have not been carried successfully without the cooperation from many parties who contributes in preparing and helping in order to complete the thesis.

My sincere thanks I dedicate to my understanding supervisor En. Ahmad Fairuz Bin Muhammad Amin for his invaluable guidance, ideas, constant encouragement and continuous support during completing the thesis. Without his commitment, the thesis might unable to complete and function properly.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

CCTV	-	Closed Circuit Television
IoT	-	Internet of Things
RPi	-	Raspberry Pi
PIR	-	Passive Infrared Sensor
LED	-	Light Emitting Diode
PIC	-	Peripheral Interface Controller
GSM	-	Global System for Mobile
SMS	-	Short Message Service
RISC	-	Reduced Instruction Set Computer
CMOS	-	Complementary Metal-Oxide Semiconductor
MCU	-	Multipoint Control Unit
bps	-	bits per second
UART	-	Universal Asynchronous Receiver Transmitter
AT	-	ATtention
2G	-	Second Generation
3G	-	Third Generation
SD	-	Secure Digital
IDE	-	Integrated Development Environment
RTC	-	Real Time Clock
USB	-	Universal Serial Bus
VNC	-	Virtual Network Computing
OS	-	Operating System
C	-	Compile (C programming)
OpenCV	-	Open Source Computer Version
HTML	-	Hypertext Markup Language
IP	-	Internet Protocol
WEB	-	World Wide Web (www also known as web)
IR	-	Infrared Receiver

LAN	-	Local Area Network
ARM	-	Advanced RISC Machines
MHz	-	Mega Hertz
GPU	-	Graphic Processing Unit
RAM	-	Random Access Memory
GPIO	-	General Purpose Input Output
V	-	Voltage
A	-	Ampere
GB	-	Gigabit
SDRAM	-	Synchronous Dynamic Random Access Memory
I/O	-	Input/Output
+V	-	Positive Voltage
+	-	Positive
–	-	Negative
GND	-	Ground
H	-	High
L	-	Low
g	-	gram
mm	-	millimetre
kgf.cm	-	kilogram-force centimeter
s	-	second
µs	-	micro second
~	-	approximate
°C	-	Degree Celcius
MP	-	Mega Pixel
HD	-	High Definition
AVI	-	Audio Video Interleave
Windows XP	-	Windows eXperience
BMP	-	bitmap
JGP	-	Joint Photographic Expert Group
W	-	Watt
nm	-	nanometre
UNIX	-	Uniplexed Information and Computing Service

SSH	-	Secure SHell
ZIP	-	Compressed Folder
PCB	-	Printed Circuit Board
GUI	-	Graphic User Interface
Wi-Fi	-	Wireless Fidelity

CHAPTER 1
INTRODUCTION

1.0   Introduction

This section consist of the project background, problem statement, objective, work scope and thesis outline.

1.1   Project Background

Nowadays, the system of home security turns into a requirement with the increasing cases of home breaking or thievery cases. Years ago, the traditional home surveillance systems have obtained much demand. As time passes, the technology of traditional home surveillance systems has evolved and offers many exciting benefits to the user. Home surveillance security system is a smart method for controlling and observing at home by utilizing information technology. Hence, the Internet of Things (IoT) have become more familiar with these devices and services which are being used to control the recent home surveillance security Therefore, this project is developed using a Raspberry Pi 3 Model B, (RPi3) based image capturing alarm system. The intruder is detected using PIR sensor. The changes in voltage are checked by the sensor. At the point when an intrusion happens, the presence of an intruder will be detected by the developed system and an image of an intruder will be

captured simultaneously. From there on, an email will be sent to the user with the captured image as an attachment. The link of live streaming also will be provided in the mail for user. Meanwhile, an LED will be turned on simultaneously in this developed system. Not only that, this system will also trigger an alarm sound to alert the house neighborhood using a buzzer. The system will assist the house owner to make a report to authorized party with the intruder's image as evidence. In this era of technology, exploration towards a product that costs reasonable price and capable of solving ideas is increasing. A small embedded microcontroller with a flexible platform utilization of the hardware projects is known as the Raspberry Pi. Raspberry Pi is a card-sized minicomputer that can either operate on mains or battery power. It has Linux as its operating system.

1.2   Problem statement

Burglary crime rate is increasing from year to year, especially during the festive season. The temporarily abandoned house without presence of security guard will be target of the robbers. In addition, the residential area that away from the main route will ease the work of burglary. The percentages of homes that are not equipped with security cameras monitoring have a higher risk of burglary than households equipped with security camera surveillance. Normally, the house that is not equipped with surveillance security camera unable to track the robbers because there is no evidence available during burglary occurs. Another problem encountered is that homeowners do not know the security level of their home when the homeowner is not at home. Homeowners also unable monitor the situation around the house. Therefore, the existence of this system at home, homeowners can monitor the condition of the house anytime and anywhere. The system is able to increase the level of safety of homeowners since it will alert surrounding if there is burglary. The system also will capture the image of bugler and send to homeowner email. The image can be used as evidence to lodge police report.

1.3   Objectives

The objectives of the project are:

i.   To alert user if there is burglary occur at their house through email notification

ii.   To help user to identify the level security in their home all time during the absence of the user anytime and everywhere.

iii. To provide user live streaming of their house condition.

1.4   Work Scope

The work scope of this system created for residential areas. This project will benefits consumer especially during the festive season where the consumer is not at home for a period of time. This project is mainly focus on monitoring house surrounding by using Raspberry Pi. The project used Raspberry Pi 3 Model B as main brain of the system. The PIR sensor will be the input of the system which detects the presence of burglary and the output will be buzzer and email notification. The Raspberry Pi will be programmed python language as a server in this system. The servo motor reads input from PIR sensor. Since the system using two PIR sensor and will be placed at different direction, the servo motor will rotate to which sensor that have been activated first. The image of burglary will be captured and send through email. The homeowner also able to watch live streaming by click at the link that have be provided in the email. Both software and hardware component integrated together.

1.5   Thesis Outline

In this thesis, it is divided into three sections namely Chapters 1, Chapter 2, and Chapter 3. The Chapter 1 will elaborate more about project background, problem statements, objectives, and work scope.

The Chapter 2 consists of a literature review. Literature review will discuss and compare about the past research that related with surveillance system. The different types of surveillance system will also be discussed in Chapter 2.

The Chapter 3 consists of methodology of the project. In this chapter will explain the programming and component used with specification. This part will show the flow of completing the project.

CHAPTER 2
LITERITURE REVIEW

2.0   Introduction

This section basically study on the past research that related to the project. This part will compare the different main brain of the surveillance system and decide which is better. The purpose of this section is to gain more information, knowledge and skill to develop the project.

2.1   Home Surveillance Security System

Recently, the necessity of home surveillance security system is turning out to be extremely important and it is oftentimes utilized in the house or residence, business firms, offices, and also for traffic monitoring systems (Munoz-Ferreras et al. 2008). The purpose of home surveillance security system is essentially used to screen the activities, behavior or other changes in information in order to manage or protect personal belongings. These days, this surveillance system is being installed at home to monitor and avoid any unwanted activities to occur (Nguyen et al. 2013). Thus, the owner can quickly take necessary actions in case of any aggravations (Hariprakash et al. 2008).

2.2   Related Research

The research that related with proposed project title has been done to compare the advantages and disadvantages for the project. With the research on past project, project weakness can be determined and the system design of existing project can be review as references. This related research help to achieve the objective of the project.

2.2.1   Research on Surveillance System Using PIC Controller

In this project, researcher has developed a smart surveillance system using PIC16F877A as the fundamental microcontroller. For a movement detector, the PIR sensor was used and sensor will detect movement in a specific interval of time to see how many intruders. Researcher use GSM Modem to send SMS to homeowner. Once the system has been activated, the image of intruder will be recorded by camera. This highly reactive approach has low computational requirement (M.Sathishkumar & S.Rajini 2015). Figure show system architecture of the Smart Surveillance System using PIR Sensor Network and GSM.
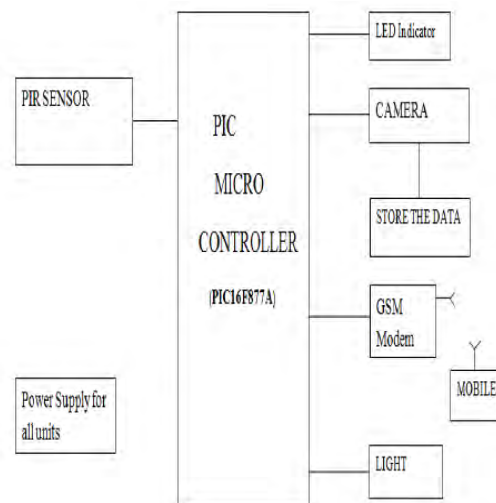

Figure 2.0: System architecture.

(Source: http://ijarcet.org/wp-content/uploads/IJARCET-VOL-4-ISSUE-1-70-74.pdf)

Researcher has used PIC microcontroller because PIC is the first RISC based microcontroller fabricated in CMOS. Both combination of RISC and CMOS makes low power consumption in small chip size. CMOS also immune to noise compared with other. The PIC16F877 is flash technology and the data is retained even power is switched off.
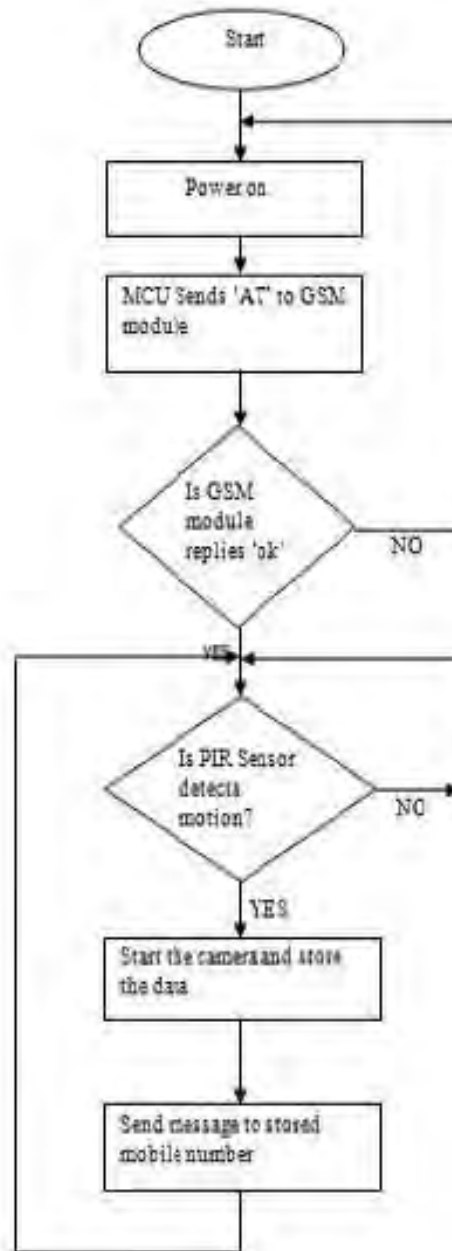

Figure 2.1: Flowchart representation.
(Source: http://ijarcet.org/wp-content/uploads/IJARCET-VOL-4-ISSUE-1-70-74.pdf)