Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF IOT BASED SMART PARCEL RECEIVER

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Bachelor of Computer Engineering Technology (Computer Systems) with Honours

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A project report submitted
in partial fulfillment of the requirements for the degree of
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Sesi Pengajian : 2020/2021

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DEDICATION

I would like to dedicate this project to my beloved family who have never failed to give me support and motivation all the time during the development of the project. Also, I would like to dedicate this project to the lecturers and friends who guided and encouraged me until the project is successfully completed.

ABSTRACT

This project is proposed to develop an IoT based smart parcel receiver which is able to provide a guarantee of safety to the parcel. This development is mainly focused on building a system at a low cost and to fulfil the objectives. The proposed system is based on Arduino UNO microcontroller with a group of hardware components such as ESP32-CAM module, microwave radar motion sensor, IR sensor and Blynk application in achieving the goals in monitoring and tracking of the parcel. Apart from that, the use of solenoid door lock and RFID reader are able to ensure that the access of collection slot is only limited to the user. This system works when there is motion detected that is moving around the parcel receiver, the signal received by the microwave radar motion sensor will then be sent to the ESP32-CAM, and the alert notification will be sent to the user via Blynk application. The appearance can be streamed and captured by the user in the application. At the internal side of the receiver box, the IR sensor is will detect the presence of parcel and a notification will be sent to the user through Blynk application. At the collection slot, the parcel receiver is kept in a locked state by the solenoid door lock and any unauthorized access is prohibited. The ID of the tag or card will be read by the RFID reader and the authoritative will be identified. The solenoid door lock can only be unlocked by using the authorized RFID. Furthermore, to increase the conveniency, the solenoid door lock can also be unlocked using the Blynk application whenever the RFID is not with the user.

ABSTRAK

Projek ini dicadangkan untuk menghasilkan sebuah penerima bungkusan pintar berdasarkan Internet untuk segalanya (IoT) yang dapat memastikan keselamatan terhadap bungkusan serta penggunanya. Penghasilan ini memfokuskan pembinaan sebuah system yang rendah dalam kos dan dapat merealisasikan ojektifnya. System yang dicadang ini berdasarkan mikropengawal Arduino UNO dengan kumpulan perkakasan seperti modul ESP32-CAM, sensor radar gerakan gelombang mikro, sensor inframerah, dan aplikasi Blynk. Selain itu, penggunaan selak soleniod serta alat pembaca RFID dapat memastikan pembukaan slot pengumpul hanya terhad kepada pengguna sahaja. System ini berfungsi ketika gerakan yang di sekeliling kotak penerima bungkusan dikesan, isyarat tersebut yang diterima oleh sensor radar gerakan mikro gelombang akan dihantar ke ESP32-CAM, dan pesanan amaran akan dihantar kepada pengguna melalui aplikasi Blynk. Rakaman dapat disiar dan ditangkap oleh pengguna di dalam aplikasi tersebut. Di bahagian dalaman kotak penerima bungkusan, sensor inframerah akan mengesan kemunculan bungkusan dan satu pesanan akan dihantar kepada pengunna melalui aplikasi Blynk. Pada slot pengumpul, penerima bungkusan akan dikekal dalam keadaan dikunci oleh selak solenoid dan sebarang pengaksesan yang tidak diberi kuasa adalah dihalangkan. ID daripada tag atau kad akan dibaca oleh alat pembaca RFID dan pemberian-kuasaan tersebut akan dikenalpasti. Selak solenoid dapat dibuka hanya dengan ID yang diberi kuasaan.Tambahan pula, untuk menambahkan kemudahan, selak solenoid juga dapat dibuka dengan aplikasi Blynk apabila RFID tidak berada dengan pengguna.

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First and foremost, I would like to grab this chance to convey my thankfulness to all wonderful people around me who always radiating good vibes and giving me support, guidance, knowledge, and tender along this project until the completion.

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Last but not least, I would also like to express my deepest appreciation to my family members for their love and support during the period of my study. Not forgetting all the lecturers and staffs at the faculty, fellow friends, as well as other individuals who are not listed here for giving me motivation and support from every aspect.

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LIST OF ABBREVIATIONS

ESP	Espressif System
IoT	Internet of Things
RFID	Radio Frequency Identification
GSM	Global System for Mobile Communication
PIR	Passive Infrared
SMS	Short Message Service
RTC	Realtime Clock
LCD	Liquid Crystal Display
MIT	Massachusetts Institute of Technology
SOC	System-On-Chip
IP	Internet Protocol
SD	Secure Digital
Wi-Fi	Wireless Fidelity
Open-CV	Open Source Computer Vision Library
ATM	Automatic Teller Machines
GUI	Graphical User Interface
NodeMCU	Node MicroController Unit
USB	Universal Serial Bus
LED	Light Emitting Diode
IR	Infrared

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CHAPTER 1

INTRODUCTION

1.1 Background

In this era of digitalization, online shopping has become a new trend among most people, especially the young generation. People tend to purchase goods from online and wait for the items to be received without getting out from home. However, the delivery of parcel requires a recipient at home so that the parcel can be received in a safe condition. If there is nobody at home, it will cause inconvenience for the individual as the parcel would not be able to deliver successfully. Other than that, dropping parcel at an unsecured area, such as doorway or car porch will also expose the security risk of the parcel that it may be damaged or stolen easily. Hence, a secured parcel receiver would be a necessity in receiving and sheltering the parcel.

1.2 Problem Statement

The parcels often being delivered during office hours while people are out for work or class. Generally, the parcel will be returned to the courier office if there is no recipient at home. This causes inconvenience for them to request for the second delivery or pick up the parcel at the courier office. There are also some couriers that simply drop the parcel in front of the house to avoid the process of returning the parcel to the courier office. Nevertheless, this will expose the parcel to a security risk as it is unprotected from being damaged or stolen by others. In addition, a parcel receiver with low security level, whether it is unlocked or locked with simple locker may also unprotected from being opened or damaged, causing the parcel to be stolen.

1.3 Research Objective

The objectives of this project are:

1. To develop an IoT based smart parcel receiver system using Arduino UNO microcontroller.
2. To monitor the parcel receiver using ESP32-CAM module and Blynk app.
3. To analyse the performance of the developed system towards parcel receiver using IoT.

1.4 Scope of Project

The scope of this project is mainly focus on the utilization of Arduino UNO microcontroller in controlling all the elements using in this project. The parcel receiver is monitored by using the ESP32-CAM module with microwave radar motion sensor and Blynk app. This monitoring system is used to detect and record the appearance in front of the parcel receiver when there is somebody comes near around it. Besides, whenever the parcel is detected by the infrared sensor inside the receiver box, the user will get a notification via Blynk app. In addition, the collection slot of the parcel receiver is locked by a solenoid lock with RFID authorization to increase the security level and prevent it to be opened by the outsiders.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The system used in this research can be mainly divided into two categories, which is security monitoring system and security lock system. The monitoring system is used as a security camera and sensors to monitor the parcel receiver to guarantee the safety of the parcel receiver from any prank actions and damages, while the internal side of the parcel receiver is used to detect the presence of parcel and notify to the user. The security lock system used in this research is to lock the collection slot of the receiver box and protect the parcel from being stolen by any outsiders. Based on the techniques nowadays, there are many types of smart security monitoring system are introduced whether commercially or self-made that seems effective and handy. Generally, this kind of system requires different types of elements blended with some related techniques to produce different kind of operations that suitable for the respective environment or budget.

2.2 Literature Reviews of Existing Security Monitoring System

In this chapter, the techniques used in the existing security monitoring system will be reviewed. Those existing techniques will also be compared in this chapter. Besides, the advantages and disadvantages of the discovered techniques will also be discussed. In short, the existing techniques of the monitoring system will be explored theoretically and methodologically.

2.2.1 Security System using Motion Detector with Communication (GSM) Module

This technique is used to detect moving object and send a notification to alert the user. As the presence of human is detected by the motion detector sensor, the security alert is triggered and will send a notification such as SMS or email to the user through GSM (Global System for Mobile communications) module. (S., 2018) (Darmawan & Taufan, 2019)

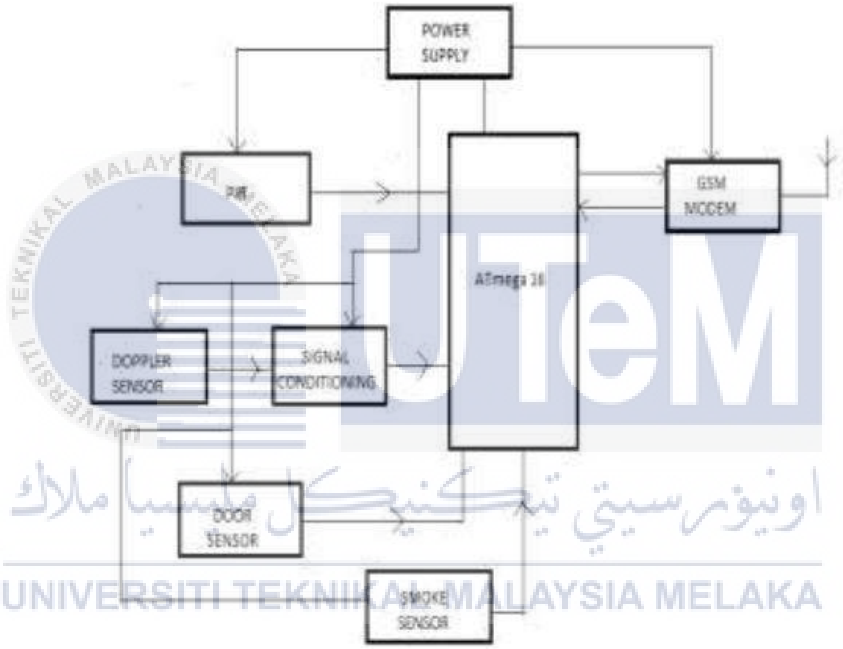

Figure 2.1: Block diagram of the hybrid security system

Source: (S., 2018)

This kind of technique can be used in home, business firm or any places that attempted to improve the security levels and prevent from any malicious attacks. This security system is controlled by ATmega16 microcontroller and GSM sim900 module with sensors such as PIR sensor in detecting human movement, and doppler sensor in detecting the velocity of the object at a distance. The other sensors such as door sensor which is a switch that senses the position of door whether it is opened or closed, and

gas sensor that senses any harmful gas leakage to trigger the buzzer. Once the security system is triggered, the GSM module will alert the user by sending an SMS or call to the saved contacts. (S., 2018)

During 2019, a study has developed a space security system which detects human movement in the shop, warehouse, and cashier slot when it is outside the operating hours. This security system using the hardware including Arduino UNO microcontroller which used to control the system, GSM Sim900A module to send SMS notification, and Realtime Clock (RTC) in measuring the time. By using the predetermined real time clock state using fuzzy logic algorithm, the alarm and the SMS notification will be operated when there is motion detected from the PIR sensors during non-operating hours. Besides, the magnetic switch is used to detect the door whether it is opened or closed. The 2x16 LCD keypad is used to key in the door password and buzzer to emit a sound as the security system is triggered. (Darmawan & Taufan, 2019)

Figure 2.2: Operation of space security system in a shop

Source: (Darmawan & Taufan, 2019)

2.2.2 Security System using Web Camera and Sensor with Mobile Application

This technique is a technique that used to develop a smart surveillance system with the combination technology of sensor and web camera with mobile application. It is a low-cost High-Definition security surveillance system which is controlled by the AT89S52 microcontroller. The PIR motion sensor is used to detect if there is any movement at a certain area, while the D-Link DCS930L web camera will record the footage of the movement and send to the Android application which is developed using MIT's App Inventor. (Rushambwa, Chamunorwa, & Nyachionjeka, 2016)

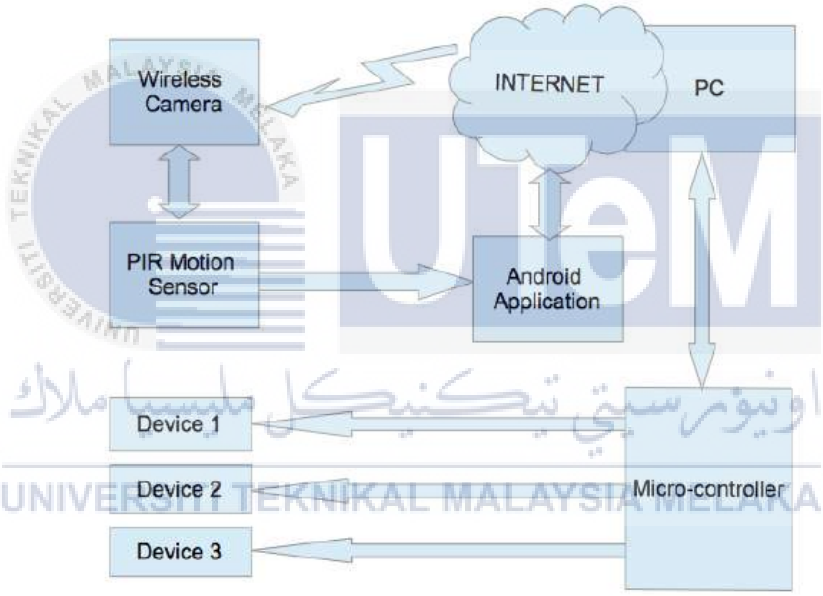

Figure 2.3: Block diagram of the web camera surveillance system

Source: (Rushambwa et al., 2016)

According to a study (Taryudi, Adriano, & Ciptoning Budi, 2018), the security system uses the hardware such as Quectel M33 web camera, GSM module and Blynk app which is controlled by the microcontroller AT89C52 with RFID (Radio Frequency Identification). This system uses an RFID tag to activate the keypad to read the correct password and open the door lock. The Blynk app is used to receive and display the data

of the sensor. If the password is incorrect, the buzzer will be triggered and an email notification will be sent to the user through the GSM module. The alert notification and video recorded by the web camera will also be sent when there is movement detected by the PIR sensor. When a notification about fire detected is received, user is able to control the solenoid valve through the smart phone. Apart from that, whenever there is rain or light detected, the notification will also be sent to the user.

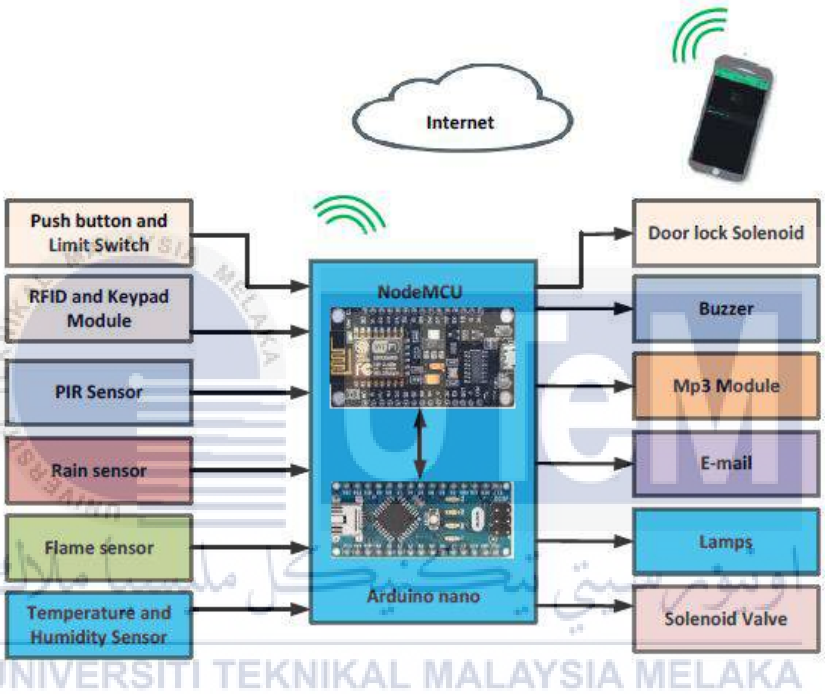

Figure 2.4: System architecture of the home security and monitoring system

Source: (Taryudi et al., 2018)

2.2.3 Surveillance System Using System-On-Chip Technology

This technique uses the “System-On-Chip” technology which is the Raspberry Pi module as the base of the development for the IoT application. It is an IP-based system that able to capture image, provide live video feed send notification and access through android device at the same time. According to a research paper (Gujral &