UNIVERSITI TEKNIKAL MALAYSIA MELAKA

VOICE RECOGNITION WIRELESS HOME AUTOMATION & SENSOR MONITORING SYSTEM BASED ON BLUETOOTH

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours.

by

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Tajuk: **VOICE RECOGNITION WIRELESS HOME AUTOMATION & SENSOR MONITORING SYSTEM BASED ON BLUETOOTH**

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Industrial Automation & Robotics) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Sistem Automasi Rumah (SAR) adalah salah satu teknologi terkenal dengan menyediakan pelbagai ciri kawalan pada masa kini. Diikuti dengan kebangkitan teknologi, aplikasi rumah menjadi lebih fungsionalistik dan manusia dapat menikmati kehidupan yang selesa dan berteknologi tinggi dengan hanya memberikan arahan suara untuk mengawal semua peralatan elektrik rumah. Tujuan membuat projek ini adalah untuk membangunkan automasi rumah yang mudah dikawal, kos murah dan mesra pengguna. Mikrokontroler Arduino Mega digunakan dalam projek ini sebagai medium untuk melaksanakan tugas. Ia juga bertindak sebagai pemproses kerana ia terdiri daripada ingatan dan kebolehan dalam decode dan melaksanakan arahan. Modul Bluetooth HC05 digunakan untuk menerima dan menghantar isyarat dari Android App Bluetooth telefon pintar manakala telefon pintar Android digunakan oleh pengguna untuk memberikan arahan suara. Modul Bluetooth digunakan sebagai peranti komunikasi di antara telefon pintar Android dan Arduino Mega untuk mengawal peralatan elektrik. Aplikasi Bluetooth perlu dilatih terlebih dahulu supaya ia dapat menyimpan suara atau aksen pengguna. Perintah suara yang diterima oleh Bluetooth App kemudiannya akan mengenali suara pengguna. Setelah pengiktirafan suara, mikrokontroler akan mengendalikan relay sama ada ON atau OFF dan notis pemberitahuan akan dihantar melalui SMS kepada pengguna apabila terdapat asap atau kebocoran gas yang dikesan. Lebih-lebih lagi, rak pakaian akan secara automatik gerak balik apabila terdapat titisan hujan dikesan oleh pengesan hujan. Dengan menyediakan sistem ini, pengguna tidak perlu berjalan-jalan ke bahagian dinding rumah yang berbeza untuk menyalakan lampu dan sebagainya. Paling penting dari semua, pengguna boleh mengelakkan atau mengurangkan peratusan kerosakan aplikasi rumah mereka. Oleh itu, kehidupan pengguna menjadi lebih mudah dan lebih cekap. Menjelang akhir projek ini, pengiktirafan suara automasi rumah tanpa wayar dan sistem pemantauan sensor berdasarkan Bluetooth telah berjaya dibangunkan.

ABSTRACT

Home Automation System (HAS) is one of the famous technologies with providing various control feature nowadays. Followed to the rise of technology, houses application became more functionalization and human were able to enjoy a comfortable and high-tech life with only giving a voice command to controls all the home electrical appliances. The purpose of making this project is to develop a simple, low-cost and user-friendly home automation. Arduino Mega microcontroller is used in this project as a medium to perform a task. It also acts as a processor because it consists of memory and ability in decode and execute a command. Bluetooth module HC05 is used for receiving and transmitting signal from Bluetooth App of Android smartphone while the Android smartphone is used by user for giving a voice command. Bluetooth module is used as a communication device in between Android smartphone and Arduino Mega to control the electrical appliances. The Bluetooth App needs to be train at a very first so that it able to store up user's voice or accent. The voice command received by the Bluetooth App will then recognize user's voice. Once the voice match, microcontroller will operate the relay either ON or OFF and the alert notification will be sent via SMS to the user when there is smoke or gas leakage detected. Moreover, clothes rack will automatically take back when there is raindrop sense by the raindrops detector. By providing this system, user will not need to walk around to switching lamp and more. Most important of all, user can avoid or reduce the percentage of damage of their home application. Therefore, user's life being easier and more efficient. By the end of this project, voice recognition wireless home automation and sensor monitoring system based on Bluetooth was successfully developed.

DEDICATION

To my beloved parents, I acknowledge my sincere indebtedness and gratitude to them for their love, dream and sacrifice throughout my life. Their sacrifice had inspired me from the day I learned how to read and write until what I have become now. I cannot find the appropriate words that could properly describe my appreciation for their devotion, support and faith in my ability to achieve my dreams.

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I would like to express my special thanks to my supervisor, TS. Madiha Binti Zahari who gave me the golden opportunity, encouragement, guidance, and advice to do this project on the topic of voice recognition wireless home automation & sensor monitoring system based on Bluetooth. Besides that, she also helps me in doing a lot of research and I came to know about many new things. This project report might be impossible to complete without her help. Last but not least, thank you to everyone those directly and indirectly involved in helping me finishing this Final Year Project report. Thank you very much.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

API	-	Application Program Interface
CO	-	Carbon Dioxide
CPU	-	Central Processing Unit
DC	-	Direct Current
EEPROM	-	Electrically Erasable Programmable Read-only Memory
GHz		Giga Hertz
GND		Ground
GSM/ GPRS	-	Global System for Mobile/ General Packet Radio Service
HAS	-	Home Automation System
I/O		Input/ Output
I2C	-	Protocol for two-wire interface to connect low-speed devices
IDE	-	Integrated Development Environment
iOS	-	internet Operating System
IoT	-	Internet of Thing
IR sensor	-	Infrared sensor
LCD		Liquid Crystal Display
LED	-	Light-emitting diode
LPG	-	Liquefied Petroleum Gas
PIR sensor	-	Passive Infrared sensor
PPM	-	Parts per million
PWM	-	Pulse-width modulation
RF	-	Radio-frequency

RX	-	Receive
SMS	-	Short Message Service
SPRAM	-	Spin-Transfer Torque RAM
TX	-	Transmit
UART	-	Universal Asynchronous Receiver Transmitter
USB	-	Universal Serial Bus
VCC		Voltage at the Common Collector
Wi-Fi	-	Wireless Fidelity

CHAPTER 1

INTRODUCTION

1.0 Introduction

Home Automation System (HAS) is a system which it can manipulate any electrical device without manually control. There are some of the popular speech recognition application such as Amazon Echo, Google Home and Apple's SIRI as suggested in (Started, 2019). The main purpose of HAS is lead to energy efficiency saving and provide better quality of life. This system is benefit to the elderly and for inconvenient walking people with just using a simple voice command to operate any electrical home appliances. Besides, it also can reduce the amount of remote control, where only one controller needed by the way to control all electrical home appliances.

A Home Automation System (HAS) also relate to the intelligent home appliances, accommodation equipped with network communication, sensory device communicates with the environment and application which able to monitor and control according to the user needs. The wireless HAS is useful to the user as it is able to be control not only in the house, it also able to be control at a far distance. When there is any problem sense by the sensor, the system can either solve it automatically or control by the user according to the instruction being set.

There are variety of wireless communication techniques provided in HAS such as Bluetooth, GSM, Wi-Fi, ZigBee and so on. The HAS is expected to be increased due to the advance features offered in market such as ability in providing information, news, weather, playing music, calling, messaging and more. Apart from this, some home automation system only available in certain countries. For example: Australia, Canada,

France, Germany, United Kingdom and United State. According to global market research (Control, 2019), United State exhibit majority of people use Home Automation System (HAS) with the earning at about USD39.93 Billion in 2016 and forecast will continue to rise in the future.

1.1 Project Background

This project presents the implementation of the prototype of voice recognition wireless home automation and sensor monitoring system based on Bluetooth. Android smartphone is act as a receiver and converter where it Bluetooth feature inside the phone receives the voice command from the user then transmit it into wave form signal to HC-05 Bluetooth module. The Bluetooth module is then converting the signal into nearest matching words or text which have stored in user's google to Arduino MEGA 2560 microcontroller board. Arduino MEGA 2560 microcontroller will then receive the text from Bluetooth module and matching the text to the setup coding. A relay is an electromagnetic switch. It is operating either ON or OFF the appliances according to the signal supplied from the Arduino microcontroller.

GSM SIM900A module is used in this project for alternative alert notification function because Bluetooth cover area is too limited and user cannot get alert if they are not around home. GSM SIM900A module will be used as a media to automatically send Short Message Service (SMS) to user's smartphone. The alert notification will send to the user by SMS when gas leakage detected by MQ-2 gas sensor. The message is set so that the alert notification can be receive by the user at workplaces. Moreover, the clothes horse is set so that can automatically move back when there are raindrops sense by the raindrops detector and low light intensity sense by Light Dependent Resistor (LDR). The clothes horse will then move out in vice versa.

1.2 Problem Statement

Automated and sensor monitoring system are important by the way to give alert notification to the user when there is any gas leakage detected. Instead of it, user may control any home application with only giving a voice command via smartphone without walks around the house. This system not only can make human life become more easier; their life also being protected.

There are many types of home automation system sale in the market but the price is too expensive and some of the application are not available to be use in our country, Malaysia. Moreover, if only if there is system failure, user cannot maintain it by their own and need to pay another maintenance fee.

Besides that, user will hang out the clothes early in the morning before going to work. Therefore, it is unnecessary for them to return home in working hours. The smart clothes horse is benefit to user as it can automated move by its own. Raindrop detector, LDR sensor and limit switch is used to set the condition so that the clothes horse can move in and move out according to the situation.

1.3 Objective

The objective of this project:

i. To construct a simple and low-cost automated and sensor monitoring system using voice recognition via Android smartphone.
ii. To develop a user-friendly home application system.
iii. To analyse the performance of Home Automation System (HAS).