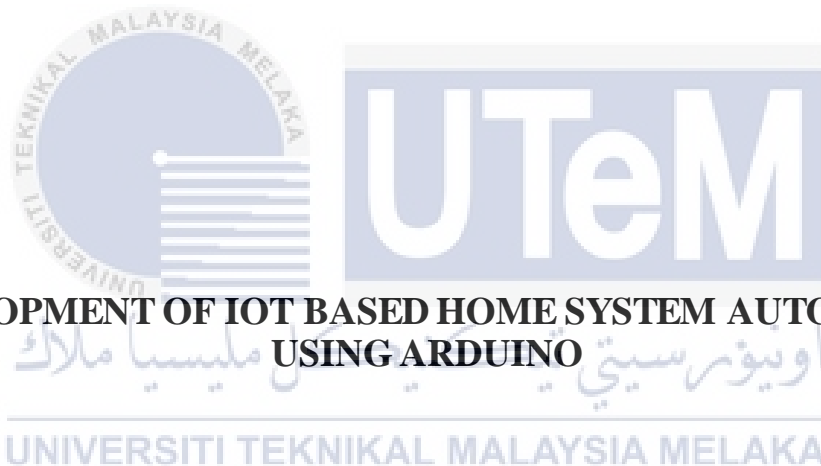




Faculty of Electrical and Electronic Engineering Technology



**DEVELOPMENT OF IOT BASED HOME SYSTEM AUTOMATION
USING ARDUINO**

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Bachelor of Electronics Engineering Technology with Honours

2022

**BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II**

Tajuk Projek : DEVELOPMENT OF IOT BASED HOME SYSTEM AUTOMATION
USING ARDUINO

Sesi Pengajian : 2022/2023

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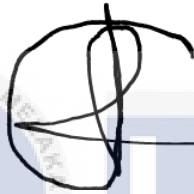
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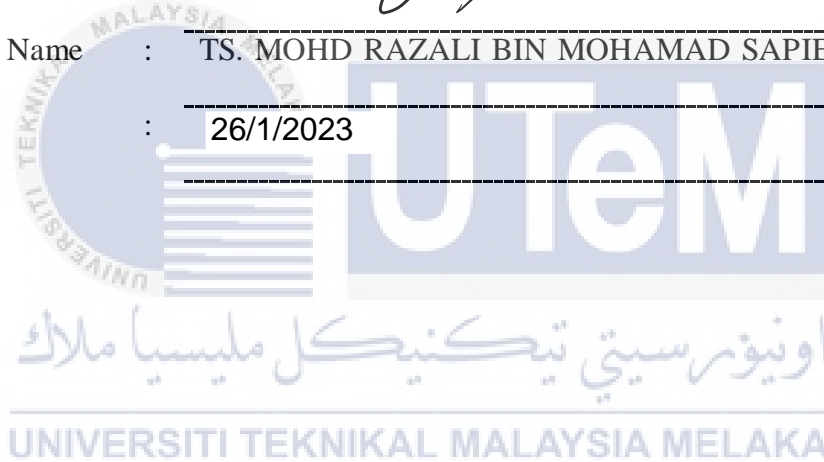


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Date :

DEDICATION

This final year project is entirely dedicated to my dear parents, who have served as an inspiration and provided me with the moral, spiritual, emotional, and financial support necessary to continue forward with my studies



ABSTRACT

Home automation or domotics refers to home-based building automation, sometimes known as a smart home or smart house. A home automation system can monitor and/or control different aspects of a home, such as the temperature, the electricity, the entertainment systems, and the appliances in a remote way. Home security features like alarm systems and access control may also be included under home automation. The concept of home automation has been a main focus in several publications and home appliance companies. In this work, the most efficient and simple strategy for automating home appliances is discussed. Among the various techniques and things to be automated, this project focuses primarily on three aspects: controlling home appliances wirelessly using Arduino UNO and IoT, sensing intruders entering the home via the window or door, and monitoring the home using a smartphone in the case of a fire. Implementations of both hardware and software are addressed sequentially. The experimental and observational analysis for all three systems is also presented, along with simulation-based circuits and methods and tools connected to the algorithm that operates on a microcontroller.

اوتومر سیتی تکنیکل ملیسیا ملاک

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ABSTRAK

Automasi rumah atau domotik merujuk kepada automasi bangunan berasaskan rumah, kadangkala dikenali sebagai rumah pintar. Sistem automasi rumah boleh memantau dan mengawal pelbagai aspek rumah, seperti suhu, elektrik, sistem hiburan dan peralatan dengan cara yang jauh. Ciri keselamatan rumah seperti sistem penggera dan kawalan akses juga boleh disertakan di bawah sistem rumah pintar. Konsep automasi rumah telah menjadi tumpuan utama dalam beberapa penerbitan dan syarikat perkakas rumah. Dalam kerja ini, strategi yang paling cekap dan mudah untuk mengautomasikan peralatan rumah akan dibincangkan. Di antara pelbagai teknik dan perkara yang akan diautomasikan, projek ini memberi tumpuan terutamanya kepada tiga aspek: mengawal perkakas rumah secara wayarles menggunakan Arduino UNO dan IoT, mengesan penceroboh memasuki rumah melalui tingkap atau pintu, dan memantau rumah menggunakan telefon pintar dalam kes api. Pelaksanaan kedua-dua perkakasan dan perisian ditangani secara berurutan. Analisis eksperimen dan pemerhatian untuk ketiga-tiga sistem juga dibentangkan, bersama-sama dengan litar berasaskan simulasi dan kaedah serta alatan yang disambungkan kepada algoritma yang beroperasi pada mikropengawal.

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CHAPTER 1

INTRODUCTION

1.1 Background

This project involves the automation of an IoT-based home system using Arduino. This project is based on controlling home appliances wirelessly with Arduino modules and Wi-Fi. The purpose of this project is to make it simpler for the user to switch or monitor household appliances, as well as to protect their home from intruders and fire. This project would utilize Arduino UNO module to wirelessly transmit and receive data using the Wi-Fi ESP32. The computer and sensor were linked to the ESP32 and Arduino module. The relay that is attached to the Arduino module would be used to connect household appliances such as lamps. The relay were served as the on/off switch for the household appliance, while the sensor would detect intruders, and fire. This initiative is focused on the residency application as well as on the elderly and disabled.

Furthermore, this project is also appropriate for monitoring whether or not a home appliance is in the on or off position. For instance, if a user on the first level wished to turn on or off an appliance on the second floor, the user does not need to walk to the second floor; instead, the appliance on the second floor may be monitored and turned on or off using a computer or a smartphone. Additionally, this project may be used to monitor our home's security against fire and invaders. As long as Wi-Fi is available, this project enabled the user to operate the appliance, monitor for fires, and get alerts for intruders while they are away from home.

1.2 Problem statement

Occasionally, when people left their houses unattended, fire or theft might occur which would lead to a major loss. When such an event happened, sometimes it's too late for one to take any rapid action due to late information received or lack of awareness of their surrounding.

Thus, with the development of alert notification of home automation systems that could detect an intruder and even fire, this method could help in coping with the issues mentioned above where one could take fast action on the problems that occur. Thanks to the development of the such system, the negative impact of theft and fire could be reduced.

Other than that, we sometimes tend to forget to close our lamp and fan when we are off for a holiday which caused electricity bills to skyrocket. with this home control appliance technology, it can help in solving the problem of expensive electricity bills. it also helps in making it easier for the elderly as well as the disabled to control their household appliances remotely.

1.3 Project Objectives

The main aim of this project is to propose systematic home automation regarding how to save energy, add more security, and have more safety in our homes. the objectives of this project are stated below:

- a) To design and model smart homes using ESP32 and Arduino UNO.
- b) To build a remote monitoring system that can access data from sensors that are saved in the cloud which is the Internet of Things platform known as Cayenne.
- c) To analyze the performance of a home automation system that displays a wide spectrum of energy saving, the effectiveness of house security as well as efficiency of home safety.

1.4 Scope of Project

By narrowing the needs for this project, a few scopes were made to make sure that it would reach its goals. The scopes covered were:

- a) Using Arduino UNO and ESP32 as a controller in monitoring home surroundings for home automation systems.
- b) To implement an IOT using the cayenne platform to monitor and control home appliance
- c) For energy saving, lamp can be monitor and control through cayenne. A relay is used as a switch to on or off the lamp.
- d) For security purposes, a magnetic reed switch, vibration tilt sensor, and infrared sensor will be used to detect if any intruders are coming into the house and are placed in the window and door.
- e) For the safety house, the flame sensor and MQ2 gas sensor are going to be used to detect the existence of fire and the level of gas respectively.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Various research papers and current literature have sought to enhance the environmental control, energy management, home security, and fire prevention of smart home automation systems. In the field of IoT, machine-learning techniques have been used for categorization, prediction, and analysis. This section contains IoT-related articles related to smart home automation systems.

2.2 Energy saving in home automation system

Siddharth Wadhvani et al in 2018 [1], presented a dynamic security system for the home using Arduino and IOT in addition to sensors that will be interfaced with Arduino. The situation of our home apparatuses will get transferred through a wireless module to a cloud system. Additionally, the framework and mobile should be associated with the same remote system. The sensors such as an accelerometer, flex sensor, magnetic sensor, flame sensor, and WI-FI module will be able to be enabled or disabled which will be under the control of the client. The flex sensor will rely on the motions of our fingers to control the apparatuses. Enhanced door-breaking security will be done by the magnetic sensor. Cloud platform like THINKSPEAK is used for data that can be seen by the user. The application of IoT can make our appointment easier and more comfortable effortlessly. This home automation system will be very advanced in our daily life to control things using smartphones and walking faster with changing of technology over the world.

In 2018, Singh et al [2] suggested an IoT-based smart home automation system that uses sensor nodes. The objective is to enhance home automation by utilizing a wireless sensor node. Multiple electrical gadgets were combined into the Home automation system and automated with little or no human interference. The smart home system monitors environmental factors and directs the operation of home appliances according to the user's preferences. The technology is used to automate household appliances, notify the homeowner of the cost of his electric bill at regular intervals, and book the gas cylinder automatically when the gas level falls below a certain threshold.

According to Muhammad Umer and Muhammad Miqdad Khan in 2020 [3], They have designed a wireless smart home automation system using the Arduino Uno microcontroller (ATMEGA328) as the primary controller. This system's architecture and implementation are low-cost, secure, universally accessible, and auto-configurable. This system's application software is based on Android, which currently has the largest smartphone user base. In addition, the construction of a Bluetooth wireless connection with the microcontroller simplifies the installation of the system. However, handicapped and elderly individuals are now able to manage their household equipment while remaining seated.

Rout et al. [4] introduced an Android-based smart home automation system with cloud computing services for the remote observation, monitoring, and control of home appliances, the physical environment, and intrusion detection using a smartphone. The system is controlled through a machine-to-machine (M2M) capability. Using a NodeMCU, ATmega 16, and ESP8266 IoT hardware, a prototype implementation was carried out.

2.3 Home security system

Soliman et al. [5] performed the Design and Implementation of a Real-Time Smart Home Automation System Based on an Arduino Microcontroller Kit and LabVIEW Platform. The suggested smart home system consists of two hardware components: using a laptop as a local server with LabVIEW platform administration and an Arduino microcontroller board. The Arduino microcontroller board is linked to sensors and home appliances. The homeowner's commands controlled, managed, and linked the home's equipment automatically. The architecture and flow diagrams of the proposed smart home system have advanced. The effectiveness and dependability of the suggested system have been examined, and a hardware implementation for three operational home devices has been developed: security camera, light, energy saving, temperature control, and ultrasonic distance detecting sensor. The system is designed to be user-friendly, versatile, and cost-effective, making it appropriate for the future of smart homes.

In 2018, Hossain et al. [6] proposed a security framework for IOT based Smart Home Automation System. Among other things, facilitates the separation of devices linked by motion sensors, fog computing, server, and switch connection. The home appliances in this system are controlled by a personal computer. activate home components based on the motion sensor's detection. When the motion sensor senses movement, the components are automatically turned ON/OFF. The developed intelligent home automation system is capable of observing things in the user's house and controlling the following actions: Webcam/CC-Camera ON/OFF, Fan ON/OFF, Light ON/OFF, Door ON/OFF Window ON/OFF, and Fire-Alarm/Sprinkler ON/OFF.

Hoque and Davidson developed an architecture for a smart door system in 2019 [7] the system is a versatile and cost-effective mobile Android application used to notify a house owner of door open events in an office or residential environment. The system's architecture comprises a Raspberry Pi 2 board for communication with a web server implementing a RESTful API and an Arduino microcontroller board compatible with Elegoo Mega 2560.

In 2018, Satapathy et al. accomplished Internet of Things (IoT) home automation using Arduino [8]. Using Arduino microcontroller boards, a cost-effective, dependable, and adaptable smart home automation system with added security is shown. Local Wi-Fi with IP connection for controlling, monitoring, and accessing home appliances through smartphone apps with user consent. The suggested solution relied on an independent server and the Internet of Things (IoT) to monitor household gadgets ranging from industrial machinery to consumer items. A smartphone application, web browser, or IR remote module may be used to access and monitor various household appliances.

2.4 Home safety system

Jabbar et al. [9] presented a hybrid approach to home automation. Through a mobile application or laptop application, the system controls electrical appliances and analyses ambient conditions, motion, and gas levels in the house, both locally and remotely. The authors created a prototype for the IoTHoMe system, which used a NodeMCU as a Wi-Fi-based gateway to link various home sensors. The sensor data is uploaded to a cloud server (Adafruit IO) and may be viewed through If This Then That (IFTTT) on the user's cell phones or PCs.

According H. Alqourabah [10] suggested the device would include integrated detectors for heat, smoke, and flame, among others. The signals from these detectors are processed by the system's algorithm to determine the likelihood of a fire, and then the

system's GSM modem broadcasts the expected outcome to different parties. A technology of the Internet of Things (IoT) has been adopted to give the fire brigade essential data without putting human lives at risk. The key characteristic of the suggested system is the reduction of false alerts, which increases the system's reliability.

In 2018, F.Saeed et al. [11] built and analyzed a wireless sensor network using numerous sensors for early detection of residential fires. In addition, the system avoided false alerts by using the Global System for Mobile Communications (GSM). Using the Fire Dynamics Simulator and a programming language, we simulated a fire in a smart house to evaluate the performance of our fire detection system. The simulation results show that our system can identify early fires, even when a sensor is not functioning while using an appropriate amount of energy from the sensors.

W. Hsu et al. [12] have created a smart kitchen fire prevention system with the following components and capabilities in 2019. Installing sensors above the cooktop. When they detect fires, high temperatures, or gas leaks, they promptly switch off the gas supply by activating the gas shutoff system. The alarm alerts occupants with a loud sound and flashing lights. The Line reporting system delivers Line messages to residents and the community management center, and the main entry door is immediately opened to enable appropriate employees to enter the home to address the incident. Installing an Internet protocol camera in the kitchen allows people to watch the gas burner from their mobile devices. If they discover the gas stove is still on, they may cut off the gas supply from their phones by activating the gas shutoff mechanism. The method is designed to limit the damage caused by cooking fires.

2.5 Comparison of previous related home automation system

Therefore, several academics have conducted studies on how the internet of things technology may be used. The internet has progressed, and an increasing number of people in both developed and developing nations have access to technology. Nevertheless, the concept of the Internet of Things symbolizes the next phase of human interactions. Unavoidable is the need for a system capable of coordinating the operation of all the electronic gadgets in the home. As a consequence of irresponsible human error, risks such as fire need a framework for their management. The IoT idea ensures that problems, such as fires, are quickly detected and extinguished. The IoT is a current trend, according to the literature study, which is another important point. Numerous research focused on how the IoT may be exploited to facilitate living and enhance security, such as by using CCTV and alarm systems. The global community is adopting the concept of sustainability, particularly concerning environmental damage. Consequently, the IoT trend because it solves various human concerns. Moreover, the IoT would reduce the cost of departing since it will enhance system management. Therefore, the argument that the IoT system would compromise the security of homes is unfounded. Utilizing technology effectively gives more advantages. Nonetheless, Table 2.1 summarises and tabulates the major aspects of earlier work that were discussed in the literature review section.