CONTROLLING AND MONITORING THE POWER OF HOME AUTOMATION USING IoT PLATFORM

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This report is presented in partial fulfilment of the requirements for the Bachelor of Computer Science (Networking) with Honours.

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DECLARATION

I hereby declare that the following project report, titled

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is written by me, it is my work, and no portion of it has been plagiarized

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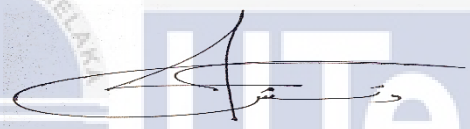
STUDENT : _____  _____ Date: 06/09/2021_

(MOHAMMED MOHSEN MOHAMMED BA LHAMAR)

I hereby declare that I have read this project report and found

this project report is sufficient in terms of the scope and quality for the award of

Bachelor of Computer Science (Networking) with Honors.

SUPERVISOR : _____ Date: _____

(MRS. KHADIJAH WAN MOHD. GHAZALI)

DEDICATION

[To my beloved parents Mohsen Mohammed and Faizah Omar]

ACKNOWLEDGEMENT

I would like to thank Mrs Khadijah Wan Mohd. Ghazali for giving assistant to complete the project successfully...

I would also like to thank my great parents for their encouragement and support.

ABSTRACT

Energy consumption is quickly growing nowadays as a result of widespread use and the installation of new equipment. A substantial part of the power used is generally squandered or used inefficiently. This is due to a lack of an efficient management system for managing energy use. Unused appliances, laziness, forgetfulness, or an inability to switch off waste a substantial amount of energy in homes. The project's goal is to develop and build a low-power home automation system using Arduino, sensor, GSM, and Wi-Fi model. The suggested solution could assist users in remotely manage their home appliances using an IoT Platform and Wi-Fi Technology. Alternatively, the system could assist the user in automating the operation of household devices by utilizing sensors. The suggested system was built with an Arduino UNO, a Wi-Fi module, a GSM module, a temperature sensor, a light sensor, and an IoT Platform. The user can be able to control the house light, fan, and socket remotely through the IoT Platform. Also, the system can automatically control house lights and fan through sensors as well as users can receive SMS through the GSM module if there is any breaking down in the system and would be used for implementing voice messages by using Google Assistance. The significance of this project is its ability to bring convenience to users as well as enable disabled people to control the house appliance either remotely with help of Google Assistance by using voice commands or automatically. The objectives of this project have been successfully achieved by designing a home automation system for saving power.

ABSTRAK

Penggunaan tenaga meningkat dengan pesat pada masa kini akibat penggunaan yang meluas dan pemasangan peralatan baru. Sebilangan besar daya yang digunakan umumnya terbuang atau digunakan dengan tidak cekap. Ini disebabkan oleh kekurangan sistem pengurusan yang cekap untuk menguruskan penggunaan tenaga. Peralatan yang tidak digunakan, kemalasan, kealpaan, atau ketidakupayaan untuk mematikan membuang sejumlah besar tenaga di rumah. Matlamat projek ini adalah untuk membangunkan sistem automasi rumah berkuasa rendah menggunakan model Arduino, sensor, GSM, dan Wi-Fi. Penyelesaian yang dicadangkan dapat membantu pengguna dalam menguruskan perkakas rumah mereka dari jauh menggunakan Platform IoT dan Teknologi Wi-Fi. Sebagai alternatif, sistem ini dapat membantu pengguna dalam mengautomasikan operasi peranti rumah dengan menggunakan sensor. Sistem yang disarankan dibina dengan Arduino UNO, modul Wi-Fi, modul GSM, sensor suhu, sensor cahaya, dan Platform IoT. Pengguna dapat mengawal lampu, kipas, dan soket rumah dari jarak jauh melalui IoT Platform. Selain itu juga, sistem ini dapat mengendalikan lampu rumah dan kipas secara automatik melalui sensor serta pengguna dapat menerima SMS melalui modul GSM jika ada gangguan dalam sistem dan akan digunakan untuk menerapkan pesan suara dengan menggunakan Bantuan Google. Kepentingan projek ini adalah untuk memberi kemudahan kepada pengguna serta membolehkan orang kurang upaya mengawal perkakas rumah sama ada dari jauh atau dekat dengan aplikasi Google Bantuan dengan menggunakan perintah suara atau secara automatik. Objektif projek ini berjaya dicapai dengan merancang sistem automasi rumah untuk menjimatkan tenaga.

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LIST OF ABBREVIATION

IoT	**Internet Of Things**

Wi-Fi	**Wireless Fidelity**
TV	**Television**
SMS	**Short Message Service**
GSM	**Global System for Mobile**
LDR	**Light Dependent Resistors**
LED	**Light Emitting Diode**
IDE	**Integrated Development Environment**
3D	**Three Dimensions**
PWM	**Pulse Width Modulation**
MHz	**Megahertz**
USB	**Universal Serial Bus**
ICSP	**In-Circuit Serial Programming**
AC	**Alternating Current**
DC	**Direct Current**
SOC	**System On Chip**
GPIOs	**General Purpose Input Output**
PCB	**Printed circuit boards**
APSD	**Advanced Power Semiconductor Device**
VIOP	**Voice over Internet Protocol**
RF	**Radio Frequency**
ETSL	**European Telecommunications Standards Institute**
2G	**Second-Generation**
MMS	**Multimedia Messaging Service**
DFD	**Data Flow Diagram**
SIM	**Subscriber Identification Module**
ADC	**Analog-to Digital Converter**

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CHAPTER 1: INTRODUCTION

1.1 Background

Nowadays, with the rapid advancement in technological and electrical fields, our homes contain multiple electrical appliances, each of which consumes a certain portion of the electricity supplied to the home. Commonly, these appliances are operated manually, with the user switching each one according to their needs. This results in a significant amount of energy waste because the consumer could forget or become lazy about turning off an appliance when it is not in usage. With our modern world's high energy usage, this may be a major problem, resulting in significant energy waste and a scarcity of energy supplies.

As a result, home automation systems that save energy have been designed to address these concerns and reduce energy waste. This is accomplished by developing the device with advanced signal processing and IoT tools such as Arduino and sensors. This device aims to minimize energy consumption by remotely or automatically turning off unused appliances.

In recent years to save energy while still offering comfort to consumers; artificial intelligence, the IoT, and microcontroller tools were the key components of such systems, and the significance of these systems in assisting the disabled (Physical impairment) and elderly are among the system's benefits. Furthermore, this project

aims to build a system based on Wi-Fi and Arduino to provide full control of home appliances automatically and remotely, using the IoT Platform and Google assistance to control appliances remotely via Wi-Fi and a sensor.

1.2 Problem Statement

World energy consumption is increasing rapidly due to the daily installation of new electrical equipment. According to the International Energy Agency (2007), with fossil fuel as the primary source of energy, global energy demands are expected to rise (Sorrell, 2015). With such high energy usage and demands, a significant amount of energy **is** wasted (Özbay, 2015). It can be wasted for several reasons, including energy transmission, inefficient equipment, and the most important one, unnecessarily used energy (Parajuly, et. al, 2016) Unnecessarily used energy is the power being used without any need for it such as illumination during the daytime, TV running with nobody watching, and other operating devices when not needed. This is usually caused by the user forgetting, becoming lazy, or the inability of the user to switch these appliances (Draaijer and Foglar, 2010) (Munir, et. al, 2015).

This system can conserve power by not turning on any appliances that are not in use. Furthermore, this device can include simple and automated equipment, it could be more useful to elderly people or those with disabilities (physical impairment). The home appliance in this project can be operated automatically and remotely using Wi-Fi and sensors, as well as switched off or on automatically depending on environmental conditions using a sensor. Using IoT Platform can power home appliances remotely and can use Google assistance to control by voice. The user may forget to switch off all the house appliances, also the house may encounter hot weather whilst the user is asleep, in which case the device could automatically turn on the fan, and once the sensors misreading and got errors, an SMS alert would be sent to the user via Sim card using GSM Module. A Wi-Fi board, Arduino, sensor, and the IoT Platform are used to complete the device. This project's planned appliances to be controlled are a lamp, a socket, and a fan.

1.3 Motivation

With the significant rise in electricity needs, a significant amount of this energy is being lost. It is necessary to improve processes, methods, and strategies that can help reduce energy waste. The home automation system is one of the most essential systems for reducing energy waste by turning off appliances while they are not in operation. Furthermore, home control is a beneficial device for the aged and disabled. The development of an automation system is a prerequisite for lowering electricity bills. Aside from that, with the availability of low-cost microcontrollers and other electronic tools, the device can be generated at a low cost, making it accessible to people with low incomes.

1.4 Objectives

The key objective of this project is to create a system for controlling home appliances to save electricity. As a result, the following goals must be approached:

1. To develop an Arduino-based light and fan automation system that can automatically monitor home appliances using sensors.

2. To integrate the IoT function into the system by using a Wi-fi module that enables remote monitoring, either through the screen of mobile phone, or by using voice-base command.

3. To provide safety and speed of response by connecting the user's phone to the system with a GSM Module, so that communications can reach him in the case of the sensors misreading data.

1.5 Scope

The project's scope includes learning about and developing a power-saving home appliance control system. The project scope covers the following:

1. Prototype and program implementation which entails putting the project idea and visualizing how it will perform. Arduino programming and IoT platform design

are also included.

2. Hardware installation, which entails buying the necessary components and combining them to create a single home automation system that can be operated directly via Wi-Fi or automatically based on sensors.

3. Demonstration of the system, which suggests that the home appliances will be described by a lamp and a tiny cooling fan. The project will not be implemented in a real house.

1.6 Project Contribution

The project seeks to be available for use by a wide range of people, for those looking for comfort and an easy way to control home appliances can benefit from the system. On the other hand, for those who wish to save energy through the devices in the house, the system will provide them with all methods in terms of control and automatic method. Also, this is the main objective of the project.

Finally, people with physical disabilities can also benefit from the system in remote control and activate automatic control, as it is possible to use remote control through voice recognition.

The control and monitoring of the home appliances are what it needs, without wasting the power at home. Will find out more about the traditional Home Automation system of saving power and how to be in a better place to make the right choice when the time comes. That is why this project should be read through.

1.7 Report Organization

1.7.1 Chapter 1

The first chapter is all about the project's concept and objectives. The scope and motivation drove me to create this system.

1.7.2 Chapter 2

Studies and research on the same subject of the project Home Automation of conserving energy would be addressed and compared. As previously stated, the project's components will be listed.

1.7.3 Chapter 3

Will demonstrate the project's approach and sequencing, as well as how it will begin and progress till it achieves its goals at the conclusion.

1.7.4 Chapter 4

Analyse and design the system that will be built in this project using diagrams to demonstrate how the data, code, and so on will be integrated and implemented.

1.7.5 Chapter 5

This chapter will implement the system and show how it has been well developed to be ready for use. To achieve the objectives that had been established previously, software and hardware would be linked.

1.7.6 Chapter 6

The testing sequences will be stated in this chapter, beginning with a plan for testing with the organization and the environment, as well as the testing approach. The system's design and data would be tested, and the results would be reported.

1.7.7 Chapter 7

In conclusion, would like to give an overview of the system and my contribution. As the project's limitations would be highlighted with the Future work that would enhance the system to make it better.

1.8 Conclusion

The background of this project has been discussed or clarified in this chapter,

as have the system's aims and scope. The current problem that would be solved by the system, as well as the project objectives, were also addressed.

Finally, the project's motivation and overall structure were reviewed, and appropriate concepts and plans were proposed so that there would be flexibility to finish the next chapter linked to prior research in the same subject and the components utilized.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Electricity usage is increasingly rising because of the electricity demand and the construction of modern, high-energy-consumption appliances. Every year, the global energy demand rises, owing to advances in technology and the industrial field, where everything runs on electricity. Most of this energy comes from fossil fuels and coal, with just a small amount coming from alternative sources including solar and wind (Global Energy Demand and Consumption, 2017) (International Energy Agency, 2017). Energy is used in several sectors, industry, transportation, and households. Since any home has several electrical appliances, households often use a significant portion of global electric resources. Most of the electricity used in households is lost owing to inadequate appliance usage and control (Merchant and Hugger, 2012).

The home automation approach is one of the most powerful and commonly used strategies for reducing energy consumption and avoiding losses. This is a useful tool for remotely monitoring and controlling home appliances depending on the needs and specifications. A home automation system may be implemented in a variety of ways to monitor one or more household appliances automatically or remotely using connectivity and internet tools. This chapter explores how to conserve electricity and reduce pollution by automating home with various resources. This chapter discusses the theoretical principles and elements used in the home automation method for energy

conservation. The devices are investigated and analysed to demonstrate their efficacy in reducing household energy consumption.

2.2 Saving Power of Home Automation Concept

Home automation has seen rapid advancements in system-enabled digital technologies in recent years. This technological advancement offers new and appealing opportunities to increase the availability of devices within the home with the objective of home automation. Furthermore, with the rapid growth of the Internet, there is an increased possibility for remote control and monitoring of such systems allowing gadgets (Gill and Khusvinder, 2009). Home automation is one of the rapidly growing sectors that are promising and addressing difficulties for the entire population in a variety of ways. It was created for a variety of reasons that are required for persons searching for a comfortable and easy living, but it may also be useful or necessary to other people who are unable to move or have any impairments (Kamarudin and Yusof, 2013). Home automation was developed in response to a variety of factors, including those desiring a luxurious contemporary lifestyle, as well as those with specific requirements, such as the elderly and disabled.

Home automation is an extremely appealing area. Its major benefits vary from increased comfort and a safer and more secure environment to more efficient use of power and other resources, resulting in significant savings. It also provides an effective way of supporting and improving the unique needs of individuals with disabilities and the elderly. This implementation sector is critical and will continue to emerge in the future (Chattoraj, 2015).

Demotics is another term for home automation. Demotics is defined as "a set of items that, when configured, interfaced, and driven automatically in a house, minimize the users' worrying about the same tasks every day, giving improvements in their comfort, power consumption, security, and communication as well" (Kamarudin and Yusof, 2013). A home automation system for the disabled and elderly is known as assistive demotics.

2.3 Component Used

A home automation system is made up of various parts, and this chapter covers the most important ones.

2.3.1 Arduino UNO

Arduino is a free and open-source electronics program that makes use of basic hardware and software to make it easy to use. Arduino boards will take inputs like light from a sensor, a finger on a button, or a Twitter tweet and convert them to outputs like turning on an LED, starting a generator, or posting anything online. You may tell the board's microcontroller what to do by giving it a sequence of instructions. To do this, the Arduino programming language (based on Wiring) and the Arduino Software (IDE) (based on Processing) are utilized. It also differentiates itself with its product line, which includes anything from simple 8-bit boards to IoT applications, wearables, 3D printers, and embedded ecosystems. All Arduino boards are open source, allowing users to design and adapt them to their unique needs. The software is still open-source, and it is improving as a result of feedback from users all around the world.

Arduino hardware is designed with a Wiring-based language (syntax and libraries) and a Processing-based optimized programming environment, which is close to C++ except with some simplifications and modifications. Current models are available pre-assembled; additionally, third parties have launched variants of the Italian-made Arduino with differing degrees of compatibility; some of them are programmed using the Arduino software (Lovine, 2004). The Arduino Uno is an ATmega328P-based microcontroller module. There are 14 digital I/O pins (six of which may be used as PWM outputs), six analogue inputs, a 16 MHz quartz crystal, a USB link, a power port, an ICSP header, and a reset button. Simply connect it to a device via USB connection or power it with an AC-to-DC converter or battery to get started.