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Bluetooth-Enabled Smart Home Based on Android

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Abstract: This article explains how to use an Arduino microcontroller to create a voice-activated home automation system with Bluetooth and an Android app. The system's goal is to create an automated appliance control that is easy to use and intuitive. The design included an Android application (MIT App Inventor 2), a Bluetooth module (HC-06), and an Arduino ATMEGA328 microcontroller board. The Arduino was created using the C++ programming language and an Integrated Development Environment (IDE) to control any connected component. The switching mechanism makes use of relays and triacs. The user controls the electrical appliances that are connected to the home-automated system after it has been connected. The Google assistant that comes with Android smartphones can also be used to control the appliances with voice prompts. The Android app, Bluetooth module, and voice prompt are used by the system to turn the household appliances on and off. Additionally, it can be programmed to turn off appliances for a predetermined 12-hour period, making the application simple and practical to use on a smartphone.

Index Terms: BlueTooth, Microcontroller, Integrated Development Environment(IDE), Triacs, Program.

I. INTRODUCTION

Using one or more computerized remote controls to remotely and occasionally automatically operate basic household appliances is known as home automation. It is intended to control alarm systems, lighting outlets, entertainment systems, and home security features like access control. In the twenty-first century, automation and wireless technology have emerged as crucial technologies. It facilitates communication between locations without the need for cables, increasing system security. Due to its high performance and accessibility, using a phone to control electrical devices has become more and more appealing. Elderly people and people with physical disabilities can benefit from connecting appliances to smart phones because they can access and control them remotely without assistance from others. Home automation systems are technological tools that allow intelligent appliance monitoring, control, feedback, and behavior based on occupant needs. Zig Bee, Bluetooth, wireless Fidelity (Wi-Fi), Short Message Service (SMS), Android applications, and other wireless Wire less Sensor Network (WSN), Radio frequency identification (RFID) and Software Defined Network just mention a few serves as a medium of communication between the appliances and the control unit and according to home automation are essential for non-invasive and non-intrusive implementation of the advanced automation system.. The most popular mobile device operating system (OS) available today is Android. In our world, particularly in Nigeria, the Android smartphone has emerged as the most widely used operating system. This led us to base the home automated system's control terminal on an Android application, since research has shown that most people are constantly on their phones.

II. LITERATURE REVIEW

1) A.K. Kasim, A. Raheem, *Bluetooth based smart home automation system using Arduino UNO microcontroller, Al-Mansour J. 27 (2017) 139.*

In recent years, the number of network enabled digital devices at homes has been increasing fast. With the rapid expansion of the Internet, the owners have been requesting remote control and monitoring of these in-home appliances. This leads to networking these appliances to form a kind of home automation system. In this paper, an Android based home automation system that allows multiple users to control the appliances by an Android application or through a web site is presented. The system has three hardware components: a local device to transfer signals to home appliances, a web server to store customer records and support services to the other components, and a mobile smart device running Android application. Distributed cloud platforms and services of Google are used to support messaging between the components. The prototype implementation of the proposed system is evaluated based on the criteria considered after the requirement analysis for an adequate home automation system. THE home automation is the introduction of technology within home to enhance the quality of life of its occupants, through the provision of different services such as telehealth, multimedia entertainment and energy conservation. In other words, home automation aims the orchestration of digital devices to provide users with real comfort together with security and ability to monitor multiple dwellings. Traditional home automation systems involve the control of digital devices which provide the functions such as heating, lighting and shading. But due

to the rapid growth of information technology and modern entertainment systems in recent years, these primary functions are expected to be enriched with additional services (i.e., the stereo reducing volume when the telephone rings). In , the benefits of home automation systems (the smart house systems) are listed as safety, comfort, power saving and communications. As the systems provide these benefits, some technical requirements must be also respected such as low cost, plug and play, flexibility, easiness of use and reliability. In this study, a home automation system, which provides two alternative user friendly interfaces, an Android application and a web application, is presented. The system is built to serve multiple users, using up-to-date and emerging technologies, such as Google Cloud Platform, in order to support the communication between the main hardware components of the system. In the following sections, the pros/cons of the employed technologies in the literature are discussed first and then the details of the proposed system architecture are given. After listing the analysis and evaluation criteria for an adequate home automation system, the paper is concluded with the possible future work comments.

- 2) *B. Yuksekkaya, A.A. Kayalar, M.B. Tosun, M.K. Ozcan, A.Z. Alkar, A GSM, internet and speech controlled wireless interactive home automation system, IEEE Trans. Cons. Electr. 52 (3) (2006) 837–843.*

This article describes the implementation of a Bluetooth technology and an android application with voice prompts based home-automated system using an Arduino microcontroller. The system is aimed at designing an automated appliance control that is user-friendly and convenient to use. The design comprised an Arduino ATMEGA328 microcontroller board, Bluetooth module (HC-06), and an android application (MIT App Inventor 2). The Arduino controls any connected component and was programmed with C++ programming language by using Integrated Development Environment (IDE). Relays and Triacs are used for the switching mechanism. Once the system is connected, the user controls the electrical appliances connected to the home-automated system, which can also be controlled using voice prompt with the help of a Google assistant inbuilt with the android smartphone. The system switches the home appliances ON and OFF using the android app, Bluetooth module, and voiced prompt. It can also be timed to switch off appliances for a pre-time of 12 h, thus making the application easy and convenient to operate via a smartphone. Home automation is the use of one or more computerized remote to control basic home appliances remotely and sometimes automatically. It is designed to control lighting points, entertainment systems, and home security such as access control as well as alarm systems. Automation and wireless technology have become a key technology in the twenty-first century. It helps communication between one point to another without the use of cables, and this makes the system to be more secure. The attractiveness of controlling electrical devices through a phone has been increasing because of its high performance and availability. Connecting appliances through smartphone is useful for the elderly and physically disabled persons, who can access and control the appliances from where they are located and access them remotely without the help of others.

III. COMPONENTS

- 1) LCD(Liquid Cristal Display)
- 2) Regulated Power Supply
- 3) Battery Power Supply
- 4) DB107
- 5) Voltage Regulator
- 6) Resistor
- 7) LED(Light Emitting Diode)

A. LCD (Liquid Cristal Display)

Android is currently the most widely used mobile device operating system (OS). The Android smartphone has become the most popular operating system in our world, especially in Nigeria. Given that most people are always on their phones, we decided to build the control terminal for the home automated system on an Android application.

B. Regulated Power Supply

Power supply is a supply of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

A power supply may include a power distribution system as well as primary or secondary sources of energy such as

C. Block Diagram

Regulated Power supply



Fig1 .Regulated Power Supply

D. Battery Power Supply

A battery is a type of linear power supply that offers benefits that traditional line-operated power supplies lack: mobility, portability and reliability. A battery consists of multiple electrochemical cells connected to provide the voltage desired.



Fig2: Hi-Watt 9V Battery

E. DB107

Now -a -days Bridge rectifier is available in IC with a number of DB107. In our project we are using an IC in place of bridge rectifier.



Fig3: DB107

F. Voltage Regulator

A voltage regulator (also called a ‘regulator’) with only three terminals appears to be a simple device, but it is in fact a very complex integrated circuit. It converts a varying input voltage into a constant ‘regulated’ output voltage.

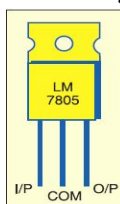


Fig4: Voltage Regulator

G. Resistors

A resistor is a two-terminal electronic component that produces a voltage across its terminals that is proportional to the electric current passing through it in accordance with Ohm's law:

$$V = IR$$



Fig5: Resistor

H. LED

A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component in 1962, early LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness. The internal structure and parts of a led are shown below.

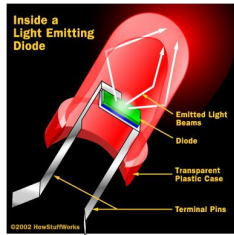


Fig6: Inside a LED

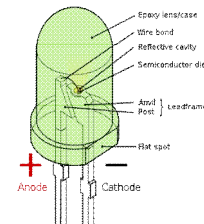


Fig7: Parts of a LED

IV. WORKING

Compared to a light bulb, an LED light has an entirely different structure. The LED's structure is remarkably robust and straightforward. The color of the LED is determined by the semiconductor material that emits light. The semiconductor diode is the foundation of the LED. Electrons can recombine with holes inside a diode when it is forward biased, or turned on, releasing energy in the form of photons. This phenomenon is known as electroluminescence, and the semiconductor's energy gap determines the color of the light, which corresponds to the photon's energy. Integrated optical components are used to help with reflection and shape the radiation pattern of an LED, which typically has a small area (less than 1 mm²). Compared to incandescent light sources, LEDs offer a number of benefits, such as reduced energy consumption, increased longevity, enhanced robustness, reduced size, quicker switching, and increased durability and dependability. Compared to conventional light sources, they are more costly and need more accurate control over heat and current. Compared to fluorescent lamp sources with similar output, current LED general lighting products are more costly to purchase. They are also used in a variety of applications, such as traffic signals and automobile lighting, especially as indicators, where they are used in place of conventional light sources. New text and video displays and sensors have been made possible by the small size of LEDs, and advanced communications technology has benefited from their high switching rates. Figure 1 illustrates the electrical symbol and polarities of an LED.

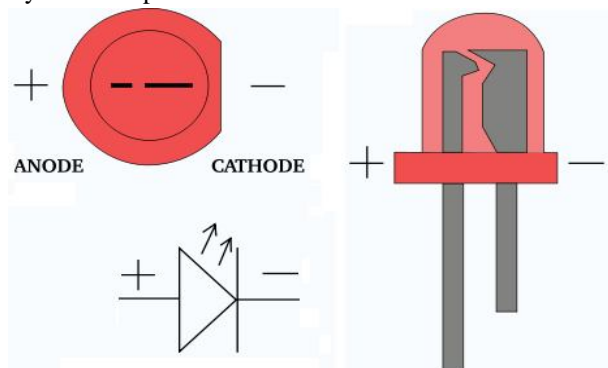


Fig8 : Electrical Symbol & Polarities of LED

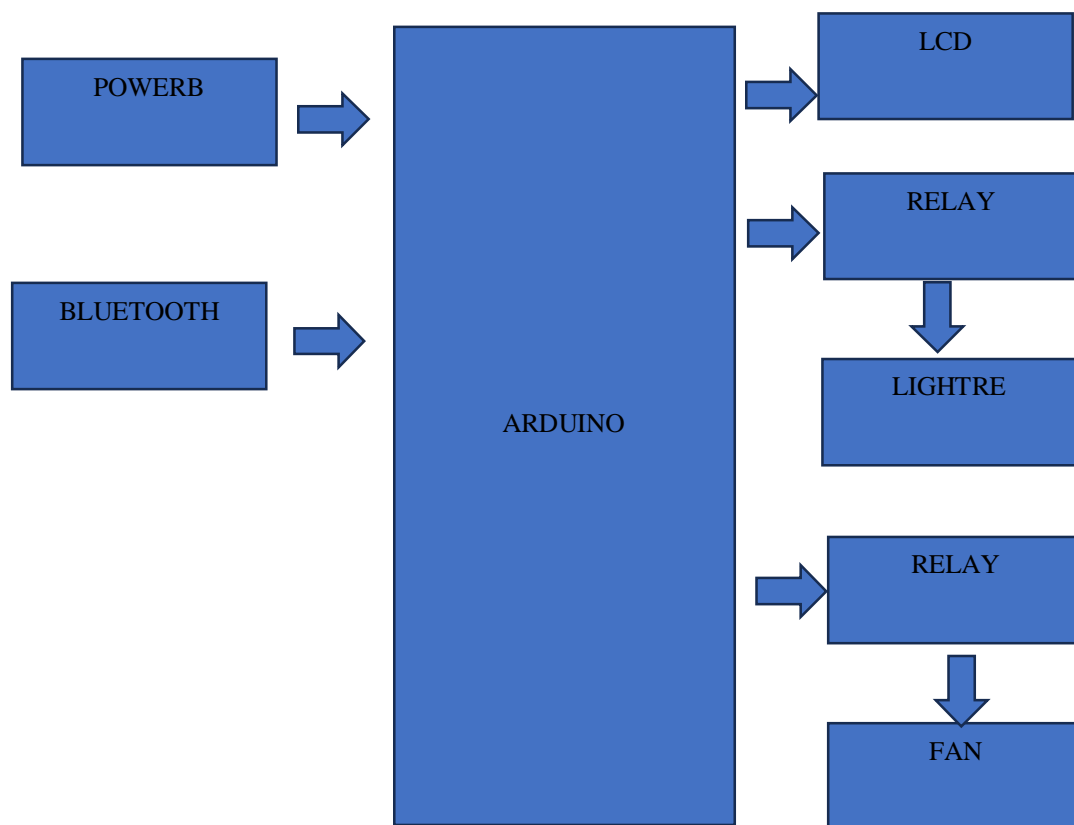


Fig9. Block Diagram

V. OPERATIVE BENEFITS

- 1) Controlling electricity consumption: Bluetooth low energy (BLE) technology can help smart meters perform efficiently and accurately, which can reduce electricity consumption.
- 2) Smart heating: Smart thermostats can be controlled remotely using a smartphone.
- 3) Home security: Smart home apps can be used as digital keys that can be shared with family and friends.
- 4) Automating routine tasks: You can automate tasks like turning lights on and off, opening and closing doors, and playing music.
- 5) Automating home health: Bluetooth medical devices like heart rate monitors, glucose monitors, and temperature sensors can be used in smart homes.

VI. RESULT

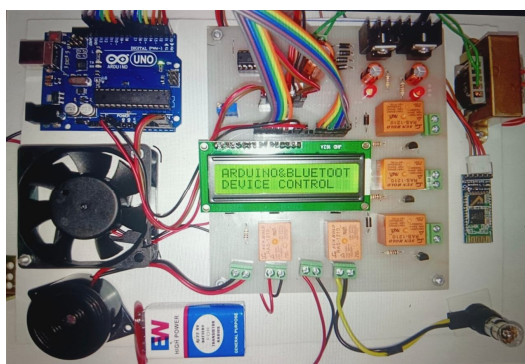


Fig10.Result

We secure the home automation system by establishing a password once the phone and the Bluetooth module are connected. When someone speaks into the microphone, the phone decodes the voice signal and turns it into text, which is then sent via Bluetooth to the Arduino board and displayed. The Arduino board then matches the text. The appliance is either turned on or off if the text matches, but displays an error message if it does not.

VII. CONCLUSION

A voice-activated Android app and Bluetooth have been used to design and implement an Arduino-based home automation system. Because Android applications and Bluetooth technology are user-friendly, quick, accessible, and dependable for communication between the remote user and devices, they were incorporated into the design of the home automation system. An inexpensive, incredibly dependable home automation system that can help the elderly and disabled was created, along with a user-friendly gadget. Future developments could include biometrics to prevent unauthorized individuals from accessing the appliances and the creation of a timing schedule for each connected appliance, both of which would significantly reduce energy consumption.

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