Ilaro Journal of Science and Technology (IJST), 2023
Published Online October 2023 (https://sciencetechjournal.federalpolyilaro.edu.ng)
Volume 3, 2023 Edition
ISSN: 2437- 1505

Design and Construction of An Android Controlled Home Appliances Using Wireless Telemetry Technic

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Abstract: *This research work involves the use of wireless telemetry technology, which is Bluetooth technology, to interact with the Android application on the Android phone to control home appliances. The control of the home appliances involves the use of an Arduino microcontroller, which acts as the processing unit of the whole system. The main aim of the project is to design and construct a good design system for the control of home appliances using Android control that is easy to understand and user-friendly. The components used in the construction are ATmega 328p, an Arduino UNO microcontroller board (UNO R3), a Bluetooth module (HC-06or HC-05), a Liquid Crystal Display (L.C.D), connecting wires, and an android application built using MIT App Inventor 2, relays and a power supply. There are other useful resources, such as the C++ programming language using Arduino Integrated Development Environment (IDE) and Open source. The completed system contains power outlet sockets for the home appliances to be connected. The total outlet designed is two which can be increased by the adjustment of some other system units and designs. This constructed home-automated system can control any home appliances connected to it, examples are refrigerators, air conditioners, TV sets, sound systems, and so on by the means of the android application on the Android phone, and Bluetooth module incorporated into the control system. This automation system can control all the appliances attached to it from any corner of the house, provided the distances to the system are within Bluetooth range.*

Keywords: ATmega 328p, Android, MIT 2 App Inventor, Bluetooth, Arduino board.

Introduction

Background information to the study

The wireless telemetry technic which is Bluetooth technology is a technology standard used to enable short-range wireless communication between electronic devices. Bluetooth operates on radio frequencies just like RFID rather than the infrared spectrum used by traditional remote controls that is the reason why it covers more distance than infrared and the device using Bluetooth technology does not have to maintain a line of sight to communicate.

Bluetooth technology allows devices to communicate wirelessly, Bluetooth relies on short-range radio frequency, and any device that incorporates the technology can establish communication so far they are within the required range. Automation can be defined as a process in which things are controlled at home/office by microcomputers remotely either by Wi-Fi, Zigbee, Z-wave, RFID (Radio frequency identification), Bluetooth control protocols etc.

An Android device is a smartphone that can be categorized as a type of portable computer that combines a mobile phone and a computer into one device. Their more powerful hardware and robust mobile operating systems set them apart from feature phones and enable wider software, internet (including web browsing over mobile broadband), and multimedia functionality (including music, video, cameras, and gaming), in addition to basic phone features like voice calls and text messaging. Smartphones commonly have several metal-oxide-semiconductor (MOS) integrated circuit (IC) chips,

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and a number of sensors, including a magnetometer, proximity sensor, barometer, gyroscope, accelerometer, and more, that can be used by pre-installed and third-party software. They also typically support wireless communications protocols (such as Bluetooth, Wi-Fi, or satellite navigation).

To control home appliances, Wanjale, Mathews, Mendes, and Navale (2014) built and deployed an Android application using a Bluetooth module and Arduino UNO board. Users may interface with the Android phone and use the Arduino UNO to control other embedded devices or sensors by sending it control signals.

A smart home model using an Android application that tracks older people's vital signs were presented (Nisar & Ibrahim, 2019). To track and extract a person's specific walking pattern, sensors such as an accelerometer, gyroscope, force sensor, and temperature sensor were mounted to the knee and walking analyzer. These sensors are utilized to categorize a person's walking pattern as either abnormal or stable. When designing a smart sleep room, vital signs like body temperature, breathing patterns, and cardiac activity was tracked using the signals collected by the sensors and data from walking analyzers and knee monitors. These signals were sent via a smartphone and a local wireless network to track the health of elderly people.

Additionally, "a smart house model utilizing android application" was proposed by (Nisar, et al., 2016). The smart home model employs a ZigBee module to interact with the android phone. Since the android phone needs to be linked to an external ZigBee transceiver, this is a poor communication method. As opposed to Bluetooth, which is already a feature of an Android phone, this results in power waste and the need for several components.

Amirah, Mohamad, & Chan (2014) proposed a low-cost Android phone-based Bluetooth home automation system. Relays and an Arduino Mega 2560-R3 board were used to link the household appliances as the board's input and output ports, and Bluetooth was utilized to provide wireless communication between them.

Tyagi, Agarwal, and Gola (2016) used Arduino and Android OS to operate home appliances using voice commands. In a similar spirit, all household appliances were networked and Bluetooth-controlled (Sriskanthan & Karande, 2002). A remote, portable host controller, and household appliances were connected to the network. The home appliance used Bluetooth to connect with the host controller, while the host controller used Bluetooth to control the home appliances through an RS232 network.

The main distinction between it and the Bluetooth-based home automation given by (Pandya et al. 2016) are that it included an authentication system that made it secure and only available to authorized users. (Teymourzadeh et al. 2013) developed and put into use a mobile phone and GSM modem-based smart home automation system.

Methodology

A number of phases, including design, implementation, testing, and validation, will be included in the research work. The actions listed below will be taken:

***2.1Design Phase*: -** List the specs of the household appliances that will be managed.
- Create the hardware configuration needed to connect to the household appliances.
- Create an Android app that is simple to use and has a user-friendly interface for managing the appliances.

2.2 Implementation Phase: - Assemble the required hardware parts in accordance with the design requirements.
- Configure the Android application to send commands to the microcontroller or microprocessor, which you can then use to operate the household appliances.
- Create a wireless telemetry connection between the hardware setup and the Android application.

2.3 Testing Phase: - To ensure correct functionality, thoroughly test each system component.
- Examine the wireless telemetry's range and dependability in various scenarios.
- Confirm that the hardware setup appropriately receives and carries out all commands from the Android application.

2.4 Hardware specifications

The following elements will be part of the hardware configuration for this project:
- A board with a microcontroller or CPU (such as an Arduino or Raspberry Pi).

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- Wireless communication modules, such as Bluetooth, Wi-Fi, or Zigbee
- Relay modules or other relevant gadgets for home appliance control
- A power source
- Sensors (optional, for use in monitoring)

2.5 *Software Preconditions*

The following are the software requirements for this project:
- An environment for developing Android applications, such as Android Studio
- Microcontroller or microprocessor programming language, such as C/C++ or Python
- Microcontroller programming integrated development environments (IDEs), such as the Arduino IDE and Raspberry Pi IDE

Hardware and software implementation strategies were used to carry out this investigation. The Android-controlled home appliances system was built using hardware components, while the software aspect of the system was composed of programming codes and application development using MIT App Inventor 2.
Through Bluetooth technology, of which a Bluetooth module (Bluetooth HC-06) was linked with the system, the android application created particularly for this system was connected through Bluetooth. The Arduino microcontroller board serves as the control system processing unit (Arduino UNO). The microcontroller and a communication technology known as Bluetooth were the basic ingredients for the control system. Five important areas were generated by the framework design which is as follows:

- *Microcontroller unit*
- *Notification unit*
- *Communication bridge*
- *Relay module*
- *Power supply unit.*

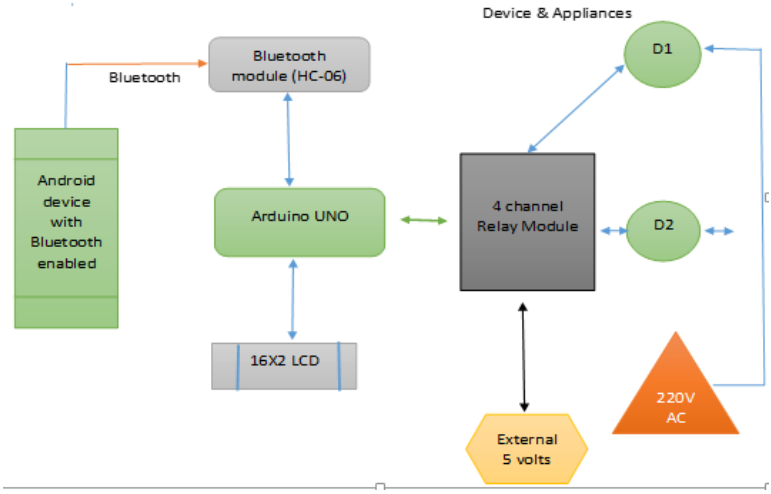

Fig. 1: The Block Diagram Of The System

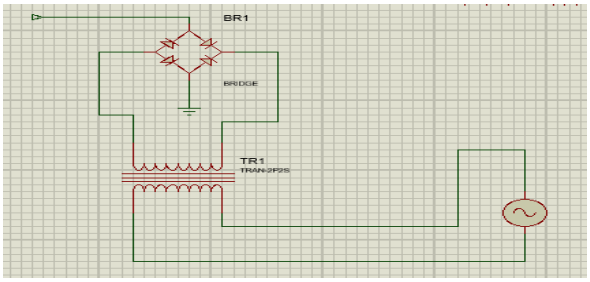

Fig. 2: The System Power Supply Circuit Diagram

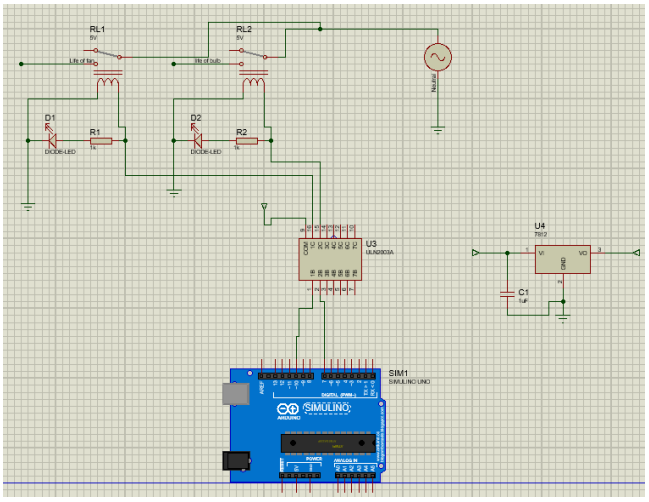

Fig. 3: The System Circuit Diagram

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Fig. 4: The Mit 2 Application And The Smarthphone

Fig. 5: Automation System in Active State.

Results

The design was achieved through the use of proteus, software for designing circuit diagrams, and the system was constructed according to the designed circuit diagram.

The control unit is dependent on the command sent from the mobile app which interacts through Bluetooth an example of a telemetry technic for communication

The Android-controlled home appliances system could be operated successfully through the following few steps:

Connect the system to an AC source e.g wall Socket and press the switch button on the housing of the system to switch it on.

Switch on the Bluetooth of your smartphone that has the home automation application already installed on it.

Go to "the Bluetooth settings" on the smartphone and pair the phone with the Bluetooth HC-06 listed in the "available device" section. Enter the default code (0000 or 1234) to successfully pair the device with each other, fig.4.

On successful pairing, open the installed application and sign up with a unique username and password, then click login.

On the welcome screen, click on any of the appliances you wish to access. On the next screen,

click on the Bluetooth **"HC-06"** to connect the app to the system. On a successful connection, (fig.5) the system can then be controlled by the smartphone. Fig. 6 was used to display how the device turned ON the electric bulb and fan.

The input voltage, $Vi = 220V$, $RL = 2.2k, R2 = 1k$,

To prevent any damage from the device (HO-06), the output voltage, V_o should be close to 3.3V;

Thus,

$$Vo = \left[\frac{2.2k}{2.2k+1k}\right] * 5V \quad (1)$$

$Vo = 3.46V$, which is close enough to 3.3V.

From the A.C source, a 12v, 600mA step-down transformer was connected to the input voltage source to step down the voltage from 220VAC to 12VAC. Then, a full wave bridge rectification circuit was connected to the 12VAC to convert 12VAC to 12VDC. A Voltage regulator of 7805 was connected

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to the 12VDc to step it down to 5Vdc for the Arduino board.

The control is done by the Arduino sending a signal of 5Vdc to control a 5Vdc relay. Thus, the relay connects the life of the 220VAC to the life terminal for the device to be active. A signal is also sent to disconnect the life of the device from the 220VAC terminal. So, the same control is done for the two terminal outputs. The current rating depends solely on the current rating for the devices. For instance, for a 60-watt bulb,

$$P = 60W$$ and $$Vi = 220v.$$

From $P = IV$, (2)

current, i = ?

Therefore,

$$i = P/V \quad (3)$$

$$i = 60/220$$

$$i = 0.27\ ampere.$$

Fig. 6: Automation Gadget Turnedon Electric Bulb And Fan.

Conclusion

Users have an easy and effective way to remotely manage their home appliances thanks to the design and installation of an Android-controlled home appliance system using a wireless telemetry technique. Users may effortlessly manage their devices from anywhere within the wireless telemetry system's range using a simple Android app and wireless connection. The Android phone can operate household appliances, making tasks simple and convenient with the touch of a button. Bluetooth technology enables the communication between the phone and the automation system (the inbuilt Bluetooth of the Android phone and the Bluetooth module HC-06 or Hc-05 in the system). To operate the system, a private application was created and installed on the Android device. The goals, approach, needed tools and software, as well as the project's anticipated results, are all discussed in this report. These recommendations can help you install an Android-controlled home appliance system employing wireless telemetry technology effectively.

Recommendation

The system may be enhanced with features like biometrics to increase system security and stop unauthorized personnel from accessing the system. The study's restriction is that only Android phone owners may evaluate the system and its application. It is possible to make the system accessible to iOS users in the future.

References

Amirah, A.B.H., Mohamad, H.I.I. & Chan, K. (2014). Bluetooth based home automation system using an android phone J. Teknologi (Sci. Eng.), 70 (3): pp. 57-61

Meyers, J. (2011). "From Backpack Transceiver to Smartphone: A Visual History of the Mobile Phone". Gadget Hacks.

Nisar, K. & Ibrahim, A. .A. (2019). Indoor roaming activity detection and analysis of elderly people using RFID technology, in: Proceedings of the 1st International Conference on Artificial Intelligence and Data Sciences (AiDAS), Ipoh, Perak, Malaysia, 2019, (pp. 174–179), doi: 10.1109/AiDAS47888.2019.8970780 .

Nisar, K., Ibrahim, A. .A., Wu, L., Adamov, A. & Deen. M.J. (2016). Smart home for elderly living using wireless sensor networks and an android application. Proceedings of the IEEE 10th International Conference on Application of Information and Communication Technologies (AICT).

Pandya, B. et al. (2016). Android based home automation system using Bluetooth & voice command, Int. Res. J. Eng. and Tech. 3 (3).

Reisinger, D. (2012). "Worldwide smartphone user base hits 1 billion". CNet. Retrieved July 26, 2013.

Sager, I. (2012). "Before IPhone and Android Came Simon, the First Android phone". Bloomberg.com. Bloomberg News.

Sager, I. (2012). "Before IPhone and Android Came Simon, the First Android phones". Bloomberg Businessweek. Bloomberg L.P.

Sriskanthan, N. & Karande, T. (2002). Bluetooth Based Home Automation Systems, J. Micro-Proc. Micros. 26 (2002) 281–289.

Teymourzadeh, R. et al., (2013). Smart GSM based home automation system, in: Proceedings of the IEEE Conference on System (ICSPC2013), Kuala Lumpur, Malaysia.

Tyagi, C.S., Agarwal, M. & Gola, R. (2016). Home Automation using voice recognition and ArduinoIJRTER , 12(7).

Wanjale, N., Mathews, R., Mendes, B. & Navale, M. (2014). Bluetooth based home automation, Int. J. Sci. Eng and Tech. Res. 3 (12): 2645–2650.