Arduino Based Home Automation System

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***Abstract*—In this recent year of technology, electronic devices and appliances have become very popular, particularly with the rapid growth of smartphones. The design of a home automation system consistent with local housing and good features for home automation through Bluetooth access is provided in this article. Design and deployment of the Bluetooth based home automation framework using android and Arduino. A component of smart home technology that uses Bluetooth on a mobile device is used in this research work, so it would be inexpensive and effective to use. This paper describes a home automation system that is used to control home appliances using a smartphone application with Bluetooth wireless technology. Three key components were included in the system an Arduino, an appliance link microcontroller, a Bluetooth signal transmission module, and a smartphone with an android app to monitor home appliances. Bluetooth connectivity technologies and controlled device are that the operating range is low, but it can be controlled from anywhere within the home. We can monitor household appliances by using smartphone apps and provide protection to decrepit people. The concept of paper is to control home appliances and escape the dangerous electrical shock and comfort of people who are decrepit and mentally impaired, who can conveniently access and control home appliances by living in a single area and accessing them remotely without other people's help. Our home automation works smartly by offering improved quality of life and user convenience through the use of this device.**

***Index Terms*—Home Automation, Bluetooth, Arduino, cost-effective, Smartphone**

I. Introduction

We are living in the 21st century where technology advancing very fast and technology is making our daily life easier and simpler. Automation home plays an important role in human life. When it comes to industrial automation, the concept is applied to large machines or robots which helps in increasing efficiency in terms of production, energy, and time. In fact, there are many Home Automation Systems are already available and it can be classified into two categories: locally controlled and remotely controlled systems [1]. In the first category, users can control their home appliance using an in-home controller with wireless communication technology such as Bluetooth, Zigbee, and GSM for achieving home automation. In the second category, users can remotely control their homes over an Internet connection using their mobile devices or personal computers. However, there are many issues involved when designing such an automation system and it should be considered [2].

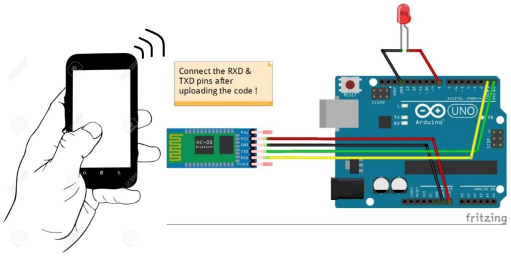

Fig. 1. An example of simple wireless home automation.

In this paper, we tried to work on the first category. Wireless technology is becoming more and more popular around the world and people appreciate this wireless lifestyle that frees them from the cable chaos. In this project, we want to create and highlight a simple low-cost home automation project through wireless technology which is really affordable and people use it and makes human life easier through this system. Here, we using simple components in which different electrical appliances or components can be switched on or off. The project is based on Arduino and I have used Arduino UNO, HC 05 Bluetooth Module. Our project is cost-effective and one can easily control and monitor electrical appliances easily and effectively through this.

Our aim is to use wireless technology in the home automation

system to make people's lives easier and to eliminate the problem of well-known cable or wire.

The objectives that need to be completed to achieve this aim are:

- To explore the main reasons of Home Automation for better security, provide comfort and energy efficiency.
- To analysis the way of increasing technology to make a house to become intelligent and automated.

To understand people's well-known "cable chaos " suffering we found the following research question:
Can we address their wire suffering in their daily life and how they are suffering in their home?
Due to limited time and the COVID-19 epidemic, we have not been able to do much work but in the future, we have a desire to work on a larger scale in this field. a desire to work on larger scale on this field.

II. Related works

A. *Home automation system based on Bluetooth and Ethernet technology*

Automation devices are now gaining popularity in the IoT and are found in different locations, such as shopping centers, toll gates, airports, etc. They are presenting a Home Automation system prototype for remotely monitor the appliances via the wireless Bluetooth system at home. It uses a smartphone application for the HC-05 Bluetooth module and Bluetooth controller to turn on or off the modules. To show the operation of the system, relays and LEDs are used as loads. Two prototypes are introduced in this article, namely home automation in an indoor environment using Bluetooth and home automation using Ethernet in an outdoor environment. Also, this research work will be carried out in a real scenario by inserting relays into the Arduino board to monitor home appliances from a remote location [3].

B. *Touchscreen and Remote Control Based Home Automation System*

Home automation needs to make use of new technology to reduce human resources as well as conserve electricity. This work focuses on the development of an integrated home automation system that uses as a user input device the standard remote controller, temperature, humidity, and touch screen. This home automation system has overcome the inconvenience of operating the machinery. Different desirable characteristics are mixed together in this proposed home automation system, which is not so commonly seen in other home automation systems. This provides a low cost, full and efficient framework for remote control of a room. In addition, this device can be used to monitor all sorts of equipment built automatically inside homes, industries, schools, hospitals, etc [4].

C. *Smart home based on Zigbee.*

This machine will send various signals gathered by a few end-nodes to the main control module, which will interpret and process them. The main control module then sends this information to the internet via the Ethernet and GSM/GPRS network to track and control the internal family environment and household equipment centrally and locally. The development of a new form of the smart home device using the CC2430 ZigBee wireless sensor networks, real-time home atmosphere temperature acquisition, humidity, three tables, infrared, smoke, gas parameters, fire, burglary warning, home equipment Appliances in the home environment, by integrating conventional sensor alarm system and image monitoring system. In addition, it is possible to map the system's operating state into SDD Cards [5].

D. *Embedded platform for web-based monitoring and control of a smart home.*

This work introduces the architecture of a low cost embedded framework for web-based surveillance and regulation of a smart home. The platform consists of a distributed sensing and control network, access control devices, and a touch-screen residential portal that offers the user an easy-to-use interface and provides remote, web-based access. The main concerns relating to the architecture of the platform proposed were addressed. The stability challenge and the robustness to network loss of the distributed control network. Scalability is one of the key benefits of this system. With new sensor/ controller /actuator nodes, the multipoint network can quickly be expanded and new integrated Ethernet gateways can be connected to the local network [6].

III. Methodolody and materials

A. *Conceptual Framework.*

This particular part of the paper illustrates the conceptual framework and methodology regarding the entire work done on the project. The overall details of the way the project is implemented as well as the structural components and their integration upon which the success of the project is dependent on is explained in detail here. The prototype of this project is done entirely by using the proteus 8 professional software and necessary components required for completion as shown in the figure[2]. After the design phase is completed using the above

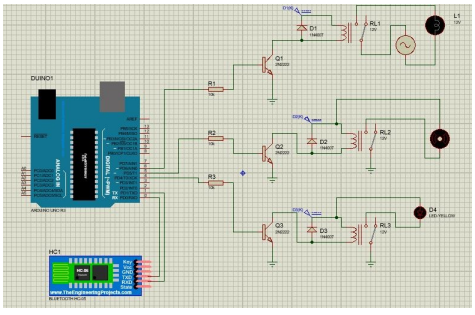

Fig. 2. circuit diagram containing required components.

figure[2] the programming phase is initiated and it is done by using Arduino UNO IDE. Afterward, the code is burnt into the Arduino board (in this case the hex file is loaded) and

after numerous tests and debugging we end up with the final product and then the overall project is evaluated.

B. Crucial Components of Home Automation System.

1) Arduino UNO: The Arduino UNO figure[3]. is an open-source microcontroller board based on the Microchip ATmega328P microcontroller. It is the lifeblood of this project and its main purpose here is to read input and turn it to output, receive and transmit serial data using the TXD and RXD pins and also using the PWM output as well as draw power from those pins. The reason being for using this particular microcontroller is because it is low cost, simple to code for, cross-platform, etc.

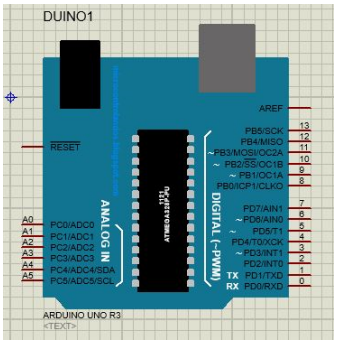

Fig. 3. Arduino UNO Microcontroller.

2) Bluetooth HC-05 module: HC-05 Bluetooth Module figure[4]. is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. This module is used in order to transfer the instructions from the android application to the Arduino board to control the appliances by various commands already instilled in the code. It is very cost-effective.

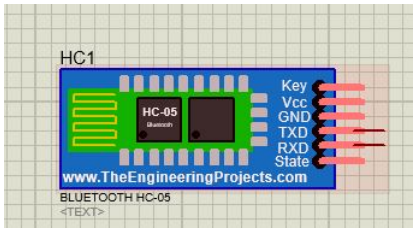

Fig. 4. HC-05 Bluetooth module.

3) NPN Relay Switch Circuit: The relay circuit figure[5] shown here is connected through an NPN transistor (2N2222) and then connected to the appliances. Here the transistor acts as a switch and whenever a certain amount of voltage is passed through the base of the transistor only then will the relay circuit activate and hence jump start the appliance as well. All of this depends on which instruction is passed through the Arduino board from the android application through the Bluetooth module.

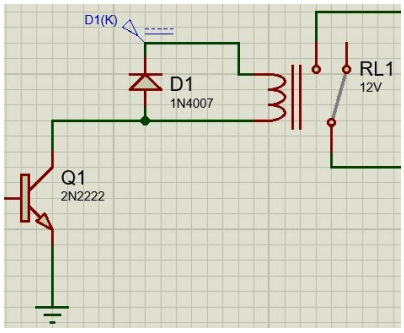

Fig. 5. NPN relay switch circuit.

IV. System Architecture and Implementation

This paper related to the Bluetooth and android application based home automation system using the Arduino UNO ATmega328P based microcontroller and HC-05 Bluetooth module is done through some elaborate steps. Firstly the android phone and the Bluetooth module are paired by setting up the physical port of the module to be on the same network as the android phone. Then an application called BT-display is used due to its easy to use interface. Then the Arduino controller is programmed to interact with the application in question and commands are sent from the application via text and through the Bluetooth channel. The NPN relay switch circuit then receives its input signals from the Arduino microcontroller and turns on or off the corresponding home appliance. Through these steps home automation via Bluetooth and android application is achieved. We show the system architecture in figure[6].

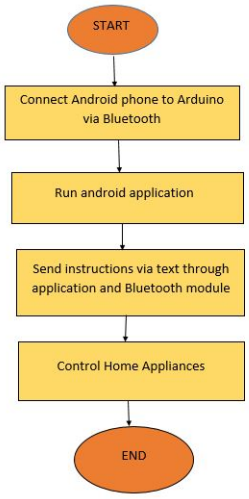

Fig. 6. system architecture.

V. Discussion and Future Works

From the above methodology and implementation analysis, Bluetooth based home automation system allows sending commands to control home appliances through text. As compared

to other technologies used for a smart home system. The smart home device based on Bluetooth would not operate beyond 100 meters. In the Bluetooth-based smart home device, there is a distance limit, but it can run inside the range properly and effectively. The few devices in home appliances are now connected and operated by us. In the future, we will connect numerous devices from all over the world to monitor it. Design and implement the Bluetooth based home automation framework using android and Arduino. A component of smart home technology that uses Bluetooth on a mobile device, So, the Bluetooth-based device is easy to use and very inexpensive. In addition, it is very low cost and easy to use. So, we can say that Bluetooth is the best-suited technology for home automation.

This set up can further be developed into IOT project by using Ethernet Arduino and wifi module.So, it can be controlled from anywhere around the world having feedback from the devices to futhure improve the energy savings.

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