Review on design of smart home automation and security system using Arduino

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***Abstract*— There is a great energy crisis in the current situation of our country. People often forget to turn off lights and other home appliances whilst not being present in-person. In these situations, application of Home Automation makes it possible to control these appliances from a distant place in a hassle-free manner with the help of smartphones. The objective of this paper is to implement a low cost, reliable and scalable Home Automation System, that can be used to remotely switch ON/OFF any household appliance, using a microcontroller to achieve hardware simplicity and an Android mobile application to toggle the operation state.**

Keywords— Smart Home, Home Automation, Android Smartphone, Arduino, Bluetooth.

1. INTRODUCTION

In the present day, we have remote controls for our television sets and other electronic systems which have made our lives easier and effortless. Time is a valuable thing; everybody wants to save time as much as they can and new technologies are being introduced every other day to save us time. The recent development in technology that permits the use of Bluetooth and Wi-Fi have enabled different devices to have capabilities of connecting with each other. Home Automation gives an individual the ability to remotely or automatically control things around the home, thus, saving the individual time and hassle. The implantation of automation technologies, techniques and processes improve the efficiency, reliability, and/or speed of many tasks that are normally performed manually. Automation lowers the human judgement to the lowest degree possible but does not completely eradicate it. An Arduino-based Home Automation System is cost effective and can give the user the ability to control all the electronic home appliances using their smartphones. By the implementation of the Home Automation System, an individual never has to worry about manually opening doors, switching off electronic appliances, and so on. The system allows individuals to save precious time and achieve more daily productivity.

2. LITERATURE SURVEY

This paper focuses on developing a main control board prototype and one Graphical User Interfaces (GUIs) on smart phones. The main control board is constructed by a main controller device, Arduino Uno. The Arduino interacts with GUIs on smart phones in order to control and monitor the function of target home appliances by using Relay circuit. The main control board is designed so that it complies with the domestic electrical standards. This paper can be implemented by using affordable electronic and software technology, making it economically, technically and operationally feasible.

A. Economic Feasibility

This paper is uses the Android OS, Arduino Uno, Bluetooth Module and Relay switches which are affordable, making it economically feasible to implement.

B. Technical Feasibility

This paper is based on wireless technology and embedded systems which are reasonably in phase with currently used technology. Therefore, it is very much favoured by the technology.

C. Operational Feasibility

This software is designed to be very easy to operate. Having a user-friendly interface will make it operable by anyone, including those who have zero to no previous experience of using softwares such as these. It could also be helpful for differently abled people, making controlling home appliances with a single tap on the screen.

3. METHODOLOGY

The Arduino Uno is a microcontroller board based on the Microchip ATmega328P microcontroller. The board has 14 digital I/O pins, 6 analog I/O pins, a 16 MHz crystal oscillator, a USB connection, a power jack an ICSP header, and a reset button.

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is a fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has a footprint as small as 12.7mmx27mm. HC-05 is a Bluetooth device use for wireless communication with Bluetooth enabled devices. It communicates with microcontrollers using serial communication. As the HC-05 Bluetooth module has 3.3V level for RX/TX and our microcontroller can detect 3.3V level, there is no need to shift the TX voltage level of HC-05 module; but we need to shift the transmit voltage level from the microcontroller to the RX of HC-05 module. The particular module that we have can be powered from 3.6 to 6 volts because it comes on a breakout board which contains a voltage regulator. However, the logic voltage level of the data pins is 3.3V so, the line between the Arduino TX and the Bluetooth module RX needs to be connected through a voltage divider in order to not burn the module. On the other hand, the line between the Bluetooth module TX pin and the Arduino RX pin can be connected directly because the 3.3V signal from the Bluetooth module is enough to be accepted as a high logic on the Arduino board. The Bluetooth module interfaced to Arduino receives the commands from the Android application that is installed on the Android device, using wireless communication. The programme which is written to the Arduino UNO with Bluetooth module serially to receive the commands. Microcontroller switches the electrical loads automatically based on the commands received from the Bluetooth.

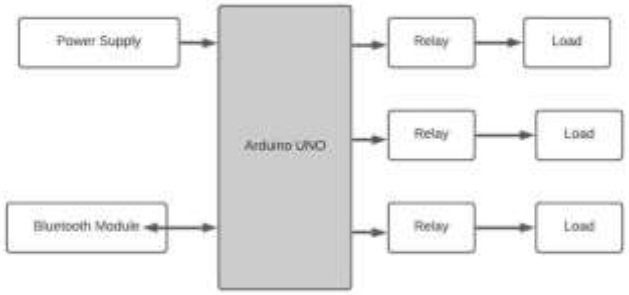

Figure 3.A - Block Diagram of Home Automation using Arduino

3.1 Steps for Implementing Home Automation using Arduino

A. Connecting Bluetooth

The Bluetooth module's TX is connected to Arduino's RX (digital pin 0) and the module's RX to Arduino's TX (digital pin 1). 5V and GND of the module is connected to the Arduino's 5V and GND.

B. Connecting Relay Driver

The Relay driver chip consist a total of 16 pins (8 pins on both sides), where pins 1-7 are inputs from Arduino digital pins and pins 10-16 are for output to the relay switches. Pin 8 is connected to the ground and pin 9 to the +12V supply. For our project, we are connecting digital pin 7 and 8 (pin 13 and 14 of ATmega328) to pin 1 and 2 of the relay driver.

C. Connecting Relay Switches

The relay we're using is SPDT, it has 5 pins on the underside. Pin 1 is connected to pin 16 and pin 3 is connected to Arduino's GND. Pin 2 is the common contact in the relay to which we have to connect the power for our appliance (AC 230V), and pin 4 is the pin to which we have to connect our appliance wire.

D. Loading the Arduino Software

Here the application checks the incoming Bluetooth signal via the Bluetooth module and then compares (ASCII values) using an "if" statement with previously defined values. If it matches the value, relay is activated using "digitalWrite (pin, HIGH)"

command, which passes 5V to the Arduino digital pin.

E. Implementing the Android application and setting up Bluetooth

There are a lot of applications available in the Google PlayStore for Home Automation. We install any one of them and once installed, we pair and connect it with our Bluetooth module. For this, we need to power the Arduino and the Bluetooth module, and then turn ON the Bluetooth on our phone to make it visible to other devices. After connecting our phone and clicking on the respective buttons, the appliances turn ON/OFF.

4. CONCLUSION

In this paper, a low cost and flexible home control and monitoring system using Android based Smart phone is proposed and implemented. It is a robust and easy to use system that can provide the facility of monitoring all kinds of electric appliances within a communication range through Bluetooth. The system consists of mainly three components - a Bluetooth module, Arduino microcontroller and relay circuits. WIFI is used as the communication channel between the Android phone and the Arduino microcontroller.

Smart phone with built in support for Wi-Fi can be used to access and control the devices at home. When a Wi-Fi connection is not available, mobile cellular networks such as 3G or 4G can be used to access the system.

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