

Arduino and Android Based Home Automation System

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Abstract- Home automation system based on Arduino Uno is implemented and designed in this project. Microcontroller Arduino Uno is the heart of the system. All of the processes are instructed in it. In this project, four appliances can be controlled from the mobile phone by using android application and Bluetooth module. Homeautomation.apk is designed in MIT App Inventor2 software to contact the Bluetooth module from mobile. Four channel relay module is used to open and close the home appliances. Dual power supply (5V and 12V) is used for arduino and all appliances.

Indexed Terms- Arduino Uno, Bluetooth module, four-channel relay module, android application

I. INTRODUCTION

Home Automation is becoming more and more popular day by day due to its numerous advantages. Many household tasks were automated by the development of specialized appliances.

This can be achieved by local networking or by remote control. Usually conventional wall switches are located in different parts of the house and often require persons for their operations and, thus, manual pressing turn them on and off. It becomes very difficult for the elderly or physically handicapped people to operate them. This system is enhanced to control the home applications through an android application of smart phones by entering the selected number for corresponding load.

Android is the customizable, easy to use operating system that powers more than a billion devices across the globe from phones and tablets to watches, TV, cars and more to come.

The block diagram of the home automation system is shown in Fig.1. This project uses an Arduino board and a rectified power supply. A Bluetooth is

interfaced to the Arduino board using Rx and Tx pins for communication. The electrical loads connected with various home appliances are controlled by the four-channel relay module.

If an owner connects the user's android application device to an Arduino system through Bluetooth then the user can send the control signals through the Bluetooth attached to the Arduino system. The user can enter the selected option in the Arduino system. The received data is compared with the stored data in the Arduino and, if it matches, then the microcontroller will perform the desired operation.

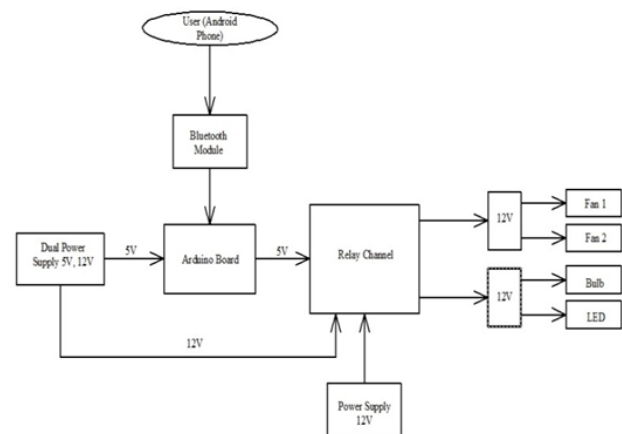


Figure 1. Block Diagram of Home Automation System

II. FEATURES OF MAIN COMPONENTS

In this project, the following things are required to build the home automation system.

- Aduino Uno
- Bluetooth module
- Four channel relay module
- Some appliance for demonstration such as fan, bulb
- Power supply

A. Arduino Uno

Arduino is an open-source project that created microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices.

The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets of digital and analog input/output (I/O) pins that can interface to various expansion boards (termed shields) and other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named sketch, which also supports the languages, C and C++.

B. Bluetooth module

Bluetooth is a wireless technology standard for exchanging data over short distances. Bluetooth makes better than other technologies because it is everywhere, it operates on low power, it is easy to use and it doesn't cost a lot to use.



Figure 2. Bluetooth Module

Officially class 3 radios have a range of up to 1meter (3ft), class 2, most commonly found in mobile devices, 10meters (33ft), and class 1, primarily for industrial use cases, 100meters (300ft). Bluetooth marketing qualifies that class 1 range is in most cases 20–30meters (66–98ft) and class 2 range 5–10meters (16–33ft).

The Bluetooth core specification mandates a range of not less than 10 meters (33 ft), but there is no upper limit on actual range. Bluetooth is one of the popular

wireless communication technologies because of its low power consumption, low cost and a light stack but compensates on range.

C. Four channel relay module

This is a 5V four-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC250V 10A or DC30V 10A. It has a standard interface that can be controlled directly by microcontroller.



Figure 3. Four Channel Relay Module

Relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. As shown in Fig. 4, when the signal port is at low level, the signal light will light up and the opto-coupler 817c will conduct, and then the transistor will conduct, the relay coil will be electrified, and the normally open contact of the relay will be closed. When the signal port is at high level, the normally closed contact of the relay will be closed. So the load can be connected and disconnected by controlling the level of the control signal port.

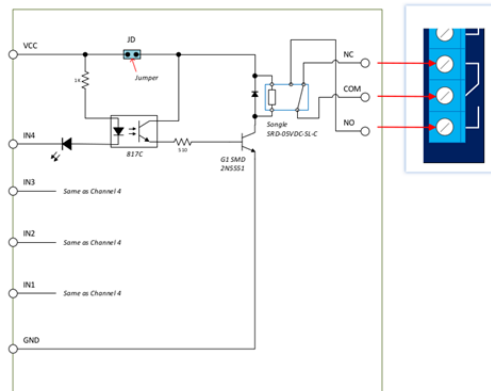


Figure 4. Pin Description of Relay Module

D. Dual Power Supply

Fig.5 illustrates a simple approach to construct a dual DC power supply of 5V and 12V from the 230V AC mains supply. The voltage ranges 5V and 12V are used in this project.

The output from the center-tapped rectifier was filtered by the capacitor C1 to offer a steady DC level to the input pins of the regulators used in the power supply circuit. The DC voltage is then fed in to the IC 7805 which is a 5V regulator and also to the IC 7812 which was s 12V regulator. The output obtained from the 7805 and 7012 are 5V and 12V respectively.

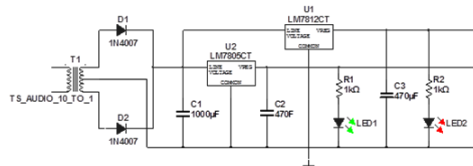


Figure 5. Dual Power Supply Circuit

III. IMPLEMENTATION OF HOME AUTOMATION SYSTEM

A. Flowchart

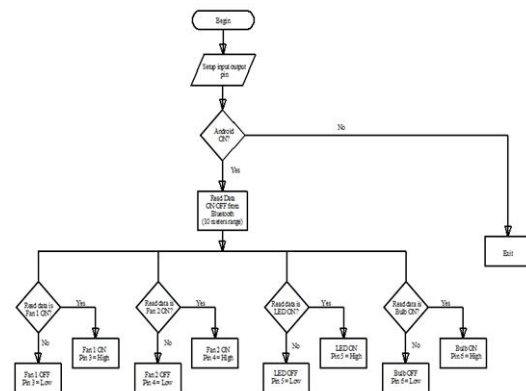


Figure 5. Flowchart of Home Automation System

B. Android Application and Setting up Bluetooth

The user created Bluetooth control android application by MIT's App Inventor. App Inventor for Android is an open-source web application originally provided by Google, and now maintained by the Massachusetts Institute of Technology (MIT). It allows newcomers to computer programming to create software applications for the Android operating system (OS).

It uses a graphical interface, which allows users to drag-and-drop visual objects to create an application that can run on Android devices. In creating App Inventor, Google drew upon significant prior research in educational computing, as well as work done within Google on online development environments. In this home automation system, Homeautomation.apk is created by using MIT App Inventor2 to control fan1 on/off, fan2 on/off, LED on/off and bulb on/off from mobile phone as a remote control.

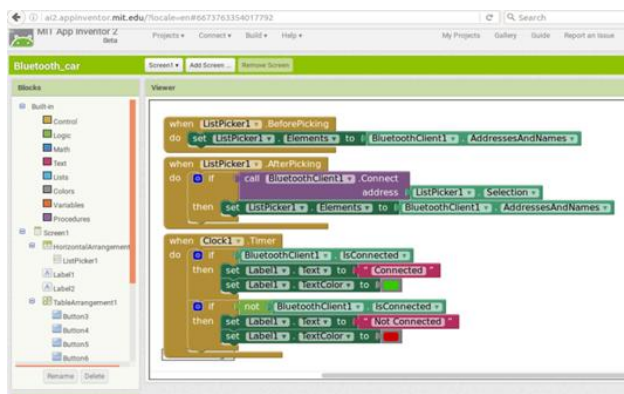


Figure 6. Code Block List for Bluetooth Control

IV. OPERATION OF HOME AUTOMATION SYSTEM

The connection diagram for Arduino is shown in Fig.7. For setting up this system, wiring connections have to be made between the Arduino and Bluetooth module and also with the relays. The Bluetooth module's Tx is connected to Arduino Rx and the module's Rx to Arduino Tx. 5V and GND of the module are connected to the Arduino's 5V and GND. The connection between four channel relay module and home appliances is shown in Fig.7.

The android application controls the various four appliances connected to the Arduino and relays. When the toggle buttons on the application are pressed, corresponding Bluetooth signals are sent from the android phone to the Bluetooth module. The Arduino receives the sending signal and compares it to the predefined signals assigned for each appliance. When it identifies that signal, the Arduino activates the relay on to its digital pin by passing 5V through it. Thus the relay is switched on and the corresponding appliance connected to the relay is also turned on as well. To switch it off, Arduino passes a 0V or logic low to its corresponding digital pin.

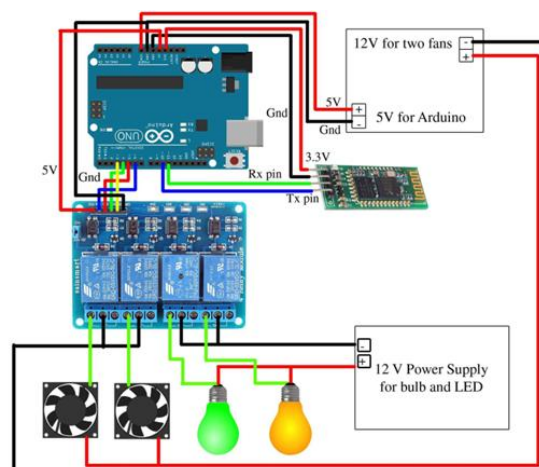


Figure 7. Hardware Design of Arduino Based Home Automation System

V. TEST AND RESULTS OF HOME AUTOMATION SYSTEM

After testing of arduino and each module, results of arduino based home automation system by using Bluetooth and android application are presented in Fig.8 to Fig.11.

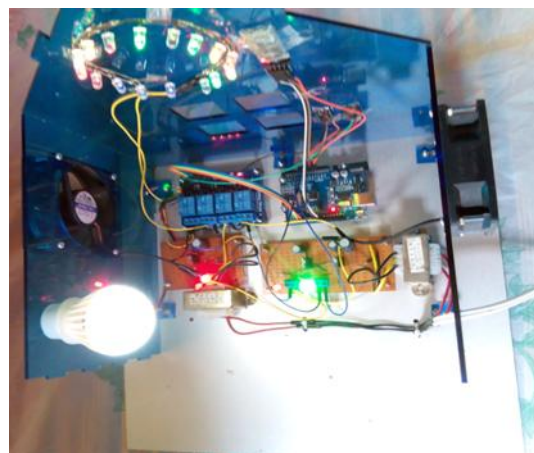


Figure 8. Top View of Home Automation System



Figure 9. Front View of Home Automation System

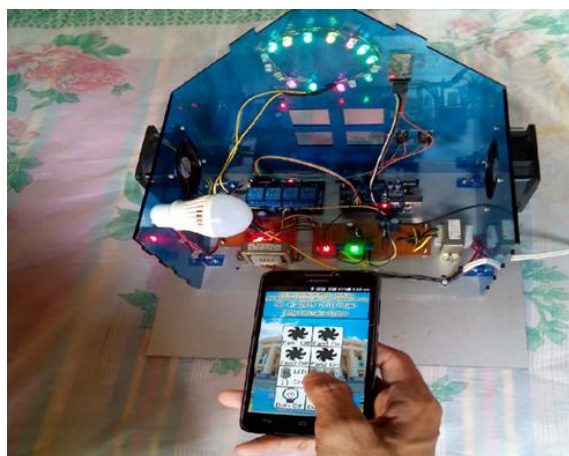


Figure 10. Switch On LED



Figure 11. Switch On Bulb

VI. CONCLUSION AND DISCUSSIONS

This project helps to control the electrical loads with the help of android application. The electrical loads are controlled based on Bluetooth input signal. This input signal is received from the android device. Many times it becomes too tiring to operate the electrical switches manually every now and then. This is a big problem especially in case of aged or handicapped people. The android solves the issue by interfacing a unit with home appliances that switches these loads based on the input received from android device.

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