

# Home Automation Using Arduino

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**Abstract**—In this project we have developed a low cost but flexible and secure smartphonebased Home Automation System. This project aim is to develop and design a home automation system using Arduino with Bluetooth module. The communication between the smartphone and the Arduino board is wireless. Password protection is also used nowadays to allow authorized users from accessing the appliances at home. Home Automation system using the latest and new technology provides more convenience, security and safety. Nowadays, people have less time to handle any work so automation is simple way to handle any device automatically. Many home appliances like fan, bulb, automatic door locks are controlled by home automation system. The project mainly focuses on the control of smart home by Smartphone and tries to provide a security based smart home, when the people are not present at home. The motive of this project is to control home appliances in smart home with user friendly design at low cost and simple installation by using Bluetooth technology.

**Index Terms**—Technology, Automation, Bluetooth, communication, security.

## I. INTRODUCTION

Home automation system is described as use of automatic technologies that aims to reduce the human labour. Due to quick growth in technologies, there is need to use smartphones to remotely control the home appliances. An automated devices is capable of working with adaptability and with low error rate.

A remotely available environment is well-defined as an environment where each appliance or device can be remotely accessed and controlled using software which includes an Android and a Web application. Such remotely accessible systems are already present in the market, but they contain various drawbacks. So, Home automation systems are designed to increase user accessibility to control the daily used appliances via wired or wireless communication.

Here, the word “wired” suggests that appliances are actually connected to a central controller of the home automation system, while “wireless” means that home appliances are connected wirelessly to central controller or remote-control unit. Some appliances such as TVs, DVD players, air conditioning already have their respective remote-control units. While installing a home automation, at least one remote controlled unit is added.

Automation system decreases the human labour and also saves the time and energy. Earlier home automation systems

were used only in labour saving machines but nowadays its main objective is to provide facilities to elderly, handicapped and disabled people to switch ON or OFF any electrical appliance remotely.

A Bluetooth and smartphone based wireless home automation system can be implemented with a low cost and it is easy to install in an existing home. In a research work it was proved that Bluetooth based systems are faster than wireless and GSM based systems. Bluetooth based technology has ability to transmit data within a range of 10m to 100m depending on the type of Bluetooth device being used.

The main components used in designing the project are Arduino UNO board, HC-05 Bluetooth module, smartphone application and software tool named as Arduino IDE software which is free to use. Home appliances are connected to the Arduino board via a relay, and a Bluetooth module called HC-05 is interfaced with the Arduino board. For serial communication between a smartphone and a Bluetooth module, a smartphone application called Arduino Bluetooth Control Device is used. Then all other appliances are connected to relay board and further connections are made. The elderly people can learn the use easily and small children can also use the system without any physical contact.

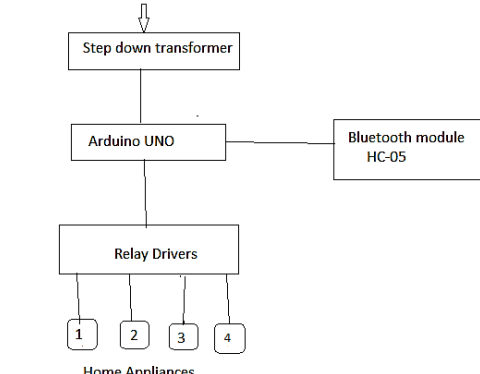


Fig. 3(a)- Architecture of Home Automation

Fig. 1. . Architecture of home automation

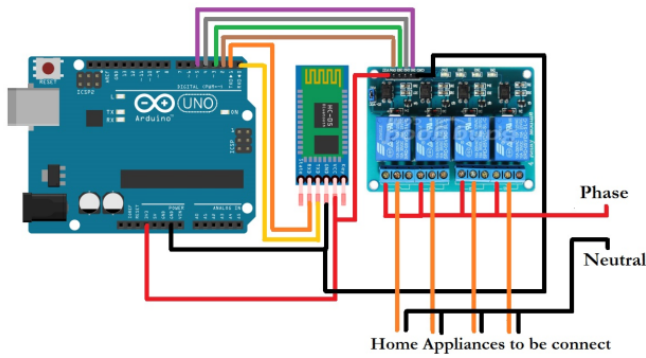


Fig. 2. . Circuit Diagram

## II. METHODOLOGY

### A. Components

1) *Hardware components:* The designed Home Automation system contains three main hardware components Arduino UNO board, 4- Channel 5V relay Module and HC-05 Bluetooth module. Smartphone is used to provide communication between Arduino UNO board and Bluetooth module using a smartphone application named as Arduino Bluetooth Control Device. In this project Bluetooth module HC-05 and Arduino Uno board are used for hardware implementation. It communicates with the microcontrollers using serial communication (USART), it has a frequency of 2.45GHz. Relay are the switch that operates on electricity. It is based on electromagnetism. The switches opens and closes the circuits by receiving electrical signals from outside sources, as soon as the relay will receive a signal from Arduino it will turn on the respective circuit. Other devices include simple jumper wires, bulb, etc. The software application is built for the master device which will control the overall devices that are needed to be connected to relay and microcontroller. User can try for manual buttons that are available at the main screen of application. The number of devices to be connected depends on the number of modules in relay the more the modules the more the device connections.

2) *Software components:* In this study, two pieces of software—the Bluetooth terminal application and the Arduino Integrated Development Environment (IDE)—are employed.

**Arduino IDE :** The term "Integrated Development Environment" (IDE) refers to the software used for this entire programming process, which is known as the Arduino IDE tool. Nearly 9600 bits per second is the baud rate for serial communication between an Arduino board and a smartphone. how to retrieve serial data from a smartphone using code. A state variable is used to store the value of a received byte, which is subsequently utilised to conduct a specified operation after being compared to various conditions. Below is a screenshot of the Arduino IDE code for turning on and off a light.

**MIT App Inventor :** The Massachusetts Institute of Technology now manages MIT App Inventor, an integrated development environment for online applications that was first

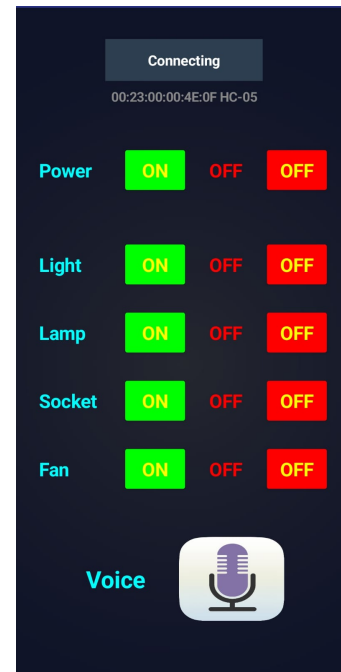


Fig. 3. . App

made available by Google. It enables those who are new to computer programming to produce application software for the Android and iOS operating systems, which, as of Final beta testing is taking place on July 8, 2019. It is dual-licensed software that is both free and open-source.

**App Development :** When we will connect our smartphone with HC-05 Bluetooth module through the above app we would automatically get connected to the app and we will be able to see number of buttons named as ON and OFF of. And for connecting app with Bluetooth device, we could see one button at the bottom and for moving out of the app we can click on exit button. Hence, home appliances can be automatically controlled through this Arduino Bluetooth Control device. And also, we will be able to control eight devices through this single android application. It is user friendly and easy to use.

## III. DESCRIPTION OF HARDWARE

**Arduino Uno :-** Arduino Uno is a microcontroller chip dependent on the Atmega328(datasheet) with 14 computerized I/o pins, in which 6 pins can be utilized as yields, 6 pins are utilized as simple information sources .It has 16 MHz clay resonator ,a USB association, a power jack and a reset button.

The microcontroller has 32kB of ISP flash memory, 2kB RAM and 1kB EEPROM. The board provides serial communication capability via UART, SPI and 12C.Because of well design in the form of arduino it is easy to understand. In Arduino we use high level of programming language like C language, C++ language ect. It is easy to understand and user friendly language. It has much advantage like multitasking, automation, time domain etc. Arduino Uno fig4 (a) is given below.

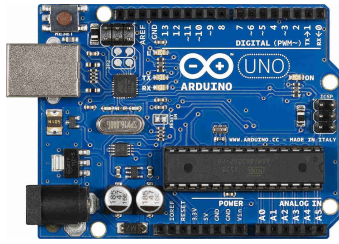


Fig. 4. . Arduino Uno



Fig. 5. . Arduino Uno

**Bluetooth module :-** HC-05 Bluetooth module is used to connect the microcontroller with android application. Bluetooth receive the information from user and send to the microcontroller (Arduino Uno). It is simple to use Bluetooth Serial Port Protocol(SSP), designed as wireless serial connection setup. The Bluetooth of serial port module is Advanced Bluetooth v2.0+Enhanced data Rate at 3Mbps modulation with 2.4 GHz radio receiver with BB(base band). The Bluetooth of Rx and Tx pins are connected to the arduino pins of Tx and Rx respectively . HC-05 module is a simple to utilize Bluetooth SPP (Serial Port Protocol) module, intended for straightforward remote sequential association setup. It utilizes CSR Blue canter 04-External single chip Bluetooth framework with CMOS innovation and with AFH (Adaptive Frequency Hopping Feature). It has the impression as little as 12.7mmx27mm. The figure 4(b) of Bluetooth HC-05 module is given below.

**Relay :-** Relay is an electromagnetic switch which is used to defer two circuits electrically and connect magnetically. When arduino transmit the signal then relay driver receive signal and start its work. They are frequently used to interface an electronic circuit (working at low voltage) to an electrical circuit which works at extremely high voltage. For instance, a hand-off can make a 5V DC battery circuit to switch 230V AC mains circuit. In this way a little sensor circuit can drive, say, a fan or an electric knob. A transfer switch can be separated into two sections: information and yield. The info area has a loop which creates attractive field when a little voltage from an electronic circuit is connected to it. This voltage is known as the working voltage. Generally utilized transfers are accessible in various arrangement of working voltages like 6V, 9V, 12V,

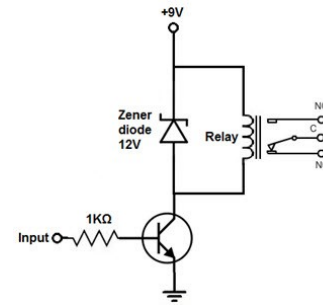


Fig. 6. . Arduino Uno



Fig. 7. . Arduino Uno

24V and so on. In a basic hand-off there are three contactors: ordinarily shut (NC), regularly open (NO) and normal (COM). At no info express, the COM is associated with NC. At the point when the working voltage is connected the transfer curl gets charged and the COM changes contact to NO. Diverse transfer setups are accessible like SPDT and DPDT which have distinctive number of changeover contacts. By utilizing legitimate blend of contactors, the electrical circuit can be turned on and off. Relay circuit shown in fig4(c).

So as to drive the hand-off, we use transistor and just less power can be utilized to get the transfer driven. Since, transistor is an intensifier so the base lead gets adequate current to make increasingly current stream from Emitter of Transistor to Collector. In the event that the base once gets control that is adequate, at that point the transistor lead from Emitter to Collector and power the transfer. When the power is transmit to the relay works as a switch due to electromagnetic effect so that we can switch ON or OFF our home appliances. The figure 4(d) of relay is given below.

#### IV. ADVANTAGES

1. Everything is automated so it is easy to use.
2. It is control by mobile application so no extra training is required.
3. We can change controlling system as our requirement.
4. It works on arduino based system so we can easily understand how it works.
5. It saves our time.
6. Every home appliance can control by one android application.
7. Easy installation and user friendly.

## V. RESULTS AND DISCUSSIONS

According to the proposed plan the final outcome of this paper leads to the development of a home automation. Through this project, an automation system has been created so that we can easily control home appliances like as light, fan, tube light, AC, bulb, etc. One of the objectives of this project is also to get us a smart automation and low cost project. This can be used in large malls, event halls, and many other locations in addition to classrooms and colleges. In this paper we have also provided information about arduino Uno, Bluetooth controller and relay module. And the information about their work is given. Along with the component of home automation, its advantage has also been discussed. The system is easy and secured for access from any user or intruder. Final outcome of the project is given below in fig 5(a)(b)(c)(d).

## VI. FUTURE SCOPE

This Home Automation project can be further developed by designing it with the internet to control home while sitting in a remote and inaccessible zone. Through a mobile device, PC, or laptop with internet access, one can monitor their home. Passwords can be set so that only user can have access to his device and automation system. In future whole school can be automated. Automated attendance system can be installed and many more development could be done. IOT-based wireless technology can take the place of Bluetooth, allowing for remote control from anywhere in the world. Additionally, the software that controls the entire system needs to include additional features like an alert system, graphs showing how electricity is optimised, and data on how each component is used so that it may provide practical ways to limit those additional costs.

## VII. CONCLUSION

In this proposed system we have designed low cost, wireless and Flexible home automation. This system provides security for accessing from any user. The only thing user need to pair password for the Arduino board and the smartphone in order to access the home appliances, this provides the protection from unauthorized or fraud users. Any equipment that needs to turn ON/OFF apps without use of internet connection can be tested using this approach. The wireless communication between the smartphone and Arduino board was tested to ensure that the home automation system was fully functional and it was discovered that its range was only 50 metres in a house and 100 metres in an open area. For further work, it is advised to create a GUI application for the smartphone that is built in Java so that it may be supported by the majority of the devices that are currently on the market.

## REFERENCES

- [1] H. Ghasemian. "A Novel High-Speed Low-Power Dynamic Comparator with Complementary Differential Input in 65 Nm CMOS Technology." *Microelectronics Journal*, vol. 92, pp. 104603, 2019.
- [2] P. Rajesh, M. Priyanka, P. Nalini, M. Chandra Mouli, "An optimized Low-voltage Low-power Double Tail Comparator for High Speed ADCs" *International Journal of Advances in Engineering & Technology*, vol. 9, pp. 22311963, June 2016.
- [3] A. Khorami, and M. Sharifkhani. "A Low-Power High-Speed Comparator for Precise Applications." *IEEE Transactions on Very Large Scale Integration (VLSI) Systems*, vol. 26, pp. 2038–2049, 2018.
- [4] J. Lu and J. Holleman, "A Low-Power High-Precision Comparator with Time-Domain Bulk-Tuned Offset Cancellation," *IEEE Transactions on Circuits and Systems I: Regular Papers*, vol. 60, pp.158–1167, 2013.
- [5] Fabian Khateb, Dalibor Biolek, Nabhan Khatib, Jiri Vavra. "Utilizing the Bulk-driven technique in analog circuit design", *13th IEEE Symposium on Design and Diagnostics of Electronic Circuits and Systems*, 2010.