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## Home Automation with Arduino Uno

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### ABSTRACT

*The advancement in the field of technology provides innovative ways of doing work through various smart means. Automation is one such mind-blowing technology which is revolutionizing the present and future generation. In this paper we present a home automation system using Arduino uno and Bluetooth module and also the home appliances area unit connected to the input/output ports of the board through relays. The communication between the mobile phone and the Arduino is through hc 05 Bluetooth module which is low-cost, safe, fast and scalable technique permitting the user with remote control of various lights and appliances within their home.*

**Keywords:** Automation, Arduino Uno, Bluetooth Module.

### 1. INTRODUCTION

#### A. Overview:

Home automation is a unique system that can control and establish communication between nearly all aspects of your house. It is a means that allows the users to control electric appliances of varying kind.

There are many existing and well-established home automation systems are based on wired communication. This is not a problem until the system is planned well and installed in advance during the physical construction of the building. But implementing this system to already existing buildings the cost goes very high. So, to overcome this we have used wireless technology which is Bluetooth which is more safer and user friendly.

#### B. Advantages of Home automation systems:

1. You can manage all of your home devices from one place. So, it is convenient to use.
2. It is a user-friendly system which makes an everyday person to use it easily and also can assist handicapped/old aged people.

3. The ability to lock the door through your phone is one of the greatest benefits of home automation. This will make you feel safer knowing that the door is close and not guessing.
4. With the ability to control the light, whether turning on/off on specific time will saves homeowner a great ton of money.

For all these reasons, home automation technology is not only an attractive choice in renovation and refurbishment, but also other new features can be added in future which contributes for a digital India

### 2. HARDWARE COMPONENTS

#### Arduino UNO

The Arduino Uno is a microcontroller board that uses the ATmega328P microcontroller. It has 14 digital I/O pins (six of which can be used as PWM outputs), six analog inputs, a 16 MHz quartz crystal, a USB connection, the power jack, an ICSP header, and a reset button. It basically comes with everything you need to assist the microcontroller, precisely connect it to a computer via USB or power it via an AC-to-DC adapter or battery this to get it begin. This is now the processing brain that drives the tasks of this home automation, that was being used to connect the entire system. The Arduino board has a number of board is equipped with sets (I/o) pins all of which can be connected to different development boards and perhaps breadboards as well as many other circuit designs. The title "Uno" implies "one" in Italian and it was selected to commemorate the launch of the Arduino Software (IDE) 1.0. This same Uno board as well as version 1.0 of the Arduino Microcontroller have been the sample versions of Arduino which have since been replaced by latest version. The Arduino Uno board was indeed the first throughout a sequence of USB Arduino boards and serves as the service's system model

#### Bluetooth Module (HC-05)

The HC-05 Bluetooth module is intended for wireless transmission. Such an module can indeed be configured as either a master or a slave. Bluetooth sequential modules allows any serial enabled devices to interact with one another over

Bluetooth. These have six pins and the following key/EN: It's used to get the Bluetooth module to respond to AT commands. This module only function in command mode when the Key/EN pin has been set to high. Alternatively, it's in data mode by default. In command mode, the HC-05's default baud rate is 38400bps, while in data mode, it's 9600bps. The HC-05 module provides 2 configurations: data exchange and data storage. AT commands are used in command mode. often used alter the HC-05's settings VCC: Connect 5 V or 3.3 V to this Pin, GND: Module Ground Pin, is used to deliver these commands to the module serial (USART) port. RXD: Receive data serially (gained information would be communicated wirelessly by Bluetooth module), TXD: Transmit Serial Data (wirelessly gained information by Bluetooth module will be transmitted out serially on TXD pin), TXD: Transmit Serial Information (wirelessly gained information by Bluetooth module would be communicated out serially on TXD pin), TXD: Transmit Serial Data (wirelessly gained information by Bluetooth module will indeed be communicated out serially on TXD The state of a module indicates whether it is interconnected or otherwise.

**Relay Module**

Relay is a electromechanical device which uses an electric current to open or close the contact of a switch. In general, they are referred to as switches that open and close circuits. Relays work on principle of electromagnetic attraction. A relay module is a hardware device that consists of other electronic components to make a relay compatible for the devices to be operated as well as the Arduino UNO circuit board. Usually relay module have 5 pins of which 3 of them are high voltage terminals they are:[1]COM-common [2]NO-Normally open [3]NC-Normally Closed, these connect the device that we want to control. In our project we are using Single channel relay which can be used to control highvoltage, high current load such as lamps, motor and AC load. These relays are designed such that it can be interfaced with microcontrollers like Arduino, PIC etc.

**Arduino software**

The Arduino Integrated Development Environment or IDE is a platform that allows us to connect the Arduino hardware and to upload programs and communicate with them. This Application can be run-on platforms like Windows, macOS, Linux. This Arduino Software (IDE) contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. The Arduino IDE supports the languages C and C++ using special rules of code structuring, while Processing's underlying language is Java. The working of this is pretty simple as we connect Arduino board to a computer via USB, where it connects with the Arduino development environment (IDE). The user writes the Arduino code in the IDE, then uploads it to the microcontroller which executes the code, interacting with inputs and outputs such as sensors, motors, and lights. So, Arduino as a software platform has become popular because of its ease of use and this tool makes it easy for users to ac

**3. IMPLEMENTATION**

In smart home automation system arduino IDE software is used. Bluetooth HC 05 is connected to android application to control home appliances like light, fan, night lamp etc. Block Diagram of the implemented project shown as:



Figure 1: Block Diagram

Arduino Uno is connected to bluetooth module where bluetooth module TXD/RXD pin is operated at 3.3v. Connect the RXD pin on the Arduino with the TXD pin on the HC 05 module. This connection allows the HC-05 to send data to the Arduino. The TXD pin is used to transmit data from the bluetooth transceiver, while the RXD pin is used to receive data on the Arduino. Arduino is operated at 5V signal levels, and the HC-05 is using only 3.3V signal levels, no level shifting is required on this particular signal. This is because the Arduino is based on an Atmel ATmega328 microcontroller which considers above 3v as high. So, no level shifting is necessary when going from 3.3V to 5V. Next step is to connect the TXD pin on the Arduino to the RXD pin on the HC-05. This connection will form the second half of the two-way communication and is how the Arduino sends information to the HC-05. Now to convert the 5V transmit signal coming from the Arduino into a 3.3V signal. Here resistor is used which act as a voltage divider. So, connect 1k ohm and a 2.2k ohm resistor across the GND and TXD pins on the Arduino. This is called a resistor divider because it divides down the input voltage.

The next step is to connect the Arduino to a relay module, so that we can turn the connected device ON/OFF. Relay module is connected in series with electrical load, to break the connection to turn connected device ON/OFF. To connect relay module to breadboard, connect the 5V and GND pins of the relay module to the bus terminals on the breadboard. Then connect the AC load to the relay module. Relay module has three terminal,they are-Common, normally open, normally close. When the relay is off, the COM terminal is connected to the NC (Normally Closed) terminal, which means bulb is connected to NC terminal, it will turn ON even when the relay isn't energized. But we want to turn on the bulb only when we send a signal from smartphone. That's the reason we connect the load to the NO (Normally Open) terminal, so that when the relay is triggered from the Arduino, the contact switches from the NC terminal to the NO terminal, thereby completing the circuit.

Next step is to upload a code through USB port and open Arduino IDE. After successfully uploading a code, next step is to control the setup from smartphone. Circuit diagram and Flow chart is given below:

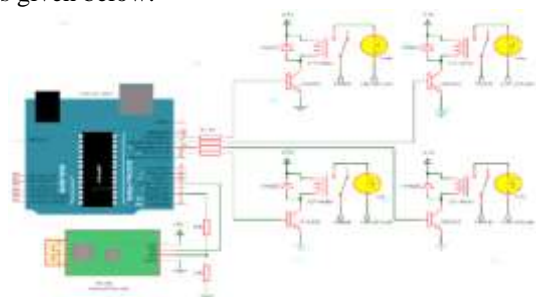


Figure 2. Circuit diagram of bluetooth based home automation system

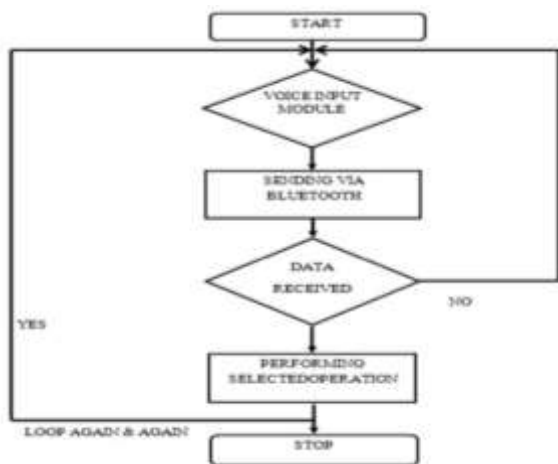


Figure 3. Flow chart of the system operation



Figure 4. App for home automation system



Figure 5. Test run system architecture with controlled output results

#### 4. CONCLUSION

This project is indeed a low-cost and efficient project for home application. By using this method, we can control our home appliances by smart phone and we can avoid the electric shock and it is convenience for users. With few additions and modifications, this project can be enter commercial scale products for Home Automation System. In future we can add temperature sensors so that it can monitor some surrounding temperature around the house and we can improve the communication using Internet web base technology.

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