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(Technical Education Division)**

FRONT PAGE

**Internal Assessments of Theoretical Subjects for 4th & 6th Semester Students
(Academic Session 2020-21)**

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BT CONTROL HOME APPLIANCES SYSTEM USING ARDUINO UNO

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*A comprehensive project report has been submitted in partial fulfillment of the
requirements for the degree of
“ DIPLOMA IN ENGINEERING”*

IN ELECTRONIC AND INSTRUMENTATION ENGINEERING

**UNDER THE SUPERVISION OF
MR.AMIT NATH**

PROFESSOR

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CERTIFICATE OF APPROVAL

The project report titled “**Bluetooth Control Home Appliances**” prepared by **Divya Gupta**, Roll No: DSLGEIES6-10022277 is hereby approved and certified as a creditable study in technological subjects performed in a way sufficient for its acceptance for partial fulfillment of the degree for which it is submitted. It is to be understood that by this approval, the undersigned do not, necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein, but approve the project only for the purpose for which it is submitted.

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ABSTRACT

The main objective of this project is to develop a home automation system using an Arduino board with Bluetooth being remotely controlled by any Android OS smartphone. As technology is advancing, houses are also getting smarter. Modern houses are gradually shifting from conventional switches to centralized control systems, involving remote controlled switches. Presently, conventional wall switches located in different parts of the house makes it difficult for the user to go near them to operate. Even more it becomes more difficult for the elderly or physically handicapped people to do so. Remote controlled home automation systems provide a most modern solution with smartphones. In order to achieve this, a Bluetooth module is interfaced to the Arduino board at the receiver end while on the transmitter end, a GUI application on the cell phone sends ON/OFF commands to the receiver where loads are connected. By touching the specified location on the GUI, the loads can be turned ON/OFF remotely through this technology. The loads are operated by Arduino board through optoisolators and thyristors using triacs

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INTRODUCTION

Nowadays, we have remote controls for our television sets and other electronic systems, which have made our lives real easy. Have you ever wondered about home automation which would give the facility of controlling tube lights, fans and other electrical appliances at home using a remote control? Off-course, Yes! But, are the available options cost-effective? If the answer is No, we have found a solution to it. We have come up with a new system called Arduino based home automation using Bluetooth. This system is super-cost effective and can give the user the ability to control any electronic device without even spending for a remote control. This project helps the user to control all the electronic devices using his/her smartphone. Time is a very valuable thing. Everybody wants to save time as much as they can. New technologies are being introduced to save our

time. To save people's time we are introducing a Home Automation system using Bluetooth . With the help of this system you can control your home appliances from your mobile phone. You can turn on/off your home appliances within the range of Bluetooth.

COMPONENTS REQUIRED

- 1) ARDUINO UNO
- 2) 4 CHANNEL RELAY(5v)
- 3) BLUETOOTH MODULE HC05
- 4) POWER SUPPLY
- 5) LOAD(BULB 220V)
- 6) CONNECTING WIRES(jumping wires)
- 7)SWITCHBOARD

8)SMARTPHONE (BLUETOOTH ENABLED)

DESCRIPTION ARDUINO UNO

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY) kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers.

The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.¹¹ The name Arduino comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduin of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014.

Features of the Arduino UNO:

Microcontroller:-ATmega328

Operating Voltage: 5V Input Voltage (recommended): 7-12V

Input Voltage (limits): 6-20V

Digital I/O Pins: 14 (of which 6 provide PWM output)

Analog Input Pins: 6

DC Current per I/O Pin: 40 mA

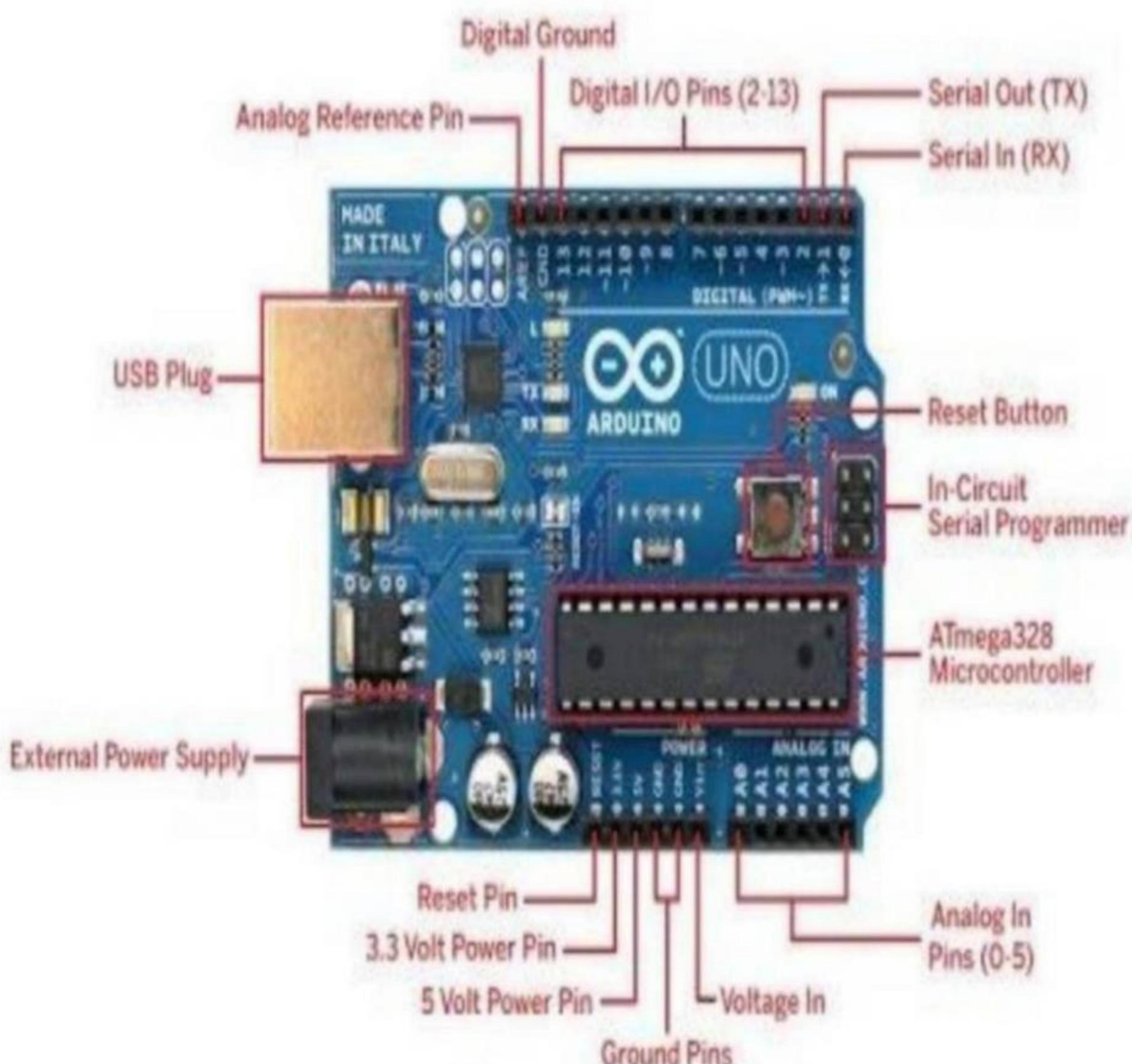
DC Current for 3.3V Pin: 50 mA

Flash Memory: 32 KB of which 0.5 KB used by bootloader

SRAM: 2 KB (ATmega328)

EEPROM: 1 KB (ATmega328)

Clock Speed: 16 MHz



ARDUINO HARDWARE PART:- Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available. Although the hardware and software designs are freely available under copyleft licenses, the developers have requested the name Arduinoto be exclusive to the official product and not be used for derived works without permission. The official policy document on use of the Arduino name emphasizes that the project is open to incorporating work by others into the official product. Several Arduino-compatible products commercially released have avoided the project name by using various names ending in -duino. Most Arduino boards consist of an Atmel 8-bit AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, ATmega2560) with varying amounts of flash memory, pins, and features. The 32-bit Arduino Due, based on the Atmel SAM3X8E was introduced in 2012. The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Multiple and possibly stacked shields may be individually addressable via an I²C serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the LilyPad, run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions. Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default bootloader of the Arduino UNO is the optiboot bootloader. Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS232 logic levels and transistor-transistor logic(TTL) level signals. Current Arduino boards are programmed via Universal Serial Bus (USB), implemented using USB-to-serial adapter chips such as the FTDI FT232. Some boards, such as later-model Uno boards, substitute the FTDI chip with a separate AVR chip containing USB-to-serial firmware, which is reprogrammable via its own ICSP header. Other variants, such as the Arduino Mini and the unofficial

Boarduino, use a detachable USB-to-serial adapter board or cable, Bluetooth or other methods. When used with traditional microcontroller tools, instead of the Arduino IDE, standard AVR in-system programming (ISP) programming is used.

The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. The Diecimila, Duemilanove, and current Uno provide 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs, which can also be used as six digital I/O pins. These pins are on the top of the board, via female 0.1-inch (2.54 mm) headers. Several plug-in application shields are also commercially available. The Arduino Nano, and Arduino-compatible Bare Bones Board and Boarduino boards may provide male header pins on the underside of the board that can plug into solderless breadboards. Many Arduino-compatible and Arduino-derived boards exist. Some are functionally equivalent to an Arduino and can be used interchangeably. Many enhance the basic Arduino by adding output drivers, often for use in school-level education, to simplify making buggies and small robots. Others are electrically equivalent but change the form factor, sometimes retaining compatibility with shields, sometimes not. Some variants use different processors, of varying compatibility.

ARDUINO SOFTWARE PART:- IDE The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code

for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Sketch

A program written with the Arduino IDE is called a sketch. [58] Sketches are saved on the development computer as text files with the file extension .ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde. A minimal Arduino C/C++ program consist of only two functions: setup(): This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch. loop():

After setup() has been called, function loop() is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

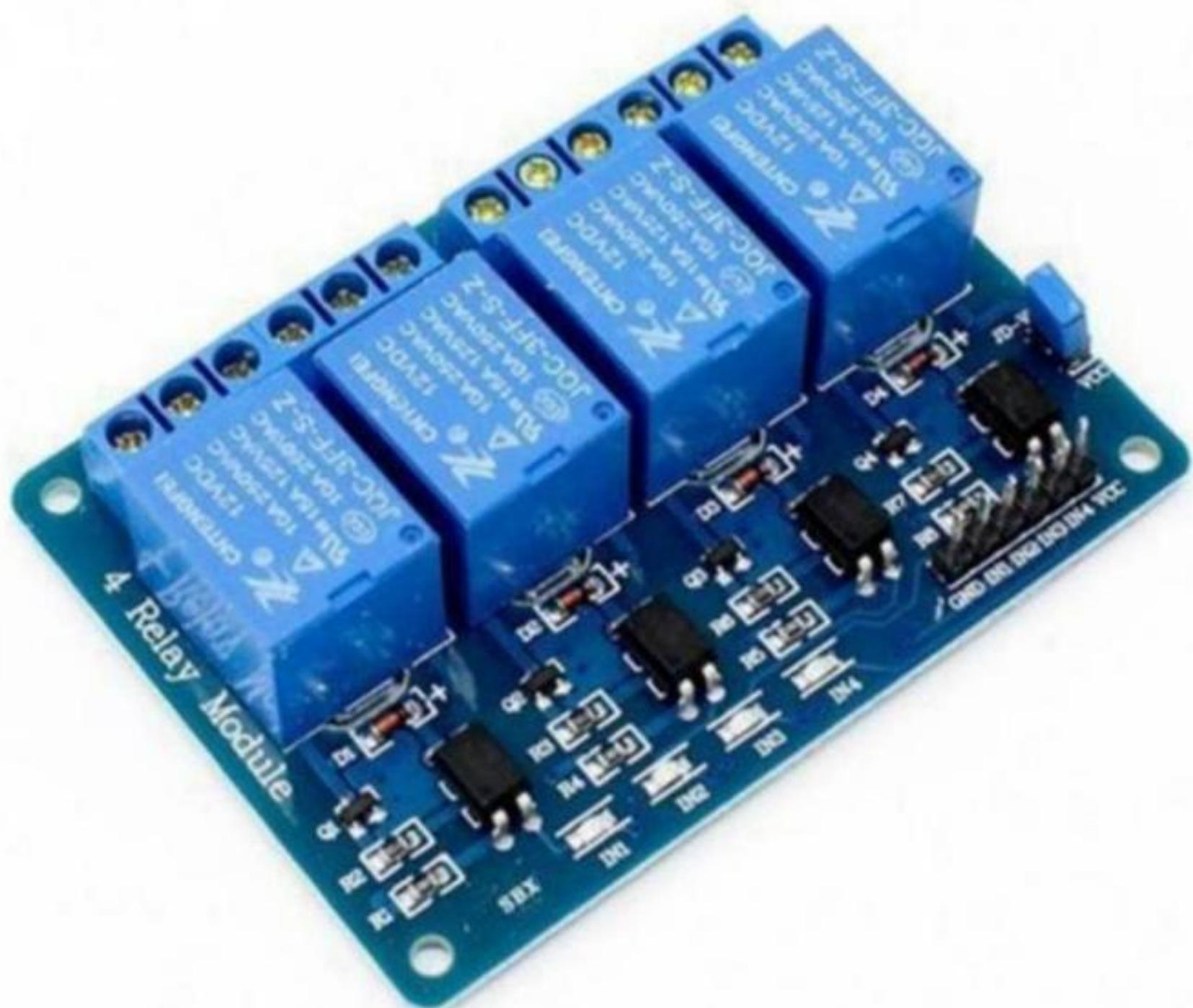
Blink example

Most Arduino boards contain a light-emitting diode (LED) and a load resistor connected between pin 13 and ground, which is a convenient feature for many tests and program functions. A typical program for a beginning Arduino programmer blinks a LED repeatedly. This program uses the functions pinMode(), digitalWrite(), and delay(), which are provided by the internal libraries included in the IDE environment. This program is usually loaded into a new Arduino board by the manufacturer.

RELAY:-

4 Channel 5V Optical Isolated Relay Module

This is a LOW Level 5V 4-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 currents. 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 a microcontroller. This module is optically isolated from high voltage side for safety requirement and also prevent ground loop when interface to microcontroller.



Brief Data:

- Relay Maximum output: DC 30V/10A, AC 250V/10A
- 4 Channel Relay Module with Opto-coupler. LOW Level Trigger expansion board, which is compatible with Arduino control boards.
- Standard interface that can be controlled directly by microcontroller (8051, AVR, *PIC, DSP, ARM, ARM, MSP430, TTL logic).
- Relay of high quality low noise relays SPDT. A common terminal, a normally open, one normally closed terminal.
- Opto-Coupler isolation, for high voltage safety and to prevent ground loop with microcontroller.

Schematic:

VCC and RY-VCC are also the power supply of the relay module. When you need to drive a large power load, you can take the jumper cap off and connect an extra power to RY-VCC to supply the relay; connect VCC to 5V of the MCU board to supply input signals. NOTES: If you want complete optical isolation, connect "Vcc" to Arduino +5 volts but do NOT connect Arduino Ground. Remove the Vcc to JD-Vcc jumper. Connect a separate +5 supply to "JD-Vcc" and board Gnd. This will supply power to the transistor drivers and relay coils. If relay isolation is enough for your application, connect Arduino +5 and Gnd, and leave Vcc to JD-Vcc jumper in place.

It is sometimes possible to use these relay boards with 3.3V signals, if the JD-VCC (Relay Power) is provided from a +5V supply and the VCC to JD-VCC jumper is removed. That 5V relay supply could be totally isolated from the 3.3V device, or have a common ground if opto-isolation is not needed. If used with isolated 3.3V signals, VCC (To the input of the opto-isolator, next to the IN pins) should be connected to the 3.3V device's +3.3V supply. NOTE: Some Raspberry-Pi users have found that some relays are reliable and others do not actuate sometimes. It may be necessary to change the value of R1 from 1000 ohms to something like 220 ohms, or supply

+5V to the VCC connection. NOTE: The digital inputs from Arduino are Active LOW: The relay actuates and LED lights when the input pin is LOW, and turns off on HIGH.

Operating Principle: See the picture below: A is an electromagnet, B armature, C spring, D moving contact, and E fixed contacts. There are two fixed contacts, a normally closed one and a normally open one. When the coil is not energized, the normally open contact is the one that is off, while the normally closed one is the other that is on.

Supply voltage to the coil and some currents will pass through the coil thus generating the electromagnetic effect. So the armature overcomes the tension of the spring and is attracted to the core, thus closing the moving contact of the armature and the normally open (NO) contact or you may say releasing the former and the normally closed (NC) contact. After the coil is de-energized, the electromagnetic force disappears and the armature moves back to the original position, releasing the moving contact and normally closed contact. The closing and releasing of the contacts results in power on and off of the circuit.

Input: VCC :

Connected to positive supply voltage (supply power according to relay voltage) GND : Connected to supply ground. IN1: Signal triggering terminal 1 of relay module IN2: Signal triggering terminal 2 of relay module IN3: Signal triggering terminal 3 of relay module IN4: Signal triggering terminal 4 of relay module.

Output: Each module of the relay has one NC (normally close), one NO (normally open) and one COM (Common) terminal. So there are 4 NC, 4 NO and 4 COM of the channel relay in total. NC stands for the normal close port contact and the state without power. NO stands for the normal open port contact and the state with power. COM means the common port. You can choose NC port or NO port according to whether power or not.

APPLICATIONS OF RELAY

Relays are used wherever it is necessary to control a high power or high voltage circuit with a low power circuit, especially when galvanic isolation is desirable. The first application of relays was in long telegraph lines, where the weak signal received at an intermediate station could control a contact, regenerating the signal for further transmission. High-voltage or high-current devices can be controlled with small, low voltage wiring and pilots switches. Operators can be isolated from the high voltage circuit. Low power devices such as microprocessors can drive relays to control electrical loads beyond their direct drive capability. In an automobile, a starter relay allows the high current of the cranking motor to be controlled with small wiring and contacts in the ignition key. Electromechanical switching systems including Strowger and Crossbar telephone exchanges made extensive use of relays in ancillary control circuits. The Relay Automatic Telephone Company also manufactured telephone exchanges based solely on relay switching techniques designed by Gotthilf Ansgarius Betulander. The first public relay based telephone exchange in the UK was installed in Fleetwood on 15 July 1922 and remained in service until 1959. The use of relays for the logical control of complex switching systems like telephone exchanges was studied by Claude Shannon, who formalized the application of Boolean algebra to relay circuit design in A Symbolic Analysis of Relay and Switching Circuits. Relays can perform the basic operations of Boolean combinatorial logic. For

example, the boolean AND function is realised by connecting normally open relay contacts in series, the OR function by connecting normally open contacts in parallel. Inversion of a logical input can be done with a normally closed contact. Relays were used for control of automated systems for machine tools and production lines. The Ladder programming language is often used for designing relay logic networks. Early electro-mechanical computers such as the ARRA, Harvard Mark II, Zuse Z2, and Zuse Z3 used relays for logic and working registers. However, electronic devices proved faster and easier to use. Because relays are much more resistant than semiconductors to nuclear radiation, they are widely used in safety-critical logic, such as the control panels of radioactive waste-handling machinery. Electromechanical protective relays are used to detect overload and other faults on electrical lines by opening and closing circuit breakers.

BLUETOOTH MODULE(HC-05 Bluetooth Module)

HC-05 Specification

Bluetooth protocol: Bluetooth Specification v2.0+EDR

Frequency: 2.4GHz ISM band

Modulation: GFSK(Gaussian Frequency Shift Keying)

Emission power: ≤4dBm, Class 2

Sensitivity: ≤-84dBm at 0.1% BER

Speed: Asynchronous: 2.1Mbps(Max) / 160 kbps,

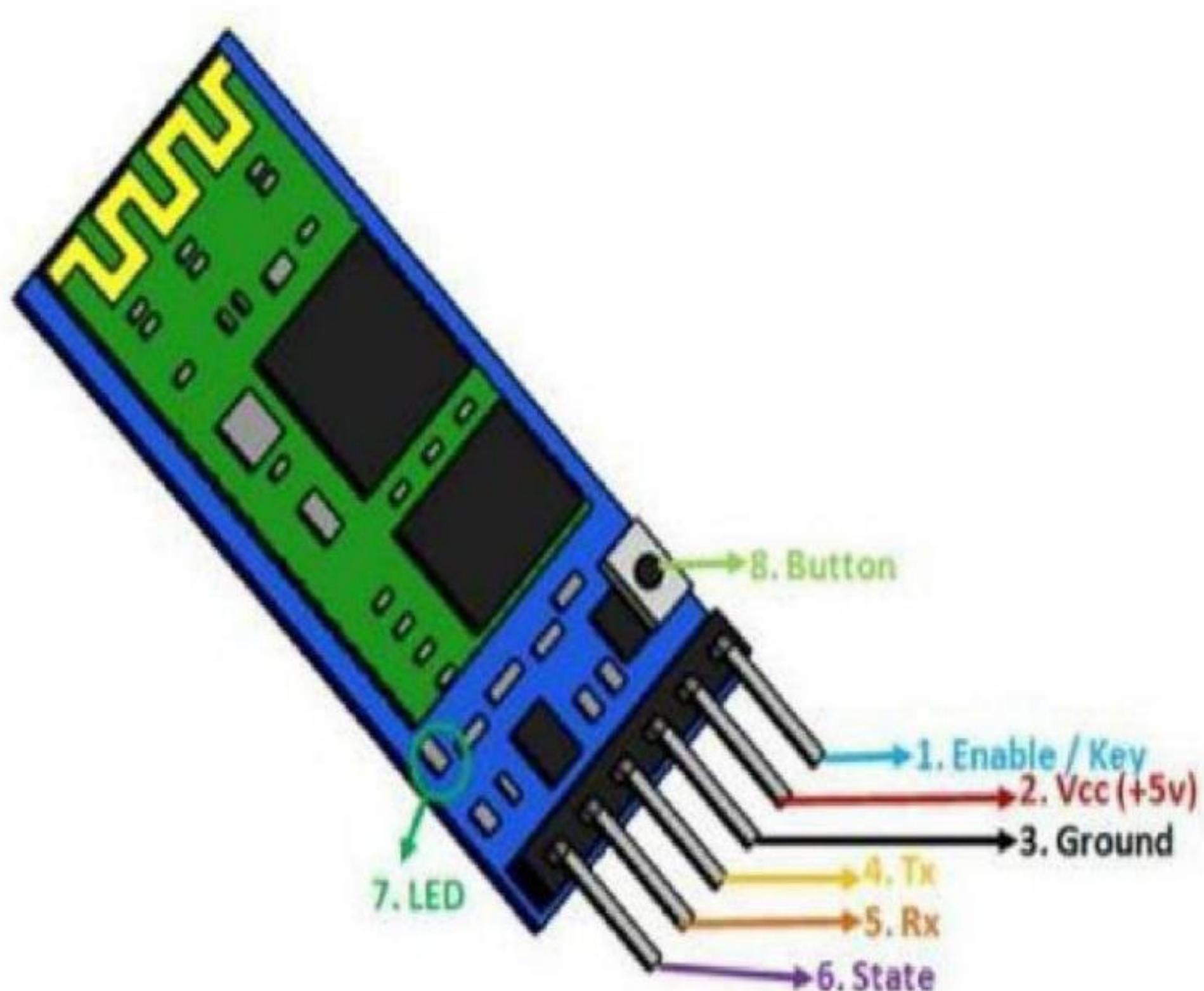
Synchronous: 1Mbps/1Mbps

Security: Authentication and encryption

Profiles: Bluetooth serial port Power supply: +3.3VDC 50mA

Working temperature: -20 ~ +75Centigrade

Dimension: 26.9mm x 13mm x 2.2 mm



Overview

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port bluetooth module is 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).

Bluetooth Module HC-05

The Bluetooth module HC-05 is a MASTER/SLAVE module. By default the factory setting is SLAVE. The Role of the module (Master or Slave) can be configured only by AT COMMANDS. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project, etc.

Pin Description:-

The HC-05 Bluetooth Module has 6 pins. They are as follows:

ENABLE: When enable is pulled LOW, the module is disabled which means the module will not turn on and it fails to communicate. When enable is left open or connected to 3.3V, the module is enabled i.e the module remains on and communication also takes place.

Vcc: Supply Voltage 3.3V to 5V

GND: Ground pin

TXD & RXD: These two pins acts as an UART interface for communication

STATE: It acts as a status indicator. When the module is not connected to paired with any other bluetooth device, signal goes Low. At this low state, the led flashes continuously which denotes that the module is not paired with other device. When this module is connected to/paired with any other bluetooth device, the signal goes High. At this high state, the led blinks with a constant delay say for example 2s delay which indicates that the module is paired.

BUTTON SWITCH:-

This is used to switch the module into AT command mode. To enable AT command mode, press the button switch for a second. With the help of AT commands, the user can change the parameters of this module but only when the module is not paired with any other BT device. If

the module is connected to any other bluetooth device, it starts to communicate with that device and fails to work in AT command mode.

HC-05 Default Settings:-

Default Bluetooth Name: ,HC-05

Default Password: 1234 or 0000

Default Communication: Slave

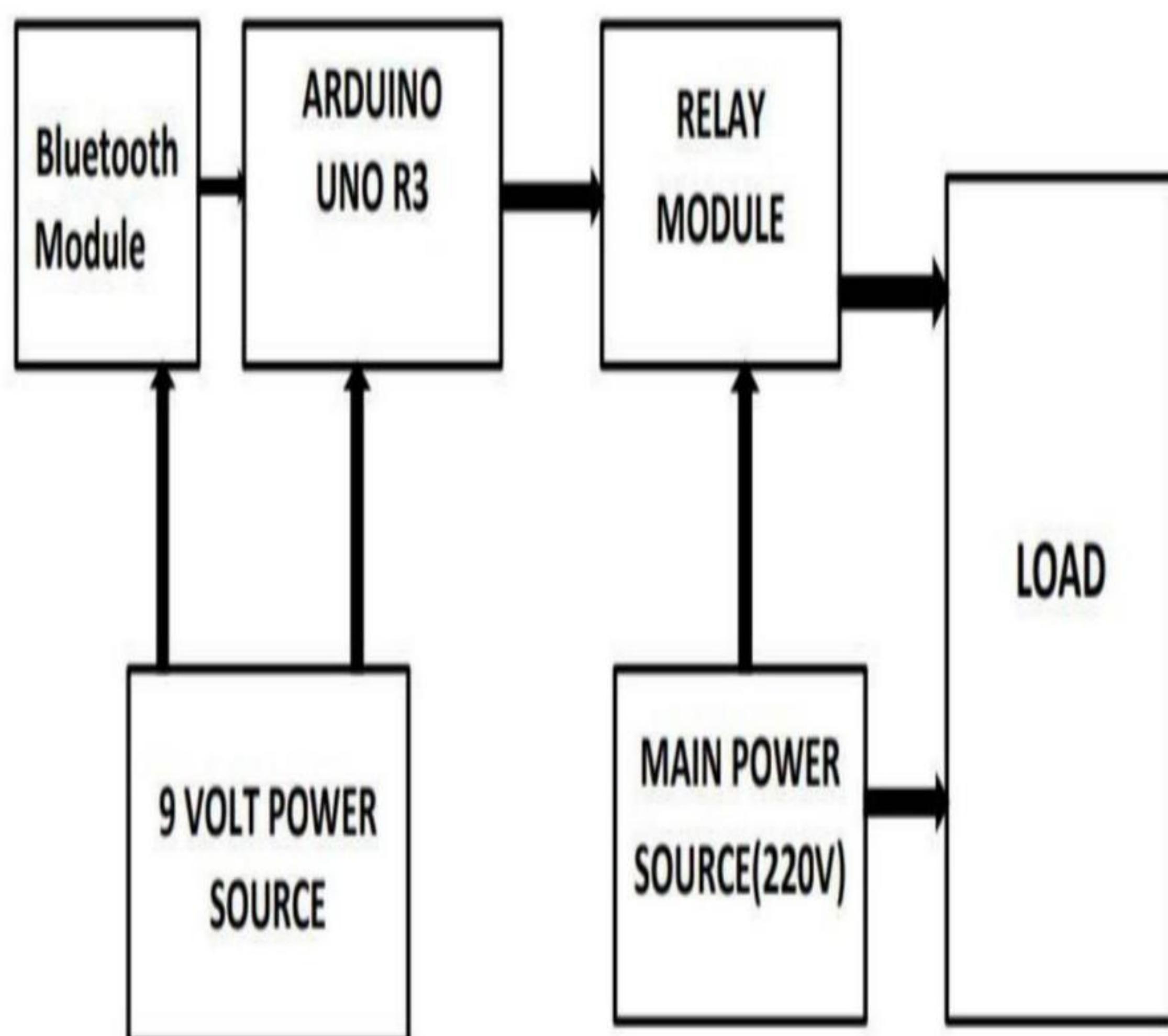
Default Mode: Data Mode

Data Mode Baud Rate: 9600, 8, N, 1

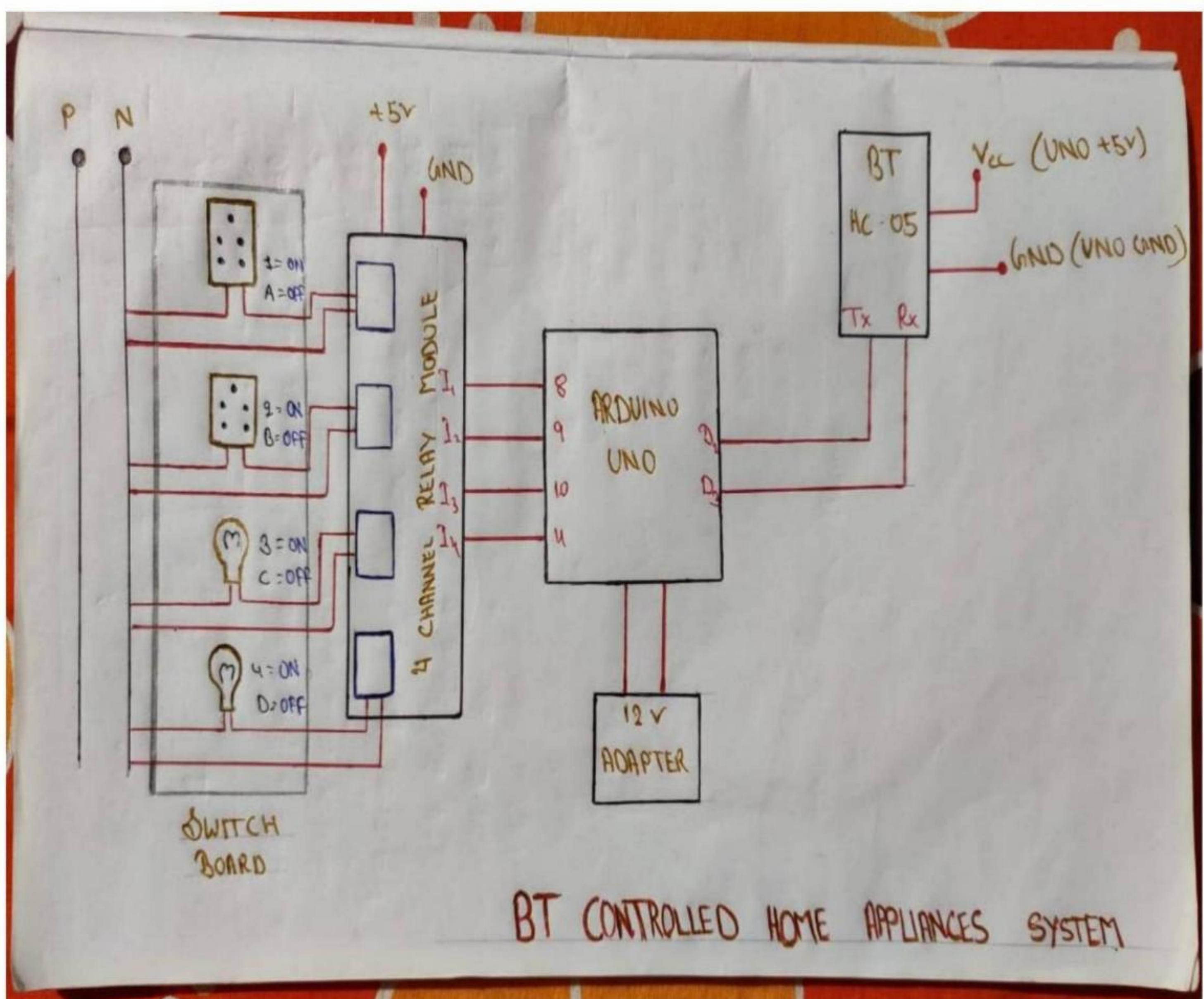
Command Mode Baud Rate: 38400, 8, N, 1

Default firmware: LINVOR

BLOCK DIAGRAM



CIRCUIT DIAGRAM



CODE

```
#include <Dabble.h>

#include <Servo.h>

void setup() {
    //put your setup code here, to run once:
    Dabble.begin(9600);
    pinMode(8, OUTPUT);
    pinMode(9, OUTPUT);
    pinMode(10, OUTPUT);
    pinMode(11, OUTPUT);

}

void loop() {
    //put your main code here, to run repeatedly:
    Dabble.processInput();
```

```
if(Terminal.compareString("1")) {  
    digitalWrite(8, true);  
}  
  
if(Terminal.compareString("A")) {  
    digitalWrite(8, false);  
}  
  
if(Terminal.compareString("2")) {  
    digitalWrite(9, true);  
}  
  
if(Terminal.compareString("B")) {  
    digitalWrite(9, false);  
}  
  
if(Terminal.compareString("3")) {  
    digitalWrite(10, true);  
}  
  
if(Terminal.compareString("C")) {  
    digitalWrite(10, false);  
}  
  
if(Terminal.compareString("4")) {  
    digitalWrite(11, true);  
}  
  
if(Terminal.compareString("D")) {
```

```
digitalWrite(11, false);  
}  
}
```

APPLICATION

Home Is Where the Smart Is?

Evm Machine-to-machine communication, and you understand you're not the most tech-savvy consumer, it's impossible that you've missed the abundance of home automation products filling the shelves and ads of every home improvement store. Suddenly an ordinary errand for light bulbs will leave you wondering if your lamp could send you a message alerting you that the light bulb needs to be replaced. Furthermore, if your lamp is talking to you, could your refrigerator and sprinkler system be too? Experts say: Yes, the possibilities are endless. If that's the case, where do you begin? Any day-to-day, repeatable process is automatable with smart home applications. The greater the control and flexibility of these processes, the more energy and cost savings the resident experiences, which are factors anyone who pays utilities strives to moderate. The smart home revolution is likely to be more of an evolution, with the incorporation of one or two home systems at a time, gradually automating our households through smart mobile devices. However, with these elements of efficiency comes the question of ease of use. Will it bring you enjoyment or exasperation? With so many brands and models already available in an ever growing market, how do you know which is best for you?

Lighting Control:

Leaving the Dark Ages and Stepping Into the Light Smart lighting allows you to control wall switches, blinds, and lamps, but how intuitive is a lighting control system? It turns out, quite; its capabilities are extensive. You're able to schedule the times lights should turn on and off, decide which specific

rooms should be illuminated at certain times, select the level of light which should be emitted, and choose how particular lights react through motion sensitivity, as seen with Belkin's WeMo Switch + Motion, which is both affordable and easy to use with its plug-and-play simplicity.

HVAC Regulation: No Longer Burned by Your Heating Bill As fuel costs rise and the availability and sustainability of our resources becomes a greater concern, heating/cooling our homes efficiently is less a budgetary bonus and more of a necessity. Over the past year, smart thermostats and automated home heating systems have become more readily available and easily incorporate into any home. Heating and cooling our homes consumes an average of 50% of energy costs yearly, making daily HVAC regulation progressively rewarding. Maintaining a substantial lead among the nearly non-existent competition, the Nest Learning Thermostat, learns your heating and cooling preferences over time, eliminating the need for programming and is accessible from your smartphone app. With automated HVAC you are able to reduce the heat when a room is unoccupied, and increase or decrease it at specific times based on your schedule and occupancy.

Security System:knock Knock

Who is there? The internal of things...smart locks with bluetooth can increase the security of our home and it is easy to use for everyone.

Fanspeed Regulator:-

It can control the speed of our fan with the bluetooth enabled devices and it is very easy for everyone and makes us feel smarter.

CONCLUSION

The system as the name indicates, 'Home automation' makes the system more flexible and provides an attractive user interface compared to other home automation systems. In this system we integrate mobile devices into home automation systems. A novel architecture for a home automation system is proposed using relatively new communication technologies. The system consists of mainly three components: a BLUETOOTH module, Arduino microcontroller and relay circuits. WIFI is used as the communication channel between android phone and the Arduino microcontroller. We hide the complexity of the notions involved in the home automation system by including them into a simple, but comprehensive set of related concepts. This simplification is needed to fit as much of the functionality on the limited space offered by a mobile device's display. This paper proposes a low cost, secure, ubiquitously accessible, auto-configurable, remotely controlled solution. The approach discussed in the paper is novel and has achieved the target to control home appliances remotely using the WiFi technology to connect system parts, satisfying user needs and requirements. WiFi technology capable solution has proved to be controlled remotely, provide home security and is cost effective as compared to the previously existing systems. Hence we can conclude that the required goals and objectives of the home automation system have been achieved. The system design and architecture were discussed, and the prototype presents the basic level of home appliance control and remote monitoring has been implemented. Finally, the proposed system is better from the scalability and flexibility point of view than the commercially available home automation systems.

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2. Wireless Sensor Networks: Concepts, Applications, Experimentation and Analysis. 2016. p. 108. ISBN 9811004129. The use of standardized, open standards over proprietary protocols provides the industry with the freedom to choose between suppliers with guaranteed interoperability. Standardized solutions usually have a much longer lifespan than proprietary solutions.

3.You tube