Project Name : Home Automation simulation using Arduino .

Introduction :
Home automation or domotics is building automation for a home, called a smart home or smart house. A home automation system will monitor and/or control home attributes such as lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems. When connected with the Internet, home devices are an important constituent of the Internet of Things ("IoT"). A home automation system typically connects controlled devices to a central smart home hub (sometimes called a "gateway"). The user interface for control of the system uses either wall-mounted terminals, tablet or desktop computers, a mobile phone application, or a Web interface that may also be accessible off-site through the Internet.

Components :

1) Arduino Uno :
Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. **[1]**

The 14 digital input/output pins can be used as input or output pins by using pinMode(), digitalRead() and digitalWrite() functions in arduino programming. Each pin operate at 5V and can provide or receive a maximum of 40mA current, and has an internal pull-up resistor of 20-50 KOhms which are disconnected by default. Out of these 14 pins, some pins have specific functions as listed below:

Serial Pins 0 (Rx) and 1 (Tx): Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip.
External Interrupt Pins 2 and 3: These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
PWM Pins 3, 5, 6, 9 and 11: These pins provide an 8-bit PWM output by using analogWrite() function.
SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK): These pins are used for SPI communication.
In-built LED Pin 13: This pin is connected with an built-in LED, when pin 13 is HIGH – LED is on and when pin 13 is LOW, its off.
Along with 14 Digital pins, there are 6 analog input pins, each of which provide 10 bits of resolution, i.e. 1024 different values. They measure from 0 to 5 volts but this limit can be increased by using AREF pin with analog Reference() function.
Analog pin 4 (SDA) and pin 5 (SCA) also used for TWI communication using Wire library.
Arduino Uno has a couple of other pins as explained below:
AREF: Used to provide reference voltage for analog inputs with analogReference() function.
Reset Pin: Making this pin LOW, resets the microcontroller. **[1]**

Figure 4.1 : Arduino Uno **[1]**

2) HC -05 Bluetooth Module :

It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications.

HC-05 is a Bluetooth device used for wireless communication with Bluetooth enabled devices (like smartphone). It communicates with microcontrollers using serial communication (USART).Default settings of HC-05 Bluetooth module can be changed using certain AT commands.As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, there is no need to shift TX voltage level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module.For more information about HC-05 Bluetooth module and how to use it, refer the topic HC-05 Bluetooth module in the sensors and modules section.

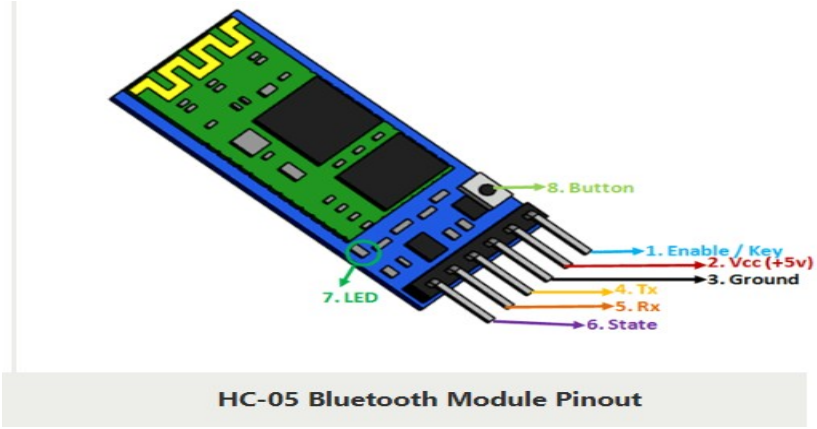


Figure 4.2 : HC -05 Bluetooth module **[2]**

1) ENABLE: When enable is pulled LOW, the module is inactivated which means the module will not turn ON and it fails to transmit/receive data (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.
2) VCC : Supply Voltage 3.3V to 5V
3) GND : Ground pin connected to ground.
Next these two pins act as an UART interface for communication
4) TXD: To transmit data from BT memory to device (generally microcontroller or microprocessor)
5) RXD : To receive data from device to BT memory
6) STATE: It acts as a status indicator. When the module is not connected to/paired with any other Bluetooth device, the signal goes Low. At this low state, the led (inbuilt in module) flashes continuously which denotes that the module is not paired with another 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.One more important thing to notice in the module is a small button.

3) 2N222 Transistor :
The 2N2222 is a common NPN bipolar junction transistor (BJT) used for general purpose low-power amplifying or switching applications. It is designed for low to medium current, low power, medium voltage, and can operate at moderately high speeds. It was originally made in the TO-18 metal can as shown in the picture. The 2N2222 is considered a very common transistor,] and is used as an exemplar of an NPN transistor. It is frequently used as a small-signal transistor, and it remains a small general purpose transistor of enduring popularity.

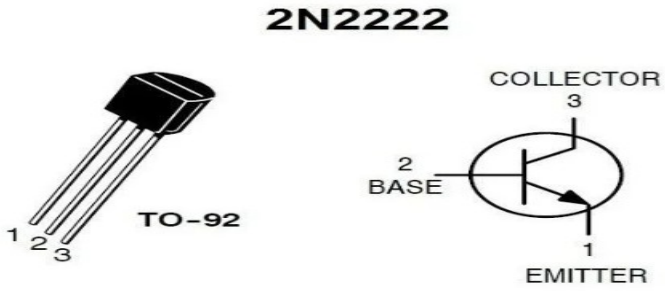


Figure 4.3 : 2N222 Transistor **[3]**

Pins of 2N222 Transistor :
1) Emitter : This pin act as an inlet as the current enters the transistor from here. The collector is denoted by ‘C’.

2) Base : This pin controls the transistor biasing. The base is denoted by ‘B’.
3) Collector : This pin act as an outlet and the current comes out of the transistor from here. The emitter is denoted by ‘ E’.

4) Alternator:
An alternator is a device that converts mechanical energy into AC electrical energy. A generator is a mechanical device which converts mechanical energy to either AC or DC electrical energy. An alternator always induces an alternating current. A generator can generate either alternating or direct current.

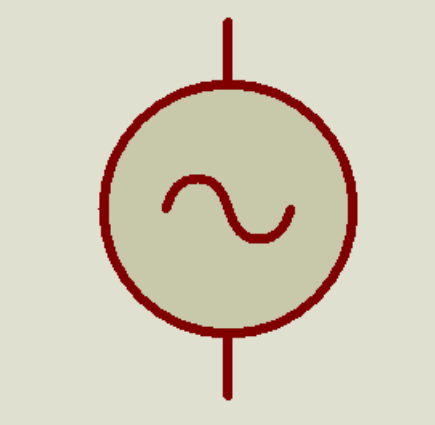


Figure 4.4 : Motorin proteus [4]

5)Motor :
DC motor is a simple motor which needs polarity difference at its two ends. IF this polarity is in forward direction then DC motor moves in one direction and if we reverse the polarity then the DC motor moves in the opposite direction. So, let's get started with DC Motor Drive Circuit in Proteus ISIS.

Figure 4.5 : Motor in Proteus **[5]**

6)Relay :

Relay modules use low-level data signals to switch relays capable of handling loads up to 10 Amps. Ideal for devices like PIR detectors and other sensors that output low level signals that need to turn another device on or off. Great for use with Arduino and other microcontrollers.

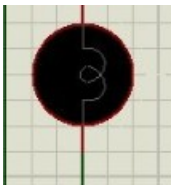


Figure 4.6 : Relay in proteus [6]

References :

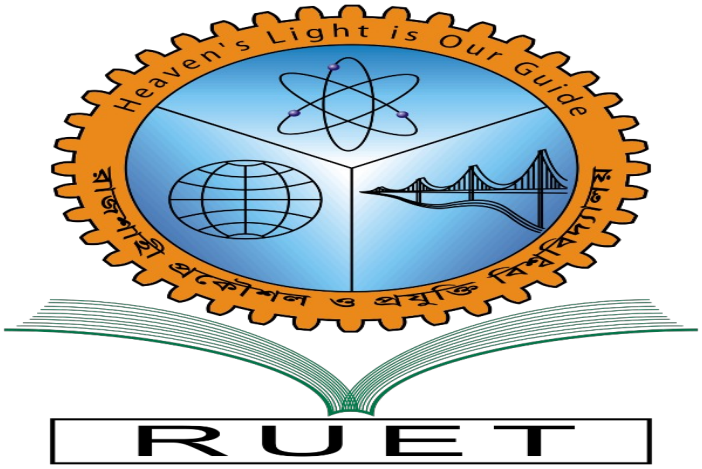
[1] 2022.[UNO R3].https://docs.arduino.cc/hardware/uno-rev3 [Accessed: 19 – December – 2022].

[2]2022.[HC 05 Bluetooth module].Available:https://components101.com/wireless/hc-05-bluetooth-module [Accessed: 19-December- 2022].

[3]2022.[2N222].Available:https://en.wikipedia.org/wiki/2N2222[Accessed: 19- December- 2022].

[4]2022.[DC Motor Drive Circuit in Proteus ISIS].Available: https://www.theengineeringprojects.com/2013/06/dc-motor-drive-circuit-in-proteus-isis.html[Accessed: 19 - December- 2022].

[6]2022.[Relay Module Simulation in Proteus].Available:https://projectiot123.com/2020/03/28/relay-module-simulation-in-proteus/ [Accessed: 19 – December – 2022].



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