International Journal of Scientific Research in Science, Engineering and Technology
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET

Bluetooth based Home Automation using Arduino

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ARTICLEINFO

Article History:

Accepted: 10 June 2023
Published: 20 June 2023

Publication Issue
Volume 10, Issue 3
May-June-2023

Page Number
523-528

ABSTRACT

This research paper presents a comprehensive study on the design, implementation and evaluation of a Bluetooth-based home automation system using Arduino. The system can control and monitor various household appliances such as lights, appliances, temperature and security via a phone app. This article discusses the hardware and software of the system, including electrical design, Arduino programming, mobile application development, and integration of Bluetooth communication. Experimental results demonstrate the effectiveness and efficiency of the proposed method, showing the potential to improve the potential of home automation.

Keywords - Home Automation, Mobile Phones, Arduino, Bluetooth, Home Stuff.

I. INTRODUCTION

In recent years, the concept of home automation, which provides more convenience, efficiency and management of many home appliances, has received great attention. Combined with the various features of the Arduino microcontroller, Bluetooth technology has become the perfect combination to create inexpensive and customizable home electronics. This research paper examines the design, implementation, and evaluation of a Bluetooth-based home automation system using Arduino.

The proposed system is widely used in Bluetooth smartphones and simplicity of Arduino boards to give users the ability to control and monitor the home.

People using a mobile app as a user interface can easily interact with home automation from anywhere via a Bluetooth connection. The integration of Arduino board, Bluetooth module, sensors and actuators provides seamless communication and automation of various home devices such as lights, appliances, temperature control and security. The system allows users to turn devices on or off, adjust settings, get real-time recommendations and even perform certain predefined tasks.

II. RELATED WORK

Bluetooth Low Energy Based Home Automation System" by A.

K. Vishwakarma et al. (2017): This study presents a Bluetooth Low Energy (BLE) based home automation

system using Arduino. The authors discuss the hardware and software implementation of the system, including the integration of Arduino, BLE module, and various sensors. This study demonstrates energy efficiency and presents experimental results to demonstrate the effectiveness of the proposed method.

III. SYSTEM DESCRIPTION

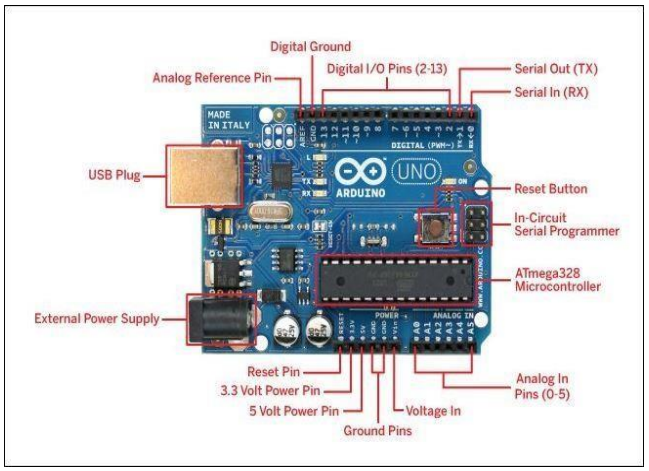
Clients are presupposed to have faraway manipulate and tracking abilities over an expansion of family home equipment using the Bluetooth-based totally household Automation device with Arduino. customers may also get admission to their domestic automation system from any region within the Bluetooth connection's variety way to the system's usage of Bluetooth to wirelessly join a cellular tool to an Arduino-based totally controller.

HARDWARE ARCHITECTURE

The hardware structure for Bluetooth-based home automation the use of an Arduino is made of a set of components that cooperate to automate and manipulate family appliances. The hardware architecture is summarised within the sentences that follow:

Arduino Uno

Arduino Uno, component B The machine is targeted on the Arduino board, which acts because the device's brain. it's far in fee of processing Bluetooth instructions acquired from the cell tool and controlling the related gadgets as essential. Any Arduino microcontroller board, which includes the Uno, Nano, or Mega, can serve as the Arduino board.



A microcontroller, such as an ATmega328P for the Arduino Uno or an ATmega2560 for the Arduino Mega, is constructed within the Arduino board. The Arduino programming language is utilized by the microcontroller to run code that accommodates Bluetooth command processing, tool control, and communique with sensors and actuators. The Bluetooth module, sensors, actuators, and different peripherals are all integrated into the home automation device's predominant part, the Arduino board. it's far a nicely-liked choice for developing Bluetooth-primarily based domestic automation projects because of its adaptability, simplicity, and huge community aid.

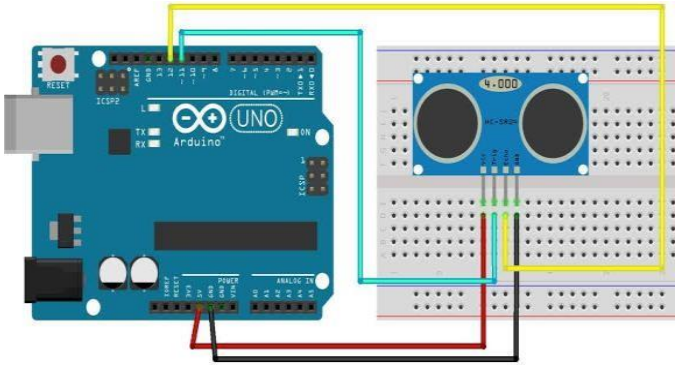
A. Bluetooth module HC-05

An Arduino board is connected to a Bluetooth module to set up a wireless verbal exchange hyperlink with the cellular device. The HC-05 and HC-06 are two Bluetooth modules that are frequently used. The Arduino board might also take instructions from the cellular app and reply by sending updates or different statistics back to the cell tool for the reason that Bluetooth module can cope with bidirectional connection.

B. Ultrasonic Range Sensor HC-SR04

A dependable and low-cost option for measuring distances in Arduino programs, including Bluetooth-based home automation systems, is the HC-SR04 sensor. it's miles a nicely-appreciated choice for

incorporating proximity sensing abilities into tasks due to the fact to its simplicity of use, accessibility, and compatibility with Arduino boards.



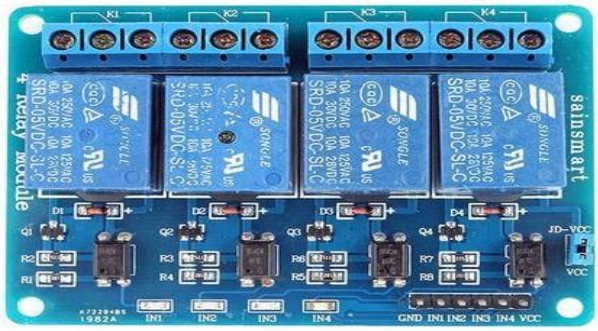
An ultrasonic sensor's workings are proven. Ultrasonic pulses shifting at 340 mls in keeping with 2nd are utilised as the Ping, and the again echo from the sensor is used to decide distance. the constraints placed at the HC-SR04 ultrasonic sensor's settings. in the proposed paintings, an ultrasonic sensor is used to gauge the water stage inside the water tank. It measures the gap between the water degree and the pinnacle of the water tank using Bluetooth technology and communicates its outcomes to a smartphone app.

C. CHANNEL RELAY BOARD

for your project's switching utility, a 4 Channel Relay Board is a simple and useful option to join four relays. because of its tiny size, this board is handiest suitable for low voltage applications.

Features:

- 4-Channel Relay interface board, and each one needs 15-20mA Driver Current
- Both controlled by 12V and 5V input Voltage
- Equipped with high-current relay, AC250V 10A ; DC30V 10A
- Standard interface that can be controlled directly by microcontroller (Arduino , 8051, AVR, PIC, DSP, ARM, ARM, MSP430, TTL logic active low)
- Opto-isolated inputs
- Indication LED's for Relay output status.



Pin-out Instruction:

"Vcc"	Power(5V DC)
"GND"	GND
"in1"	Signal pin, connected with Arduino and control Relay 1
"in2"	Signal pin, connected with Arduino and control Relay 2
"in3"	Signal pin, connected with Arduino and control Relay 3
"in4"	Signal pin, connected with Arduino and control Relay 4
"COM"	Common pin, which usually directly connect with the" Gnd" unless you want to change the TTL mode(default the HIGH level activate)
"NO"	Normally Open Connection
"NC"	Normally Closed Connection
"C"(middle pin)	Common Connection, Which connected with the power forthe load.

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	Arduino and control Relay 1
“in2”	Signal pin, connected with Arduino and control Relay 2
“in3”	Signal pin, connected with Arduino and control Relay 3
“in4”	Signal pin, connected with Arduino and control Relay 4
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	Common Connection, Which
“Vcc”	Power(5V DC)
“GND”	GND
“in1”	Signal pin, connected with Arduino and control Relay 1

"Vcc"	Power(5V DC)
"GND"	GND
"in1"	Signal pin, connected with Arduino and control Relay 1
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"NO"	Normally Open Connection
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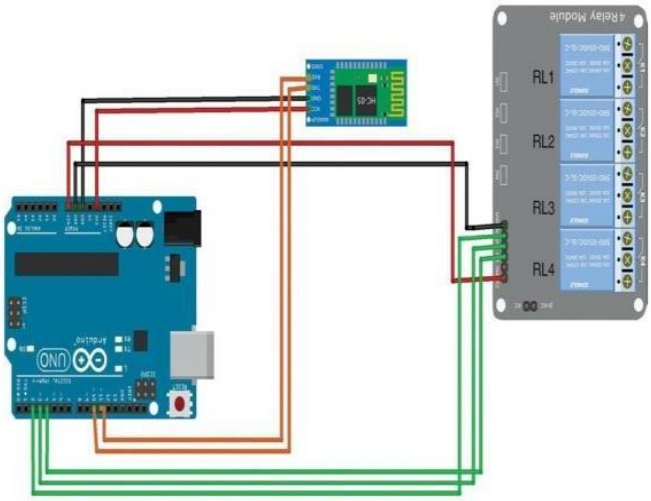
Note: the last pin "COM" "NC" "C" are not indicated on 1 the Board, because there are no enough place for these. But we indicates the by a simple graphic for each Relay terminal.

Circuit diagram:



IV. SOFTWARE ARCHITECTURE

In Two Arduino Integrated Development Environment (IDE) software and Bluetooth terminal application were used in this research.

A. Arduino IDE

IDE stands for Integrated Development Environment and it is recommended that all programming of the system be done in the Arduino IDE tool.

The baud rate for serial communication between the Arduino board and the smartphone is set to 9600 bits per second. The Arduino IDE command "Serial.A contains 0" is used to receive data serially from the smartphone, and the "Serial.printlnO" command is

used to send data serially from the Arduino board to the smartphone. The code used to get the data string on the smartphone.

A state variable is used to store the value of the received bytes and then compared with different conditions and special operations are performed. The Arduino IDE code for turning the lights on and off is shown below.

```
if (state == '0') %condition check
{
Serial.println("LIGHT ON"); digitaIWrite(LIGHT, HIGH); %Turn On the Light
}
if (state == '1 ') %condition check
{
Serial.println("LIGHT OFF"); digitaIWrite(LIGHT, LOW); %Turn OFF the Light
}
```

V. CONCLUSION

In this article, we presented the design and implementation of a low-cost, flexible wireless home automation solution. The system is secure from any user or login. Users need to get a password to connect Arduino BT and mobile phone to access the device. This increases protection against unauthorized users. The system can be used as a testing platform for any device that needs to switch apps without an internet connection.

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Cite this article as :

Shaik Shanwaz, Ravulapalli Vinay Karteek, Advin Manhar, "Bluetooth based Home Automation using Arduino", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 10 Issue 3, pp. 523-528, May-June 2023.
Journal URL : https://ijsrset.com/IJSRSET23103128