DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF ENGINEERING

PROJECT REPORT

Voice controlled home automation

A PROJECT REPORT

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Introduction to Internet of Things and Laboratory

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ABSTRACT

•This report details the development of voice recognition based led lighting system designed to help the physically disabled and home automation.
• The system utilizes an
-Bluetooth HC-05 Module to provide Bluetooth connectivity.
-a Dual-Channel relay module.
-LEDs to indicate the voice recognised by the Bluetooth module.
• The report outlines the system components, operation, implementation details, and potential enhancements for future iterations.

INTRODUCTION

Overview: Our project aims to create a DIY Voice Controlled Home Automation with Arduino and Bluetooth using the following components:

1. Arduino UNO: A versatile microcontroller board for prototyping and DIY electronics projects.

2. HC-05 Bluetooth Module: Enables wireless communication between Arduino and other devices like smartphones or computers.

3. 2-channel Relay Module (5v): Controls high voltage devices using low voltage signals from Arduino.

4. 2 led: Light sources for electrical projects, commonly used for illumination or signalling.

5. 220v Electrical wire with a 2-pin male socket: Connects devices to power sources safely and efficiently.

6. Jumper wires: Flexible connectors for easily linking components on a breadboard or circuit.

7. Smartphone: A powerful tool for remote control, data monitoring, and interaction with Arduino projects via Bluetooth or other connectivity options.

8. Buzzer: Provides audible alerts and notification in the system, complementing Arduino and Bluetooth integration for enhanced user experience.

Objectives:

1. Voice Control Interface:

Develop a user-friendly voice-controlled system for home automation.

2. Bluetooth Connectivity:

Establish reliable communication between Arduino and smartphones for remote control.

3. Appliance Integration:

Enable control of diverse home devices through voice commands.

4. User Experience:

Design an intuitive interface for seamless interaction and command execution.

5. Safety and Scalability:

Implement security measures and ensure the system's adaptability for future expansion.

Motivation:

1. Convenience and Accessibility:

Enable users to control their home appliances and devices hands-free, improving convenience, especially for individuals with mobility issues or busy schedules.

2. Integration with Modern Technology:

Utilize emerging technologies like voice recognition and Bluetooth connectivity to modernize home automation systems, aligning with contemporary lifestyles.

3. Customization and Personalization:

Empower users to tailor the automation system to their preferences, allowing for personalized setups and routines.

4. Energy Efficiency and Cost Savings:

Facilitate efficient usage of energy by enabling users to remotely control devices, potentially reducing electricity bills and environmental impact.

5. Learning and DIY Spirit:

Foster curiosity and learning by providing an opportunity for enthusiasts to delve into electronics, programming, and smart home technology through hands-on project development.

LITERATURE SURVEY

1. Paper 1 title: "IoT-Based Home Automation System" Abstract: This paper presents the design and implementation of an Internet of Things (IoT) based home automation system. The system utilizes sensor nodes to monitor environmental parameters and actuator nodes to control home appliances remotely via a web interface or mobile application. The architecture integrates various communication protocols to enable seamless connectivity and interaction between devices, providing users with enhanced convenience and energy efficiency.

2. Paper 2 title: "Voice-Controlled Home Automation System using IoT"
Abstract: This study explores the development of a voice-controlled home automation system leveraging Internet of Things (IoT) technologies. The system utilizes voice recognition algorithms to interpret user commands and trigger corresponding actions to control home appliances. Through integration with IoT platforms and devices, users can remotely manage their home environment using natural language commands, enhancing accessibility and user experience.

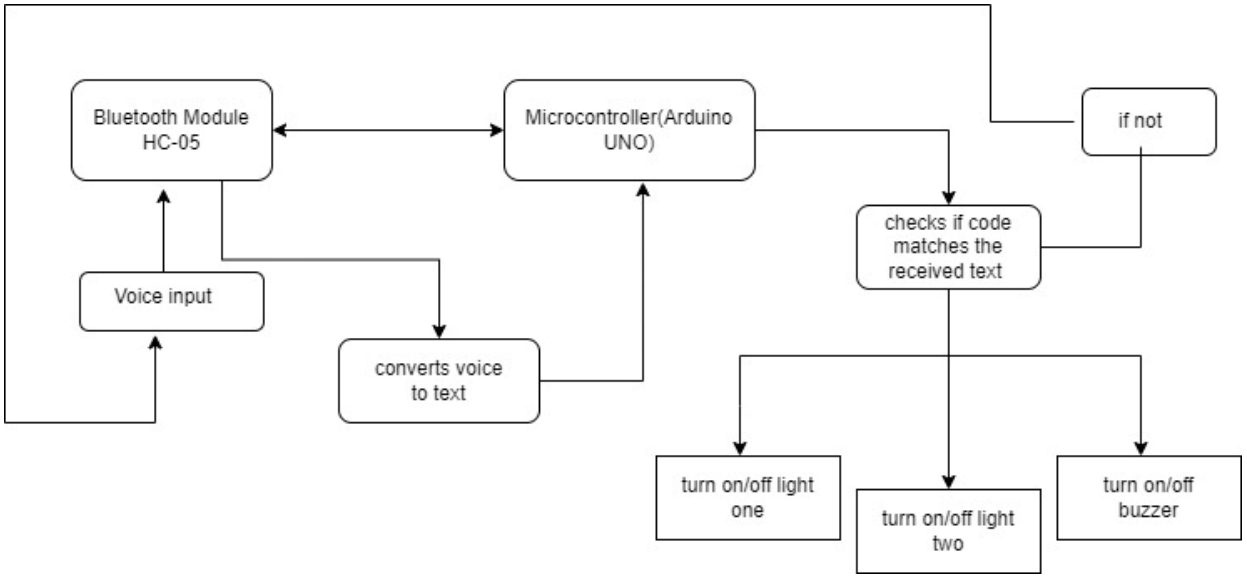
3. Paper 3 title: "Smart Home Automation System using IoT and Machine Learning"
Abstract: This research presents a smart home automation system that combines Internet of Things (IoT) technology with machine learning algorithms for intelligent decision-making. The system collects data from various sensors deployed within the home environment and employs machine learning techniques to analyze user behavior patterns and preferences. Based on these insights, the system autonomously adjusts appliance settings and schedules to optimize energy usage and enhance user comfort.

4. Paper 4 title: "Security Framework for IoT-Based Home Automation Systems"
Abstract: This paper proposes a security framework tailored specifically for Internet of Things (IoT)-based home automation systems. The framework addresses various security challenges, including device authentication, data privacy, and secure communication protocols. By implementing cryptographic techniques and access control mechanisms, the framework aims to safeguard sensitive information and protect against potential cyber threats, ensuring the integrity and reliability of home automation

functionalities.

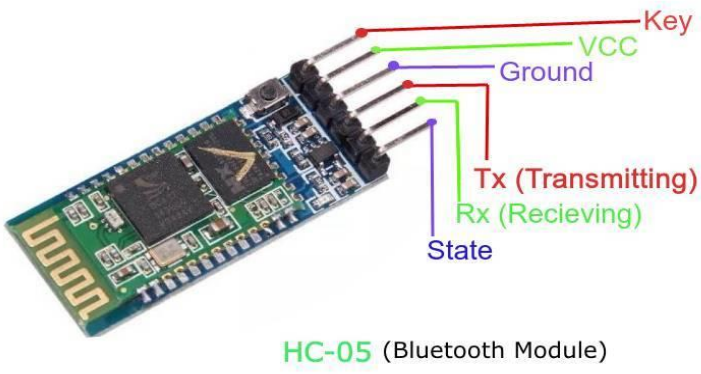
5. Paper 5 title: "Energy-Efficient Home Automation using IoT and Renewable Energy Sources"
Abstract: This study presents an energy-efficient home automation system that leverages Internet of Things (IoT) technology and renewable energy sources. The system integrates smart meters and sensors to monitor energy consumption patterns and environmental conditions. Through intelligent control algorithms and integration with renewable energy systems such as solar panels and wind turbines, the system optimizes energy usage, reduces reliance on grid power, and promotes sustainability in residential setting

PROPOSED METHODOLOGY



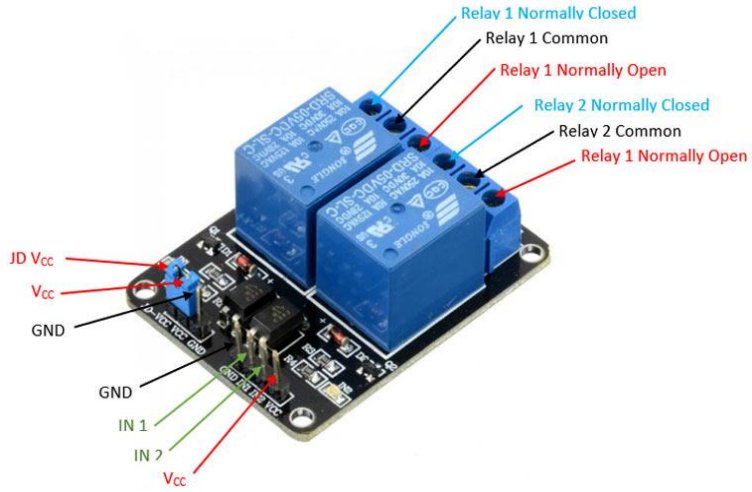
Pin Diagrams:

- **HC-05 Bluetooth Module:**

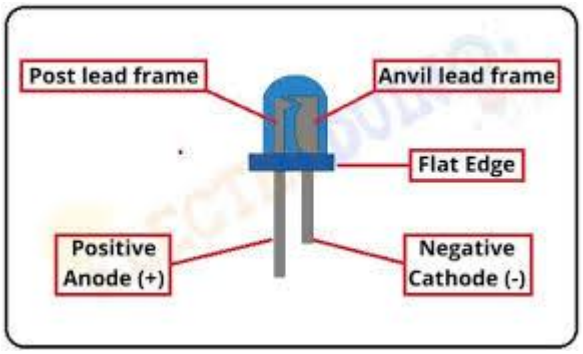


HC-05 (Bluetooth Module)

- **2-channel Relay Module (5v):**

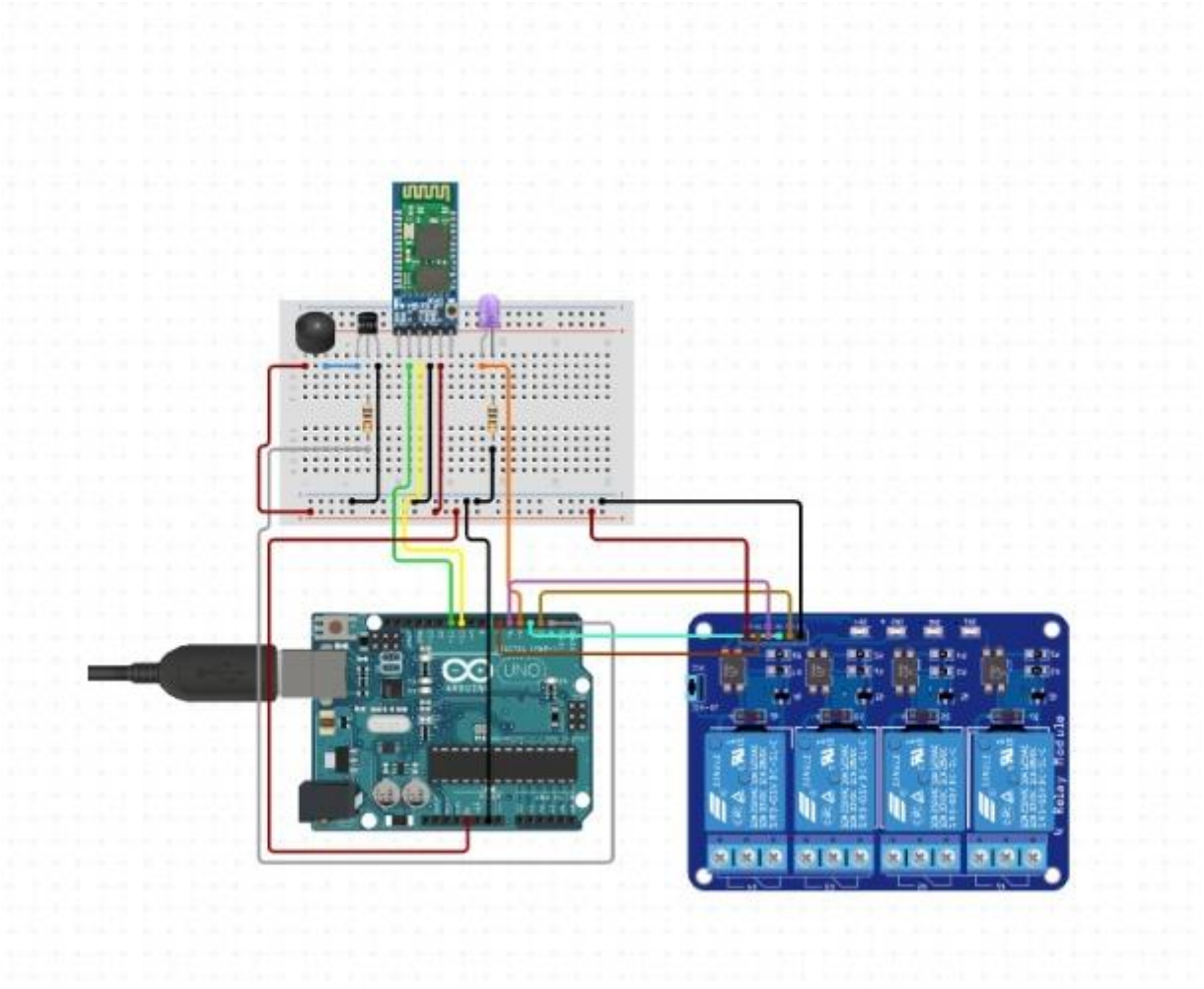


- **LED:**



- **Buzzer:**

CIRCUIT DIAGRAM:



Hardware and Software used (With Technical Specification):

Hardware and Software used (With Technical Specification):

1. HC-05 Bluetooth Module:
   • Technical Specifications:
   • Bluetooth version: 2.0 + EDR (Enhanced Data Rate)
   •Frequency: 2.4 GHz ISM band
   •Modulation: GFSK (Gaussian Frequency Shift Keying)
   •Transmit power: Class 2 (up to 4 dBm)
   •Sensitivity: -80 dBm typical
   •Range: approximately 10 meters (or 33 feet) in open air
   •Profiles supported: SPP (Serial Port Profile), HID (Human Interface Device) and others
   •Operating voltage: 3.3V to 5V DC
   •Operating current: less than 50mA
   •Standby current: less than 2.5mA
   •Sleep current: less than 1mA
   •Interface: UART (Universal Asynchronous Receiver/Transmitter)
   •Baud rates: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, and 460800
   •Operating temperature: -20°C to 75°C (-4°F to 167°F)

2. Dual-Channel relay module:
   •Technical Specifications:
   •Number of Channels: 2.
   • Input Voltage: Typically 3.3V, 5V, 12v and 24V DC.
   •Input Signal Voltage: 3.3V to 5V.
   •Output Voltage: Varies depending on model (24V to 220V AC or up to 30V DC)
   •Maximum Switching Current: Varies depending on model (typically 7A to 10A per channel)

3. Arduino Microcontroller:
   •Technical Specifications
   •Microcontroller: ATmega328P
   •Operating Voltage: 5V
   •Digital I/O Pins: 14
   •Analog Input Pins: 6
   •Flash Memory: 32KB (of which 0.5KB used by bootloader)
   •SRAM: 2KB
   • Clock Speed: 16MHz.
4. LED (Light-Emitting Diode):
   •Technical Specifications:
   •Operating Voltage: [1.8V to 3.6V.]

5.BUZZER
   •The frequency range is 3,300Hz
   •Operating Temperature ranges from – 20° C to +60°C
   •Operating voltage ranges from 3V to 24V DC
   •The sound pressure level is 85dBA or 10cm
   •The supply current is below 15mA

6. Arduino IDE (Integrated Development Environment):
   • Version:[2.3.2]
   • Description: Used for programming the Arduino microcontroller to control the operation of the gas leakage detection and prevention system.

7.C/C++ Programming Language:
Description:
Used for writing code to interface with the hardware components, implement control logic, and handle sensor data processing.

Methodology of Project

1. Design Phase:
- Component Selection: Identify appropriate components for the voice-controlled home automation system, including microphones, speakers, Arduino boards, and Bluetooth modules.
- System Architecture: Design a schematic outlining the connections between the chosen components, considering power requirements and communication protocols.
- User Interface Design: Create a user-friendly interface for voice commands and feedback, ensuring ease of interaction and clear communication.

2. Development Phase:
- Hardware Assembly: Connect microphones, speakers, Arduino boards, and Bluetooth modules according to the system architecture design.
- Software Programming: Develop code to process voice commands, establish Bluetooth communication with smartphones, and control home devices based on user inputs.
- User Interface Development: Implement the designed user interface, integrating voice recognition and feedback mechanisms.

3. Testing Phase:
- Functional Testing: Verify the functionality of individual components, including microphone sensitivity, speaker clarity, Bluetooth connectivity, and device control.
- System Integration Testing: Test the entire system to ensure seamless interaction between voice commands, smartphone control, and appliance integration.

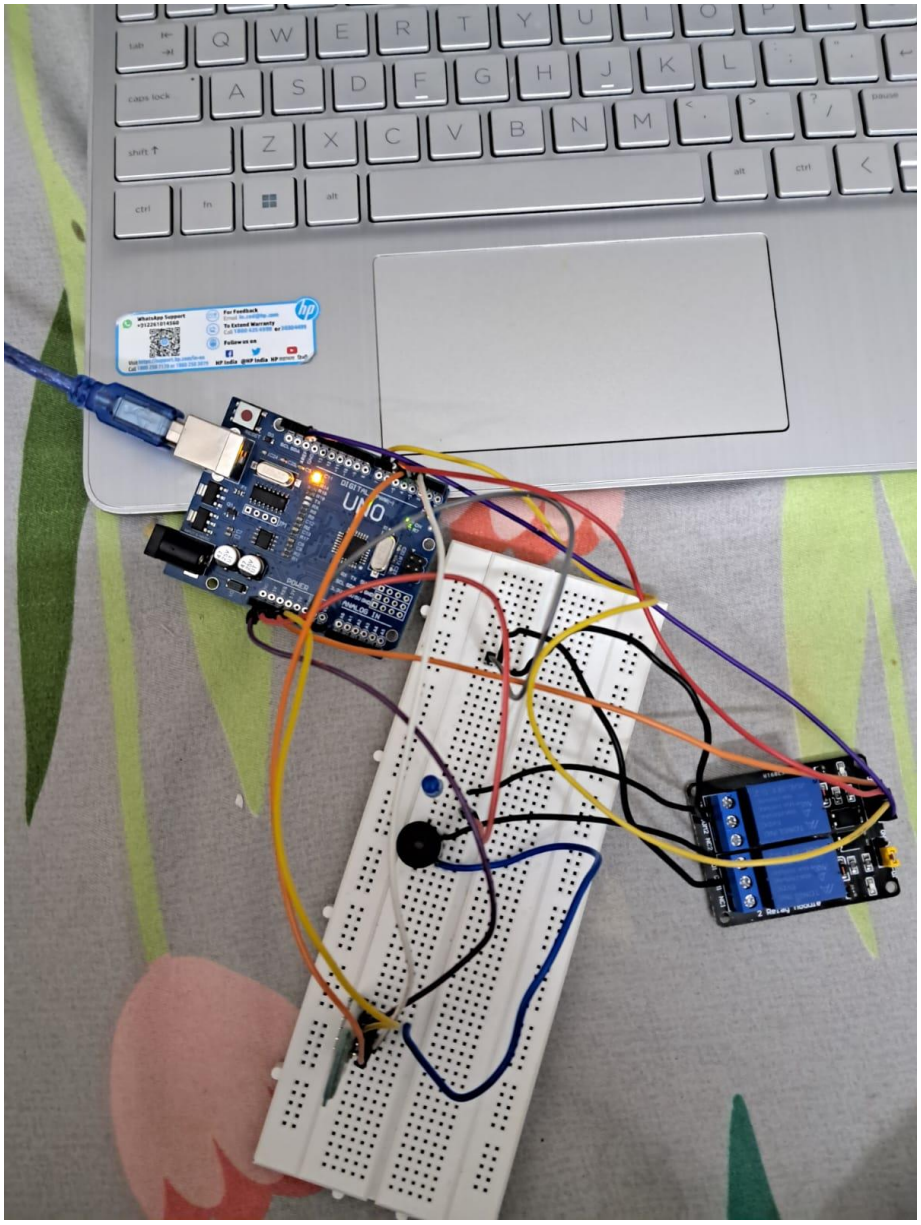
4. Deployment Phase:
- Installation: Deploy the voice-controlled home automation system in a residential environment, ensuring proper placement of microphones, speakers, and Arduino boards.
- Configuration: Pair smartphones with the system via Bluetooth and configure device control settings according to user preferences.

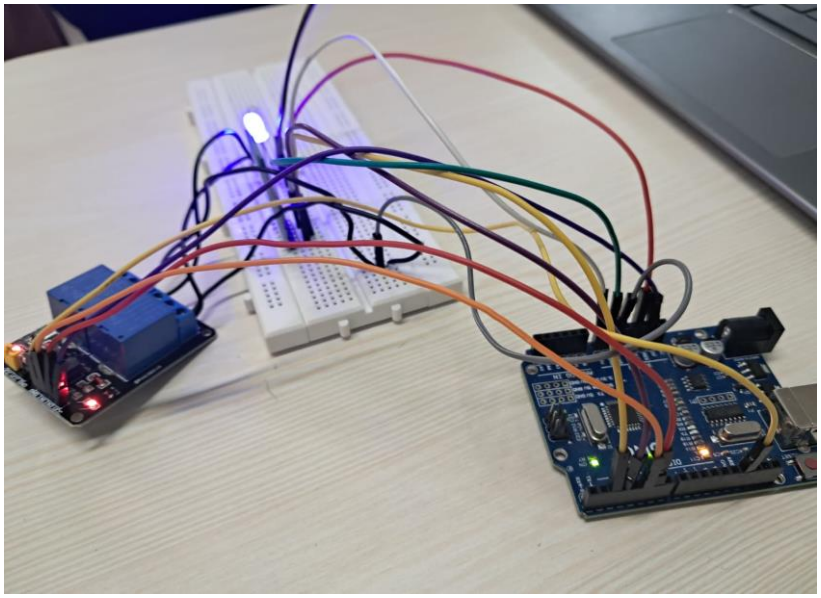
5. Maintenance Phase:
- Performance Monitoring: Regularly monitor system performance to identify and address any issues or malfunctions.
- Software Updates: Implement software updates to improve system functionality, security, and compatibility with new devices.
- User Support: Provide ongoing support to users for troubleshooting and assistance with system operation.

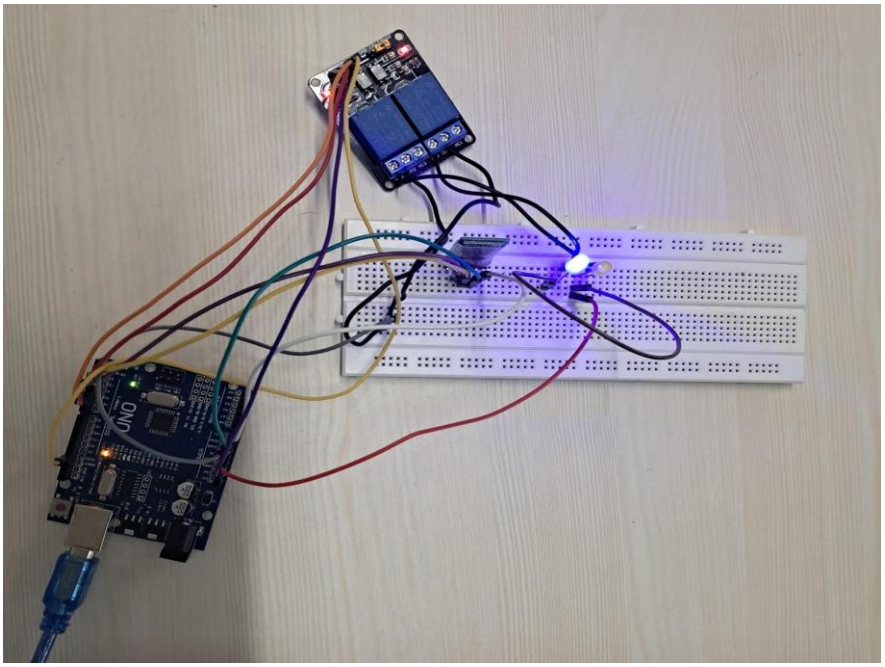
PROGRAM CODE

```
#include<SoftwareSerial.h>
// Define 2 channel relay pins
const int Light1 = 6; // Relay pin 1 (IN1)
const int Light2 = 5;   // Relay pin 2 (IN2)
/* Create object named bt of the class SoftwareSerial */
SoftwareSerial bt(2, 3); /* (Rx,Tx) */
void setup() {
  bt.begin(9600); /* Define baud rate for software serial communication */
  Serial.begin(9600); /* Define baud rate for serial communication */
  // Set Relay pins as OUTPUT
   pinMode(Light1, OUTPUT);
   pinMode(Light2, OUTPUT);
   digitalWrite(Light1, HIGH);
   digitalWrite(Light2, HIGH);
}
void loop() {
  String data="";
  char ch;
  while (bt.available()) /* If data is available on serial port */
    { ch = bt.read(); /* Print character received on to the serial monitor
*/
      data=data+ch;
    }
   Serial.print(data);
  // Control the devices using voice command
    if ((data == "turn on buzzer")||(data == "turn on the buzzer"))
// turn on Device1
    {
      digitalWrite(Light1, LOW);
      delay(200);
    }
    else if ((data == "turn off buzzer")||(data == "turn off the buzzer"))
// turn off Device1
    {
      digitalWrite(Light1, HIGH);
      delay(200);
    }
    // Control the devices using voice command
    else if ((data == "turn on light two")||(data == "turn on light
to")||(data == "turn on light 2")) // turn on Device2
    {
      digitalWrite(Light2, LOW);
      delay(200);
    }
    else if ((data== "turn off light two")||(data == "turn off light
to")||(data == "turn off light 2")) // turn off Device2
    {
      digitalWrite(Light2, HIGH);
      delay(200);
    }
}
```

RESULT






UNO

APPLICATIONS

• Smart Home Automation: IoT devices can be used to automate and control various functions within a home, such as lighting, heating, air conditioning, security cameras, door locks, and appliances. Users can remotely monitor and manage these devices using their smartphones or voice commands.

• \Healthcare: IoT devices and sensors are employed in healthcare for remote patient monitoring, medical device integration, wearable health trackers, telemedicine, and improving healthcare delivery systems. These technologies enable continuous monitoring of patients' vital signs and health metrics, leading to better patient outcomes and reduced healthcare costs.

• Smart Cities: IoT plays a crucial role in creating smart and sustainable cities by optimizing resources, enhancing public services, and improving quality of life. Smart city applications include smart traffic management, waste management, environmental monitoring, public safety and security, energy management, and infrastructure maintenance.

• Retail: In retail, IoT technologies are used for inventory management, supply chain optimization, personalized marketing, customer engagement, and enhancing the shopping experience. Retailers utilize IoT devices such as RFID tags, beacons, and sensors to track products, analyze customer behavior, and deliver targeted promotions.

• Agriculture: IoT solutions are revolutionizing agriculture by enabling precision farming techniques, monitoring environmental conditions, optimizing irrigation and fertilization, and improving crop yields. IoT sensors collect data on soil moisture, temperature, humidity, and crop health, allowing farmers to make data-driven decisions and maximize productivity.

• Energy Management: IoT devices and smart meters are utilized for energy monitoring, demand response, energy efficiency optimization, and renewable energy integration. IoT-enabled systems help consumers and businesses track their energy usage in real-time, identify inefficiencies, and reduce energy consumption.

• Environmental Monitoring: IoT sensors are deployed for monitoring air quality, water quality, noise pollution, and other environmental parameters. These sensors provide valuable data for environmental agencies, researchers, and policymakers to assess environmental health, implement pollution control measures, and mitigate environmental risks.

INFERENCE

- The project objectives were successfully achieved, resulting in the development of a sophisticated home automation system.
- A user-friendly voice control interface was implemented, allowing for intuitive and hands-free control of various home devices.
- The establishment of reliable Bluetooth connectivity enabled seamless communication between the system and smartphones, empowering users with convenient remote control capabilities.
- Diverse home devices were seamlessly integrated and controlled through voice commands, enhancing the system's versatility and functionality.
- The designed interface prioritized user experience, ensuring smooth interaction and efficient execution of commands for enhanced usability.

- Robust security measures were implemented to safeguard user data and system integrity, while the system's architecture allowed for easy scalability and adaptability to accommodate future expansions and integrations.
- In summary, the project successfully delivered a comprehensive home automation solution that prioritizes user convenience, security, and scalability

CONCLUSION AND FUTURE WORKS

Concluding this endeavor, the development of the home automation system has been a significant achievement, meeting its objectives of providing seamless control and management of household devices through voice commands and smartphone connectivity. Looking forward, the following future works are envisioned:

- Enhanced Mobile Application Integration: Integrate the system with a dedicated mobile application to offer users comprehensive control and monitoring capabilities from anywhere, anytime.

- Advanced Smart Home Integration: Expand the system's compatibility and integration with existing smart home platforms and protocols, allowing for interoperability with a broader range of devices and services.

- Partnerships and Industry Collaboration: Forge strategic partnerships with appliance manufacturers, service providers, and smart home ecosystem developers to promote interoperability, innovation, and wider adoption of the system in the market.

- These future initiatives aim to elevate the functionality, usability, and market presence of the home automation system, ultimately contributing to enhanced comfort, convenience, and efficiency in modern living environments.

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