

PROJECT REPORT

BLUETOOTH BASED HOME AUTOMATION USING ARDUINO

1. INTRODUCTION

Home automation systems aim to improve comfort, energy efficiency, and safety by enabling remote control of household appliances. Traditional manual switching systems are inefficient and inconvenient, especially for elderly or physically challenged users.

This project presents a **Bluetooth-based Home Automation System** using an **Arduino UNO** and **HC-05 Bluetooth module**, allowing users to control electrical appliances using **voice commands** transmitted from a mobile device.

The system is simulated using **Proteus Design Suite** and demonstrates reliable control of multiple loads through relay driver circuits.

2. OBJECTIVES

The objectives of this project are:

- To control household appliances wirelessly using Bluetooth
 - To implement voice-based command control
 - To interface relays safely using transistor drivers
 - To simulate and verify the system using Proteus
 - To design a low-cost and user-friendly automation solution
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3. SYSTEM OVERVIEW

The system consists of an Arduino UNO connected to a Bluetooth module (HC-05). Voice commands are sent from a smartphone via Bluetooth. The Arduino processes the received commands and switches appliances ON or OFF through relay circuits.

Each relay controls a specific load such as:

- Light
- Fan

- Night lamp
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4. BLOCK DIAGRAM DESCRIPTION

The major blocks in the system are:

- **Arduino UNO:** Central controller that processes commands and controls outputs
 - **HC-05 Bluetooth Module:** Receives voice commands wirelessly
 - **Relay Driver Circuit:** Uses transistor (2N2222) and diode for safe switching
 - **Relays:** Isolate low-voltage control from high-voltage loads
 - **Electrical Loads:** Light, fan, and night lamp
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5. HARDWARE COMPONENTS

5.1 Arduino UNO

- ATmega328P microcontroller
- Operates at 5V
- Handles serial communication and output control

5.2 HC-05 Bluetooth Module

- Operates in slave mode
- Communicates via UART
- Receives voice commands from mobile application

5.3 Relay Module

- Controls AC/DC loads
- Provides electrical isolation

5.4 Transistor & Diode

- **2N2222** transistor used as relay driver
 - **1N4007** diode used for flyback protection
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6. SOFTWARE DESIGN

The program is written in **Embedded C using Arduino IDE**.

Key Features:

- Serial communication at 9600 baud rate
 - String-based command processing
 - Individual and group appliance control
 - Simple and readable logic
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7. WORKING PRINCIPLE

1. User gives a voice command through a mobile app
 2. Command is transmitted via Bluetooth
 3. Arduino receives the command through serial communication
 4. The command string is compared with predefined commands
 5. Corresponding output pin is switched HIGH or LOW
 6. Relay activates or deactivates the appliance
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8. VOICE COMMANDS USED

Command Action

light on Turn ON light

light off Turn OFF light

fan on Turn ON fan

fan off Turn OFF fan

night lamp on Turn ON night lamp

night lamp off Turn OFF night lamp

Command	Action
all on	Turn ON all loads
all off	Turn OFF all loads

9. SIMULATION RESULTS

- Appliances respond correctly to voice commands
 - Relay switching is stable and reliable
 - Bluetooth communication is consistent
 - System performs without delay or false triggering
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10. APPLICATIONS

- Smart homes
 - Assistive technology
 - Wireless switching systems
 - IoT-based automation foundation
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11. LIMITATIONS

- Limited Bluetooth range
 - No authentication or encryption
 - Requires continuous Bluetooth connection
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12. FUTURE ENHANCEMENTS

- Replace Bluetooth with Wi-Fi (ESP32)
- Add mobile app with GUI
- Integrate IoT cloud monitoring

- Add sensor-based automation
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13. CONCLUSION

The Bluetooth-based Home Automation System successfully demonstrates wireless and voice-controlled appliance management. The system is simple, cost-effective, and scalable, making it suitable for real-world smart home applications.

14. AUTHOR

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