

WIRELESS HOME AUTOMATION USING ARDUINO AND BLUETOOTH

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Abstract—

This paper presents a low-cost and user-friendly wireless home automation system using an Arduino board, Bluetooth module, smartphone application, ultrasonic sensor, and soil-moisture sensor. The proposed system enables users to control up to 18 home appliances through a smartphone app via Bluetooth communication. Unlike most conventional home automation systems designed for specific purposes, the proposed model is general-purpose and can be easily implemented in existing homes. Additional features include automatic water-level detection using an ultrasonic sensor and an automatic plant-irrigation system based on a soil-moisture sensor. The paper also describes the hardware and software architecture, implementation process, and scope for future enhancement. The prototype was successfully implemented and tested on hardware, demonstrating accurate and reliable performance.

Keywords — Home Automation, Arduino, Bluetooth Module, Smartphone Application, Remote Control, Low Cost, User Friendly, Ultrasonic Sensor, Moisture Sensor, Water Level Detection, Automatic Irrigation, Device Control, General- Purpose System, Wireless Communication, Prototype Implementation, Smart Home, Bluetooth Technology.

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I.INTRODUCTION

In recent years, home automation has become increasingly popular due to its ability to enhance convenience, efficiency, and security. The advancement of embedded systems and the Internet of Things (IoT) has enabled the development of intelligent and energy-efficient living environments. At the heart of many DIY and research-based home automation projects is the Arduino platform — an open-source microcontroller system known for its affordability, flexibility, and ease of use. Arduino allows users to design and build intelligent systems capable of interacting with the physical world through sensors and actuators. Among various communication technologies, Bluetooth stands out as a reliable and cost-effective option for short-range wireless connectivity. Using the HC-05 Bluetooth module, devices such as smartphones can easily communicate with the Arduino to control appliances and collect sensor data. This wireless approach allows users to remotely operate lights, fans, and other household devices, offering enhanced comfort and energy management. The proposed system utilizes Bluetooth-based control to operate home appliances, monitor water levels through an ultrasonic sensor, and

automate plant irrigation using a moisture sensor. By integrating these components, the system provides a simple yet powerful solution for smart home management. This project aims to design and implement a low-cost, user-friendly, and reliable home automation system that can be easily deployed in existing homes without extensive modifications. The following sections describe the system design, implementation, testing results, and the potential for future improvements such as IoT integration and cloud-based monitoring.

II.LITERATURE SURVEY

Smart Home Automation System Using Arduino for Real Time application. Vaishnavi S.Gunge, Pratibha S. Yalagi “Smart Home Automation: A Literature Review” International Journal of Computer Applications, National Seminar on Recent Trends in Data Mining (RTDM 2016) Home automation is becoming popular due to its numerous benefits. Home automation refers to the control of home appliances and domestic features by local networking or by remote control. Artificial Intelligence provides us the framework to go real-time

decision and automation for Internet of Things (IOT). The work deals with discussion about different intelligent home automation systems and technologies from a various features standpoint. The work focuses on concept of home automation where the monitoring and control operations are facilitating through smart devices installed in residential buildings. Heterogeneous home automation systems and technologies considered in review with central controller based (Arduino or Raspberry pi), web based, email based, Bluetooth-based, mobile based, SMS based, ZigBee based, Dual Tone Multi Frequency-based, cloud-based and the Internet with performance

Bluetooth based home automation system using cell phones

In Bluetooth based home automation system the home appliances are connected to the Arduino BT board at input output ports using relay. The program of Arduino BT board is based on high level interactive C language of microcontrollers; the connection is made via Bluetooth. The password protection is provided so only authorized user is allowed to access the appliances. The Bluetooth connection is established between Arduino BT board and phone for wireless communication. In this system the python script is used and it can install on any of the Symbian OS environment, it is portable. One circuit is designed and implemented for receiving the feedback from the phone, which indicates the status of the device

Wireless Home Automation system using IOT

This system uses mobiles or computers to control basic home control and function automatically through internet from anywhere around the world globally, an automated home is sometimes called a smart home. It is meant to save the electric power and human energy. The proposed system is a distributed home automation system, Wireless Home Automation Using Arduino And Bluetooth ECE DEPARTMENT / NNRGESI consists of server i.e. Wi-Fi module, sensors. Server controls and monitors the various sensors, and can be easily configured to handle more hardware interface module (sensors). The Arduino board, with built-in Wi-Fi module acts as web server. Automation System can be accessed from the web browser of any local PC using server IP, or remotely from any PC or mobile handheld device connected to the internet with appropriate web browser through server real IP (internet IP). Wi-Fi technology is selected to be the network infrastructure that connects server and the sensors. Wi-Fi is chosen to improve system security (by using secure Wi-Fi connection), and to increase system mobility and scalability. **Wi-Fi based home automation system using cell phones:** Wi-Fi based home automation system mainly consists of three modules, the server, the hardware interface module, and the software package. The figure shows the system model layout. Wi-Fi technology is used by server, and hardware interface module to communicate with each other. The same technology is used to login to the server web-based application. The server is connected to the internet, so remote users can access server web-based application through the internet using compatible web browser. Software of the latest home automation system is split into server application software, and Microcontroller

(Arduino) firmware. The Arduino software, built using C language, using IDE comes with the microcontroller itself. Arduino software is culpable for gathering events from connected sensors, then applies action to actuators and preprogrammed in the server. Another job is to report the record the history in the server DB. The server application software package for the proposed home automation system, is a web-based application built using asp.net. The server application software can be accessed from internal network or from internet if the server has real IP on the internet using any internet navigator supports asp.net technology. Server application software is culpable of, maintain the whole home automation system, setup, Configuration. Server uses database to keep log of home automation system components, we choose to use XML files to save system log.

Home automation using RF module:

The important goal of Home Automation System is to build a home automation system using a RF controlled remote. Now technology is accelerating so homes are also Wireless Home Automation Using Arduino And Bluetooth ECE DEPARTMENT / NNRGESI getting smarter. Modern homes are deliberately relocating from current 1 switches to centralized control system, containing RF controlled switches. Today traditional wall switches situated in various parts of the home makes it laborious for the end user to go near them to control and operate. Even further it turns into more problematic for the old persons or physically handicapped people to do so. Home Automation using remote implements an easier solution with RF technology. In order to accomplish this, a RF remote is combined to the microcontroller on transmitter side that sends ON/OFF signals to the receiver where devices are connected. By operating the stated remote switch on the transmitter, the loads can be turned ON/OFF globally using wireless technology.

III. SYSTEM DESIGN

System Design Components Description Table:

Component	Description
Arduino Board	Acts as the central controller to receive commands and control the appliances via relays.
Relay Module	Electrically operated switch used to turn ON/OFF high-voltage appliances safely

Wi-Fi/Bluetooth Module	Enables wireless communication between the Arduino and user interface (e.g., ESP8266, HC-05).
Power Supply	Provides stable voltage and current to Arduino and other components (e.g., 5V adapter).
Smartphone/Web App	User interface for sending commands to control appliances remotely
AC Appliances	Household devices such as lights, fans, or TVs that will be controlled through the system
Jump Wires & Breadboard	Used for circuit connections and prototyping the system
Voltage Regulator (optional)	Ensures safe voltage levels to protect Arduino and modules, especially when using external power sources.

IV.IMPLEMENTATION



Fig:1 Implementation

The image demonstrates a basic wireless home automation system using Arduino and a Bluetooth module. In this setup, an Arduino Uno microcontroller is connected to a breadboard, which facilitates easy circuit building. Wires run between the Arduino and a Bluetooth module (likely the HC-05), allowing the system to communicate wirelessly with a smartphone or another Bluetooth-enabled device. When a user sends a command from their smartphone, the Bluetooth module receives the signal and passes it to the Arduino. The Arduino interprets these commands and controls connected devices, such as turning LEDs or relays on and off to simulate the operation of home appliances. This setup highlights the principle of remote device control where conventional switches are replaced by wireless automation, improving

convenience and accessibility for users, especially the elderly or physically challenged. Overall, the project shown enables users to manage home appliances effortlessly from their smartphones using Bluetooth connectivity and an Arduino controller

V.FLOWCHART

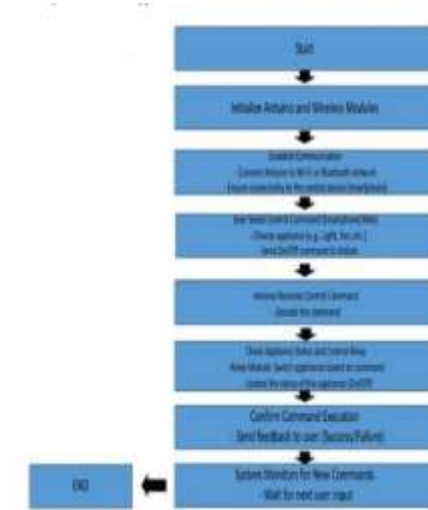


Fig :2 Flow chart

The system design includes several key components: an Arduino microcontroller (e.g., Uno or Mega) as the central control unit, relay modules to switch AC appliances, and a wireless communication module such as the ESP8266 (Wi-Fi) or HC-05 (Bluetooth) for remote connectivity. A mobile app or web interface serves as the user control panel, sending commands wirelessly to the Arduino. The system is powered by a stable DC power supply, while safety features like opto-isolators protect Wireless Home Automation Using Arduino And Bluetooth ECE DEPARTMENT / NNRGESI low-voltage components from AC current. The basic flow starts with user input from the app → sent wirelessly → received by Arduino → triggers the appropriate relay → appliance switches ON/OFF. This modular design ensures flexibility, ease of use, and scalability for smart home applications.

VI. EXPERIMENTAL RESULT



Fig:3 Results

This image sequence shows a wireless home automation system in action using an Arduino and Bluetooth module. The Arduino is connected to a breadboard and the Bluetooth module, with an LED light indicating system status. A smartphone app is used to send commands via Bluetooth, which the Arduino receives and processes to control the connected LED light. As the user presses buttons on the app, the LED turns ON and OFF wirelessly, demonstrating remote control of home devices. This setup highlights the convenience and ease of controlling appliances through Bluetooth-enabled automation.

VII. CONCLUSION

The Arduino-based wireless home appliance control system was successfully designed, implemented, and tested to demonstrate remote control capabilities using WiFi and Bluetooth technologies. The system proved to be a reliable and efficient solution for smart home automation, allowing users to operate appliances with ease through a mobile interface. The project achieved its core objectives: enabling wireless control, ensuring fast and accurate appliance switching, and maintaining stable system performance using cost-effective components. The use of the Arduino microcontroller simplified the integration of hardware modules and provided flexibility for future upgrades. This system enhances user convenience, safety, and energy management, especially benefiting the elderly and individuals with physical challenges. With further development, such as IOT integration and sensor-based automation, the system can evolve into a full-featured smart home platform. Overall, the project demonstrates the potential of open-source technology in creating practical, low-cost solutions for modern home automation.

REFERENCES

- [1] Andi Adriansyah, Akhmad Wahyu Dani, "Design of Small Smart Home System Based on Arduino," *2024 Electrical Power, Electronics, Communications, Controls, and Informatics Seminar (EECCIS)*.
- [2] Dae-Man Han and Jae-Hyun Lim, "Design and Implementation of Smart Home Energy Management Systems," *IEEE Transactions on Consumer Electronics*, Vol. 56, No. 3, August 2023.
- [3] Mingfu Li, Hung-Ju Lin, "Design and Implementation of Smart Home Control Systems Based on Wireless Sensor Networks and Power Line Communications," *IEEE Transactions on Industrial Electronics*, 2024.
- [4] Kim Baraka, Marc Ghobril, Sami Malek, Rouwaida Kanj, Ayman Kayssi, "Low-Cost Arduino/Android-Based Energy-Efficient Home Automation System with Smart Task Scheduling," *5th Int. Conf. on Computational Intelligence, Communication Systems and Networks (CICSN)*, 2022.
- [5] Zhenyu Zou, Ke-Jun Li, Ruzhen Li, Shaofeng Wu, "Smart Home System Based on IPv6 and ZigBee Technology," *Procedia Engineering*, Vol. 15, pp. 1529–1533, 2022.
- [6] Rajeev Piyare, "Internet of Things: Ubiquitous Home Control and Monitoring System using Android-Based Smart Phone," *International Journal of Internet of Things*, Vol. 2, No. 1, 2023.
- [7] Shiu Kumar, "Ubiquitous Smart Home System Using Android Application," *International Journal of Computer Networks & Communications (IJCNC)*, Vol. 6, No. 1, January 2024.
- [8] P. Sunil Warankar, M. S. Dharmadhikari, "Bluetooth Based Home Automation Using Arduino," *International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE)*, Vol. 12, No. 6, June 2023.
- [9] Aryan Singh, Gourav Baheti, Sumant Kumar Pramukh, Sheetal Pawar, "Arduino Based Home Automation Using Bluetooth and Android Smartphone," *IMPACT: International Journal of Research in Engineering & Technology*, Vol. 9, Issue 6, June 2021.
- [10] Kashish Meshram, Kshitij Meshram, Ratnesh Mekhe, Yogita Narule, "Home Automation Using Arduino," *International Journal for Research in Applied Science and Engineering Technology (IJRASET)*, Vol. 10, Issue 5, May 2022.
- [11] Leonardo Adam, Eyad Yousef, Celso Becker Tischer, "Home Automation System Using Arduino Board and Remotely Controlled by Smartphones," *Ciência e Natura Journal*, Universidade Federal de Santa Maria, Brazil, 2022.
- [12] Vikas Pal, Sumit Kumar, Virender Kumar, Gunjan Jha, Peeyush Pant, "Voice Controlled Home Automation System Using Arduino UNO, Bluetooth HC-05 and Smartphone," *IITM Journal of Management and IT*, Vol. 12, Issue 1, Jan–Jun 2021.
- [13] S. Rajput, N. D. Upadhyay, C. S. Kushwah, S. Kumari, "Bluetooth and Arduino UNO-Based Voice-Controlled Home Automation System," *International Journal of Scientific Research and Engineering Management (IJSREM)*, Vol. 5, Issue 4, 2025.