

HOME AUTOMATION USING TELEGRAM APPLICATION

DR.V.VANITHA, M.E., Ph.D.¹, PASUPATHI. S², VADIVEL. R³, MOHAN.K⁴

Professor & Head, Department Of Electrical and Electronics Engineering, Karpagam Academy Of Higher Education,
Coimbatore, Tamilnadu, India¹

Ug Student, Department Of Electrical and Electronics Engineering, Karpagam Academy Of Higher Education,
Coimbatore, Tamilnadu, India^{2,3,4}

Abstract: The Internet of Things (IoT) has generated excitement for a few years now, with start-ups and established businesses placing bets on the industry's growth. Along with the business solutions, IoT has been very vital in connecting things to the internet. There by achieving a communication among the connected devices. The Internet of things (IoT) is getting more traction in recent years. One of the usage scenarios of IoT is smart home. Smart home basically provides home automation for installed devices at home such as thermostat, lighting, air conditioning, etc and allows devices connected to the Internet to be monitored and controlled remotely by user. They still lack of important usage of IoT i.e. providing monitoring, dealing with security, and managing privacy. This paper proposes a smart home system with microcontroller as the backend that not only serves as home automation and merely a switch replacement, but to also record and report important things to the owner of the house e.g. when someone trespasses the house (security perimeter), cctv monitoring, etc, AC Loads can be controlled via Electromagnetic relays. The communication between user and the system is done using Telegram Bot.

Keywords: Telegram Bot, Real-Time Control, Home Appliances, Cloud Integration, Device Monitoring

I. INTRODUCTION

The Internet of Things (IoT) has generated excitement for a few years now, with start-ups and established businesses placing bets on the industry's growth. Along with the business solutions, IoT has been very vital in connecting things to the internet. There by achieving a communication among the connected devices. The Internet of things (IoT) is getting more traction in recent years. One of the usage scenarios of IoT is smart home. Smart home basically provides home automation for installed devices at home such as thermostat, lighting, air conditioning, etc and allows devices connected to the Internet to be monitored and controlled remotely by user. They still lack of important usage of IoT i.e. providing monitoring, dealing with security, and managing privacy.

This paper proposes a smart home system with microcontroller as the backend that not only serves as home automation and merely a switch replacement, but to also record and report important things to the owner of the house e.g. when someone trespasses the house (security perimeter), gas leakage monitoring, fire monitoring etc, The system uses PIR sensor to identify intruders or trespassers, IR Fire sensor to detect fire and GAS sensor to monitor gas leakage in the home. The Siren used to make the online control to overcome intruders and other alerts. AC Loads can be controlled via Electromagnetic relays. The communication between user and the system is done using Telegram Bot.

II. LITERATURE REVIEW

1. H.A. Vathsala, P.R. Indrasena, and R.M. Ruwanthika (2019)

- **Title:** Home Automation System Based on IoT Using Telegram Application
- **Year:** 2019
- **Description:** This paper discusses the design of a smart home automation system using the Telegram app as a user interface. The system used an ESP32 microcontroller, relays to control home appliances, and the Telegram bot to send commands. The integration with cloud services was also highlighted, making the system accessible from any location. The authors emphasize the low-cost and user-friendly nature of the system, suitable for daily life use in home environments.

2. L. Liu, G. Peng, and S. Yin (2020)

- **Title:** An IoT-Based Smart Home Automation System Using ESP32 and Blynk
- **Year:** 2020
- **Description:** This study explores the use of ESP32 for home automation through the Blynk IoT platform. The system controls devices like AC appliances and pumps via relay modules. The system's novelty lies in its flexible user interface that operates through the Blynk app. The research demonstrated the efficient use of ESP32 with real-time control, making it suitable for modern home environments where IoT devices play an integral role.

3. K. Sarma and A. Bhattacharya (2021)

- **Title:** Smart Home Automation System Using ESP32 and Telegram Bot
- **Year:** 2021
- **Description:** The paper presents a home automation system designed using ESP32, controlled via a Telegram bot for seamless communication with users. The system uses relay modules to control household appliances like lamps and water pumps. The integration with Telegram provides a secure and straightforward method for users to interact with their smart homes from remote locations. The paper highlights the scalability of the system, which allows for the addition of more devices with ease.

4. N. Gupta and A. Sharma (2022)

- **Title:** IoT-Based Home Automation with ESP32 and Blynk Application
- **Year:** 2022
- **Description:** This study implements a home automation system with ESP32 as the core microcontroller and the Blynk app as the IoT interface. Devices such as AC lamps and water pumps are controlled via 12V relay modules. The authors discuss the system's efficient power consumption and reliability, focusing on how Blynk simplifies the development of IoT projects and provides real-time feedback to users. The system is highlighted as a cost-effective solution for residential automation.

5. S. Kumar and R. K. Mishra (2023)

- **Title:** Telecontrolled Home Automation Using ESP32 and IoT Applications
- **Year:** 2023
- **Description:** This paper introduces an advanced telecontrolled home automation system, where users can operate home appliances via both the Blynk app and Telegram. The system incorporates ESP32, controlling relays that manage appliances like AC lamps and pumps. The researchers emphasize the integration of multiple communication channels, offering flexibility to users in controlling their devices through different IoT platforms. The paper also highlights the improved security measures integrated into the system using Telegram's end-to-end encryption.

III. PURPOSE AND SCOPE OF THE PROJECT**3.1 PURPOSE**

The purpose of the **Home Automation Using Telegram Application** project is to develop a cost-effective and user-friendly system that allows homeowners to remotely control and monitor their household appliances through a smartphone application. By leveraging the capabilities of the ESP32 microcontroller, Telegram messaging platform, and relay modules, the project aims to enhance convenience, improve energy efficiency, and provide real-time monitoring of devices. The system is designed to facilitate the automation of various home functions, such as lighting, heating, and irrigation, while offering users a secure and intuitive interface for managing their home environment.

3.2 SCOPE

The scope of this project includes the design, development, and implementation of a home automation system that utilizes the Telegram application for device control. Key features of the project encompass:

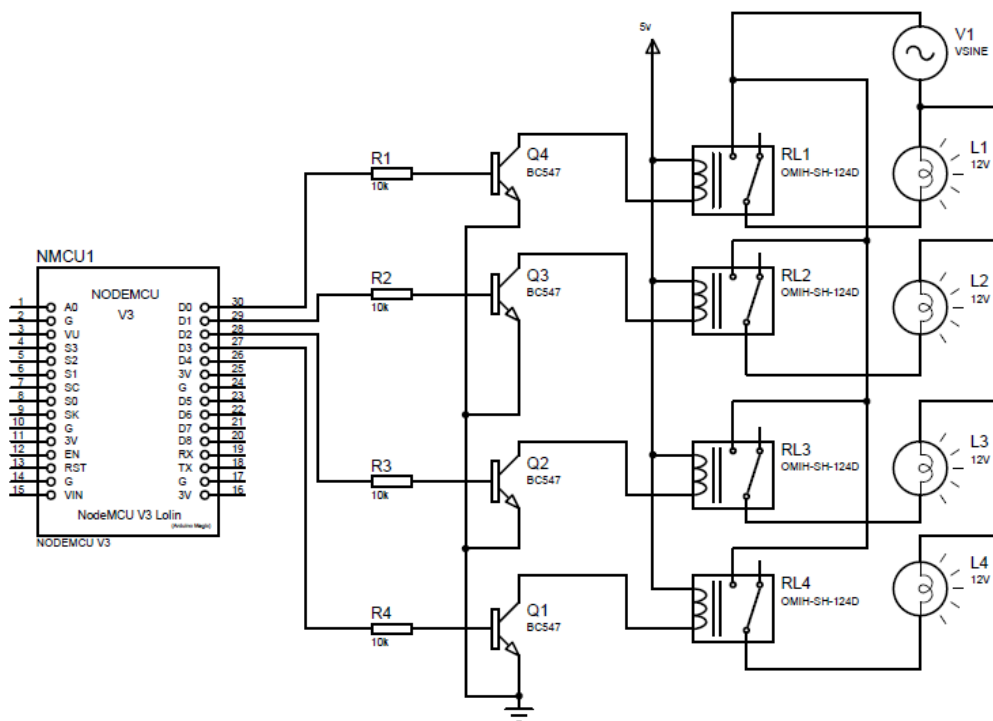
1. **Control of Home Appliances:** Users can operate devices like AC lamps, water pumps, and other electrical appliances remotely.
2. **User-Friendly Interface:** Integration with Telegram provides a simple interface for sending commands and receiving notifications.
3. **Real-Time Monitoring:** The system allows users to monitor the status of connected devices in real time.

4. **Scalability:** The system can be expanded to include additional devices and functionalities, accommodating the growing needs of smart homes.
5. **Energy Management:** The project aims to optimize energy consumption by allowing users to turn off devices that are not in use.
6. **Security Features:** Implementation of secure communication channels to protect user data and device access.
7. **Testing and Evaluation:** Comprehensive testing to ensure reliability, responsiveness, and user satisfaction.

IV. METHODOLOGY

The methodology for home automation using ESP32, Telegram, relays, and IoT (Blynk) involves several key steps. First, the system is designed by selecting essential components, including the ESP32 microcontroller, 12V relays, AC lamps, and water pumps. Circuit connections are made by wiring the ESP32 to the relays to control the appliances, ensuring appropriate power supply configurations. The ESP32 is then programmed using the Arduino IDE or MicroPython to facilitate communication with both Telegram and Blynk, enabling it to receive commands to turn appliances on or off. A Telegram bot is created via BotFather, allowing user commands to be interpreted and executed by the ESP32, while the Blynk app is set up to provide a user-friendly interface for controlling devices through virtual pins. After uploading the code, the system undergoes thorough testing to ensure correct relay operation and responsiveness. Once validated, the ESP32 and relay modules are installed in the desired locations, connecting to a stable Wi-Fi network for seamless remote control, thereby completing the deployment of the home automation system.

V. CIRCUITDIAGRAM



WORKING PRINCIPLE

The **working principle** of a home automation system using **ESP32**, **Telegram**, **12V relays**, and IoT platforms like **Blynk** revolves around controlling household devices such as AC lamps and pumps remotely via a user interface. The **ESP32 microcontroller** acts as the central hub, connected to relay modules that switch the devices on or off.

Commands are sent from a smartphone through the **Telegram bot** or **Blynk app**, which communicates wirelessly with the ESP32 over Wi-Fi. When a command is received, the ESP32 activates the corresponding relay, thereby controlling the connected device (e.g., lamp or pump). This allows users to manage home appliances from anywhere with internet access, enhancing convenience, energy efficiency, and remote monitoring.

VI. MERITS AND DEMERITS**6.1 MERITS:**

- ✓ **Remote Control:** Users can control home appliances from anywhere using their smartphone via Telegram or Blynk.
- ✓ **Low-Cost:** ESP32 and relays are cost-effective components, making the system affordable.
- ✓ **Easy Integration:** The system can be easily expanded to include additional devices like lamps, fans, or pumps.
- ✓ **Energy Efficiency:** Automating appliances allows users to switch them off remotely, preventing unnecessary energy use.
- ✓ **User-Friendly Interface:** Both Telegram and Blynk provide simple, intuitive interfaces, making it easy for non-technical users to operate the system.
- ✓ **Real-Time Monitoring:** The system provides real-time status updates, enhancing the ability to monitor devices and control them accordingly.

6.2 DEMERITS:

- ✓ **Dependency on Internet:** The system relies heavily on a stable internet connection, which may limit control if connectivity issues arise.
- ✓ **Security Concerns:** Using IoT and internet-based control may expose the system to hacking or unauthorized access if not properly secured.
- ✓ **Limited Range for Local Networks:** For local control, the ESP32's range is limited by Wi-Fi coverage.
- ✓ **Complex Setup for Beginners:** While user-friendly, initial setup and configuration of ESP32, relays, and apps may be challenging for users with limited technical knowledge.
- ✓ **Power Supply:** The system depends on a reliable power source for both the ESP32 and controlled devices, and any power outages may cause disruption.

VII. APPLICATION

- **Lighting Control:** Automate indoor and outdoor lighting, allowing users to remotely switch lights on or off via the Telegram app or Blynk.
- **Appliance Management:** Control home appliances such as fans, air conditioners, and heaters, improving energy efficiency by turning them off when not in use.
- **Water Pump Control:** Remotely manage water pumps for irrigation, home water systems, or aquariums, ensuring efficient water usage.
- **Security Systems:** Automate door locks, surveillance cameras, and alarm systems, allowing remote monitoring and access control.
- **Smart Gardening:** Use the system to automate watering schedules for gardens or greenhouses by controlling pumps and sprinklers remotely.
- **HVAC Systems:** Manage heating, ventilation, and air conditioning systems remotely, ensuring that homes remain comfortable while optimizing energy use.
- **Smart Energy Monitoring:** Integrate energy meters to monitor and control the consumption of electrical devices in real time.
- **Home Entertainment Systems:** Control home theaters, audio systems, and smart TVs, enhancing user convenience.
- **Elderly or Disability Assistance:** Provide remote control over home appliances for elderly or disabled individuals, improving their independence.
- **Garage Door Control:** Remotely operate garage doors using a smartphone, providing convenience and security.

VIII. CONCLUSIONS

The **Home Automation Using Telegram Application** project demonstrates a practical and effective solution for modernizing home management through IoT technology. By utilizing the ESP32 microcontroller, Telegram messaging platform, and relay modules, the system enables users to remotely control and monitor household appliances, enhancing convenience, energy efficiency, and security. The project successfully showcases how everyday devices can be integrated into a cohesive smart home environment, providing real-time control and status updates directly from a Smartphone's a scalable and user-friendly solution, this home automation system is not only accessible to tech-savvy individuals but also offers significant benefits to those seeking to simplify their daily routines. The successful implementation of this project lays the foundation for further developments in smart home technology, including the integration of voice control, advanced security features, and machine learning capabilities.

In conclusion, this project reflects the growing trend toward smart living, where users can achieve greater control over their home environments, ultimately leading to improved quality of life and energy conservation. The future enhancements and possibilities outlined indicate a promising trajectory for expanding the functionality and impact of home automation systems, making them an integral part of modern households.

IX. FUTURE SCOPE

The future scope of the **Home Automation Using Telegram Application** project includes several enhancements and expansions that can further improve functionality, user experience, and integration with emerging technologies:

1. **Integration with Voice Assistants:** Future developments can incorporate compatibility with popular voice assistants such as Amazon Alexa, Google Assistant, or Apple Siri, enabling voice control for enhanced convenience.
2. **Advanced Security Features:** The implementation of additional security measures, such as video surveillance, smart locks, and motion detectors, can provide comprehensive home security solutions.
3. **Machine Learning and AI:** Incorporating machine learning algorithms can enable predictive analytics for user behavior, allowing the system to automate routines based on user preferences and habits.
4. **Mobile Application Development:** Development of a dedicated mobile application for Android and iOS platforms can provide a more user-friendly interface and additional features compared to using Telegram.
5. **Energy Consumption Analytics:** Future iterations can include energy monitoring capabilities to track the consumption of individual devices, offering insights and recommendations for energy efficiency.
6. **IoT Cloud Integration:** Integration with cloud platforms can enhance data storage, enabling remote access and control over multiple devices from various locations without relying solely on local Wi-Fi.
7. **Interoperability with Other IoT Devices:** Future updates can focus on interoperability with other IoT devices and ecosystems, allowing seamless communication and control between different systems and manufacturers.
8. **Mobile Notifications and Alerts:** Implementing a notification system for alerts regarding appliance statuses, energy usage, or security breaches can enhance user awareness and response capabilities.
9. **Geofencing Capabilities:** Incorporating geofencing features can enable the system to automatically turn devices on or off based on the user's location, enhancing convenience and energy savings.
10. **User Customization:** Allowing users to customize automation rules and scenarios through an intuitive interface can enhance user engagement and satisfaction.

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