JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Home Automation and Security System using AI and IOT

Mrs. N. Maragatham [1], J.Mohamed jassim[2], D.B.Monishwaran[3], V.mugesh[4], S.Surya[5]

Assistant Professor, Department of C.S.E, Jansons Institute of Technology, Coimbatore, India 1
UG Students, Department of C.S.E, Jansons Institute of Technology, Coimbatore, India 2 – 5

ABSTRACT

The Home Automation and Security System using AI and IoT is designed to enhance both security and convenience by integrating smart automation, artificial intelligence, and real-time monitoring.

This system leverages IoT-based automation to allow users to remotely control household appliances such as lights, fans, and door locks via a mobile application, improving energy efficiency and ease of use.

The incorporation of AI-driven security mechanisms ensures that only authorized individuals can access the home, providing an added layer of protection.

By utilizing Arduino, ESP8266 (WiFi module), and automated control systems, the project enables seamless home automation and remote monitoring.

Motion-based automation ensures that appliances turn off when not in use, significantly reducing power consumption. Additionally, real-time notifications inform users about security breaches, making the system highly reliable.

This project aims to create a scalable and user-friendly smart home solution by integrating mobile app functionality and AI-driven security features.

Future enhancements include biometric authentication and AI-based predictive automation to further optimize energy consumption and user experience. By implementing this system, homeowners can achieve greater security, convenience, and cost savings, making smart homes more accessible and efficient.

INTRODUCTION

With the rapid advancement of technology, smart home automation has become an essential aspect of modern living. Traditional home security and automation systems are often manual, inefficient, and lack intelligence, making them inconvenient for users. The increasing demand for remote control, energy efficiency, and enhanced security has led to the adoption of AI and IoT-based automation systems. These technologies enable seamless control of home appliances, improve security, and optimize energy usage.

The Home Automation and Security System using AI and IoT is designed to provide an integrated and intelligent solution for controlling household appliances while ensuring home security. Unlike conventional systems, which rely on manual switches and basic alarms, this system enables users

to remotely control lights, fans, and door locks via a mobile application the home

RELATEDWORK

Home automation and security systems have evolved significantly with the integration of IoT and AI technologies. Several studies have explored the impact of smart home automation, security mechanisms, and energy efficiency. This section reviews key research works that have contributed to the field and highlights their limitations, addressing how our proposed system improves upon them.

1**. Smart Home Technology Adoption**

Research conducted by Gøthesen et al. (2023) investigated the adoption of smart home technologies and their impact on daily life. Their study highlighted the increasing demand for remote control and automation but also pointed out challenges related to high implementation costs and compatibility issues. While their research provided insights into user adoption patterns, it did not focus on security vulnerabilities and energy efficiency, which are critical for smart home automation.

2. **AI-Driven Smart Room Security**

A study by D. Kamal Surya Teja et al. (2022) introduced an AI-powered smart room security system that combined intelligent power management and security authentication. Their system used IoT-based monitoring to enhance home security. However, it was limited to indoor security applications, and their approach did not integrate motion-based automation for energy conservation or remote appliance control. Our proposed system extends this concept to provide a complete home automation solution with real-time monitoring and automated appliance control.

3. IoT-Based Person Detection for Home Security

Sajid Nazir et al. (2021) developed a deep learning-based person detection system integrated with IoT for smart home security. Their research focused on identifying unauthorized individuals using AI models on Amazon Cloud. While effective, their approach relied heavily on cloud computing, which increases latency and raises privacy concerns. In contrast, our system leverages local AI processing for security authentication, minimizing dependence on cloud services and ensuring faster response times.

4. IoT-Based Smart Home Monitoring for Energy Efficiency

A systematic review by K. Maswadi et al. (2020) examined various IoT-based smart home monitoring technologies, particularly for elderly care and energy optimization. Their research demonstrated that automated energy management can reduce power consumption by 30-40%. However, many of the reviewed systems relied on expensive infrastructure and cloud storage, making them less accessible. Our system addresses this gap by providing a cost-effective solution using Arduino and ESP8266 to achieve energy-efficient automation without requiring cloud-based services.

Traditional home automation and security systems lack intelligence and remote control features, making them inefficient in addressing modern user needs. Several existing solutions offer basic automation and security measures, but they have significant limitations in terms of cost, scalability, and real-time monitoring.

EXISTING SYSTEM:

1. Traditional Home Security Systems

Conventional home security solutions rely on manual locks, key-based access, and alarm systems. While these systems provide a basic level of security, they suffer from several drawbacks:

Lack of real-time monitoring – No instant notifications or remote access to security status.

No automated threat detection – Unauthorized access is detected only after a break-in occurs.

Dependency on human intervention – Requires physical monitoring or security personnel, increasing cost and inefficiency.

2. Basic IoT-Based Smart Home Solutions

Some modern IoT-enabled devices, such as smart locks, smart lighting, and security cameras, allow users to control appliances remotely. However, they often face integration and compatibility issues, leading to

High dependency on cloud-based systems, increasing latency and security risks.

Limited automation – Most devices require manual activation rather than automated operations based on environmental conditions.

Expensive setup – Full home automation solutions often require proprietary smart hubs, making them costly for users.

3. Energy-Intensive Home Appliances

In many homes, electrical appliances consume power unnecessarily, as users often forget to turn off devices. Existing solutions, such as timers and smart plugs, offer limited automation but do not optimize energy efficiency effectively. The main issues include:

No motion-based automation – Devices stay ON even when the room is unoccupied.

Manual control required – Users need to schedule timers or manually turn off appliances via apps.

High power wastage – Increased electricity bills due to inefficient energy management.

DRAWBACKS

- No Real-Time Security Alerts Traditional systems lack instant notifications, delaying response to threats.
- High Power Consumption Appliances remain ON unnecessarily, increasing electricity costs.
- Cloud Dependency Many systems require continuous internet access, leading to privacy risks and reliability issues.
- Expensive and Complex Setup Smart hubs and proprietary devices increase costs and complicate installation.
- Limited AI Integration No intelligent automation for security and energy optimization.

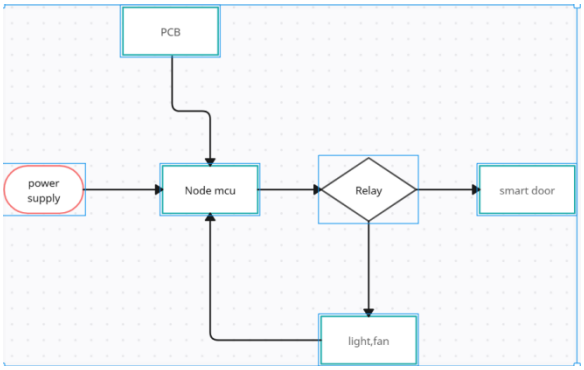
PROPOSED SOLUTION:

The proposed security system is designed using an Arduino or ESP32 as the central processing unit, integrating multiple sensors and security mechanisms to ensure safety and automation. The system primarily consists of input sensors, including PIR motion sensors for detecting movement, door/window reed switches for unauthorized entry detection, and an ultrasonic sensor for proximity-based intrusion alerts.

Once the sensors detect an anomaly, the Arduino/ESP32 processes the data and determines an appropriate security action. This could include triggering a buzzer or siren for an alarm, sending SMS or app notifications through a GSM module or WiFi connectivity, or activating a relay-based door lock system to prevent unauthorized access. Users can also monitor the premises remotely via a mobile application connected to the system.

For user authentication, the system includes an RFID module and a keypad for passcode-based access control. Additionally, the system can be enhanced with AI-based anomaly detection to analyze unusual patterns in security threats.

With its multi-layered security approach, real-time monitoring, and automated actions, this system provides a robust and scalable security solution for homes, offices, or industrial applications.



Merits

Automate Home Functions: Smart sensors and IoT devices control lighting, temperature, and appliances based on user presence and preferences.

Enhance Security: AI-powered verifies authorized users, while motion sensors detect intruders and trigger alerts.

Remote Access & Monitoring: Users can control and monitor home devices remotely via a mobile app.

Energy Efficiency: AI optimizes power consumption by turning off unused devices, reducing energy waste.

Real-Time Alerts: The system provides instant notifications for security breaches or unusual activities.

MODULE DESCRIPTION:

NodeMCU (ESP8266)

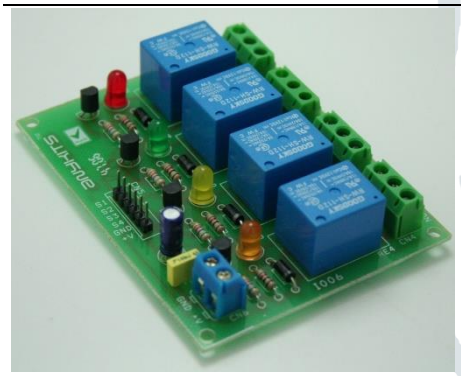
The NodeMCU is an open-source IoT development board based on the ESP8266 WiFi module, designed for smart automation and IoT-based applications. It features built-in WiFi connectivity, allowing seamless communication with cloud services, mobile applications, and other connected devices. The board operates at 3.3V logic level and is equipped with multiple GPIO pins, enabling easy integration with sensors, relays, and actuators. With support for PWM, I2C, SPI, and UART protocols, it can interface with a wide range of electronic components. The NodeMCU can be programmed using the Arduino IDE, Lua, or MicroPython, making it beginner-friendly while offering powerful features for advanced users. In an automation or security system, it functions as the central controller, processing data from sensors and sending control signals to actuators like fans, relays, or alarms. Its compact design, low power consumption, and WiFi capabilities make it ideal for home automation, smart security systems, and remote monitoring applications.

Buck Converter Module,

The DC-DC Buck Converter Module, likely based on the LM2596 step-down voltage regulator, is an essential component for power management in electronic circuits. It efficiently reduces a higher DC input voltage (such as 12V or 24V) to a stable lower

voltage (such as 5V or 3.3V), making it ideal for powering microcontrollers, sensors, and other low-power devices. The module consists of an inductor, capacitors, a voltage regulator IC, and a potentiometer for adjusting the output voltage. The inductor helps in voltage regulation, while capacitors stabilize the output to ensure a smooth supply. This module is widely used in embedded systems, IoT projects, and battery-powered applications where a stable power supply is crucial.

Relay Module



The Relay Module (green PCB with four relays) is a crucial component in automation and control systems, enabling low-power microcontrollers to switch high-power electrical devices like fans, lights, motors, and appliances. Each relay on the module acts as an electrically operated switch, controlled by a microcontroller such as an Arduino or ESP32. When the microcontroller sends a signal, the relay coil is energized, creating a magnetic field that closes or opens the circuit, thereby controlling the connected device. The module includes optocouplers for isolation, ensuring safe operation by protecting the microcontroller from high voltages. This relay module is commonly used in home automation, industrial control, and IoT-based projects

CONCLUSION

The AI and IoT-based Home Automation and Security System revolutionizes modern living by combining artificial intelligence, smart sensors, and cloud connectivity. This system enhances home security through AI-driven facial recognition, motion detection, and automated alerts, ensuring that unauthorized access is prevented. Additionally, IoT-enabled devices allow seamless automation of household appliances, optimizing energy consumption and improving convenience.

With remote access via a mobile application, homeowners can monitor and control their homes from anywhere, making real-time decisions about security and automation. The integration of AI also ensures intelligent power management by reducing unnecessary energy consumption, contributing to sustainability.

This solution not only enhances security and efficiency but also improves the overall quality of life by reducing human intervention. With advancements in AI and IoT, smart homes will continue to evolve, making living spaces safer, smarter, and more energy-efficient.

REFERENCES

- Sara Gøthesen , Moutaz Haddara , Karippur Nanda Kumar, “Empowering homes with intelligence: An investigation of smart home technology adoption and usage” Kristiania University College, Kirkegata 24, 0153 Oslo, Norway b SP Jain School of Global Management, 10 Hyderabad Rd, Singapore 119579, 2023.
- D. Kamal Surya Teja, Ch. Rupa, Ch. Roop Kumar and K. Pavan, "Secure Smart Room with Intelligent Power Management", 2022 International Conference on Electronics and Renewable Systems (ICEARS), pp. 923-928, 2022.
- Sajid Nazir, Yovin Poorun and Mohammad Kaleem, "Person Detection with Deep Learning and

IoT for Smart Home Security on Amazon Cloud", 2021 International Conference on Electrical Computer Communica-tions and Mechatronics Engineering (ICECCME), pp. 1-6, 2021.

- K. Maswadi, N. B. A. Ghani and S. B. Hamid, "Systematic Literature Review of Smart Home Monitoring Technologies Based on IoT for the Elderly", IEEE Access, vol. 8, pp. 92244- 92261, 2020.

- . Dr. Dinesh Kumar V , Jaswanth Raj S2 , Hareesh R3 , Kameshwaran M**.** ” Smart Home Automation System ” Vol. 02 Issue: 05 May 2024.

- Majid Al Kuwari, Ramadan Abdulrahman et al “"Smart-Home Automation using IOT-based Sensing and Monitoring Platform” , IEEE 12th International Conference on Compatibility Power Electronics and Power Engineering, 2019.

- Chaabouni, N., Mosbah, M., Zemmari, A., Sauvignac, C., Faruki, “Network Intrusion Detection for IoT Security Based on Learning Techniques.” In IEEE Communications Surveys & Tutorials, 21(3): 2671-2701 ,2018.

- . Takeshi Yashiro, Shinsuke Kobayashi, Noboru Koshizuka et al., “An Internet of Things (IOT) Architecture for Embedded Appliances”, IEEE Region 10 Humanitarian Technology Conference, 2016