

Eventia: Smart Home Automation & Security System

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Abstract:

The accelerated growth of technology and the growing need for convenience have driven the innovation of smart home automation systems. This project discusses the implementation and design of an affordable, scalable, and efficient smart home automation system based on the ESP8266 microcontroller, Firebase real-time database, and a cross-platform mobile app developed using React Native. The main goal is to improve home convenience and energy management through remote control of various household appliances, including lights, fans, and other electronic devices, along with real-time monitoring of environmental parameters such as room temperature and humidity. The system utilizes the Internet of Things (IoT) to facilitate smooth communication between the hardware and software elements so that users can interact with their home from any place in the world via a smartphone. The hardware installation consists of the ESP8266 microcontroller that is joined together with a DHT11 temperature and humidity sensor and a relay module that enables the powering and switching off of different domestic appliances. The microcontroller communicates with Firebase, an Internet-based real-time database, which stores data that is passed in and pulled out, thereby ensuring that the mobile application has all the devices and sensors synced.

Keywords— Home Automation, IoT, Security System, ESP8266, ESP32, Firebase, Smart Home, AI Assistance.

I. INTRODUCTION

This project focuses on developing a smart home automation system from scratch, utilizing the ESP8266 and ESP32 microcontroller, Firebase for realtime data management, and cross-platform mobile app development. The system is designed to control four or more home appliances remotely, while also providing real-time monitoring of room temperature, humidity. By integrating the ESP8266 with Firebase, the

project ensures reliable, real-time communication between the hardware and the mobile app, allowing users to manage their home environment efficiently and with ease. The Smart Home Automation & Security System is an advanced solution designed to enhance convenience, efficiency, and safety in modern homes. This system integrates cutting-edge technologies, enabling users to control devices remotely, monitor environmental conditions in

real-time, and ensure home security with intelligent automation. Its include multi-user login, AI & voice assistance, device timers, IR remote control, and real-time monitoring of temperature, humidity, and air quality (AQI). The security aspect is strengthened with a live security camera, motion detection, and instant

II. RELATED WORK

From the literature review, various methods have been used in the past to address the problem of home automation and security. Many programs have been developed to provide solutions in this domain.

In [1], the authors mainly focus on providing various IoT-based smart home automation systems designed to control household appliances using microcontrollers such as ESP8266, ESP32, and Raspberry Pi. An automation system based on MQTT was developed for controlling home appliances via cloud connectivity, but it lacked security features. Most home automation systems rely on Wi-Fi, making them vulnerable to cyber threats.

[2] proposed Ethernet-based communication for improved stability, but the implementation costs were a concern. Some applications provide automation features separately from security monitoring.

[3] developed an app-based home automation system but required separate applications for security surveillance, making user experience fragmented.

[4], implements voice control and predictive automation. While beneficial, these systems often lack integration with security measures such as motion detection and RFID authentication.

A study in [5] introduced a home security system using PIR sensors and GSM modules for real-time alerts. However, it relied on SMS-based communication, making it slower than real-time

alerts for fire, gas leaks, and water leakage. Additionally, an RFID-based secure home gateway ensures controlled access for enhanced safety. Powered by React Native, React JS, and Firebase, this system delivers a fast, secure, and seamless smart home experience, making everyday living smarter and safer. cloud-based solutions like Firebase.

Existing smart home systems primarily monitor temperature and humidity, but few offer Air Quality Index (AQI) tracking. Our system uses AQI sensors to detect harmful pollutants, providing real-time environmental insights to help homeowners maintain healthier indoor air quality.

Many smart home systems lack multi-user authentication and role-based access control. Our system introduces a dynamic multi-user login with access control levels.

In [6], discuss vulnerabilities in Wi-Fi-based automation, which can be compromised via brute force attacks, signal jamming, or unauthorized access. Our system mitigates this risk by adding Ethernet support for secure wired communication, encrypting user credentials and device commands through Firebase Authentication and Firestore security rules.

A major drawback of existing home automation systems is their high cost due to proprietary hardware. Research in [7] shows that many smart home systems require dedicated hubs, increasing setup expenses. Our solution uses ESP32/ESP8266 microcontrollers, which are low-cost yet powerful, making automation affordable and scalable.

Smart home systems primarily focus on appliance automation, but few integrate environmental monitoring. Our system goes beyond traditional automation by incorporating: Real-time Air Quality Index (AQI) monitoring to track indoor air pollution levels. Gas leak and

fire detection sensors that instantly trigger alerts and activate safety measures.

While existing home automation and security systems provide essential features, they often suffer from high costs, security risks, limited offline functionality, and fragmented control. Our Home Automation & Security System offers a cost-efficient, scalable, and secure solution, integrating automation, AI, multi-user authentication, real-time monitoring, and enhanced security into a single platform.

Sr. No.	Features	Existing smart home automation solution	Our proposed System (Home Elite)
1	Device Compatibility	Limited to smart devices only.	Support both smart & non-smart devices.
2	Security Mechanisms	Basic motion detection & camera integration.	RFID access, AI-based alerts, Ethernet security.
3	Offline Functionality	Requires continuous internet connection	GSM-based control for offline operation in remote areas.
4	Automation Intelligence	Cloud-based AI (privacy risk).	On-device AI for automation & predictive control.
5	User Access Control	Single-user access in most systems	Multi-user authentication with role-based access.
6	Environmental Monitoring	Limited to temperature & humidity.	Real-time AQI, gas, fire, and water leakage detection.
7	Security Threat Prevention	Only motion-based alerts.	Live intrusion alerts with smart door locking & emergency notifications.
8	Integration with Third-Party Devices	Restricted to proprietary ecosystems (Google Nest, Alexa).	Universal IR remote & cloud API integration for all devices.
9	Data Privacy & Security.	Cloud-dependent, prone to hacking.	End-to-end encryption with blockchain event logging (future scope).
10	Cost & Scalability	Expensive, requiring proprietary hubs.	Affordable ESP32-based system, scalable up to 20 devices.
11	Service/Team	Limited to customer	Dedicated technical

	Support	service from manufacturer.	team (Team Code Elite) for maintenance & updates.
12	Compact Model Design	Bulky & space-consuming hubs.	Compact, modular ESP-based models for easy integration.
13	Cross-Platform Compatibility	Limited to Android or iOS separately.	React Native-based app works on both Android & iOS.
14	Dynamic Device Management	Static device list, cannot add/remove devices.	Users can ADD, DELETE, and DISABLE devices dynamically.
15	React.js Web Interface	Mostly app-based, no web control.	Includes React.js-based web dashboard for remote control.
16	Smart Scheduling & Routines	Limited timer functions.	AI-based scheduling & geofencing automation. And user can also set timer as per their need .
17	Gesture-Based Control	Not available	Future scope: Gesture recognition for hands-free control.

III.IMLEMENTATION

A. Mobile App Ui

Figure 1 represents the user interface design of the Application titled as HomeElite of the project Smart Home Automation and Security System, that has been created by the members of team titled as Team Code Elite . The interface presents functionalities like device control, real-time monitoring, security camera viewing, motion detection, and hazard notification. The app offers a simple and visually pleasing UI for the efficient handling of smart home devices.

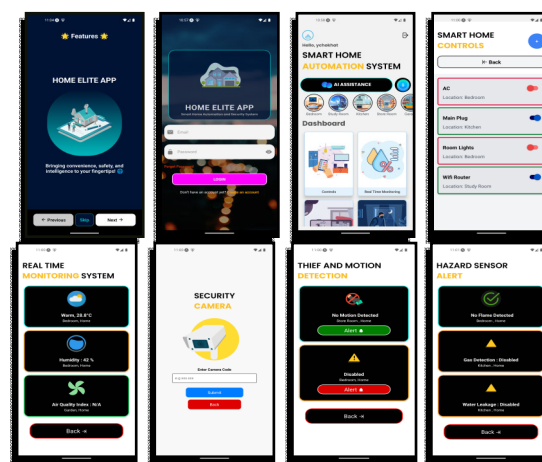


Figure 1: Smart home automation and security system app UI.

B. Web Application Ui

Figure 2 represents the website interface design created by team members of Team Code Elite for the Smart Home Automation & Security System project. This website provides an interactive interface for users to control smart and non-smart devices using a web browser. It offers a user-friendly dashboard for managing home automation functionalities, including device control, scheduling, and security monitoring. The site utilizes real-time data communication with Firebase for efficient interaction between users and the integrated home automation system. The UI is both aesthetic and enhances usability while maintaining strong security features.

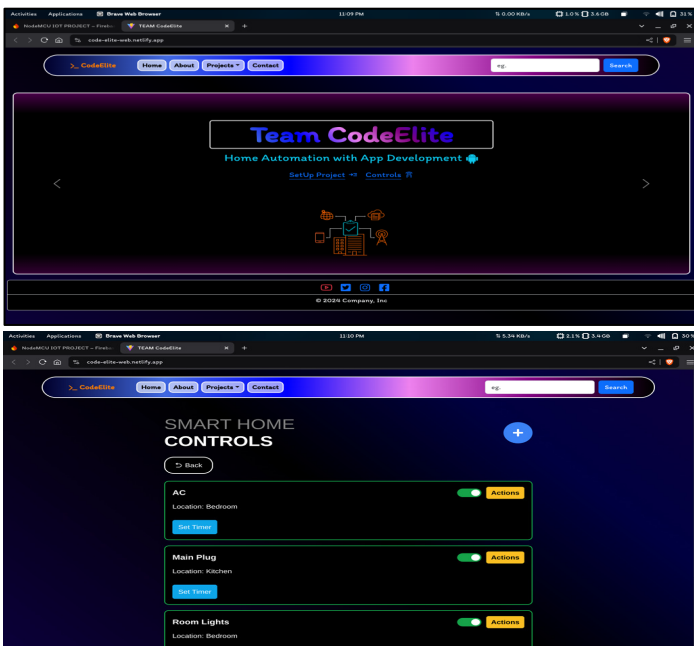


Figure 2: Smart home automation and security system website UI.

C. System Architecture Diagram

The Figure 3 represents the System Architecture of the Smart Home Automation & Security System, designed by Team Code Elite. This architecture demonstrates the interaction between the user, Firebase Realtime Database, NodeMCU, and the relay-controlled electrical

appliances. Users can turn devices ON or OFF and access other features of the smart home automation system via the mobile application or website. When a user performs an operation through the app or website, the updated values are stored in Firebase Realtime Database. The Firebase then sends commands to NodeMCU, which processes the data and activates or deactivates the connected relays. These relays function as switching mechanisms, controlling the electrical appliances as per the received command from Firebase. The Smart Home Automation System leverages cloud-based control and IoT technology to provide remote access to household appliances. The architecture consists of a mobile application, Firebase Realtime Database, NodeMCU (ESP8266), and relay modules that allow users to control devices from anywhere using an internet connection.

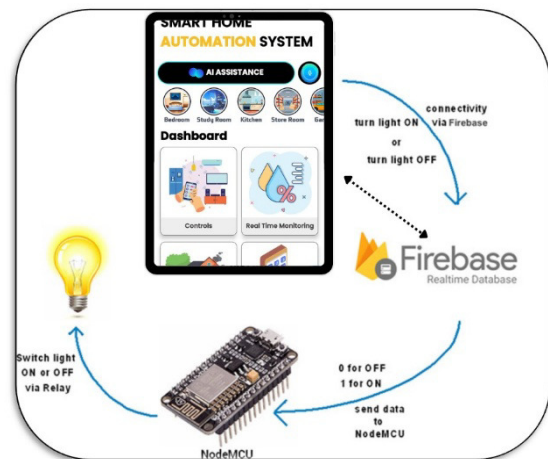


Figure 3: System architecture diagram.

D. Circuit Diagram

The above Figure 4 represents the circuit diagram of the Smart Home Automation & Security System, designed by Team Code Elite. This circuit integrates multiple components, including an ESP8266 microcontroller, relay module, switches, and sensors such as the DHT11 temperature sensor and LDR (Light Dependent Resistor). The system enables users to remotely control electrical appliances through a web-based interface while also incorporating

sensor-based automation for enhanced efficiency. The relay module acts as an interface between the microcontroller and high-voltage devices, ensuring safe and reliable operation. This configuration supports both manual and automatic control of home appliances, contributing to the development of a secure and efficient smart home system. The system is built around an ESP8266 microcontroller, which acts as the central processing unit for controlling home appliances through a relay module. The DHT11/DHT22 temperature sensor provides real-time environmental data, while the LDR (Light Dependent Resistor) with a 10kΩ resistor is used for automatic light control based on ambient brightness. The relay module is responsible for switching high-voltage electrical appliances (such as 220V bulbs) on and off, ensuring safe operation by isolating low-voltage control signals from the high-voltage circuits.

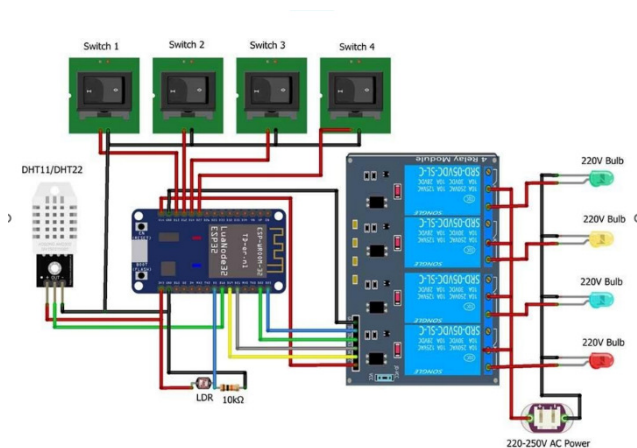


Figure 4: Circuit diagram.

IV. CONCLUSIONS

The Smart Home Automation & Security System, developed by Team Code Elite, provides an innovative solution for remote home appliance control and security. Through the combination of IoT technology, sensor-based automation, and real-time database management, the system maximizes efficiency, security, and user convenience. By means of the mobile app and web interface, users can conveniently control and monitor smart and non-smart devices, thus optimizing energy usage and automating

processes. The integration with Firebase facilitates effective communication between devices, ensuring real-time updates and immediate response to user commands. Additionally, the relay module safeguards high-voltage operations, providing reliability and security. This project clearly illustrates how IoT and automation can transform traditional homes into smart, secure, and energy-efficient environments. Future advancements may include voice assistant integration, AI-based automation, and extended device support, making the system even smarter and more adaptive.

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