A Minor Project Report

Home Automation

Submitted in partial fulfilment of requirement for the award of the degree of

BACHELOR OF TECHNOLOGY
in
ELECTRONICS AND COMMUNICATION ENGINEERING

BY

PRANAV KUMAR (ROLL NO. 22134502021)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
SRINAGAR GHARHWAL, DISTRICT - PAURI GARHWAL
UTTARAKHAND -249161

Acknowledgement

I take this opportunity to express my heartfelt gratitude to all those who supported and guided me throughout the successful completion of this project report titled “Home Automation”.

First and foremost, I would like to extend my sincere thanks to **MR. ARUN SHEKHER BAHUGUNA.** Head of the Department of Electronics and Communication Engineering, HNB Garhwal University for providing the necessary resources, encouragement, and a conducive academic environment for carrying out this project.

I am also deeply grateful to **Mr. Kuldip Kumar Tamta, Mr. Sachin kala, Mrs. Gunjan Chaudhary.** Project Coordinator, for their valuable guidance, continuous support, and insightful suggestions throughout the course of this work. Their mentorship has been instrumental in shaping the direction and depth of the project. I would also like to thank all the faculty members of the department for their academic support and encouragement during the preparation of this report.

Last but not least, I am thankful to my family, friends, and peers who supported me morally and intellectually throughout this journey.

PRANAV KUMAR

B. Tech (Electronics and Communication Engineering)

HNB Garhwal University

Abstract

This project focuses on the development of a smart home automation system using the Cadio ASS controller and its official firmware. The main goal is to enable users to control household electrical devices such as lights and fans remotely through a smartphone application. With the growing adoption of IoT technologies, such systems enhance convenience, energy efficiency, and security in modern living environments.

The Cadio ASS controller acts as the core of the system, providing seamless integration between hardware and mobile interfaces. It supports real-time control and monitoring via Wi-Fi, allowing users to operate appliances from anywhere. The use of Cadio's firmware simplifies setup and reduces development time, making it ideal for rapid deployment.

The system was tested in a home environment and demonstrated reliable performance. This project showcases the potential of affordable, scalable home automation solutions and provides a foundation for future enhancements such as voice control and AI-based automation.

Table of contents Page No.

CHAPTER 1

INTRODUCTION

Home automation refers to the use of technology to control and monitor household appliances and systems such as lighting, fans, security cameras, and other electrical devices. These systems often utilize internet-based platforms and mobile applications to allow users to manage their home environment remotely and efficiently. By integrating electronics, wireless communication, and automation technologies, home automation systems provide enhanced convenience, energy savings, and security.

In today's fast-paced and digitally connected world, home automation has become increasingly important. It enables users to control devices remotely, set schedules, reduce energy consumption, and receive alerts or updates in real-time. Smart homes not only improve comfort and accessibility, especially for the elderly or physically challenged, but also contribute to sustainable living by optimizing energy use.

This project aims to design and implement a cost-effective home automation system using the Cadio ASS controller and its official firmware. The system allows users to control and monitor appliances through a smartphone app via Wi-Fi. The use of Cadio simplifies the integration process, offering a user-friendly platform with real-time control capabilities. The project demonstrates the practical application of IoT-based solutions in creating a scalable, efficient, and accessible smart home environment [1].

1.1 What is Home Automation?

Home automation refers to the use of technology to control and automate household systems and appliances. It involves the integration of hardware and software to enable remote or scheduled operation of devices such as lights, fans, air conditioners, televisions, security systems, door locks, and other electrical appliances. Home automation systems are commonly referred to as smart home systems.

At the core of home automation is the ability to remotely monitor, control, and manage devices through a centralized system, often using a smartphone, tablet, or computer. These systems typically rely on wireless communication technologies such as Wi-Fi, Bluetooth, Zigbee, or Z-Wave, and are often connected to the Internet of Things (IoT) ecosystem.

A typical home automation setup may include:

- Sensors (for motion, temperature, light, etc.)
- Actuators (relays or switches)
- A central controller (like a microcontroller or IoT board)
- User interfaces (mobile apps or web dashboards)

Home automation can be used for:

- Turning lights or fans on/off remotely
- Setting schedules for appliances
- Enhancing home security with sensors and cameras
- Reducing energy consumption
- Improving comfort and accessibility

In short, home automation transforms a regular house into a smart home that is more convenient, energy-efficient, and secure.

1.2 Importance of Home Automation in Modern Life:

In today's fast-paced and technology-driven world, home automation has become an essential part of modern living**.** With the rise of the Internet of Things (IoT), artificial intelligence, and mobile connectivity, smart home solutions are no longer futuristic concepts—they are practical tools that enhance daily life.

Here are some key reasons why home automation is important in modern life:

- Convenience and Comfort

  Home automation allows users to control appliances with just a smartphone, voice command, or automation schedule. Tasks like turning off lights, adjusting fans, or locking doors can be done remotely, saving time and effort.
- Energy Efficiency

  Smart systems help monitor and reduce energy usage by automatically turning off appliances when not in use or adjusting lighting based on occupancy or natural light. This results in lower electricity bills and reduced environmental impact.
- Security and Safety

  Integrated home automation can include surveillance cameras, smart locks, motion detectors, and alarms. These systems alert users of unusual activities, enabling real-time monitoring and enhanced home security.

- Accessibility for Elderly and Disabled

  Automation significantly improves the quality of life for people with physical limitations, allowing them to control home systems without needing to move around.
- Remote Access and Control

  Whether at work or on vacation, users can control and monitor their home appliances from anywhere, offering peace of mind and control at all times.
- Integration with AI and Voice Assistants

  Smart homes can be connected to AI assistants like Alexa, Google Assistant, or Siri, allowing for seamless voice-based control and intelligent automation[2].

CHAPTER 2

OBJECTIVES

The main objective of this project is to design and implement a smart home automation system using the Cadio ASS controller and its official firmware. The goal is to create a cost-effective, user-friendly, and efficient system that allows users to remotely control and monitor household electrical appliances through a smartphone. In the context of increasing energy demands, security concerns, and the growing importance of IoT in daily life, this project aims to provide a practical solution that enhances convenience and control in residential environments.

The specific objectives of the project are:

- To automate common household appliances
  The system is designed to control devices like lights, fans, or other electrical appliances through a mobile application, replacing manual operation with remote functionality.
- To utilize the Cadio ASS platform for seamless integration
  The use of the Cadio ASS controller ensures a simplified, plug-and-play setup that eliminates the need for custom firmware or complex programming, making the system accessible to non-technical users.
- To enable real-time monitoring and control via smartphone
  The project aims to allow users to monitor the status of connected appliances in real-time and control them remotely using Wi-Fi connectivity and the official Cadio app.
- To ensure reliability, responsiveness, and stability of the system
  The system is expected to perform consistently under real-world conditions, with minimal delay in command execution and reliable connection to the internet.
- To reduce energy consumption and improve operational efficiency
  By automating device control and offering remote access, the system can help reduce unnecessary power usage, contributing to energy efficiency and cost savings.
- To develop a scalable and flexible smart home solution
  The design should support future upgrades, such as integration with voice assistants (e.g., Alexa or Google Assistant), automation schedules, or smart sensors for environmental monitoring.
- To gain hands-on experience in implementing IoT-based home solutions

As an academic project, this work helps in understanding real-world applications of IoT, embedded systems, and automation technology [3].

CHAPTER 3

Literature Review

Previous Systems or Technologies for Home Automation

Home automation has evolved significantly over the years, from simple timer-based systems to intelligent, internet-connected smart homes. Earlier systems were either too expensive or too complex for average users, but advancements in embedded systems and wireless communication have made home automation more accessible.

Some commonly used systems before include:

- Timer-Based Switches:
  These were among the earliest automation devices. They allowed users to set timers to turn devices ON or OFF. However, they offered no flexibility or remote access.
- Microcontroller-Based Systems (8051, AVR, PIC, Arduino):
  These systems involved custom circuit design and programming. For instance, Arduino-based projects could control relays using sensors and smartphones via Bluetooth or Wi-Fi modules like ESP8266. These projects were low-cost but required significant coding, soldering, and configuration.
- Wi-Fi Modules (ESP8266, NodeMCU):
  These became popular for wireless automation, enabling IoT features like smartphone control via Blynk, MIT App Inventor, or custom apps. However, users had to write the firmware, build their cloud or database, and ensure security.
- Commercial Smart Devices (Philips Hue, TP-Link Kasa, Sonoff):
  These are ready-to-use devices but can be expensive and are often locked into proprietary ecosystems. Integration with other devices can be limited, and customization options are minimal.

Why Cadio ASS Was Chosen

For this project, the Cadio ASS (Automation Smart Switch) platform was selected due to its ability to overcome many of the limitations of earlier systems while still being affordable and beginner-friendly.

Reasons for selecting Cadio ASS include:

- Plug-and-Play Simplicity:
  Cadio ASS requires no coding, no firmware uploading, and no complex configuration. Users only need to wire the device, connect it to the internet, and link it with the Cadio mobile app.
- In-Built Wi-Fi Connectivity and Mobile App Integration:
  Unlike microcontroller-based systems that need external Wi-Fi modules and app development, Cadio ASS comes with built-in Wi-Fi and is natively supported by the Cadio mobile app for remote control and automation.
- Time Efficiency:
  Cadio drastically reduces development time. While traditional systems may take days to code, test, and debug, Cadio can be set up and functional within hours.
- No Programming or Cloud Setup Required:
  The Cadio firmware is preloaded and connects directly to the Cadio cloud, removing the need to create or manage databases, host servers, or deal with API integration.
- Reliability and Stability:
  Cadio ASS has been tested to provide reliable performance in home environments, with stable internet connectivity and responsive device control.
- Expandable and Scalable:
  The platform allows multiple devices to be controlled from a single app and can be scaled with future automation scenes or voice assistant integrations[4].

CHAPTER 4

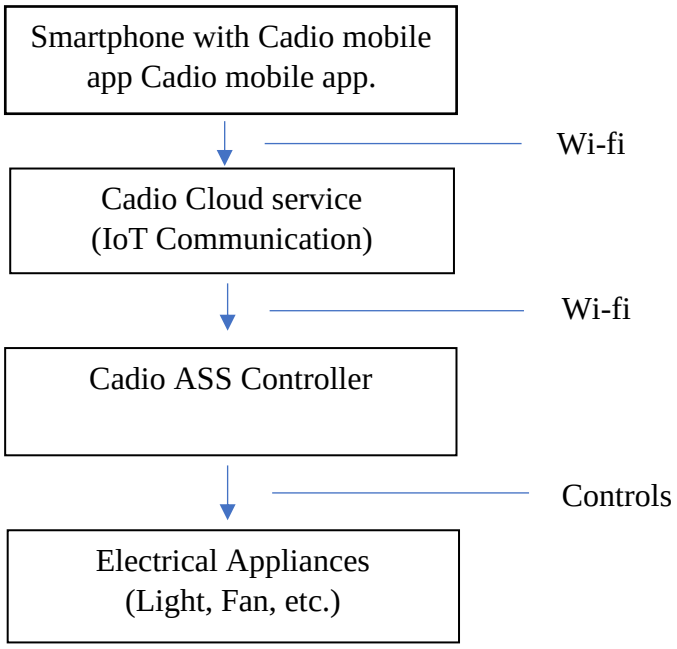
SYSTEM OVERVIEW

The home automation system designed in this project is based on the Cadio ASS (Automation Smart Switch) platform. The system allows users to control electrical appliances remotely using a smartphone application connected via Wi-Fi. The core of the system is a smart switch module that can receive commands from the cloud and perform switching actions accordingly. This system eliminates the need for manual operation of appliances and offers convenience, energy efficiency, and real-time control. The Cadio ASS controller is preloaded with firmware, making it a plug-and-play solution with no coding or external configuration required.

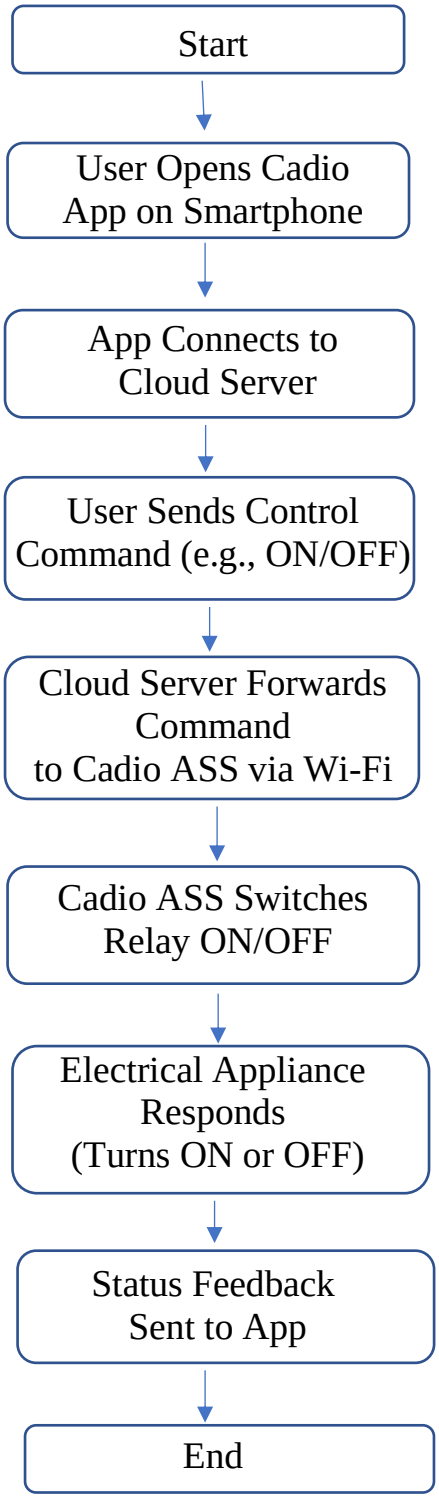
Key Components:

1. Cadio ASS Controller
2. Wi-Fi Router
3. Smartphone with Cadio App
4. Relay Circuit (internal in controller)
5. Electrical Appliances (e.g., light, fan, etc.)
6. Power Supply

4.1 Block Diagram



4.2 System Workflow



4.3 Working Principle

1. User Interaction:

   The user opens the Cadio mobile app and selects the appliance they want to control.
2. Cloud Communication:

   The app communicates with the Cadio cloud server over the internet to send control commands.
3. Command Execution:

   The Cadio ASS controller, connected to Wi-Fi, receives the command and toggles the corresponding relay circuit inside the device.
4. Appliance Control:

   The relay either completes or breaks the circuit of the connected appliance (e.g., light or fan), turning it ON or OFF accordingly.
5. Real-Time Feedback:

   The system updates the status on the app, showing whether the device is currently ON or OFF [5].

CHAPTER 5

Hardware and Software Used

Hardware Components

- Cadio ASS Controller

  The central device of the system. It contains built-in relays, Wi-Fi connectivity, and preloaded firmware to control electrical appliances through the Cadio mobile app.
- Relay Module (Built-in)

  Used to switch high-voltage appliances like lights or fans. The relay receives signals from the Cadio ASS controller and toggles the appliance ON or OFF.
- Wi-Fi Router (Existing Network)

  Provides internet connectivity to the Cadio ASS controller and connects it to the Cadio cloud server for remote access.

  Smartphone

  Used to install and operate the Cadio mobile app for controlling appliances.
- Electrical Appliances

  Devices such as bulbs, fans, or any standard 230V home appliance that are connected to the relay output of the Cadio ASS.
- Power Supply

  Provides the necessary voltage (typically 230V AC) for both the Cadio ASS module and connected appliances.

Software Used

1. Cadio Mobile Application (Android/iOS)
2. The official app used to pair with the Cadio ASS controller, allowing users to control appliances, monitor status, set schedules, and automate scenes.
3. Cadio Cloud Platform (Built-in)

4. The backend service automatically integrated with the controller and app. It enables real-time communication and remote access through the internet.

   Smartphone Operating System (Android/iOS)
5. Required for running the Cadio app and accessing the home automation interface.
6. (Optional) Web Dashboard (if used)
7. Some Cadio platforms also provide web access for desktop-based monitoring and control [6].

CHAPTER 6

System Design and Implementation

This section outlines the design architecture, hardware connections, wiring setup, and the implementation process for the home automation system using the Cadio ASS controller**.**

6.1 Circuit Diagram and Wiring Setup

Basic Wiring Steps:

- Power Supply Connection:

  Connect the Live (L) and Neutral (N) AC input wires to the respective terminals of the Cadio ASS controller.
- Appliance Connection:

  Connect the live output from the Cadio ASS to the appliance (e.g., light or fan).

  The neutral line of the appliance is connected directly to the AC neutral line.
- Wi-Fi Configuration:

  The controller connects to your home Wi-Fi network for cloud-based control via the Cadio mobile app.

6.2 Configuration Steps

The configuration of the Cadio ASS is simple and does not require uploading code or manual firmware flashing.

Steps:

- Power ON the Controller

  After wiring, turn on the main power to energize the Cadio ASS module.
- Download the Cadio App

  Install the official Cadio app from the Play Store or App Store.
- Create an Account / Login

  Register with your email or mobile number and log in.
- Add New Device

  Use the “+” icon in the app to add a new device. Follow on-screen instructions to connect the controller to your Wi-Fi network.

- Name and Save

  Assign a name to your device (e.g., “Living Room Light”) and save it in the app dashboard.

6.3 Firmware Setup

One of the key benefits of the Cadio ASS platform is that it comes with preloaded firmware. This removes the need for:

- Coding or programming
- Uploading firmware via Arduino IDE or any other tools
- Managing cloud databases or APIs

The firmware includes:

- Built-in Wi-Fi setup logic
- Cloud connectivity
- Relay switching logic
- Real-time feedback to the app

6.4 Mobile App Integration

The Cadio Mobile App plays a crucial role in the control and management of your home automation system. It allows users to:

- Switch appliances ON/OFF remotely
- View the real-time status of devices
- Set timers and schedules
- Create automation scenes (e.g., turn on lights at sunset) [7]

CHAPTER 7

Testing and Results

This section presents the functional testing, real-use case analysis, and performance evaluation of the home automation system. The system was tested in a real residential environment using standard appliances such as lights and fans.

7.1 Functional Testing

After successful installation and configuration of the Cadio ASS controller, the system was tested for its core functionalities:

Test Case	**Expected Output**	**Result**
Turning light ON via mobile app	Light turns ON instantly	Successful
Turning fan OFF via mobile app	Fan turns OFF without delay	Successful
Checking device status in app	Real-time status displayed accurately	Accurate
Scheduling auto ON/OFF	Appliance follows set time	Successful
Wi-Fi reconnection after power failure	Device reconnects to cloud automatically	Reliable

7.2 Real-Use Case Analysis

Use Case 1: Remote Light Control

- Scenario: User turns on the living room light while away from home.
- Result: The command was sent via mobile app, and the light turned ON with a delay of less than 1 second.

Use Case 2: Fan Control with Scheduling

- Scenario: Fan set to turn ON at 10:00 PM and OFF at 6:00 AM automatically.
- Result: The fan followed the schedule consistently for multiple days without errors.

Use Case 3: Power Interruption Handling

- Scenario: Power supply was turned off and restored.

- Result: Cadio ASS successfully reconnected to Wi-Fi and resumed functionality without manual intervention.

7.3 Performance Discussion

AI and IoT are revolutionizing manufacturing and heavy industries through automation and insight-driven operations.

Use-Cases:

Predictive maintenance: Sensors track machine health; AI predicts failures before they happen.

Robotics: Smart robots perform tasks like assembly, welding, and inspection.

Quality control: AI analyzes visual or sensor data to detect defects.

Benefits:

Reduced downtime, improved productivity, and enhanced safety[8].

CHAPTER 8

Applications, Limitations, and Future Enhancements

This section outlines the practical use cases of the home automation system, the current limitations identified during implementation, and future improvements that can enhance functionality and scalability.

8.1 Applications

The home automation system developed using the Cadio ASS controller can be used in a wide range of real-world scenarios:

- Smart Homes:
  Automate lights, fans, and other appliances to improve comfort, security, and energy efficiency.
- Offices and Workspaces:
  Control multiple electrical devices remotely, reduce manual effort, and schedule usage during working hours.
- Elderly and Physically Challenged Users:
  Offers easy control of home appliances through a mobile phone, eliminating the need to move around physically.
- Rental Properties and Hostels:
  Landlords can control utilities remotely or monitor energy usage patterns for better management.

8.2 Limitations

Despite its advantages, the system has a few limitations:

- Internet Dependency:
  The system requires an active and stable internet connection for remote access. Any internet failure can disrupt control.
- Range Limitations:
  While remote access works via the cloud, local Wi-Fi coverage must be strong near the device for proper communication.
- Limited to Electrical Appliances:

The current setup only supports devices with ON/OFF switching and does not manage variable-speed appliances or Analog inputs.

- Lack of Voice Control (in current setup):
  Without additional platforms, native support for Alexa or Google Assistant is not available.

8.3 Future Enhancements

Several improvements and extensions can make the system more powerful and intelligent:

- AI-Based Automation:
  Implement machine learning algorithms to study user behavior and automate appliances accordingly.
- Voice Assistant Integration:
  Integrate with popular voice platforms like Amazon Alexa or Google Assistant for hands-free control.
- Energy Monitoring and Reporting:
  Add current sensors to monitor energy usage and provide real-time energy analytics via the app.
- Sensor-Based Automation:
  Include sensors like PIR (motion), DHT11 (temperature), or LDR (light) to trigger actions based on environment conditions.
- Local Network Control:
  Add offline (LAN-based) control features to reduce reliance on cloud connectivity[10] [9].

9. CONCLUSION

The home automation system developed using the Cadio ASS platform has proven to be an effective and practical solution for modern smart living. Through this project, the objective of remotely controlling household electrical appliances such as lights and fans was successfully achieved without the need for complex programming or circuit design. By leveraging the built-in firmware and mobile app provided by Cadio, the system offered a seamless setup experience, enabling users to interact with their home appliances through their smartphones from any location with internet access.

This project highlighted the importance of automation in contemporary life, where convenience, efficiency, and energy management play significant roles. With a growing interest in Internet of Things (IoT) applications, this implementation reflects how readily available tools can be used to transform traditional homes into smart environments. The integration of cloud-based control and mobile app features not only enhanced the user experience but also demonstrated the feasibility of expanding the system for broader use in offices, rental properties, and support for elderly individuals.

Moreover, the system performed reliably during functional testing, maintaining stable connectivity and quick response times. Although limitations such as internet dependency were observed, the overall outcome of the project was highly successful. This work also opens doors to future enhancements like voice assistant integration, AI-based automation, and energy monitoring, making it a scalable and forward-thinking solution. The experience gained through this project contributes significantly to understanding practical IoT implementation and lays the groundwork for more advanced home automation developments in the future.

REFERENCES

1. Cadio ASS Official Website
2. Cadio. (2024). Smart Automation Made Simple. Retrieved from https://cadio.in
3. Cadio Mobile Application
4. Cadio Smart App. (2024). Available on Google Play Store and Apple App Store. Cadio Technologies Pvt. Ltd.
5. Kumar, R., & Patel, M. (2021). IoT-Based Home Automation System. International Journal of Engineering Research & Technology (IJERT), Vol. 10, Issue 5, pp. 325–329.
6. Sharma, S., Gupta, A., & Rathi, R. (2020). Smart Home Automation Using IoT and Cloud Computing. International Journal of Computer Applications, Vol. 176, pp. 22–26TutorialsPoint. (n.d.). IoT Home Automation - Overview and Implementation. Retrieved from https://www.tutorialspoint.com
7. Circuit Digest. (2023). Home Automation Projects Using IoT. Retrieved from https://circuitdigest.com
8. Arduino.cc. (n.d.). Getting Started with IoT Concepts. Retrieved from https://www.arduino.cc/en/Guide
9. Cadio ASS Controller Datasheet. (2024). Technical Specifications and Pin Details. Provided by Cadio Technologies Pvt. Ltd.
10. Project Guide and Internal Faculty Support. (2025). Lecture Notes and Guidance on Home Automation Implementation. Department of Electronics and Communication Engineering, [HNB].