

SMART HOME AUTOMATION

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Abstract – This project presents the overall design of Home Automation System with low cost and wireless system. It specifically focuses on the development of an IOT based home automation system that is able to control various components via internet or be automatically programmed to operate from ambient conditions. Project implements wireless technology to provide remote access from smart phone. We are using a cloud server-based communication that would add to the practicality of the project by enabling unrestricted access of the appliances to the user irrespective of the distance factor. The system intended to control electrical appliances and devices in house with relatively low cost design, user-friendly interface and ease of installation. The status of the appliance would be available, along with the control on an android platform. This system is designed to assist and provide support in order to fulfil the needs of elderly and disabled in home. Also, the smart home concept in the system improves the standard living at home.

Key Words: *Smart, Automation, Wireless, IOT, Cloud*

1.INTRODUCTION

The Internet can be described as the communication network that connects individuals to information while The Internet of Things (IOT) is an interconnected system of distinctively address able physical items with various degrees of processing, sensing, and actuation capabilities that share the capability to interoperate and communicate through the Internet as their joint platform [1]. Thus, the main objective of the Internet of Things is to make it possible for objects to be connected with other objects, individuals, at any time or anywhere using any network, path or service Automation performs an increasingly vital role in daily experience and global economy. Engineers strive to combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications and human activities. A home automation system means to grant the end users to manage and handle the electric appliances. If we look at different home automation systems over time, they have always tried to provide efficient, convenient, and safe ways for home inhabitants to access their homes. Regardless of the change in user's hope, growing technology, or change of time, the appearance of a home automation system has remained the same. Many existing, well-established home automation systems are

based on wired communication such as ESP32 based home automation systems. This does not pose a problem until the system is planned well in advance and installed during the physical construction of the building. But for already existing buildings the implementation cost goes very high. In contrast, Wireless systems can be of great help for automation systems like Bluetooth, WiFi and IOT based home automation systems. With the advancement of wireless technologies such as Wi-Fi, cloud networks in the recent past, wireless systems are used every day and everywhere. The system is implemented via the use of IOT, which is the interconnection of machines via Internet for advanced connectivity. This proposed system presents a low cost and flexible le home control and monitoring system using an embedded micro-web server, with IP connectivity for accessing and controlling devices and appliances remotely.

2. AIM AND OBJECTIVE

The main aim of this project is to design and develop a smart home automation system using the ESP32 microcontroller that allows users to control and monitor household electrical appliances remotely through Wi-Fi using a mobile or web-based application. The system aims to enhance comfort, convenience, energy efficiency, and security in modern homes by replacing manual operation with intelligent and automated control.

- To automate home appliances such as lights, fans, and other devices using a microcontroller based system.
- To provide remote control access via smartphone, SMS, or internet connection.
- To enhance energy efficiency by operating appliances only when required.
- To improve home security through sensors and alert mechanisms (e.g., motion, gas, or fire sensors).
- To develop a user-friendly interface for monitoring and controlling devices easily.
- To implement cost-effective and scalable technology suitable for modern homes.
- To promote the concept of smart living through automation and intelligent decision-making.

3. LITERATURE SURVEY

- [1]. In this paper we focus on home automation using smart phone and manual. The system provides remote access and control of home appliances from anywhere in the world using an Internet connection. It is designed to be cost-effective, scalable, and efficient, making it suitable for modern smart home applications.
- [2]. This research paper presents home automation system that uses an ESP32 microcontroller. The system allows users to remotely monitor and control home appliances through a mobile application.
- [3]. The paper discusses the hardware and software components of the system, including the ESP32 microcontroller, sensors and actuators, and mobile applications.
- [4]. Saurav Sagar et al. (2020) titled "Smart Home Automation Using IoT and Raspberry Pi" in ICICC 2020 proposes a system using Raspberry Pi, sensors, and PiCam to control appliances and monitor home security. A web server and web interface are implemented for controlling devices remotely via the internet. Work in
- [5]. Ivanshu Patil et al. (2023) titled "Home Automation System Using IoT" published in IJCRT discusses a voice-controlled home automation system using Amazon Echo, ESP32, and Alexa cloud services. The system controls appliances via voice commands, showing how IoT platforms can make homes smarter and improve appliance communication.
- [6]. Ashutosh Mahindrakar et al. (2024) titled "IoT Based Smart Home Automation System Using Node MCU" in IJFMR focuses on an ESP8266 based system with DHT11 sensors, relays, and Blynk Platform. It enables remote and automatic control of appliances like fans and lights based on room temperature and humidity.

4. BLOCK DIAGRAM

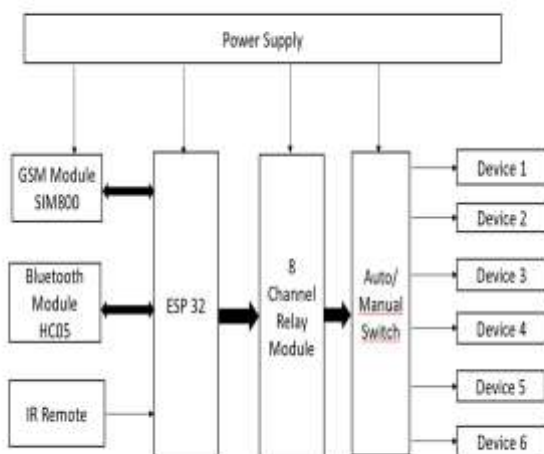


Fig. 1 BLOCK DIAGRAM

The power supply provides the required voltage and current to all components in the circuit. ESP32, GSM module (SIM800), Bluetooth module (HC05), IR receiver, and relay module all need power to operate. Generally, 5V or 12V DC supply is used (with regulators for 3.3V if needed by ESP32). This module allows the system to be controlled via SMS or phone calls. It communicates with the ESP32 using serial communication (TX & RX pins). The user can send commands through SMS to turn ON/OFF connected devices remotely (from anywhere using a mobile network). The HC-05 Bluetooth module enables wireless communication between a smartphone and the ESP32. It works within a short range (about 10 meters). Through a mobile app, the user can control appliances by sending Bluetooth commands to the ESP32. The IR remote allows local control of devices using infrared signals. An IR receiver connected to the ESP32 receives the IR signal from the remote and decodes it. This enables turning ON/OFF devices without internet or Bluetooth (just using an IR remote like a TV remote). The ESP32 is the main controller of the system. It receives inputs from GSM, Bluetooth, and IR modules. According to the received command, it sends control signals to the 8-channel relay module. ESP32 can be programmed using Embedded C / Arduino IDE to handle all these operations. The relay module acts as an interface between the low-voltage ESP32 and high-voltage electrical devices. Each relay controls one electrical device (like a light, fan, pump, etc.). When the relay receives a signal from the ESP32, it switches the corresponding device ON or OFF.

5. CIRCUIT DIAGRAM

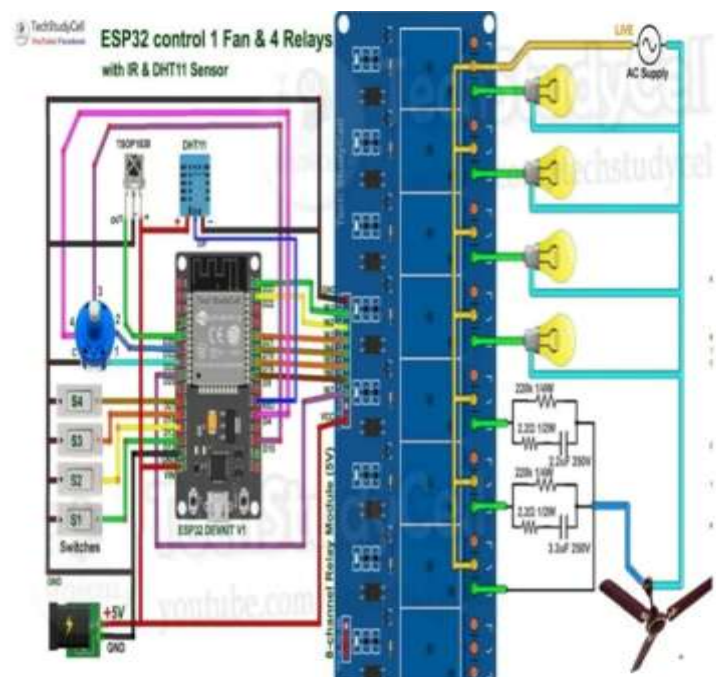


Fig. 2 CIRCUIT DIAGRAM

A +5V regulated power supply is used to power the ESP32 board and relay module. ESP32 requires 3.3V (internally regulated from 5V input). The relay module, sensors, and switches all share a common ground (GND) connection. This is the main controller and decision-making unit. It processes input signals from: IR Receiver (TSOP1838) – receives commands from an IR remote. DHT11 Sensor – measures temperature and humidity. It sends output signals to: Relay module – to control the connected AC appliances. ESP32 can also connect via Bluetooth, Wi-Fi, or GSM for remote control. (a)IR Receiver (TSOP1838) Detects infrared signals from the IR remote. (b) DHT11 Sensor Measures temperature and humidity. (c)Manual Switches (S1–S4) Connected to input pins of ESP32.Used for manual ON/OFF control of appliances when not using remote or wireless control. Relays act as electromechanical switches that control AC loads using small control signals from the ESP32.Each relay has: Input pin from ESP32 (for signal) Common (COM), Normally Open (NO), and Normally Closed (NC) terminals When ESP32 sends HIGH/LOW signal: The relay energizes or de-energizes. This switches the connected load (light/fan) ON or OFF. The AC loads such as: Bulbs (220V, 12W) – connected to first Six relays. Fan (220V, 35W) – connected to the Two relay. Each load is powered by AC supply (Live & Neutral) through the relay contacts. Bluetooth (HC-05): Used for wireless control via mobile app (short range). GSM (SIM800): Used for SMS-based or call-based control (long distance). Wi-Fi (ESP32 built-in): Used to connect with IoT dashboard or cloud for monitoring.

6. COMPONENTS



Fig. 3 ESP32 PIN DIAGRAM

The ESP8266 is, the name of a microcontroller designed by Espressif Systems. It is a self- contained WiFi networking solution offering as a bridge from the existing microcontroller to WiFi and is also capable of running self-contained applications. It can monitor and control things from anywhere in the world – perfect for just about any IOT project.

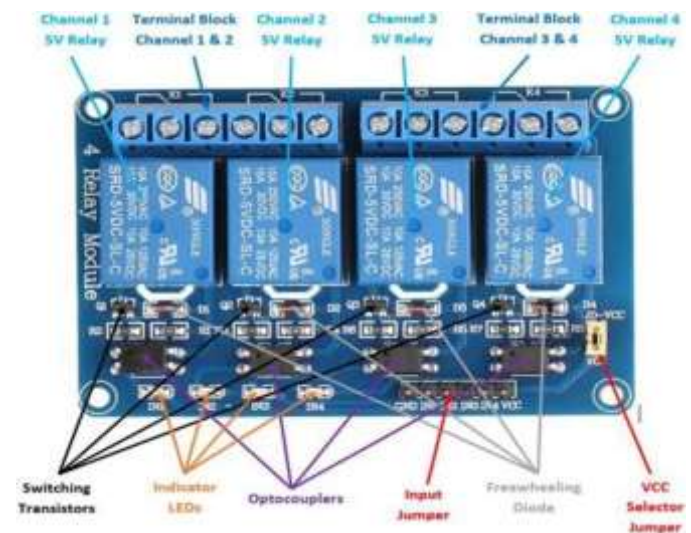


Fig. 4 RELAY OF 4 CHANNEL

The Eight-channel relay module contains four 5V relays and the associated switching and isolating components, which makes interfacing with a microcontroller or sensor easy with minimum components and connections.



Fig. 5 GSM SIM 800L

The SIM800L is a GSM (Global System for Mobile Communication) module developed by SIM Com.It allows microcontrollers like ESP32,to communicate over the mobile network for sending/receiving SMS, calls, and GPRS data (internet).

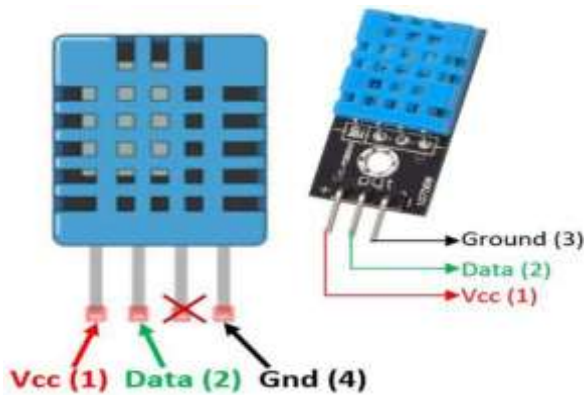


Fig. 6 TEMPERATURE AND HUMIDITY SENSOR

The DHT-11 Digital Temperature and Humidity Sensor is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds, so when using our library, sensor readings can be up to 2 seconds old.

7. METHODOLOGY

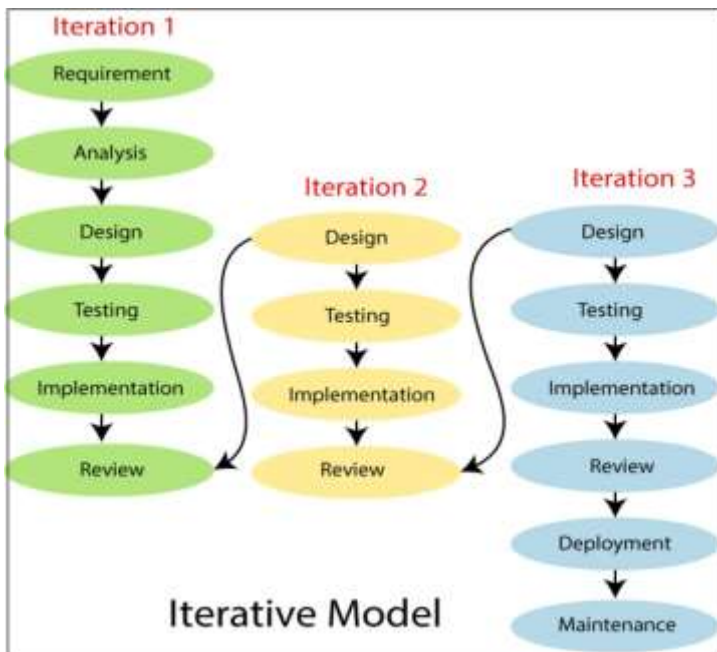


Fig. 7 METHODOLOGY

We will be using iterative methodology. The iterative method is a traditional approach to project management. In it, tasks and phases are completed in a linear, iterative manner, and each stage of the project must be completed before the next begins. This project will use iterative software development. An iteration incorporates a

loosely sequential set of activities in business modeling, requirements, analysis and design, implementation, test, and deployment, in various proportions depending on where in the development cycle the iteration is located. Iterations in the inception and elaboration phases focus on management, requirements, and design activities; iterations in the construction phase focus on design, implementation, and test; and iterations in the transition phase focus on test and deployment. The stages of iterative project management generally follow this sequence located. Iterations in the inception and elaboration phases focus on management, requirements, and design activities; iterations in the construction phase focus on design, implementation, and test; and iterations in the transition phase focus on test and deployment.

8. RESULT

- The ESP32 microcontroller was able to connect with the Wi-Fi network and communicate with the mobile application effectively.
- All connected home appliances, such as lights and fans, were controlled remotely through the Blynk app without any delay.
- The relay module responded quickly to ON/OFF commands sent from the smartphone, showing excellent switching performance.
- Real-time status of each device was displayed accurately on the app, confirming smooth two-way communication between the ESP32 and the user interface.
- The system operated reliably within the Wi-Fi range of approximately 30 meters, maintaining stable connectivity.
- Power consumption of the controller was low, making the system energy-efficient.
- Overall, the project demonstrated a smart, low-cost, and user-friendly method of controlling household appliances using the Internet of Things (IoT) technology.

9. CONCLUSION

In this proposed system we focus on the process of operating or controlling various equipment, machinery, and other electrical and electronic appliances using various control systems remotely. This method of operating or controlling such applications is referred to as automation which has become an integral part of everyday life for human beings. The proposed system has its focal point on home automation providing 100% efficiency. The model has its roots on an IOT platform that allows devices to synchronize with the IOT platform so that it can be controlled remotely. The platform uses the IOT technology to create a network between the main server and the other electrical and electronic appliances making home a smarter place to live in. The whole network consists of a single admin which makes our model a secure one as the admin only have the authority

to access all the nodes present under each user. The model is quite economical as though there is only a single admin but the number of user under the admin may increase making a large complex network but a secure one. In our proposed Smart Home Automation System, appliances will be access through voice commands for disabled people using Google Assistant or Amazon Alexa. This system would help disabled people to control electrical equipment such as TV, lights, and fans using voice commands of Google Assistant on smartphones. Users do not need to move to turn on or turn off electrical equipment. The Google Assistant application will accept voice commands when the pronunciation is correct. Voice commands are simpler to apply, without typing text messages. Users get convenience compared to using text. Users only send voice commands to the Google Assistant Application, and the system will automatically display the text messages that we said before, without typing text messages.

10. REFERENCES

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