

# **IoT Based Monitoring and Controlling of Home Appliances**

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# ABSTRACT

The rapid evolution of Internet of Things (IoT) technology has paved the way for innovative solutions in the realm of home automation. This research introduces а comprehensive Home Automation System integrated with robust data monitoring capabilities, aimed at enhancing energy efficiency and providing users with unprecedented control over their living spaces. The proposed system leverages a network of smart sensors, actuators, and intelligent algorithms to automate various aspects of home management, such as lighting, climate control, security, and appliance usage. There are various types of automations like Home automation, Industrial Automation, Machinery Automation etc... Key Words: Internet of Things (IoT), Remote Access

via mobile, Voice Command Access, Home Automation System.

# I. INTRODUCTION

The Internet of Things (IoT) has revolutionized the way we interact with technology and has transformed various aspects of our daily lives. One of the areas where IoT has made a significant impact is in the monitoring and controlling of home appliances. With the increasing number of smart home devices and the availability of high-speed internet, home automation has become more accessible and affordable. In this paper, we will explore the concept of IoT-based monitoring and controlling of home appliances, its benefits, and its impact on our daily lives. IoT-based monitoring and controlling of home appliances refers to the use of internet-connected devices to monitor and control various household appliances and systems. These devices, also known as smart home devices, are connected to the internet and can be controlled remotely through a mobile application or a voice assistant. These devices use sensors, actuators, and microcontrollers to gather data, process it, and perform a specific action, such as turning on or off a device.



Fig 1 Home Automation



# **II. PROPOSED WORK:**

Home automation using NodeMCU (a popular ESP-32 WROOM -based development board) and sensors can be a rewarding DIY project. Below is a basic guide on how to set up a simple home automation system using NodeMCU and sensors. For this example, we'll focus on creating a home automation system that monitors the consumption of current and room temperature and controls a relay to switch a device on or off manually and automatically. It is used to store the record of consumption of supply.

# **III. METHODOLOGY:**

A home automation system is designed to enhance the efficiency, comfort, and security of residential spaces by integrating smart devices and technologies. The following is a comprehensive system overview detailing the key components and functionalities of a typical home automation setup:

1. Hub or Controller:

A central hub or controller acts as the brain of the home automation system, facilitating communication between different devices and ensuring seamless integration. The hub can be a standalone device or part of a smart assistant platform (e.g., Amazon Alexa, Google Home) that enables voice control.

## 2. Communication Protocols:

Devices within the home automation system communicate through various protocols such as Wi-Fi, Zigbee, Z-Wave, Bluetooth, or Thread, IR Remote The choice of protocol depends on factors like range, power consumption, and compatibility with different devices.

# 3. Mobile Apps and User Interfaces:

Users interact with the home automation system through dedicated mobile apps or user interfaces.

Apps allow users to control devices, create automation routines, monitor security, and receive alerts.

# 4. Voice Control:

Fig 3.4 Integration with voice assistants (e.g., Alexa, Google Assistant, Siri) allows users to control devices and execute commands using natural language. Voice control enhances user convenience and accessibility.



5. En "Hey Alexa" "Hey Siri" "Hey Google" The Fig. 5.5 shows the Smart energy monitoring devices provide insights into energy consumption, allowing users to make informed decisions for optimizing efficiency. Energy-efficient devices and automation contribute to overall sustainability.



home automation system from anywhere using a smartphone or web interface as shown in Fig 3.6





Fig 3.6 Remote Access

7. Security and Privacy:

Security features, including encrypted communication, secure authentication, and regular software updates, are implemented to protect the system from unauthorized access.

## **IV. DESCRIPTION OF THE HARDWARE**

#### 1. Nodemcu (ESP32)



Fig 4.1 ESP32

NodeMCU is an open-source firmware and development kit that helps in prototyping IoT products. It initially started with ESP8266 microcontroller support and expanded to ESP32 The NodeMCU firmware simplifies the process of programming ESP8266/ESP32 modules with Lua scripts

Fig 4.1 Shows the ESP controller. It is often used in IoT applications due to its integrated Wi-Fi and Bluetooth capabilities, along with various GPIO pins and other peripherals. The ESP32 is more advanced than the ESP8266 and provides additional features and capabilities.

## 2. Relay Module



## Fig 4.2 Relay Module

Fig 4.2 shows the relay which is an electrical switch that can be used to control devices and systems that use higher voltages. In the case of module relay, the mechanism is typically an electromagnet. The relay module input voltage is usually DC. However, the electrical load that a relay will control can be either AC or DC, but essentially within the limit levels that the relay is designed for. A relay module is available in an array of input voltage ratings: It can be a 3.2V or 5V relay module for low power switching, or it can be a 12 or 24V relay module for heavy-duty systems.



## 3. DHT11 Sensor



Fig 4.3 DH111 Sensor

Fig 4.3 shows the DHT11 which is an low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi and Nodemcu etc... to measure humidity and temperature instantaneously. DHT11 humidity and temperature sensor is available as a sensor and as a module.. DHT11 is a relative humidity sensor. To measure the surrounding air this sensor uses a thermistor and a capacitive humidity sensor.

4. ACS712 Sensor



Fig 4.4 ACS712 Sensor

Fig 4.4 The 20A Range Current Sensor Module ACS712 consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field in which the Hall IC converts into a proportional voltage.

Sensing and controlling current flow is a fundamental requirement in a wide variety of applications including, over-current protection circuits, battery chargers, switching mode power supplies, digital watt meters, programmable current sources, etc.

# **CONTROL SYSTEM**



# VOICE ASSIATANCE



1. Convenience: The primary benefit of IoT-based monitoring and controlling of home appliances is convenience. With the use of smart home devices, homeowners can control their appliances from anywhere, at any time, using their smartphones or voice commands. This eliminates the need to manually operate appliances, making daily tasks more manageable and efficient.

2. Energy efficiency: IoT-based home automation allows for the optimization of energy usage. Smart thermostats, for example, can adjust the temperature based on the homeowner's preferences and schedule, leading to energy savings. Similarly, smart lighting systems can automatically turn off lights when a room is unoccupied, reducing energy wastage.

3. Increased security: IoT-based home monitoring systems can provide enhanced security for homeowners. Smart cameras, door locks, and motion sensors can be connected to a central hub, allowing



homeowners to monitor their homes remotely and receive alerts in case of any suspicious activity.

4. Cost savings: Home automation can lead to cost savings in the long run. With energy-efficient appliances and systems, homeowners can reduce their utility bills. Moreover, IoT-based monitoring and controlling of home appliances can also help in early detection of any appliance malfunctions, preventing costly repairs or replacements.

## RESULTS

The experimental model was constructed in accordance with the circuit schematic, and the results were as predicted. The household appliances might be controlled remotely via a Wi-Fi network. The control approaches for switch mode were successful. The Blynk app also worked well in terms of presenting the status of each programme. The experimental model was made according to the circuit diagram and the results were as expected. The home appliances could be remotely switched over Wi-Fi network. Both the switch mode and the voice mode control methodologies were successfully achieved. The Blynk application was also successful in displaying the status of every application.



The impact of IoT-based monitoring and controlling of home appliances on our daily lives is significant and continues to grow. It has transformed how we interact with our homes, making our lives easier and more comfortable. With the ability to control appliances remotely, homeowners can save time and focus on other tasks. Moreover, the optimization of energy usage can lead to cost savings, providing financial benefits to homeowners. IoT-based home automation has also made our homes more secure. With the ability to monitor and control security systems remotely, homeowners can have peace of mind, knowing that their homes are protected at all times. This is especially beneficial for working individuals and families with children, who can keep an eye on their homes even when they are away.

## CONCLUSION

In conclusion, IoT-based monitoring and controlling of home appliances has transformed the way we interact with our homes. It has provided us with convenience, energy efficiency, increased security, and cost savings. However, there are also concerns that need to be addressed to ensure the safe and secure use of these devices. As technology continues to advance, we can expect to see further developments in IoT-based home automation, making our lives even more comfortable and efficient.

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