iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** V **Month of publication:** May 2023

DOI: https://doi.org/10.22214/ijraset.2023.53357

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue V May 2023- Available at www.ijraset.com

IOT Based Home Automation System over Cloud

Prof. N.A. Dawande[1], Ravikant Morye[2], Dinesh Sarode[3], Nisar Siddiqui[4]
[1, 2, 3, 4]*Department of E&TC Engineering, D Y Patil College of Engineering, Ambi, Pune, India*

Abstract: ***The proposed home automation system capitalizes on the NodeMCU board's versatility and the Arduino IoT Cloud platform's capabilities to establish a robust and efficient solution. This powerful combination enables seamless connectivity, real-time data exchange, and remote control of home devices via the internet and Alexa Voice Assistance integration. Users can effortlessly monitor and manage their homes from anywhere using web or mobile interfaces, offering unparalleled flexibility.***
The IoT home automation system encompasses essential features such as device control, energy management, security, and environmental monitoring.
Leveraging the Arduino IoT Cloud platform, users gain easy access to configure and personalize their automation settings. They can establish custom rules and receive notifications based on predefined events or specific conditions, enhancing their overall automation experience.
Keywords: Internet of Things, NodeMCU ESP8266, Arduino IOT Cloud Platform, 4 Channel Relay Module, Amazon Alexa Voice Assistance Interface

I. INTRODUCTION

In this research paper, we delve into the concept of IoT-based home automation over the cloud, exploring its potential benefits and associated challenges. Our study begins by introducing the essential elements of an IoT home automation system, including sensors, devices, cloud platforms, and communication protocols. We then delve into the advantages that cloud-based solutions bring to IoT home automation, such as improved scalability, flexibility, and enhanced security measures. Furthermore, we thoroughly analyse the challenges that arise during the development and deployment of such systems. These challenges encompass aspects like data privacy, interoperability, and reliability. The advent of the Internet of Things (IoT) has revolutionized our interactions with the environment, particularly within our homes.

The integration of smart devices and appliances has given rise to home automation systems that grant us control and monitoring capabilities for various aspects of our living spaces, even from a remote location. While traditional home automation systems were limited by their reliance on on-premise infrastructure, the cloud has opened up new avenues for IoT-based home automation. Through cloud-based solutions, homeowners can conveniently monitor and control their homes using mobile devices or computers, offering enhanced convenience and flexibility.

II. LITERATURE SURVEY

The following statements emerge from an examination of various authors' works and are disclosed within this realm of literary analysis.

1) Arpit Yekhande, Prof. Kapil Misal in 2017 provided security factor and authenticated control for devices in home which can be done by portable devices like mobile phones. The Raspberry Pi is used as microcontroller to connect it with the peripherals.
2) Abhijit Shejal, Amit Pethkar, Akash Zende, Pratyusha Awate, Prof. Sudhir. G. Mane in 2019 proposed a model device were controlled with user needs and demands. This method is flexible and user friendly. In this smart switching concept is used to control the home appliances through mobile app.
3) Sudha Kousalya, G Reddi, Priya Vasanthi, B Venkatesh in 2018 developed an architecture for smart home and monitor systems by Arduino and gives basic idea to control appliances and provide security.
4) K Eswari, DeviK Shravani, M Kalyani, Mr. Abbas Hussain, Mrs. N Gayathri in 2020 configured a light sensor to detect the presence of human and turning on LED’s. The lights and fans are the main appliances which are controlled through Wi-fi technology.
5) Bouzid Amine, Chaib Zohra, Hamani Ilyes , Aid Lahcen, Allaoui Tayeb in 2018 given a smart technology which give different level of standard. The fully automatic system are essential part of comfort living. They used Arduino UNO R3 with the programmable ATmega328 microcontroller.

III. METHODOLOGY

The IoT-based home automation system over the Arduino IoT Cloud works by integrating various components, including NodeMCU board, relay modules, optocouplers, and the Arduino IoT Cloud platform, and Amazon Alexa Voice Assistance to enable remote control and monitoring of home devices and appliances by voice commands. Here's an overview of how the system operates:

1) Hardware Setup: The system involves connecting NodeMCU board to the devices and appliances you want to control or monitor within your home with 4 channel relay module. This includes lights, fans, motors, soil sensors. The board act as the interface between these devices and the IoT system.
2) Arduino IoT Cloud Platform: The Arduino IoT Cloud platform provides the necessary infrastructure for managing and controlling the connected devices. It allows to securely connect NodeMCU to the cloud, enabling remote access and communication.
3) Device Registration: To integrate a device with the Arduino IoT Cloud, it need to register it on the platform. This involves specifying the device type, capabilities, and desired functionality. The Arduino IoT Cloud provides a user-friendly interface for managing and configuring devices.
4) Data Acquisition: Sensors connected to the NodeMCU board collect data from the surrounding environment. For example, a soil moisture sensor may measure the soil moisture. The NodeMCU board process this data and send it to the Arduino IoT Cloud for storage and analysis.
5) Device Control: The Arduino IoT Cloud platform allows to define rules and logic for controlling home devices. Using the IOT Remote App or Amazon Alexa mobile interface, which can create custom automation routines based on triggers, conditions, and actions. For instance, it can set a rule to turn on the lights when motion is detected in a specific area.
6) Remote Monitoring: Through the Arduino IoT Cloud, it is possible to remotely monitor the status and data of connected devices. This includes viewing real-time sensor readings, device states, and any notifications or alerts generated by the system. The cloud platform provides a convenient and centralized dashboard for accessing and managing this information.
7) Cloud-to-Device Communication: The Arduino IoT Cloud acts as a bridge between the cloud and the connected devices. It facilitates bidirectional communication, allowing user to send commands from the cloud to the devices for control purposes. For example, user can remotely turn off a device or adjust its settings.

A. Overall Detail of Main Parts

1) NodeMCU ESP8266

It is an open-source development board that combines the functionality of an ESP8266 Wi-Fi module with a microcontroller unit (MCU). It provides an easy-to-use platform for building Internet of Things (IoT) projects and applications. The ESP8266 module on the NodeMCU board is a low-cost, Wi-Fi-enabled system-on-a-chip (SoC) that integrates a microcontroller, Wi-Fi connectivity, and ample memory for storing program code and data.

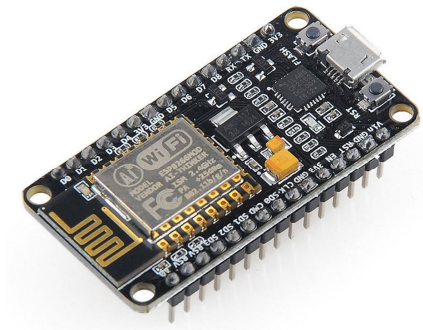


Fig. 1 NodeMCU ESP8266

2) 12V 4 Channel Relay Module

It is an electronic device that allows control of multiple electrical circuits using low voltage signals. It consists of four relays that are capable of switching on and off separate electrical loads, such as lights, motors, or other devices, using a 12V input signal.

The 4 Channel Relay Module provides isolation between the input control signal and the high voltage load, ensuring the safety of the controlling device.

Fig. 2 4-Channel Relay Module

3) 817C Optocoupler DIP

It is an electronic component that provides electrical isolation between input and output circuits using an optical coupling method. It consists of a phototransistor enclosed in a DIP package.

Fig. 3 817C Optocoupler DIP

4) AC/DC 12V Adapter

It also known as a power supply or transformer, is an electrical device used to convert alternating current (AC) from a wall outlet into direct current (DC) at a voltage of 12 volts. It is commonly used to power a wide range of electronic devices and appliances that require a 12V DC power source.

Fig. 4 12V Adapter

5) CPU Cooling Fan

It is a component designed to dissipate heat generated by a computer's central processing unit (CPU). The cooling fan operates based on the principles of convection and airflow. By continuously circulating air over the heatsink, it helps maintain the temperature within safe limits, ensuring optimal performance and longevity

6) Soil Moisture Sensor

It is an electronic device used to measure the moisture content or level of water in the soil. It provides valuable information about the soil's water content, which is essential for efficient irrigation and plant health management in agriculture, gardening, and landscaping applications.

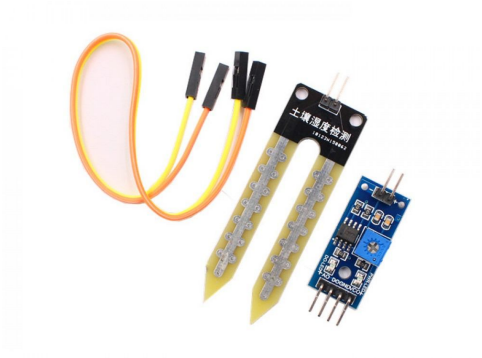


Fig. 5 Soil Moisture Sensor

IV. SOFTWARE INTERFACE

To connect and upload code from a NodeMCU to the Arduino IoT Cloud platform, first start by creating an Arduino IoT Cloud account and setting up the platform by adding a new device, specifying the name and board type as NodeMCU. Configure the Arduino IDE by adding the ESP8266 platform URL and selecting the NodeMCU board. Open the Arduino IoT Cloud sketch example, configure the WiFi credentials and Thing ID in the sketch. Connect the NodeMCU to the computer via USB and upload the sketch. Monitor the serial output using the Arduino IDE's Serial Monitor to check for any issues. By verify the connection on the Arduino IoT Cloud platform, where user should see the NodeMCU device listed as "Connected." Once connected, we can control and monitor the NodeMCU-based IoT device through the Arduino IoT Cloud platform, defining properties, creating dashboards, and implementing automation rules for interaction with the connected NodeMCU.

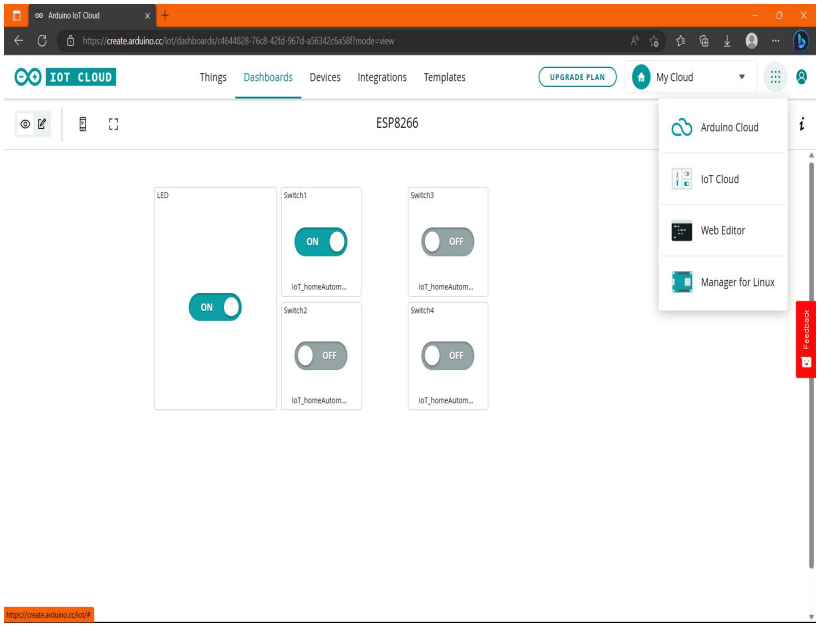


Fig. 6 Arduino IOT Cloud Dashboard for connected devices

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue V May 2023- Available at www.ijraset.com

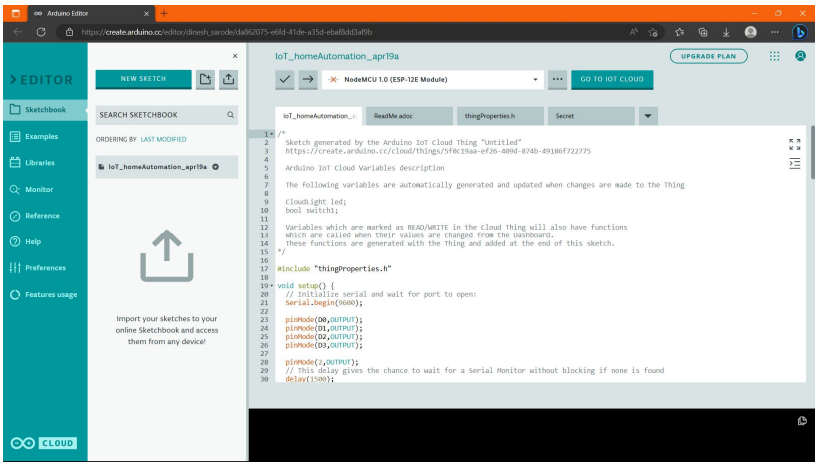


Fig. 7 Uploading program into NodeMCU via Arduino IOT Cloud Platform

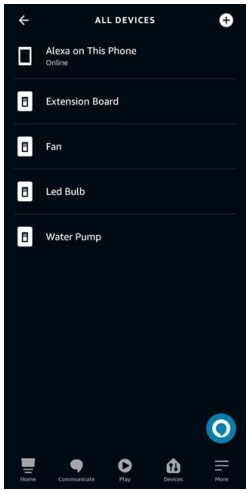


Fig. 8 Amazon Alexa App dashboard

V. RESULTS

The IoT-based Home Automation system proved its efficacy in wirelessly controlling and monitoring home appliances, while enabling real-time data storage and control. The seamless connection between devices and sensors was facilitated by integrating NodeMCU and the 4-Channel relay module, ensuring reliable data acquisition and transmission.

By leveraging the Arduino IoT Cloud Platform, users could switch appliances on and off and monitor sensor data from any internet-capable device. The water pump control relied on the soil moisture sensor connected to NodeMCU, which measured soil humidity. Other appliances were connected to the relay module, allowing users to control them through the Arduino IoT Dashboard. Real-time data was easily accessible through the IoT Cloud Dashboard and the Alexa App on smartphones, tablets, and laptops, granting users convenient control and communication with their home appliances.

Overall, this project demonstrated the effectiveness and practicality of an IoT-based home automation system over the cloud, enabling seamless connectivity, device control, and monitoring within a smart home environment. It empowers users to automate routines, improve energy efficiency, and manage their homes remotely, providing enhanced convenience and comfort.

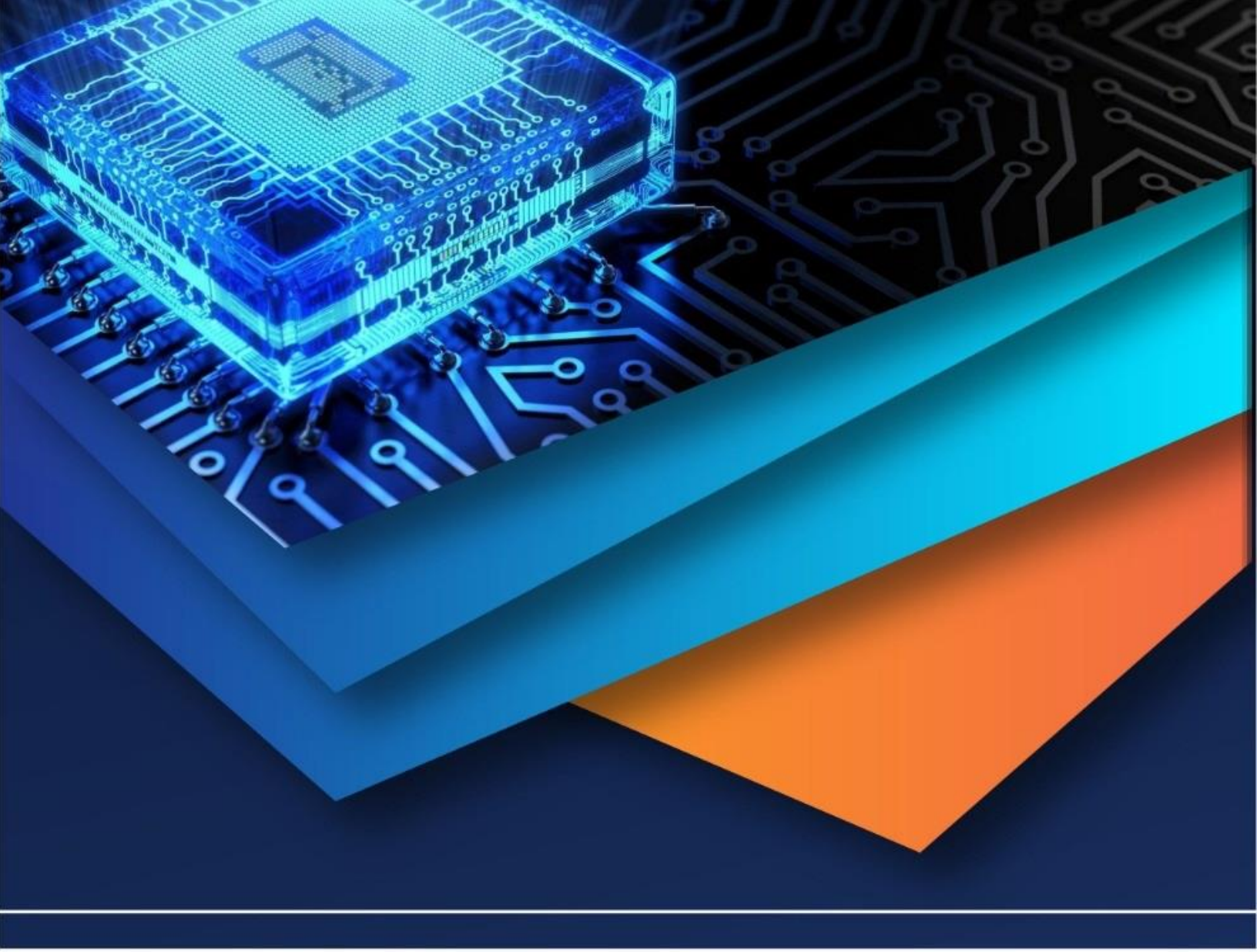
VI. CONCLUSIONS

Based on an extensive research on NodeMCU and Relays, the selection of the 12V 4 Channel Relay Module was driven by its ability to effectively control desired outcomes and its compatibility with modern IoT systems. This module was utilized to centralize device management and simplify complex structures. The implementation of the Home Automation algorithm in C language exhibited minimal errors, resulting in a seamless operation. Leveraging IoT for Home Automation offers significant advantages, including substantial electricity savings and increased cost efficiency.

In today's fully automated environment, automation systems and wireless devices have become integral to our daily lives. The objective of this project was to wirelessly manipulate and control various appliances and devices. The ultimate goal was to develop a system that could wirelessly control home appliances through programming in the Arduino IoT Cloud Platform and integration with the Alexa voice assistant mobile app. While this project only covers a fraction of real-world scenarios, its outcomes hold immense potential for smart home systems and a wide range of IoT and voice assistant-based applications in global organizations.

REFERENCES

[1] Yekhande, A., Misal, K. "Home Automation System Using Raspberry Pi." International Research Journal of Engineering and Technology (IRJET), vol. 10, Oct 2017.
[2] Shejal, A., Pethkar, A., Zende, A., Awate, P., Mane, S. G. "Designing of Smart Switch for Home Automation." International Research Journal of Engineering and Technology (IRJET), vol. 05, May 2019.
[3] Kousalya, S., Reddi, G., Vasanthi, P., Venkatesh, B. "IoT Based Smart Security and Smart Home Automation." International Journal of Engineering Research & Technology, vol. 04, April 2018.
[4] Eswari, K., Shravani, D. K., Kalyani, M., Hussain, A., Gayathri, N. "Real-Time Implementation of Light and Fan Automation using Arduino." International Journal for Research in Applied Science & Engineering Technology (IJRASET), June 2020.
[5] Mohamed Amine, B., Zohra, C. F., Ilyes, H., Lahcen, A., Tayeb, A. "Smart Home Automation System." International Journal of Robotics and Automation (IJRA), Dec. 2018.
[6] http://www.ieee.org/
[7] https://en.wikipedia.org/wiki/NodeMCU
[8] https://projecthub.arduino.cc/trending



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY