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Home Automation Using Esp32 through Google Home and Amazon Alexa

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ABSTRACT: This paper presents an idea or a concept for home automation using ESP32 with ESP Rainmaker, IR remote and manual switch to control 7 7 relays with and without internet and monitor the real time feedback in the ESP rainmaker app. Automation of device has a wide scope for this generation as well as in forthcoming generation. In this mobile communication technology is playing a major role in the world of automation. With advancement of Automation technology, life is getting simpler and easier in all aspects. In today's world Automatic systems are being preferred over manual system. With the rapid increase in the number of users of internet over the past decade has made Internet a part and parcel of life, and IoT is the latest and emerging internet technology. Internet of things is a growing network of everyday object-from industrial machine to consumer goods that can share information and complete tasks while you are busy with other activities. Wireless Home Automation system using IoT is a system that uses computers or mobile devices to control basic home functions and features automatically through internet from anywhere around the world, an automated home is sometimes called a smart home. It is meant to save the electric power and human energy. The home automation system differs from other system by allowing the user to operate the system from anywhere around the world through internet connection.

In this paper we present a Home Automation system (HAS) using ESPRainmaker wireless communication, to provide the user with voice as well as remote control of various lights, fans, and appliances within their home and storing the data in the cloud. The system will automatically change on the basis of sensors' data. This system is designed to be low cost and expandable allowing a variety of devices to be controlled.

KEYWORDS::- Home automation System (HAS), Internet of Things (IoT), Cloud networking, Wi-Fi network..

I. INTRODUCTION

A. Overview:

Homes of the 21st century will become more and more self-controlled and automated due to the comfort it provides, especially when employed in a private home. A home automation system is a means that allow users to control electric appliances of varying kind. Many existing, well-established home automation systems are based on wired communication. 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. With the advancement of wireless

B. Proposed system functions:

This is IoT project, It's to make a simple ESP32 IoT smart home automation using ESP Rainmaker & IR remote to control 7 relays with and without the internet. With this ESP32 project, It can control 5 home appliances from the smartphone, IR remote, and manual switches. If there is no internet available still it can control the relay module from the IR remote and manual switches.

In this project required following component for this ESP32 home automation system and smart relay module PCB. Includes,

- ESP32 DEV KIT V1.
- 7-channel 5v SPDT relay module.

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- IR receive (with metallic casing).
- Switches or Push Buttons.
- Any IR remote.

C. Advantage of Home automation system

In recent years, wireless systems like Wi-Fi have become more and more common in home networking. Also in home and building automation systems, the use of wireless technologies gives several advantages that could not be achieved using a wired network only.

1. **Reduced installation costs**: First and foremost, installation costs are significantly reduced since no cabling is necessary. Wired solutions require cabling, where material as well as the professional laying of cables (e.g. into walls) is expensive.
2. **System scalability and easy extension**: Deploying a wireless network is especially advantageous when, due to new or changed requirements, extension of the network is necessary. In contrast to wired installations, in which cabling extension is tedious. This makes wireless installations a seminal investment.
3. **Aesthetical benefits**: Apart from covering a larger area, this attribute helps to full aesthetical requirements as well. Examples include representative buildings with all-glass architecture and historical buildings where design or conservatory reasons do not allow laying of cables.
4. **Integration of mobile devices:** With wireless networks, associating mobile devices such as PDAs and Smartphones with the automation system becomes possible everywhere and at any time, as a device's exact physical location is no longer crucial for a connection (as long as the device is in reach of the network).

For all these reasons, wireless technology is not only an attractive choice in renovation and refurbishment, but also for new installations.

II. SYSTEM ANALYSIS

A. Problem Definition:

Home automation systems face four main challenges, these are high cost of ownership, inflexibility, poor manageability, and difficulty in achieving security. The main objectives of this research is to design and implement a home automation system using IoT that is capable of controlling and automating most of the house appliances.The problem definition in a home automation system could be related to the challenges or issues that the system is trying to address or solve. Some of the potential problem definitions that a home automation system may be designed to address could include:

- **Energy Efficiency:** With rising energy costs and increasing concerns about environmental sustainability, home automation systems can be designed to optimize energy usage and reduce wastage. This could involve automating lighting, heating and cooling systems, and other appliances to minimize energy consumption.
- **Security:** Home automation systems can be designed to enhance home security by integrating with security cameras, motion detectors, and other sensors to monitor and control access to the home.
- **Convenience:** Home automation systems can be designed to improve the overall convenience and comfort of living in a home. This could involve automating tasks such as adjusting the temperature, turning on lights, or controlling home entertainment systems, all through a single user interface.
- **Cost Savings:** Home automation systems can be designed to help save costs in the long run by reducing energy bills, maintenance costs, and other expenses associated with operating a home.
- **Tedious:** sometimes the flow o

The problem definition will depend on the specific needs and requirements of the home and its occupants, and the home automation system will be designed to address these needs in the most effective way possible.

B. IMPLEMENTATION :

In this ESP32 project, we have explained how to make a practical ESP32 IoT project using ESP Rainmaker with ESP32, sensors. to control relays and fan speed from Alexa, Google Home. So with this IoT project, you can control appliances, and fan speed without internet from IR remote and manual switches. The ESP32 will automatically connect with the ESP Rainmaker IoT cloud if the Wi-Fi is available. Then you can control the lights and fan speed from anywhere in the world through the internet and monitor the real-time feedback in Amazon Alexa, Google Home, and ESP Rainmaker App. we have used all the FREE tools for this ESP32 home automation project using ESP Rainmaker.

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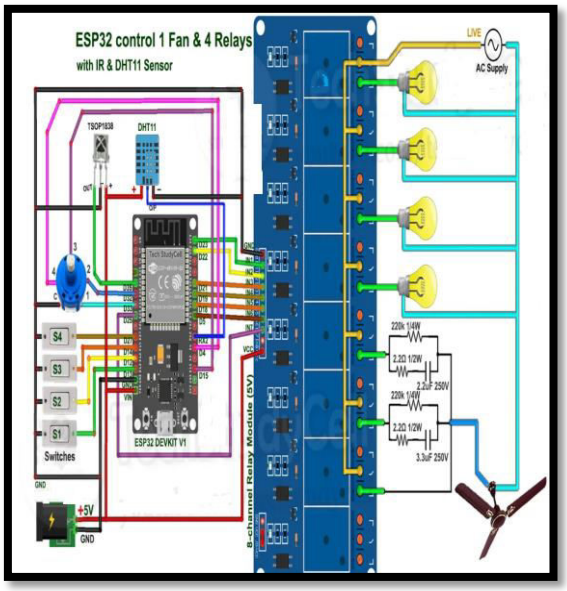
❖ **Program ESP32 with Arduino IDE** :

- Update the Preferences –> Additional boards Manager
- URLs: **1**.https://dl.espressif.com/dl/package_esp32_index.json.
- **2**.http://arduino.esp8266.com/stable/package_esp8266com_index.json • Then install the ESP32 board.

C. Circuit of the IOT Projects using ESP32:



- The circuit is very simple, we have used **D23, D22, D21 & D19** GPIO to control the 4-channel relay module. GPIO **D13, D12, D14 & D27** are connected with switches, and GPIO **D33, D32, D15 & D4** are connected with a 4-step selector switch to control the relay module manually also with switches.
- we have used the **INPUT_PULLUP** function in Arduino IDE instead of using the pull-up resistors with each push button.
- As per our source code, when the control pins of the relay module receive a **LOW** signal the relay will **turn on** and the relay will **turn off** for the **HIGH** signal in the control pin.
- **IR remote receiver** (TSOP1838) connected with **D35**. And the **DHT11 sensor** is also connected to **RX2 (GPIO16)**.

III. DISCUSSION

A. Interpretation of results:

Based on the project description, it can be inferred that the implementation of the ESP32 IoT project using ESP Rainmaker was successful. The project is able to control relays and fan speed using different methods such as Alexa, Google Home, IR remote, and manual switches. It also allows for control of appliances and fan speed without internet connectivity using IR remote and manual switches. This indicates that the project is versatile and offers multiple options for controlling devices and appliances.

B. Comparison with previous research:

The project is unique in its use of ESP Rainmaker, which is a cloud-based IoT platform designed for ESP32 devices. This platform provides an easy and secure way to connect ESP32 devices to the cloud, making it a convenient solution for IoT projects. Previous research may have focused on different IoT platforms or may not have used IoT platforms at all. Therefore, this project offers a new perspective on implementing IoT projects using ESP Rainmaker.

The use of ESP Rainmaker and multiple control options adds to the convenience and flexibility of the project. Further research could explore the potential applications of this project in different settings and with different devices.

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C. Limitations of the study:

The project focused on controlling relays and fan speed, and did not explore other potential applications of the ESP32 and ESP Rainmaker. Future studies could investigate the use of these devices for other IoT projects and applications.
The project used a limited number of sensors and devices, and did not test compatibility with a wide range of devices. Future research could investigate the compatibility of the ESP32 and ESP Rainmaker with other sensors and devices.

D. Suggestions for future research:

Further research could investigate the security and privacy implications of using cloud-based IoT platforms like ESP RainMaker. This could include an analysis of potential vulnerabilities and solutions to address them.
Future studies could also explore the potential for using the ESP32 and ESP RainMaker in smart home applications, such as lighting and HVAC control, security systems, and energy management.
Investigating the feasibility of using the ESP32 and ESP RainMaker in industrial IoT applications, such as monitoring and controlling machinery, could also be an area for future research.
The project used existing sensors and devices, but future research could focus on designing new sensors and devices specifically for use with the ESP32 and ESP RainMaker, to improve performance and compatibility.

IV. CONCLUSIONS AND FUTURE WORK

A. CONCLUSION:

The IoT-based home automation system has been successfully implemented and tested, showing that it is possible to control simple appliances remotely through the internet. The system monitors sensor data such as temperature, gas, light, and motion sensors, and can actuate a process accordingly, such as switching on the lights when it gets dark.
The home automation system also has the capability to store the last state of the appliances. This means that in case of a power outage or network failure, the appliances will retain their previous state when power and network are restored. This feature ensures that the system operates smoothly and without any disruptions.
Another significant advantage of this IoT-based home automation system is that multiple users can operate it through the ESP RainMaker app. This means that the entire family or multiple users can control the appliances remotely through their smartphones or tablets, making it highly convenient and user-friendly. This feature allows for seamless coordination and control of the home automation system and enhances its usability.

B. FUTURE WORK:

Using this system as a framework, it can be expanded to include various other features such as home security, capturing photos of people moving around the house and storing them on the cloud to reduce data storage compared to using CCTV cameras that record all the time. The system can also be expanded for energy monitoring, weather stations, or environmental monitoring. Additionally, this type of system with appropriate modifications can be implemented in hospitals for disabled people or in industries where human invasion is impossible or dangerous. Future research could explore these potential applications and further improve the system's functionality and performance.
Certainly, here are some potential future works for this IoT-based home automation system:

- **Integration with smart home devices**: The system can be expanded to integrate with other smart home devices, such as smart thermostats, smart locks, and smart speakers, to create a fully integrated smart home system.
- **Machine learning algorithms**: Machine learning algorithms can be implemented to learn user behaviour and preferences, allowing the system to automatically adjust and optimize the home environment for the user's comfort and energy efficiency.
- **Enhanced security features**: The system can be improved by adding enhanced security features such as facial recognition, voice recognition, or biometric authentication to ensure that only authorized users can control the home automation system.
- **Energy management:** The system can be expanded to include energy management features, such as tracking energy consumption and automatically turning off appliances when they are not in use, to improve energy efficiency and reduce energy costs.

V. CONCLUSION

We would like to express our sincere gratitude and appreciation to the experts who have contributed to the development of various home automation systems. We would also like to extend our heartfelt thanks to our project guide HOD Mr. P.D. Kate and co-guide Prof. R.C. Dhandekar for their constant support, guidance, valuable suggestions, and

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modifications to enhance the quality of our project work. Their insights and encouragement have been instrumental in the success of our project. We would also like to thank the faculty members of our department for their valuable feedback and support throughout the project.

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