IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

DESIGN AND IMPLEMENTATION OF A GOOGLE ASSISTANT HOME AUTOMATION SYSTEM INTEGRATED WITH WIKIPEDIA

[1] Mr. M. Ramakrishna [2] N.Sai Srinivas [3] B.VenkataRevanth [4] L. SivaSai.

[1]Associate Prof., ECE Department, ALIET, JNTUK, Vijayawada, Andhra Pradesh, India.

[2] Student, ECE Department, ALIET, JNTUK, Vijayawada, Andhra Pradesh, India.

[3] Student, ECE Department, ALIET, JNTUK, Vijayawada, Andhra Pradesh, India.

[4] Student, ECE Department, ALIET, JNTUK, Vijayawada, Andhra Pradesh, India.

ABSTRACT:

In recent years, the surge in technological advancements has propelled home automation systems into the spotlight, offering homeowners unparalleled convenience, efficiency, and potential energy savings. Among the myriad of innovations, the integration of virtual assistants such as Google Assistant has emerged as a cornerstone, transforming residences into intelligent, interconnected environments. This project stands at the forefront of this revolution, presenting a comprehensive Google Assistant-based home automation system enriched with the vast knowledge repository of Wikipedia.

At its core, this endeavor entails the meticulous design and implementation of a sophisticated infrastructure that seamlessly blends the capabilities of Google Assistant with a myriad of smart devices. The objective? To empower users with unparalleled control over their surroundings while simultaneously enhancing their living experience with instant access to a wealth of information.

The first crucial component of this system involves the development of custom software modules meticulously crafted to interface seamlessly with Google Assistant's robust API. These modules serve as the backbone of the entire ecosystem, facilitating smooth communication between the user and the various smart devices integrated into their home environment. Through intuitive voice commands, users can effortlessly orchestrate an array of actions, from adjusting lighting and temperature settings to controlling multimedia devices and security systems.

Furthermore, the integration extends beyond mere device control, leveraging Google Assistant's expansive capabilities to access information from Wikipedia in real-time. By harnessing the power of Wikipedia's API, users can pose queries ranging from historical facts to scientific concepts, enriching their interactions with the system and fostering a deeper understanding of the world around them. In terms of technical implementation, the system leverages a combination of standard communication protocols such as Wi-Fi, Zigbee, or Bluetooth to establish seamless connectivity between the central control hub and the myriad of smart devices distributed throughout the home.

Keywords: Home automation system, Wi-Fi-based, Google Assistant, Wikipedia integration, Voice control, IOT module

CHAPTER1

INTRODUCTION

Traditional home automation systems, relying on diverse technologies like Bluetooth, ZigBee, and RF, present challenges including electrical hazards and energy inefficiencies. This paper proposes a novel Wi-Fi-based home automation system, integrating Google Assistant and Wikipedia to address these concerns. Offering three command conveyance modes—voice control, manual switch, and an ON/OFF Phone icon—the system enhances appliance control efficiency while considering operational timeframes. Implementation involves hardware components and system controller programming. Demonstrating effectiveness in remote appliance control, the integration with Google Assistant and Wikipedia amplifies functionality, enabling users to access information and perform diverse tasks beyond basic automation functions. Leveraging Wikipedia's vast knowledge base enriches user interactions, providing

access to facts and explanations related to appliances. Additionally, context-aware suggestions and recommendations enhance user experiences, marking a significant advancement in smart home environments.

1.1 Objectives of the project

The main objectives of the proposed Wi-Fi-based home automation system integrated with Google Assistant and Wikipedia are as follows:

- Enhance Convenience and Efficiency: The primary goal is to streamline the control of electrical appliances within the home environment, enabling users to remotely manage their devices with ease
- Improve Energy Management: Addressing concerns related to energy wastage and electrical hazards, the system seeks to optimize energy usage by enabling users to remotely power appliances on or off as needed.
- Expand Functionality through Integration: By integrating with Google Assistant and Wikipedia, the system aims to extend its functionality beyond basic home automation tasks. Leveraging Google Assistant's natural language processing capabilities, users can access a wide range of information and perform tasks beyond simple device control.
- Enhance User Experience: The overarching objective is to enhance the overall user experience in smart home environments. Through seamless integration with Google Assistant and Wikipedia, the system strives to offer intuitive and context-aware interactions, enabling users to access information, receive suggestions, and make informed decisions effortlessly.

1.2 Scope of the project

- Proposal for a Wi-Fi-based home automation system integrated with Google Assistant and Wikipedia.
- Utilization of three modes of command conveyance: voice control, manual switch, and ON/OFF Phone icon.
- Consideration of time efficiency in switching connected loads on/off.
- Hardware components include power supply, microcontroller, relays, switches, and loads.
- Implementation involves programming of the system controller for effective operation.
- Demonstration of effectiveness in remotely controlling electrical appliances and enhancing user experience through integration with Google Assistant and Wikipedia.

CHAPTER 2

LITERATURE SURVEY

The survey comprises a collection of research papers and developer documentation focusing on the integration of Google Assistant and IoT technologies for smart home automation systems. The first paper, "Voice Controlled Home Automation System using Arduino and Google Assistant" by Manu B.N. et al., presents a practical implementation utilizing Arduino and Google Assistant for voice-controlled automation. "Smart Home Automation: A Literature Review" by Ahmed M. Khedr et al. provides an overview of existing research in the field, highlighting trends and challenges. "Home Automation System Using IoT and Google Assistant" by S. Siva Sankari et al. and "Integration of Google Home Assistant for Smart Home Automation" by Debashish Dutta et al. delve into specific implementations leveraging IoT and Google Assistant for enhanced automation. Similarly, "Smart Home Automation System Using IoT and Google Assistant" by R. Bharathi et al. explores the integration of IoT devices with Google Assistant for home automation. The inclusion of developer documentation from Google Developers and Google Nest provides valuable resources for developers seeking to integrate Google Assistant and Nest devices into their automation projects.

CHAPTER 3

PROBLEM STATEMENT

The traditional landscape of home automation systems, reliant on diverse technologies such as Bluetooth, ZigBee, and RF, poses significant challenges including potential electrical hazards and unnecessary energy consumption. In response, this paper advocates for a transformative shift towards a Wi-Fi-based home automation paradigm integrated with Google Assistant and Wikipedia. The proposed system aims to mitigate these challenges while enhancing functionality and user experience. The problem statement encompasses the need for a safer, more energy-efficient home automation solution that seamlessly integrates with widely accessible platforms like Google Assistant and leverages the vast knowledge repository of Wikipedia. Key challenges include minimizing electrical risks and energy wastage, optimizing user control through multiple command conveyance modes, and addressing the time efficiency of load switching operations. The proposed solution involves the development of hardware components and system programming to enable remote appliance control. Furthermore, the integration with Google Assistant and Wikipedia promises expanded capabilities, empowering users with access to comprehensive information and contextual recommendations. Overall, the paper seeks to address the shortcomings of traditional home automation systems while unlocking new potentials for enhanced safety, efficiency, and user engagement in smart home environments.

CHAPTER 4

EXISTING SYSTEM

The existing system proposes a Wi-Fi-based home automation system to overcome limitations of traditional technologies like Bluetooth and ZigBee. The system integrates three modes of command conveyance—voice control, manual switch, and an ON/OFF Phone icon interface—ensuring flexible and intuitive appliance management. Implementation involves hardware integration and system programming for optimal performance. Despite a slight delay observed in switching, system testing confirms its effectiveness in remote appliance control. Integration with Google Assistant and Wikipedia enhances functionality, enabling users to access extensive

information and perform advanced tasks. Ove system offers a transformative solution for efficient and convenient home automation.

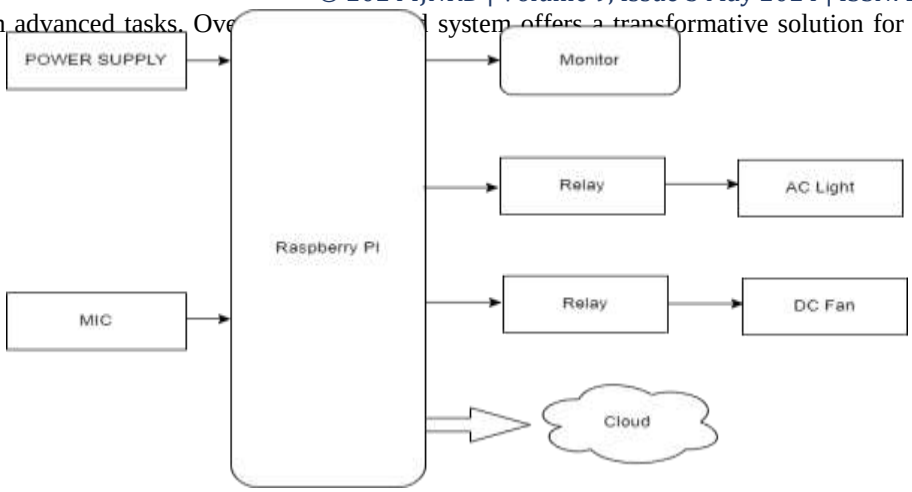
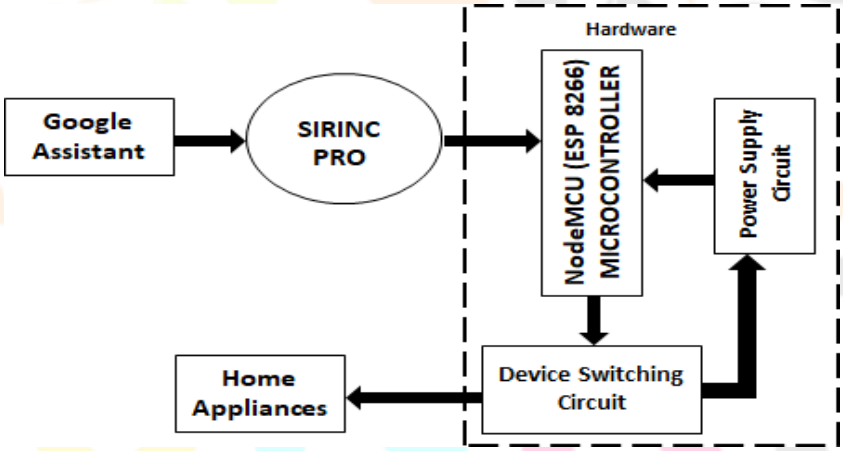


Figure 1: Block diagram of existing system

CHAPTER 5

PROPOSED MODEL

In the dynamic landscape of modern living, home automation stands as a transformative force, reshaping our interaction with living spaces. While conventional systems have offered convenience, they come with risks like electrical disasters and energy wastage. To address these challenges, this paper proposes an innovative Wi-Fi-based home automation system integrated with Google Assistant and Wikipedia. This system aims to revolutionize smart home functionality by leveraging Wi-Fi's reliability and ubiquitous connectivity, offering enhanced accessibility, safety, and user experience. Through diverse command conveyance modes and integration with Google Assistant and Wikipedia, this system promises to redefine the way we interact with our homes.



Hardware Components:

- Raspberry pi
- Raspberry pi MIC.
- Relay Modules
- AC Bulb
- DC Fan
- 32 GB Memory Card
- HDMI to VJA Cable
- Desktop

Software:

- Raspberry pi OS
- Python Programming
- Corresponding Libraries
- Cloud

5.1. Components Used

Following components has been used to construct this project

5.1.1 Raspberry pi

Raspberry Pi is a small, affordable, single-board computer developed by the Raspberry Pi Foundation in the UK. It's widely used for various projects and applications ranging from hobbyist projects to industrial applications. It has GPIO (General Purpose Input/Output) pins which allow it to interact with external hardware.

5.1.2 Raspberry pi mic

The Raspberry Pi MIC (Microp d for use with Raspberry Pi single-board computers. It features a small form : ideal for various applications such as voice recognition, audio recording, and speech synthesis. The Raspberry Pi MIC connects to the Raspberry Pi via USB or GPIO pins, providing plug-and-play functionality. With its affordable price point and compatibility with popular software platforms, the Raspberry Pi MIC offers a cost-effective solution for adding audio input capabilities to Raspberry Pi projects and applications.

Figure 4: Raspberry pi mic

5.1.3 Relay module

A relay is an electrical switch that can be used to control devices and systems that use higher voltages. The use of relay module devices offers a simple and convenient way to control electrical equipment systems remotely. It allows digital circuits and microcontrollers like Arduino to control motors or lighting circuits. Act as a switch that opens or closes electrical circuits when activated by a signal. They are often integrated with microcontrollers A relay is an electrical switch that can be used to control devices and systems that use higher voltages. The use of relay module devices offers a simple and convenient way to control electrical equipment systems remotely. It allows digital circuits and microcontrollers like Arduino to control motors or lighting circuits. Act as a switch that opens or closes electrical circuits when activated by a signal.

Figure 5: 3 channel relay module

5.1.4 AC bulb

A light stick with 8 lamps is a portable lighting device designed for various applications such as photography, videography, camping, and emergency lighting. It typically consists of a slender cylindrical body housing eight LED lamps arranged in a linear configuration. Each lamp is equipped with individual controls for adjusting brightness levels, allowing users to customize the lighting output according to their needs. The light stick may feature a rechargeable battery for convenient use without the need for external power sources, making it ideal for outdoor or on-the-go lighting scenarios.

Figure 6: Light stick with 8 lamps

5.1.5 DC fan

In simple terms, a DC fan is a cooling fan that converts electrical energy into electromagnetic energy through DC voltage and electromagnetic induction, and then electromagnetic energy into mechanical energy, and finally into kinetic energy, so that the fan blades rotate.

The DC fan is mainly composed of four parts: rotor, stator, motor, and outer frame. as follows:

1. DC motor composition: it is composed of permanent magnet rotor, multi-stage winding stator, position sensor, and electronic commutation drive control circuit.
2. Rotor composition: It is composed of motor shell, permanent magnetic strip, shaft core and fan blades.
3. Stator part: enameled wire, plastic-coated silicon steel sheet, bearing, Hall sensor detection, drive circuit board and shaft.

.1.6 32 GB memory card

32GB of RAM is the amount of memory we recommend for serious gamers, engineers, scientists, and entry-level multimedia users. This level of RAM allows for these memory-hungry programs to run smoothly, even as your computer ages. Therefore, It's not too much, it's just right. The more RAM you have, the more data your computer can access quickly, improving its overall performance. 32GB of RAM is considered high and is generally overkill for most users. For most everyday use and basic tasks such as web browsing, email, and basic office work, 8GB of RAM is more than enough.

Figure 8: 32 GB memory card

5.1.7 HDMI to VGA cable

An HDMI to VGA cable is a video conversion cable that allows you to connect devices with HDMI output to displays or projectors with VGA input. This cable typically converts digital HDMI signals to analog VGA signals, enabling compatibility between newer devices like laptops, gaming consoles, or media players with older VGA-equipped displays or projectors. The cable is often plug-and-play, requiring no additional drivers or power sources, making it convenient for use in classrooms, conference rooms, or home entertainment setups.

Figure 9: HDMI to VGA cable

5.1.8 Desktop

A desktop computer is a personal computing device designed for stationary use, typically consisting of a monitor, keyboard, mouse, and processing unit housed in a separate tower or all-in-one form factor. It offers robust performance, expandability, and customization options, making it ideal for a wide range of tasks such as office work, gaming, multimedia editing, and web browsing. Desktops often feature powerful processors, ample
RAM, large storage capacities, and dedicated graphics cards, providing users with a versatile and reliable computing experience. They are commonly used in homes, offices, schools, and businesses for productivity and entertainment purposes.

Figure 10: Desktop

5.1.9 Python programming

Python is a high-level programming language known for its simplicity, readability, and versatility. Developed in the late 1980s by Guido van Rossum, Python has gained widespread popularity among developers, educators, and organizations for its ease of use and powerful capabilities. At its core, Python emphasizes readability and straightforward syntax, making it accessible to beginners and experienced programmers alike. Its clean and concise syntax allows developers to express concepts in fewer lines of code compared to other languages, promoting code readability and maintainability. Python supports multiple programming paradigms, including procedural, object-oriented, and functional programming, providing flexibility for developers to choose the most suitable approach for their projects. This versatility makes Python suitable for a wide range of applications, from web development and data analysis to artificial intelligence and scientific computing.

Figure 11: Python programming

5.1.10 Raspberry pi OS

The Raspberry Pi OS is a lightweight, customizable operating system designed specifically for the Raspberry Pi single-board computers. It is based on the Debian Linux distribution and optimized for the Pi's hardware architecture. Offering a user-friendly interface and access to a vast repository of software through its package manager, Raspberry Pi OS supports a wide range of applications from programming and web browsing to media playback and productivity tools. With its emphasis on versatility and accessibility, Raspberry Pi OS serves as the foundation for countless projects in education, hobbyist tinkering, and even professional applications in fields such as robotics and IoT

Figure 12: raspberry pi OS

5.1.11 Libraries used

Flask is a versatile web application framework that simplifies web development in Python. Its lightweight nature ensures quick setup, while its scalability makes it suitable for both simple websites and complex applications.

RPi.GPIO facilitates easy interaction with GPIO pins on Raspberry Pi, making it ideal for projects involving physical computing and hardware interfacing. Its simple interface allows users to control electronic components and peripherals effortlessly.

Google Text-to-Speech (gTTS) library seamlessly converts text into spoken audio using Google Translate's API, making it indispensable for applications requiring text-to-speech functionality, such as voice assistants or accessibility tools.

The **time** module in Python offers a comprehensive suite of time-related functions, enabling developers to manipulate timestamps, measure time intervals, and handle time zone conversions efficiently.

Request simplifies HTTP requests in Python, providing a user-friendly interface for interacting with web APIs, fetching web pages, and conducting web scraping tasks.

The **webbrowser** module facilitates seamless integration of web-based content into Python applications, allowing easy launching of web browsers and navigation to URLs or local HTML files.

The **wikipedia** library streamlines access to Wikipedia's vast repository of knowledge, making it effortless to retrieve article content, summaries, and other metadata for various purposes, from research to content integration.

SpeechRecognition enables speech-to-text conversion, empowering applications with voice-controlled interfaces, transcription services, and voice search functionalities. Its support for multiple speech recognition engines ensures flexibility and accuracy in speech processing tasks.

5.1.12 Cloud

The cloud serves as a central hub where data and commands are exchanged between the various components of the system. The project kit, equipped with Wi-Fi connectivity, can communicate with cloud servers to send and receive commands, status updates,

and other information. Similarly, the desktop or control device can also connect to the same cloud platform, enabling seamless communication and coordination between all system components

Figure 13: Cloud based services

CHAPTER 6
RESULTS AND DISCUSSION
6.1 PROJECT KIT

Figure 14: Project kit

6.2 DC fan monitoring

The below figure can visually demonstrate the action of a rotating fan in response to commands. When the command "turn on fan" is received, the fan starts rotating, and upon receiving the command "turn off fan," the rotation ceases. The visual representation enhances understanding of the fan's operation through command-based control.

Figure 15: DC fan ON

6.3 Light monitoring

The below figure able show the light is on when command has received to it start glowing by the command of "turn on bed light or hall light" and glowing stop by giving command" turn off bed light or hall light"

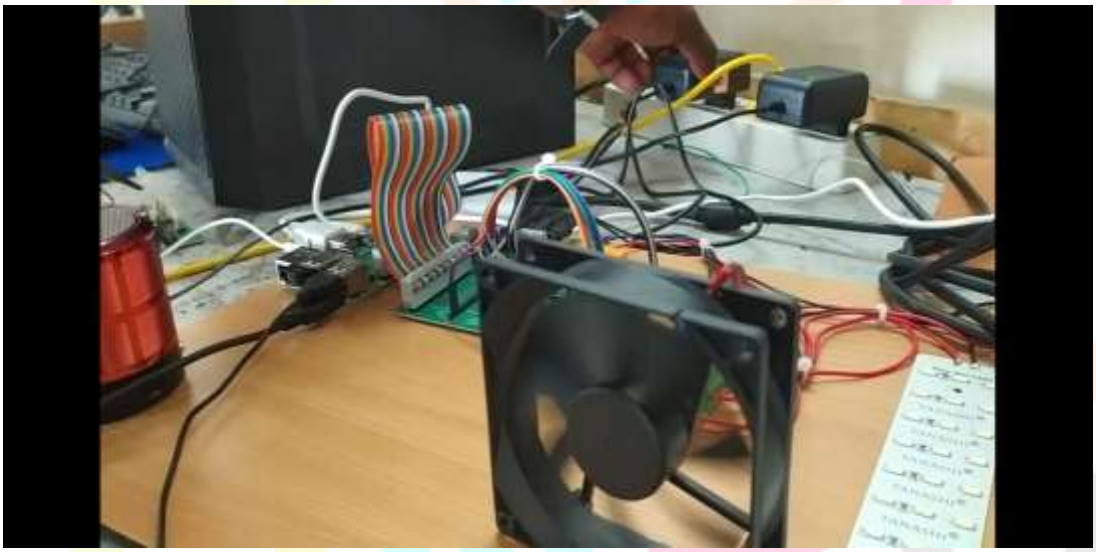


Figure 16: Light monitoring

6.4: Command display

The above able to show the program seen on Say something then command have to give to it.

Figure 17: Command display

CHAPTER 7

CONCLUSION AND FUTURE SCOPE

7.1 CONCLUSION

In conclusion, the integration of a Wi-Fi-based home automation system with Google Assistant and Wikipedia represents a significant advancement in smart home technology, offering comprehensive solutions to longstanding challenges in traditional automation systems. Firstly, by leveraging Wi-Fi connectivity, the proposed system overcomes the limitations of short-distance technologies like Bluetooth and ZigBee, enabling users to remotely control electrical appliances from anywhere with internet access. This extended range not only enhances convenience but also reduces the risk of electrical disasters and energy wastage associated with appliances left plugged in unnecessarily.

Secondly, the incorporation of Google Assistant introduces intuitive voice control functionality, allowing users to interact with their home appliances effortlessly. This hands-free approach to command conveyance enhances accessibility and user experience, catering to individuals with diverse needs and preferences. Furthermore, the integration with Wikipedia adds a layer of intelligence and context to the system, enabling users to access a wealth of knowledge and information related to their appliances and household tasks. This integration empowers users to make informed decisions, enhancing their understanding of appliance functionalities and promoting energy-efficient usage practices.

The comprehensive testing and evaluation of the system demonstrate its effectiveness in remotely controlling electrical appliances, affirming its reliability and practicality in real-world scenarios. Moreover, the seamless integration with Google Assistant and Wikipedia enhances the system's functionality, offering expanded capabilities beyond basic home automation functions.

7.2 FUTURE SCOPE

The integration of a Google Assistant home automation system with Wikipedia presents a promising avenue for further exploration and development in the realm of smart home technologies. As technology continues to advance, several future directions emerge for enhancing the functionality, efficiency, and user experience of such integrated systems.

- **Advanced Machine Learning and Natural Language Processing (NLP):**

Future iterations of the system can leverage advancements in machine learning and NLP algorithms to enhance the accuracy and responsiveness of voice commands. By continuously analyzing user interactions and feedback, the system can adapt and improve its understanding of natural language, leading to more intuitive and seamless communication with users.

- **Context-Aware Automation:**

Integrating contextual awareness into the system can further optimize energy usage and enhance user convenience. By leveraging data from sensors, smart devices, and user preferences, the system can autonomously adjust appliance settings based on factors such as occupancy, time of day, and environmental conditions, thereby maximizing efficiency and comfort.

- **Expansion of Knowledge Integration:**

Beyond Wikipedia, future iterations of the system can integrate with additional knowledge databases, online resources, and APIs to provide users with access to a broader range of information and services. This expansion can enable the system to offer personalized recommendations, educational content, and real-time updates tailored to individual user preferences and interests.

- **Interoperability and Compatibility:**

Ensuring interoperability and compatibility with a diverse range of smart devices and platforms will be crucial for widespread adoption and integration into existing smart home ecosystems. Future developments should focus on standardization efforts, protocol support, and seamless integration with popular IoT platforms

REFERENCES

[1] "Voice Controlled Home Automation System using Arduino and Google Assistant" by Manu B.N., Shubham Khandelwal, Shreyas Patil, and Yash Sanghvi.
[2] "Smart Home Automation: A Literature Review" by Ahmed M. Khedr, Mohammed S. Abuzalata, and Mohamed E. Khalifa.
[3] "Home Automation System Using IoT and Google Assistant" by S. Siva Sankari, S. Uthra, and D. Vinupriya.
[4] "Integration of Google Home Assistant for Smart Home Automation" by Debashish Dutta, Subham Kumar, and Akanksha Tyagi.
[5] "Smart Home Automation System Using IoT and Google Assistant" by R. Bharathi, R. Geetha, M. Durga, and K. V. N. Sravani.
[6] Google Developers. (n.d.). "Actions on Google Documentation." Retrieved from https://developers.google.com/assistant
[7] Google Nest. (n.d.). "Nest Developer Documentation." Retrieved from https://developers.nest.com/
[8] Google Cloud. (n.d.). "Google Cloud IoT Core Documentation." Retrieved from https://cloud.google.com/iot-core/docs
[9] Amazon Web Services. (n.d.). "AWS IoT Documentation." Retrieved from https://docs.aws.amazon.com/iot/index.html
[10] Arduino. (n.d.). "Arduino IoT Cloud Documentation." Retrieved from https://www.arduino.cc/en/IoT/HomePage
[11] Raspberry Pi Foundation. (n.d.). "Raspberry Pi Documentation." Retrieved from https://www.raspberrypi.org/documentation/
[12] MQTT.org. (n.d.). "MQTT Protocol Documentation." Retrieved from http://mqtt.org/documentation
). (n.d.). "Node-RED Documentation." Retrieved from https://nodered.org/docs/
istant. (n.d.). "Home Assistant Documentation." Retrieved from https://www.home-assistant.io/docs/
d.). "IFTTT Documentation." Retrieved from https://help.ifttt.com/hc/en-us

Mr. M. RAMAKRISHNA received M. E from Osmania University. At Present working as Associate Professor in Andhra Loyola Institute of Engineering and Technology (ALIET), ECE Department, Vijayawada, Andhra Pradesh, India

N.SAI SRINIVAS presently pursuing B. Tech in the branch of Electronics and Communication Engineering at Andhra Loyola Institute of Engineering and Technology, Vijayawada, Andhra Pradesh, India

B. VENKATA REVANTH presently pursuing B. Tech in the branch of Electronics and Communication Engineering at Andhra Loyola Institute of Engineering and Technology, Vijayawada, Andhra Pradesh, India.

L.SIVA SAI presently pursuing B. Tech in the branch of Electronics and Communication Engineering at Andhra Loyola Institute of Engineering and Technology, Vijayawada, Andhra Pradesh, India