iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** V **Month of publication:** May 2024

DOI: https://doi.org/10.22214/ijraset.2024.61912

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 12 Issue V May 2024- Available at www.ijraset.com

Internet of Things (IoT) Based Home Automation Using ESP-32

Mrs. K. Anusha[1], S. Aravind[2], N. Umamaheshwar Rao[3], T. Ravisagar[4]
[1]*Assistant Professor,ECE, CMR College of Engineering and Technology Hyderabad, India*
[2, 3, 4]*ECE, CMR College of Engineering and Technology, Hyderabad, India*

Abstract: ***In the era of rapidly advancing technology, automated home systems have emerged as an innovative solution to enhance convenience, efficiency, and security in residential environments. This project focuses on the execution of a automated home system utilizing the ESP32 microcontroller, a versatile and powerful platform renowned for its connectivity capabilities. The system integrates various sensors, actuators, and communication protocols to enable seamless control and monitoring of household devices and appliances. The ESP32 serves as the central hub of the home automation network, facilitating communication between different components and providing connectivity to the internet for access and control. Sensors such as motion detectors, temperature and humidity sensors, and light sensors gather environmental data to inform automated actions and trigger responses based on predefined conditions. Actuators such as relays, servo motors, and LED lights enable the system to communicate with and control appliances, lights, locks, and other devices within the home. Through a user- friendly interface, residents can remotely monitor and manage their home environment, adjust settings, schedule tasks, and receive notifications/alerts via a mobile application or web interface***

Keywords: Home Automation, ESP32 Microcontroller, IoT-enabled home Automation, Remote Monitoring.

I. INTRODUCTION

Home automation represents the use of technology into daily household activities to enhance convenience and, efficiency. In contemporary living, the demand for automated home has surged, for interconnectedness and streamlined control over domestic environments. In response this trend, this project introduces a cutting-edge automated home system powered by the ESP32 microcontroller, heralding a new way of intelligent living.

This system lies on ESP32 microcontroller, generally used for its versatility and robust capabilities. Leveraging its built-in Wi-Fi functionality, our solution enables seamless connectivity within the home network, facilitating communication between various smart devices and the central control hub. Integrated with sensors and actuators, our automated home system enables real-time monitoring and control of key parameters within the household environment. From temperature and humidity levels to lighting and security, oursolution empowers users with comprehensive insights and the ability to remotely manage their homes with ease.

A standout feature of our system is its intuitive user interface, accessible via a smartphone application or web dashboard. Through this interface, homeowners gain seamless control over their living spaces, which allows them to customize settings, schedule tasks, and get notifications as per their preferences. By automating routine tasks and optimizing resourceutilization, our automated home not only gives easyness even it contributes to optimized energy usage and cost savings. Moreover, the inclusion of advanced security features adds an extra layer of protection, ensuring peacefor occupants. As a result, this research identifies the limitations of existing automated home systems and pioneers a viable and innovative solution. Leveraging the capabilities of the ESP32, advanced sensors, and automated control processes, our system contributes to the evolution of simple and sustainable Home management.

II. RELATED WORKS

1) In their review published in the IEEE Journal in January 2020, A. Aziz and M. S. Hossain extensively explore IoT- based automated home systems. The paper delves into the architecture, communication protocols, sensor devices, and applications within this domain. It offers an insightful analysis of state-of-the-art technologies while addressing the challenges and opportunities present.

2) R. Gupta and S. Verma's examination, published in the Journal of Communication Systems in December 2021, focuses specifically on communication protocols in IoT-based home automation. They meticulously review various protocols such as Wi-Fi, Bluetooth, Zigbee, Z-Wave, and Thread, analyzing their characteristics, advantages, and limitations. This review aids researchers and practitioners in making informed decisions regarding communication protocols tailored to their specific requirements.

©IJRASET: All Rights are Reserved

3) In October 2019, J. Lee and S. Kim published a survey in the Journal of Smart Home, concentrating on automated home systems designed for the elderly and disabled individuals. The paper explores technologies and features aimed at enhancing accessibility, safety, and comfort for this demographic. It underscores the requirment of inclusive design in automated solutions, shedding lighton challenges and opportunities in this area.

4) M. Rahman and R. Chowdhury, in their January 2020 paper published in Journal of Sensor Networks, offer a synopsis of automation systems utilizing IoT technologies. They discuss the using of IoT devices and platforms for appliance control, environmental monitoring, and security enhancement. Identifying research gaps and future directions, their review helps evolving of automated home solutions.

5) A. Gupta and S. Singh, in their February 2020 publication in the Journal of Ambient Intelligence and Humanized Computing, delve into ml for predictive maintenance in smart homes. They showcase how machine learning algorithms leverage sensor data to foresee equipment failures, thus enabling proactive maintenance scheduling. The paper tells the efficacy of various machine learning approaches in home environments, pinpointing avenues for further refinement.

6) Examining security concerns associated with automated home systems, R. Patel and N. Shah's paper, published in the Journal of CA in April 2020, identifies potential vulnerabilities posed by IoT devices. They evaluate existing security mechanisms while proposing recommendations to bolster the security posture of automated systems, safeguarding user privacy and thwarting unauthorized access.

7) S. Sharma and A. Kumar, in their June 2020 publication in the Journal of Energy Research and Environmental Technology, review the use of renewable energy sources in smart homes. They discuss other energy technologies such as solar and wind, assessing their benefits and challenges when integrated into automated home systems.

8) T. Gupta and K. Jain, in their June 2020 paper published in the International Journal of Scientific & Technology Research, provide an overview of voice- controlled home automation systems leveraging IoT technologies. They examine the integration of voice recognition technologies with IoT devices, evaluating usability and effectiveness while identifying areas for enhancement in user experience and system performance.

9) P. Verma and S. Sharma's August 2020 publication in the Journal of Engineering Research & Technology summarizes wireless sensor networks (WSNs) for home automation applications. They discuss the role of WSNs in appliance monitoring, environmental detection, and security enhancement. Their evaluation of WSN-based automated home systems offers insights into optimizing network deployment and management.

10) Reviewing automated home systems using IoT and cloud computing technologies, S. Yadav and A. Singh's February 2020 paper in the Journal of Innovative Technology explores device communication with cloud platforms. They assess the benefits and challenges of IoT- cloud integration, proposing solutions for scalability, reliability, and security enhancement.

11) S. Kumar and S. Jain's September 2020 publication in the Journal of CS and Privacy examines how IoT devices augment home security. They discuss various IoT-based security solutions such as smart cameras and motion sensors, evaluating their effectiveness and proposing recommendations for bolstering security and mitigating risks.

12) A. Mishra and R. Prasad's January 2021 paper in the Journal of Electrical and CE reviews health monitoring systems in smart homes utilizing IoT technologies. They discuss the using of IoT devices and sensors for health monitoring, medication management, and assistance to individuals with chronic conditions. Their evaluation identifies opportunities for improving remote healthcare delivery and patient outcomes.

13) M. Patel and S. Desai's March 2021 publication in the Journal of EE and Information Technology presents a summary of energy management strategies in smart homes. They explore techniques and technologies for optimizing energy consumption and promoting sustainability. Their evaluation offers recommendations for implementing energy-efficient practices and technologies in smart homes.

III. PROPOSED METHODOLOGY

The primary goal is to make a fully automated Homemanagement system utilizing the ESP32 microcontroller.

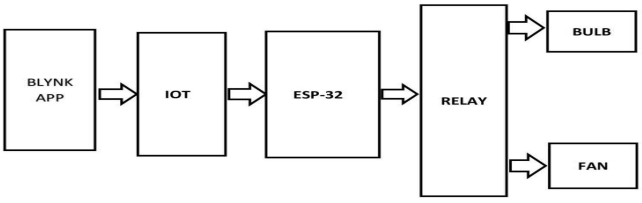


Fig 1: Block diagram

The automation of home project utilizing ESP32 and relay modules, key components such as relay Module which are integrated to esp-32 to facilitate real-time control and monitoring of various household devices.

The ESP32, equipped with Wi-Fi connectivity, works as the main control unit, allowing users to remotely access and manage the automated home systems through a web interface or a dedicated mobile application.

Automation is a main feature of the automation system, enabled by the ESP32's firmware and relay modules.relay Module Acts like switch to activate or deactivate connected devices such as lights, fans, or appliances accordingly. For instance, lights can be turned on automatically when the user operates or gives instruction from the mobile application or web interface optimizing energy usage and enchacing convenience.

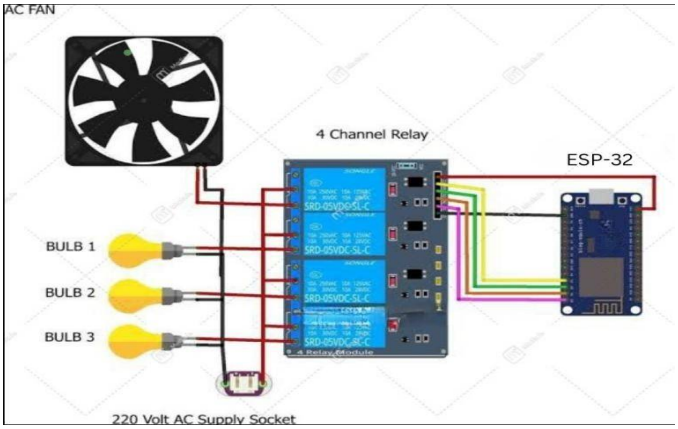


Fig2: Circuit diagram.

The relay modules provide the interface between the ESP32 and the electrical devices, allowing for integration and control. Through the web interface or mobile app, users can create schedules or set predefined conditions for device operation, optimizing energy usage and enhancing convenience.

Overall, the ESP32-based automation of home, coupled with relay modules, offers a versatile and scalable solution for controlling and monitoring household devices remotely, enhancing convenience, energy efficiency, and security in modern homes.

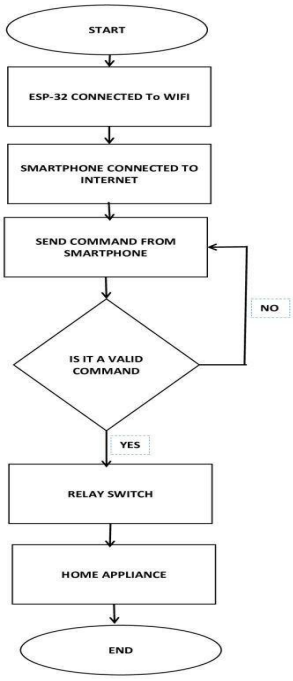


Fig 3: Flowchart 1

The above flowchart which is Fig3:flowchart 1 is the logic explaining monitoring and controlling the Home appliances like Light, Fan in a home.

To enhance user experience, a user-friendly interface is designed on the Blynk app, emphasizing simplicity for remote monitoring And Control vigorous testing is conducted to validate calibration And optimizing performance of home automation system..
Documentation underscores the system's architecture, codebase, and configurations for clarity, with scalability considerations for potential expansions.

IV. IMPLEMENTATION & RESULTS

In my Home automation study, I utilized a confined space measuring 15cm in width and 30cm in length. This compact area served as the experimental environment for testing and evaluating the efficiency of the ESP32-based automation of home. The limited dimensions of the space necessitated careful consideration and optimization of actuator functionality, and overall system design to ensure optimal performance within the constrained area. By leveraging advanced technologies and strategic planning, the system demonstrated its capabilities in maintaining ideal growthconditions for plants within this confined greenhouse space.

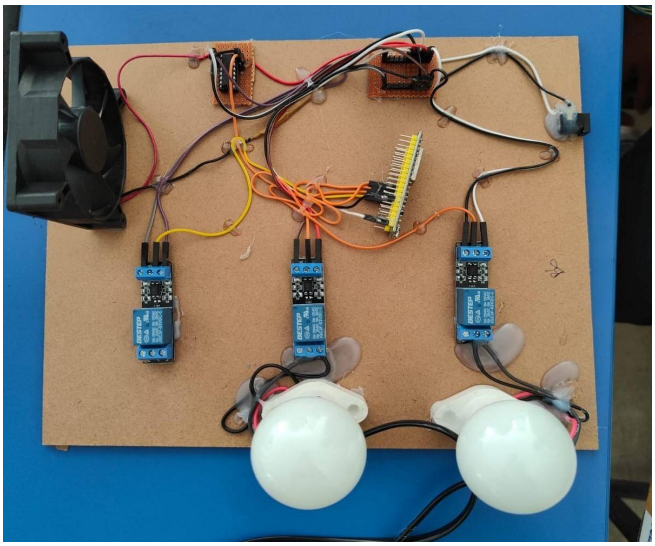


Fig 5 : working model of the automated home

The image showcasing Blynk results is pivotal in the paper, offering a visual representation of the ESP32-based Home automation system's real-time capabilities. Through the Blynk application, end users can use the automation of home and control the home appliances connected to the automated home system remotely. This image highlights the system's seamless integration with Blynk, showcasing its user-friendly design and remote accessibility. It emphasizes the system's effectiveness in providing remote monitoring and control.

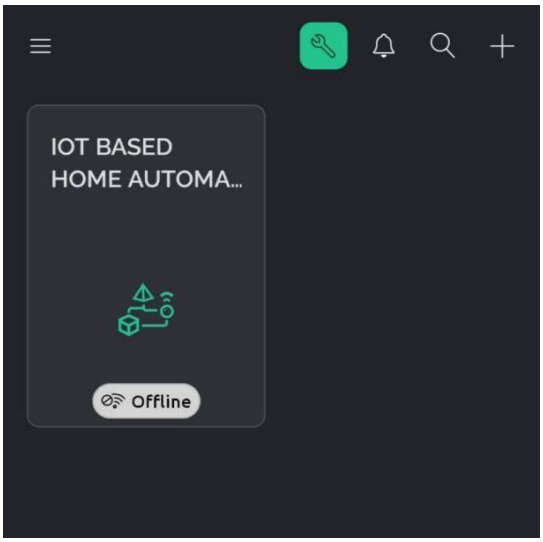


Fig 6: Blynk Output

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

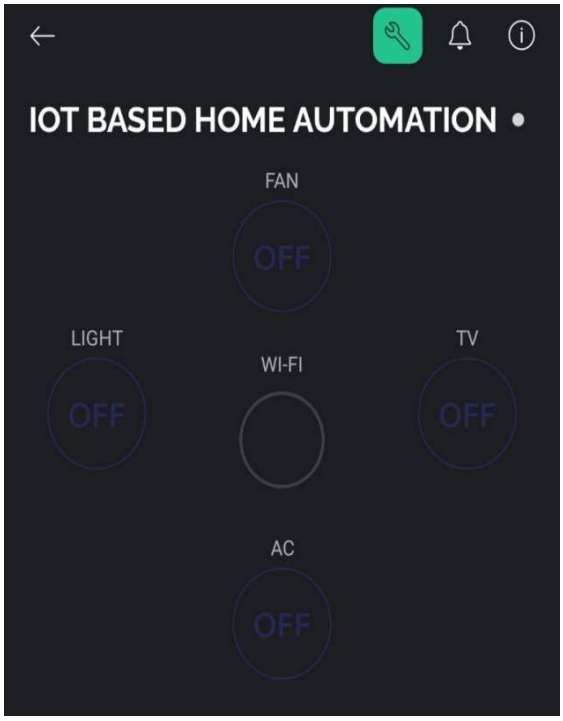


Fig 7: Blynk output

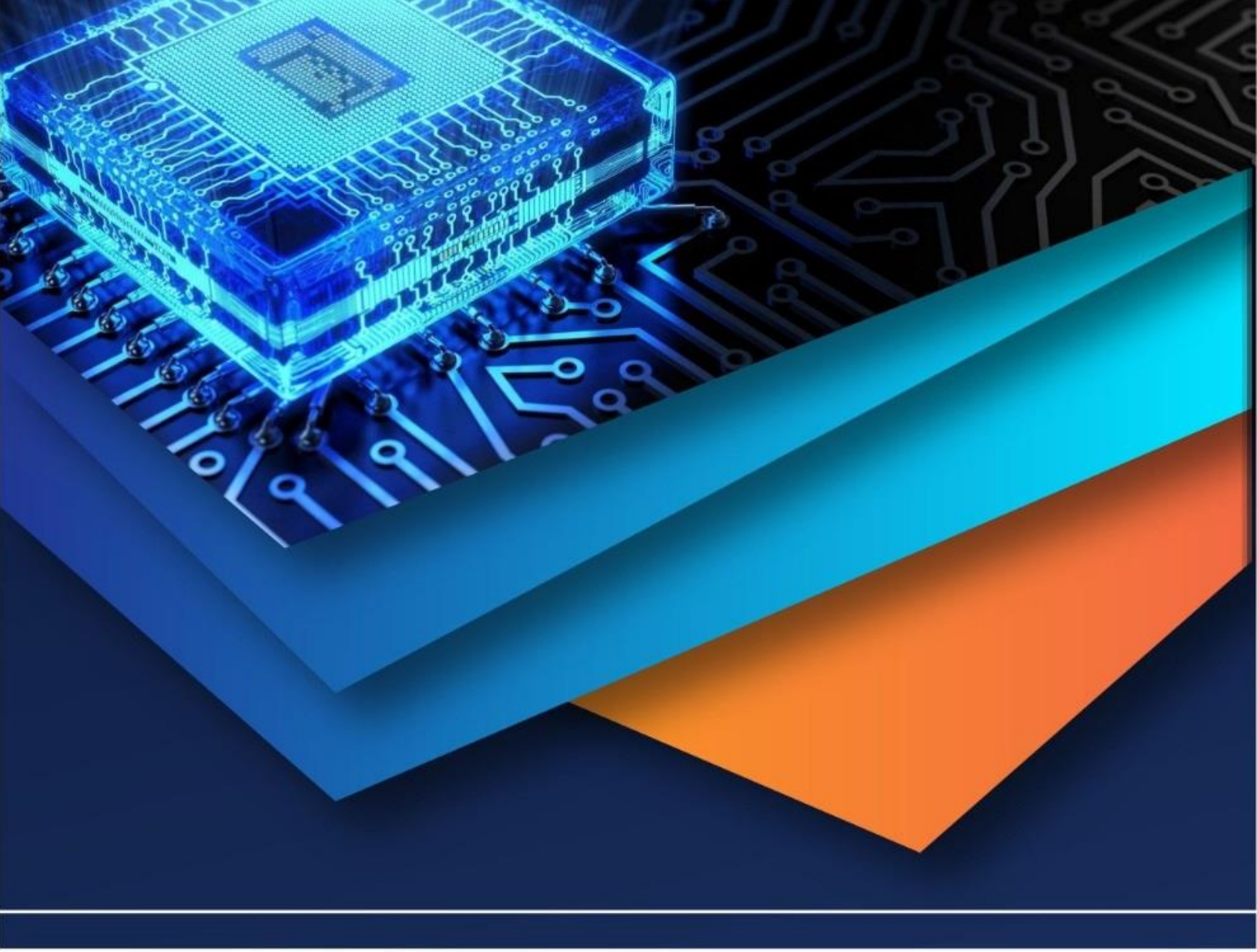
V. CONCLUSION

The usage of ESP32 microcontroller with the Blynk app has enabled the making of a robust and versatile automated home systems. Through seamless control and monitoring capabilities, users can remotely manage their devices with ease and convenience. The system's sensor-driven automation enhances overall power usage and improves overall comfort, while the intuitive user interface of the Blynk app ensures a positive user experience. With robust security measures in place, the system offers peace by safeguarding user data and privacy. As we look to the future, further innovation and expansion into advanced features remains promising,signaling a continued evolution towards smarter, more connected homes.

REFERENCES

[1] Aziz and M. S. Hossain, "IoT-based Smart Home Automation:A Review," IEEE Iot Journal, vol. 7, pp. 1-15, Jan. 2020.
[2] R. Gupta and S. Verma, "IoT-based Home Automation: A overview of Communication Protocols," Journal of Communication Systems, vol. 34, no. 12, pp. 1-18, Dec. 2021.
[3] J. Lee and S. Kim, "A Survey on Automated home System for the aged and Disabled People," Journal of Smart Home, vol. 13, no. 5, pp. 87-94, Oct. 2019.
[4] M. Rahman and R. Chowdhury, " Automated home System Using IoT: A Review," Journal of Sensor andE Networks, vol. 9, no.1, pp. 1-22, Jan. 2020.
[5] A. Gupta and S. Singh, "ML Techniques for Maintenance in Homes: A Review," Journal of Ambient Intelligence and HumanizedComputing, vol. 11, pp. 861-875, Feb. 2020.
[6] R. Patel and N. Shah, "Security and Privacy Issues in Home Automation Systems: A Review," Journal of Computer Applications,vol. 187, no. 19, pp. 36-40, Apr. 2020.
[7] S. Sharma and A. Kumar, "Integration of Renewable Energy Sources in Smart Homes: A Review," Journal of Energy Research and Environmental Technology, vol. 3, pp. 150-158, Jun. 2020
[8] T. Gupta and K. Jain, "Voice Controlled Automated home System Using IoT: A Review,"Journal of Scientific & Technology Research, vol. 9, no. 6, pp. 1010-1015, Jun. 2020.
[9] P. Verma and S. Sharma, "Wireless Sensor Networks for Home Automation: A Review,"Journal of Engineering Research & Technology, vol. 13, no. 8, pp. 1549-1555, Aug. 2020.
[10] S. Yadav and A. Singh, " Automated home System Using IoT and Cloud Computing: A Review," International Journal of Innovative Technology and Exploring Engineering, vol. 9, no. 4, pp.2081-2087, Feb. 2020.
[11] S. Kumar and S. Jain, "Enhancing Home Security with Internet of Things (IoT) Devices: A Review," Journal of Cybersecurity and Privacy, vol. 5, pp. 321-335, Sep. 2020.
[12] A. Mishra and R. Prasad, "Health Monitoring in Homes UsingIoT: A Review,"Journal of E&CEngineering, vol. 11, no. 1, pp. 554- 559, Jan. 2021.
[13] M. Patel and S. Desai, "Energy Management in Homes: A Review," Journal of EE and Information Technology, vol. 8,104-110,Mar. 2021.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)