e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

IMPLEMENTATION PAPER ON ADVANCE AUTOMATION SYSTEM

Devashish D. Ajane*1, Om D. Kothalkar*2, Priya M. Vaidya*3

*1,2Students, Department Of Computer Engineering, Smt. Radhikatai Pandav College Of Engineering, Nagpur, Maharashtra, India.

*3Assistant Prof, Department Of Computer Engineering, Smt. Radhikatai Pandav College Of Engineering, Nagpur, Maharashtra, India.

DOI : https://www.doi.org/10.56726/IRJMETS51757

ABSTRACT

In the era of smart technology, the Advance Automation System stands as a pinnacle of innovation, integrating advanced computing and communication technologies to transform ordinary Homes, Cities, Industries, and Hospitals into intelligent, responsive environments. This abstract explores the fundamental concepts and functionalities of a modern Advance Automation System, emphasizing its significance in enhancing convenience, energy efficiency, security, and overall quality of life for homeowners or business owners.

Keywords: Advance Automation, Intelligence, Microcontroller, Sensors System, User-Friendly Interface.

I. INTRODUCTION

Advanced Automation Systems have transcended the limitations of traditional automation, offering a more intelligent, adaptive, and interconnected approach to tasks and processes. From industrial manufacturing and healthcare to smart homes and sustainable energy solutions, these systems have become indispensable, promising streamlined operations, cost-effectiveness, and enhanced user experiences. In the ever-evolving landscape of technology, Advanced Automation Systems (AAS) have emerged as the epitome of innovation and efficiency. With the fusion of cutting-edge hardware, sophisticated software, and intelligent algorithms, Advanced Automation Systems are reshaping industries and revolutionizing how we perceive automation. In this introduction, Advanced Automation Systems explores their pivotal role in enhancing productivity, optimizing processes, ensuring safety, and fostering sustainability across various sectors. From manufacturing plants to smart homes, these systems have become the cornerstone of modernization, promising a future where tasks are accomplished seamlessly, swiftly, and with unparalleled precision. Let's embark on a journey to uncover the vast potential and multifaceted benefits of Advanced Automation Systems in our rapidly advancing world

There is an increasing demand for smart homes, smart industries, smart cities, smart agriculture, etc. where appliances react automatically to changing environmental conditions and can be easily controlled through one common device. This project presents a possible solution whereby the user cuts off devices by using their existing mobile phone, where control is communicated to the Microcontroller from a mobile phone through its WI-FI interface.

II. LITERATURE SURVEY

This comprehensive text provides an in-depth understanding of automation technologies, including robotics, PLCs (Programmable Logic Controllers), and computer-integrated manufacturing systems. It serves as a fundamental resource for students and researchers interested in advanced automation concepts.[1]

Focused on practical applications, this book explores the implementation of automation systems in industrial environments. It covers topics such as sensors, actuators, control systems, and HMI (Human-Machine Interface) design. The hands-on approach makes it valuable for engineers and technicians.[2]

Focusing on the convergence of IoT and industrial applications, this book investigates the role of IoT in manufacturing. It discusses concepts like data analytics, cloud computing, and cyber-physical production systems, providing insights into the future of industrial automation.[3]

This book delves into the integration of computational algorithms and physical processes, exploring the foundations of Cyber-Physical Systems (CPS). It discusses various aspects of CPS, including modeling, design, security, and real-world applications, making it pertinent for researchers in advanced automation.[4]

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

Automation has been a consistent objective of the Industrial Revolution from as early as the 18th Century. Starting from the onset of the Industrial Revolution, there have been deliberate efforts to enhance the ease and efficiency of doing work through the automation of complex processes requiring heavy workforce involvement (Janssen est. 2019). According to Janssen, the Industrial Revolution was driven mostly by need, and the needs kept evolving over time. The continuous evolution has led to the most recent outcomes in terms of AI and the Internet of Things, among others, which are characterized as serious inroads into automation.[5]

EXISTING WORK

1. **Integration of Edge Computing and IoT Devices:** Investigate the integration of edge computing technologies with IoT devices to enable real-time data processing and analysis at the edge of the network. This approach reduces latency, enhances system responsiveness, and ensures efficient utilization of network bandwidth.
2. **Adaptive Process Optimization:** Create adaptive optimization software that continuously analyzes working processes. These technologies will adjust parameters in real-time based on changing conditions, ensuring optimal efficiency, reduced waste, and enhanced energy utilization in manufacturing processes.
3. **Cybersecurity Protocols for Automation Networks:** Develop robust cybersecurity protocols tailored for automation networks. Implement encryption, intrusion detection systems, and secure communication channels to safeguard automation systems from cyber threats, ensuring data integrity and system reliability.
4. **Sustainable Automation Practices:** Research and implement eco-friendly materials, energy-efficient components, and waste reduction strategies within advanced automation systems. Aim to minimize the environmental impact of automation technologies, aligning with sustainability goals and global environmental standards.

The proposed work on advanced automation systems aims to push the boundaries of technological innovation, addressing complex challenges in various sectors. By focusing on IoT integration, adaptive optimization, cybersecurity, and sustainable practices, the research endeavors to create smarter, safer, and more efficient automation solutions for the future.

III. MODELING AND ANALYSIS

Modeling an advanced automation system using ESP32, a widely used microcontroller with built-in Wi-Fi and Bluetooth capabilities, involves designing the hardware connections and developing software to control and monitor various devices and sensors. Here's a step-by-step guide on how to model an automation system using ESP32

ESP32 and NodeMCU ESP8266 Development Board: The ESP32 and NodeMCU ESP8266 module itself serves as the brain of the automation system. It contains the microcontroller, Wi-Fi and/or Bluetooth modules, GPIO pins, and other essential components.

- Determine the tasks of automation system needs to perform.
- Identify the sensors (e.g., temperature, humidity, motion) and actuators (e.g., motors, relays) you'll be using.
- Consider the communication protocols and network architecture for data exchange.

Actuators:

Relays: Control high-power devices such as lights, motors, or appliances.

Communication Modules:

- **Wi-Fi Module:** ESP32 has built-in Wi-Fi capability for internet connectivity.
- **Bluetooth Module (Optional):** Enables communication with Bluetooth-enabled devices.
- **RFID Module (Optional):** Allows RFID-based identification and authentication.

ESP32 Hardware Setup:

Connect Sensors and Actuators: Wire up sensors and actuators to the GPIO pins of the ESP32. Use appropriate voltage level shifters if needed.

Power Supply: Ensure a stable power supply for the ESP32 and connected components.

Analyzing an advanced automation system that utilizes ESP32 involves evaluating its performance, reliability, efficiency, and user experience. Here's a guide on how to perform an analysis of such a system:

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

1. Performance Analysis:

Response Time: Measure the time taken by the system to respond to user inputs or sensor data changes.

Throughput: Evaluate how many tasks or data points the system can handle per unit of time.

2. Reliability and Stability:

Error Rate: Calculate the frequency of errors occurring in sensor readings, actuator control, or communication.

Fault Tolerance: Test the system's ability to continue functioning properly in the presence of hardware or software faults.

3. Efficiency:

Energy Consumption: Measure power usage to optimize the system for energy efficiency, especially in battery-powered applications.

4. Security Analysis:

Authentication: Evaluate the effectiveness of user authentication mechanisms to prevent unauthorized access to system controls.

5. Integration and Compatibility: Device Compatibility: Ensure seamless integration with various sensors, actuators, and other devices commonly used in automation systems.

1. HARDWARE REQUIREMENTS

- **ESP32 Development Board:** ESP32 is a system-on-chip (SoC) microcontroller that has gained prominence in the Internet of Things (IoT) space.

Fig No. 1.1: ESP32 Development Board

- **NodeMCU ESP8266:** The ESP8266 WIFI module is a self-contained SOC with an integrated TCP-IP protocol stack that can give any microcontroller access to your WIFI network.

Fig No. 1.2: NodeMCU ESP8266

- **Ultrasonic Sensor:** An ultrasonic sensor is a device that emits ultrasonic sound waves and detects the reflections or echoes of those waves from nearby objects. These sensors are commonly used for proximity sensing, distance measurement, object detection, and obstacle avoidance in various applications.

Fig No. 1.3: Ultrasonic Sensor

- **DHT Sensor:** A DHT sensor is a type of digital temperature and humidity sensor. It combines both temperature and humidity sensing capabilities into a single compact device. The name "DHT" stands for "Digital Humidity and Temperature."

The DHT sensor family includes various models, such as the DHT11, DHT22 (also known as AM2302), and DHT21 (also known as AM2301). These sensors are commonly used in projects and applications where monitoring temperature and humidity levels is important, such as weather stations, environmental monitoring systems, HVAC (Heating, Ventilation, and Air Conditioning) systems, and home automation projects.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

Fig No. 1.4: DHT Sensor

- **Relay Module:** The 8 Channel Relay Module can control various appliances and other types of equipment with a large current.

Fig No. 1.5: Relay Module

- **PRI Sensor:** A passive Infrared Sensor (PRI Sensor) is an electronic sensor that measures infrared (IR) light radiating from an object in its field of view.

Fig No. 1.6: PRI Sensor

- **MQ-2 Sensor:** The MQ2 sensor is a type of gas sensor that detects a variety of gases, including LPG, propane, methane, alcohol, hydrogen, smoke, and carbon monoxide. These sensors are commonly used for gas leakage detection, fire detection, indoor air quality monitoring, and industrial safety applications.

Fig No. 1.7: MQ2 sensor

- **Infrared Flame Sensor:** An IR (Infrared) flame sensor is a type of sensor that detects the presence of a flame by sensing the infrared radiation emitted by the flame. These sensors are commonly used in fire detection and flame monitoring systems in various applications, including industrial processes, gas and oil pipelines, heating systems, and safety equipment.

Fig No. 1.8: Infrared Flame Sensor

- **W1209 Module:** The W1209 is a low-cost temperature controller module commonly used in DIY projects, homebrewing, and small-scale temperature control applications. It is based on a microcontroller and provides simple temperature control functionality. The W1209 is a low-cost temperature controller module commonly used in DIY projects, homebrewing, aquarium temperature control, and other applications where precise temperature regulation is required. It features a digital display, onboard relay, and buttons for configuration.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

Fig No. 1.9: W1209 Module

2. SOFTWARE REQUIREMENTS

- **Arduino IDE:** The Arduino IDE contains a text editor for writing code, a message area, a text console, a toolbar with buttons for a common function, and a series of menus that connect to the microcontroller hardware to upload a program and communicate with them.

Fig No. 2.1: Arduino IDE

- **BLYNK:** BLYNK software is a comprehensive software suite that enables the prototyping, development, and remote management of connected electronic devices and hardware at any scale.

Fig No. 2.2: BLYNK Software

- **Alexa App:** The Alexa app is a companion application for Amazon's Alexa-enabled devices, such as the Amazon Echo, Echo Dot, Echo Show, and others. It serves as a central hub for setting up, configuring, and managing these devices, as well as for accessing additional features and services provided by the Alexa ecosystem. the Alexa app serves as a versatile tool for interacting with and managing Alexa-enabled devices, integrating them into users' daily routines, and expanding their capabilities through third-party skills and services.

Fig No. 2.3: Alexa App

- **Google Home App:** The Google Home app is a mobile application developed by Google for managing and controlling various smart home devices and services compatible with the Google Assistant ecosystem. It is available for both Android and iOS devices the Google Home app serves as a central hub for managing and controlling various smart home devices and services within the Google Assistant ecosystem, offering users a convenient and intuitive interface for integrating these devices into their daily routines.

Fig No. 2.4: Google Home App

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

3. CONNECTION DIAGRAM

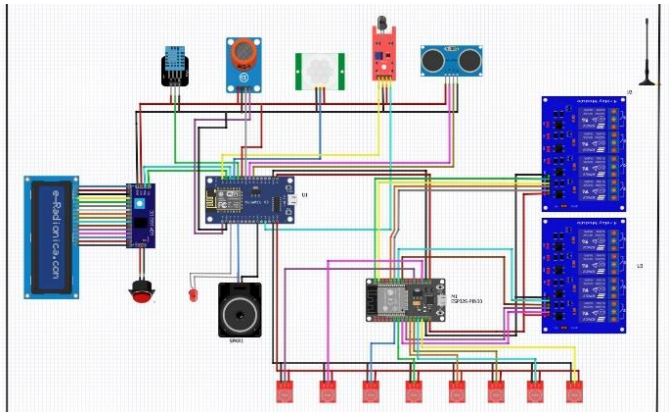

Fig No. 3.1: Microcontroller Connection Diagram

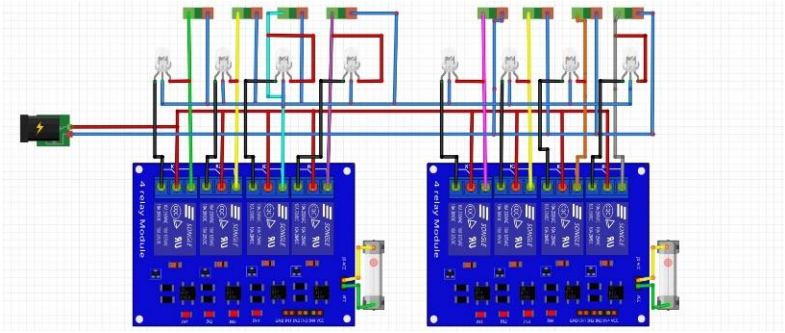

Fig No. 3.2: Relay Connection Diagram

IV. EXPERIMENTAL RESULT

Fig No. 4.1: Sensor Panel

Fig No. 4.2: Main Control Unit

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

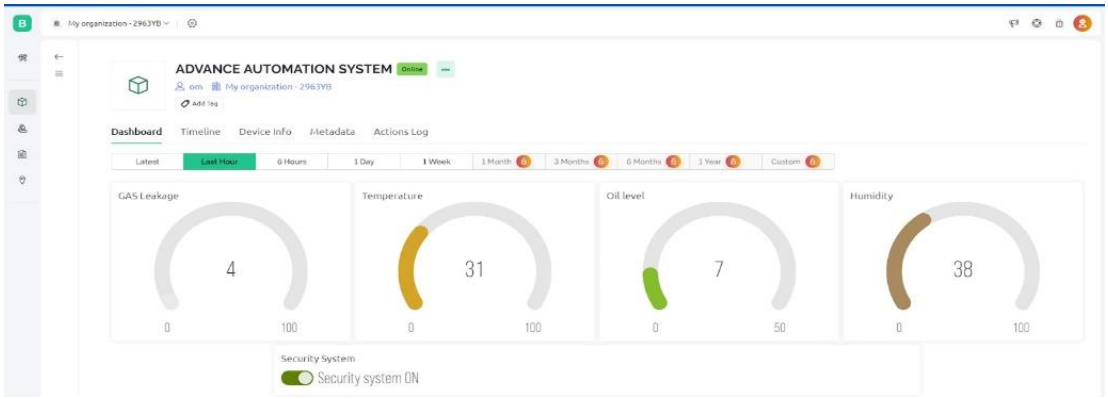

Fig No. 4.3: BLYNK Software Dashboard

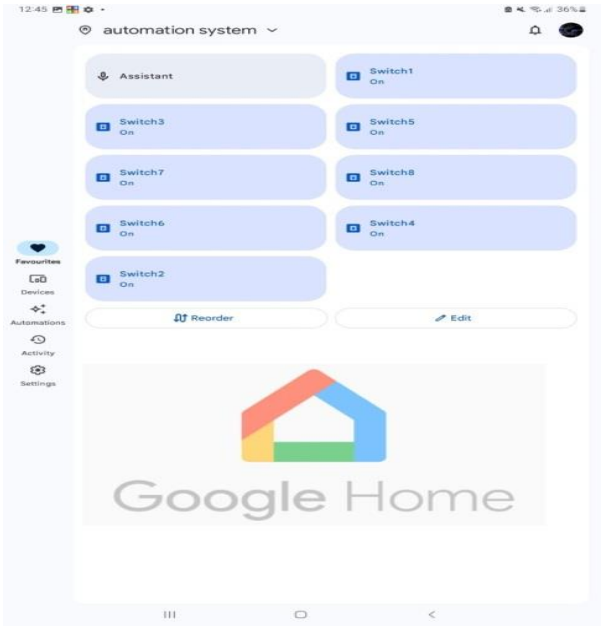

Fig No. 4.4: Google Home Dashboard

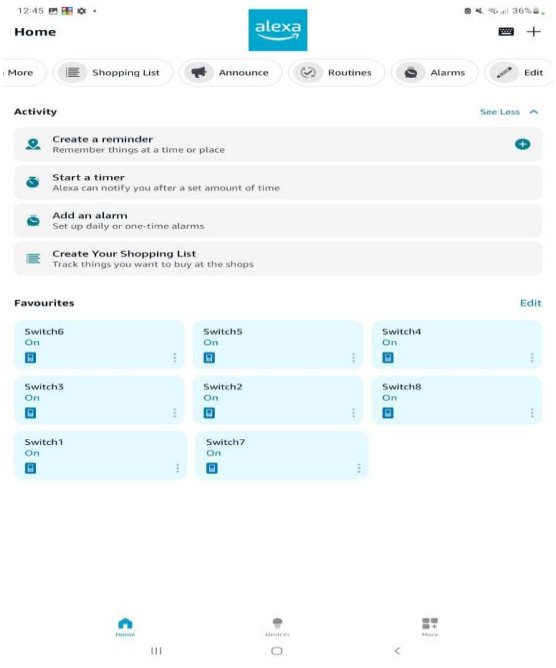

Fig No. 4.5: Alexa Dashboard

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

Fig No. 4.6: Timeline Warning Dashboard

V. CONCLUSION

In conclusion, the era of advanced automation represents a paradigm shift, where the fusion of human ingenuity and technological prowess creates a synergy that propels us into a future marked by efficiency, sustainability, and innovation. As we continue to explore and refine these technologies, the horizons of what is achievable in automation expand, opening doors to possibilities limited only by our imagination. The journey of advanced automation is not just a technological evolution; it is a testament to our ability to shape a smarter, more connected world. Through the integration of cutting-edge technologies such as artificial intelligence, IoT, and machine learning, advanced automation systems have transcended the limitations of conventional automation. These systems are not mere tools; they are the architects of a new industrial revolution, where tasks are executed with unparalleled precision, adaptability, and intelligence. In the ever-evolving landscape of technology, advanced automation systems stand as the epitome of innovation, transforming traditional industries and redefining the way we perceive efficiency, precision, and interconnectivity. The journey through the realm of advanced automation has unveiled a myriad of possibilities and advancements that hold the promise of shaping a smarter, more efficient future.

VI. REFERENCES

[1] Samer Elhajjar, Laurent Yacoub, Hala Yaacoub (2023). "AI-powered is among the trends widely researched in the Industry", The Author(s), under exclusive license to Springer-Verlag GmbH Germany, part of Springer Nature, Vol.4, No.6, June 2023

[2] Mikell p. Groover (2017). "Advanced Automation Production System, and Computer Integrated, Manufacturing", IJRITCC Volume 5, no.11, Issue March 17 (2017), Volume 5, no.21, November (2017) Issue 3.

[3] Sabina Jeschke (2017). Industrial Internet Of Things, Cyber Manufacturing System, IEEE Transactions on Consumer Electronics, vol. 50, no. 4, pp.1087-1092, Nov 2017.

[4] Danda B. Rawat (2015). "Cyber-Physical System From Theory Practice", International Journal of Computer Networks & Communications (IJCNC) Vol.6, No.1, January 2015.

[5] Frank Lamb (2013). "Industrial Automation Using Internet" IEEE Transactions on Consumer Electronics, vol. 38, no. 3, pp.34- 38, Aug 2013.