IOT ENABLED OVERLOAD MONITOR WITH CAPACITY TRACKER AND ALERT SYSTEM

[1]MRS. C. STEFFI, [2] MOHAN KUMAR. M, [3]PRABHU. K, [4]PRASANNA . S, [5]SHIBI RAJ. E,
[1]Assistant Professor, [2,3,4,5]UG scholars, Department of Electronics and Communication Engineering

Adhiyamaan College of Engineering (AUTONOMOUS), Hosur

ABSTRACT

The overload protection systems are reactive and lack real-time monitoring capabilities, often resulting in equipment damage, power outages, and safety risks. This project leverages in the IoT technology to overcome these limitations by integrating sensors microcontrollers, cloud platforms. The system uses current and voltage sensors to monitor load parameters, with data processed by a microcontroller (ESP32). Real-time data is transmitted to a cloud platform, allowing users to visualize load trends and receive alerts through mobile or web interfaces. The capacity tracker analyzes load usage patterns, enabling predictive measures to prevent overloads. Additionally, the system generates instant notifications via app, SMS, or email in case of critical conditions, ensuring proactive safety measures. The proposed system is scalable, cost-effective, and user-friendly, making it suitable for industrial, commercial, and residential applications. By providing intelligent monitoring and alert mechanisms, this project aims to enhance energy efficiency, improve safety, and reduce the risks associated with electrical overloads

Key Word:
ESP32 microcontroller, Ultrasonic sensor (HC-SR04), Overload alert system, Object counting system, Threshold-based alarm, IoT-based monitoring, Real-time data processing

---

I INTRODUCTION

This solution is particularly useful in environments where overload conditions can lead to safety risks or inefficiencies, such as warehouses, storage facilities, and public spaces. The project leverages IoT in the capabilities for remote monitoring, allowing users to track capacity levels through a smartphone or web application The project, "IoT Enabled Overload Monitor with Capacity Tracker and Alert System", aims develop a smart and automated system to monitor capacity levels and prevent overload for the conditions. continuously tracks the utilization in of a defined capacity. When the capacity exceeds for the predefined limit, it triggers an alert through a buzzer and updates the data in realtime on an IoT platform. This solution is particularly useful in environments are where overload conditions can lead to safety risks or inefficiencies, such as warehouses, storage facilities, and public spaces. The project leverages IoT capabilities for remote monitoring, allowing users to track in capacity levels through a smartphone or web application.

II LITERATURE REVIEW

The development and integration of IoT-based systems for overload monitoring, capacity tracking, and alert mechanisms have garnered significant research interest between 2021 and 2023. This literature survey compiles key advancements and findings within this domain.

Foundational Developments in IoT for Overload Monitoring

In 2021, IoT-enabled systems gained traction in load monitoring due to their ability to offer realtime data insights and remote accessibility. Early implementations utilized microcontrollers like Arduino and ESP8266 paired with sensors to detect overload conditions. These systems were primarily deployed in residential and industrial applications. For instance, IoT-based smart grids monitored energy consumption patterns and provided alerts during overload events. Additionally, predictive maintenance capabilities allowed these systems to address overload risks, enhancing the operational longevity of connected devices**.** Research during this period also highlighted the integration of wireless communication protocols like MQTT and Zigbee to ensure seamless data transfer. Cloud platforms such as Thing Speak were employed for centralized data storage and visualization.

interfaces for monitoring and control via smartphones Expansion into Industrial Applications, By 2022, the scope of IoT-enabled overload monitoring systems expanded to industrial applications, emphasizing robustness and scalability. A notable study focused on an IoT-based monitoring system for DC motors in heavy machinery, which significantly reduced maintenance costs and downtime. This system combined real-time monitoring with predictive analytics to detect overloads and notify operators instantly. Another key innovation was the integration of IoT with advanced metering infrastructure (AMI).

These systems enabled users to monitor real-time energy consumption and overloads remotely, encouraging more sustainable energy usage. IoT platforms also began leveraging machine learning algorithms to predict and prevent potential overload scenarios, enhancing system reliability. In 2023, IoT overload monitoring systems reached new heights with enhanced functionalities and broader applicability.

voltage and current levels, triggering automated shutoffs during overloads. These systems were widely adopted in smart homes and industrial setups for improved safety and efficiency. The use of platforms like Blynk allowed users to visualize real-time data on smartphones and web applications, making these systems more accessible. Furthermore, low-cost sensors and energy-efficient designs enabled wider adoption across developing regions. The integration of IoT with edge computing also reduced latency, enabling faster decision-making during overload scenarios.

III EXISTING SYSTEM

.

In more advanced systems, predictive analytics can provide early wa significant problems. predictive monitoring could use data analytics to track historical trends in power usage and flag any anomalies that suggest a potential overload in the near future. Unfortunately, traditional overload protection systems do not offer such capabilities. Without proactive notifications or alerts, users are left blind to potential risks, often only discovering issues after they cause damage or disruption.

The lack of predictive alerts also means that overload conditions are often detected only after they have caused a significant impact. For instance, when a circuit breaker trips, the system has already failed to handle the load, and the user may be left scrambling to resolve the issue, often without knowing the exact cause. This reactive approach not only prolongs system downtime but also increases the likelihood of equipment failure or safety hazards. The inability to provide timely warnings about potential overloads reduces the overall efficiency of the system and places a heavier burden on the operators to monitor and manage the system manually.

Another significant drawback of traditional overload protection systems is their limited integration with Internet of Things (IoT) technologies. In today's interconnected world, smart solutions are increasingly being adopted across industries, and IoT plays a crucial role in enabling real-time monitoring, data sharing, and automation. However, traditional overload protection systems are generally not equipped to leverage IoT technology, resulting in a lack of advanced features such as remote monitoring, data analytics, and cloud-based reporting.Without IoT integration, traditional systems operate in isolation, making it difficult to share data between different devices or to monitor the system remotely.

This can be especially problematic in large-scale industrial settings, where electrical systems may span multiple locations or require constant oversight. In these environments, IoT-enabled overload protection systems can provide operators with remote access to real-time data, making it easier to monitor the health of electrical circuits and respond promptly to issues, even from a distance. Without IoT capabilities, traditional overload protection systems miss the opportunity to harness this data and make informed decisions about how to optimize energy usage, improve system reliability, and reduce the likelihood of overload.

Another challenge posed by traditional overload protection is the use of standalone devices, such as individual energy meters. These meters typically provide basic readings of power usage, but they require manual data collection and inspection. This method is inefficient, as it relies on periodic checks and does not offer real-time updates or continuous monitoring of power consumption. Standalone devices also lack the analytical capabilities needed to detect early signs of overload or system failure, making them ill-suited for modern, fast-paced operational environments a basic energy meter might display how much energy is being used at a given moment, but it does not offer insights into trends or patterns that could indicate an impending overload. Additionally, because the data collected by these devices is not integrated into a broader monitoring system

IV.PROPOSED METHODOLOGY

The "IoT Enabled Overload Monitor with Capacity Tracker and Alert System" is designed to address the limitations of traditional overload protection systems by providing a smart, real-time monitoring solution .The system integrates current and voltage sensors to measure electrical parameters, which are processed by a microcontroller (ESP32) for overload detection. Through IoT connectivity, the system transmits real-time data to a cloud platform where users can access a user-friendly interface to visualize power usage trends and receive alerts. A capacity tracking algorithm is employed to monitor load usage, analyze historical data, and predict potential overloads. The system generates immediate notifications via app, SMS, or email and provides local alerts through buzzers or LEDs, ensuring both remote and onsite awareness.The proposed system is designed to provide an efficient, automated, and scalable solution for monitoring electrical loads, tracking capacity, and issuing alerts during overload scenarios. It integrates the principles of the Internet of Things (IoT) with real-time data analysis and userfriendly interfaces, aiming to enhance safety, reduce downtime, and optimize energy consumption across various environments, including residential, commercial, and industrial applications.

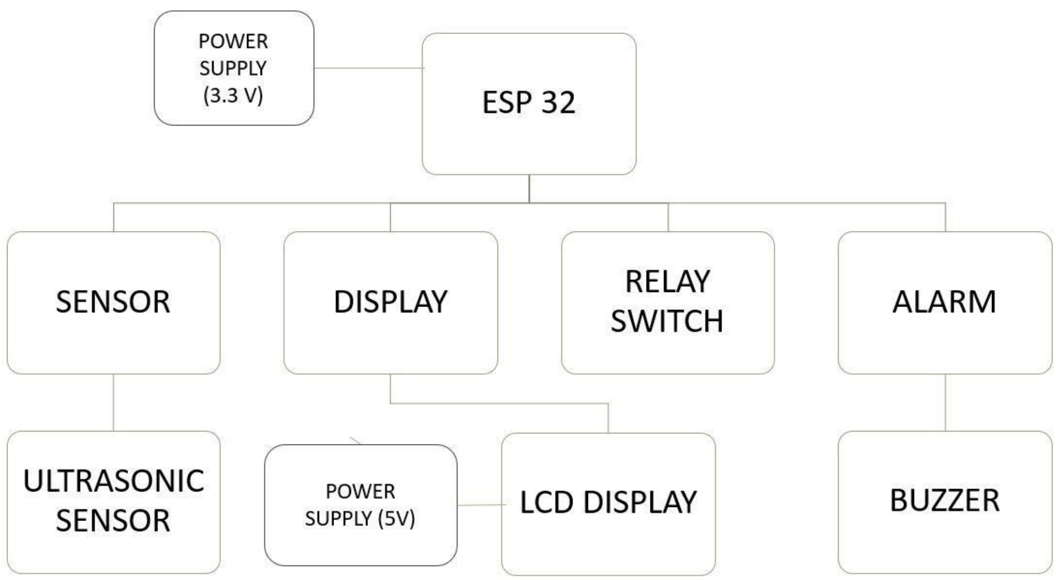


Fig 1: Basic Block Diagram.

V. ADVANTAGES

Real-Time Monitoring : Provides continuous tracking of electrical load parameters, ensuring accurate and timely detection of overload conditions.

Proactive Alerts : Issues instant notifications (via app, SMS, email) and local alarms, enabling users to take preventive measures before a critical failure occurs. **Capacity** Tracking : Analyzes load usage trends and predicts potential overloads, improving energy management and operational efficiency.

Scalability : Can be easily adapted for industrial, commercial, and residential environments by customizing thresholds and parameters

VI . DISADVANTAGES

Dependency on Internet Connectivity : System performance relies heavily on stable internet access for real-time data transmission and alerts.

Sensor Accuracy : Low-quality sensors may result in inaccurate readings, leading to false alarms or missed overloads.

Maintenance Requirements : Regular calibration and maintenance of sensors and IoT components are necessary to ensure long-term reliability.

VII . APPLICATION

Industrial : Prevents machinery damage by monitoring high-power equipment and providing timely overload alerts. Tracks energy consumption trends to optimize operational efficiency.

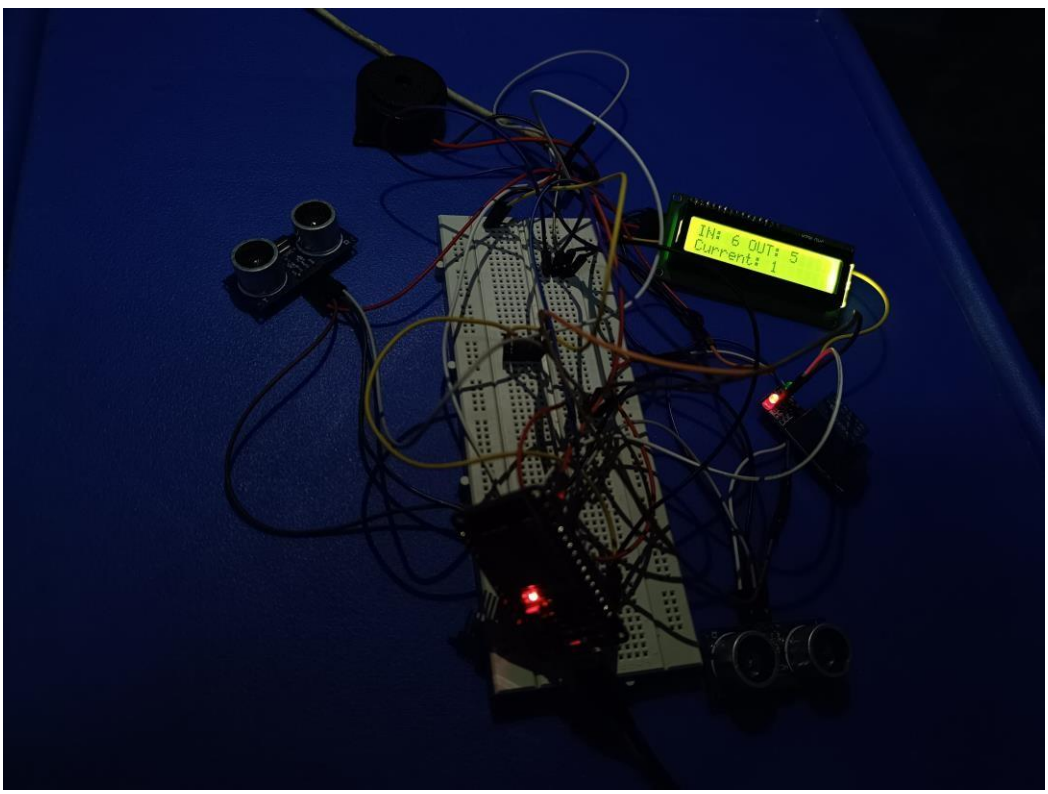
Commercial : Monitors electrical loads in offices and retail spaces to ensure safe and efficient power usage. Alerts facility managers of potential risks, avoiding disruptions in business operations.

Residential : Tracks household energy usage, helping to prevent overloads and reduce energy bills. Offers remote monitoring for homeowners, adding convenience and safety.

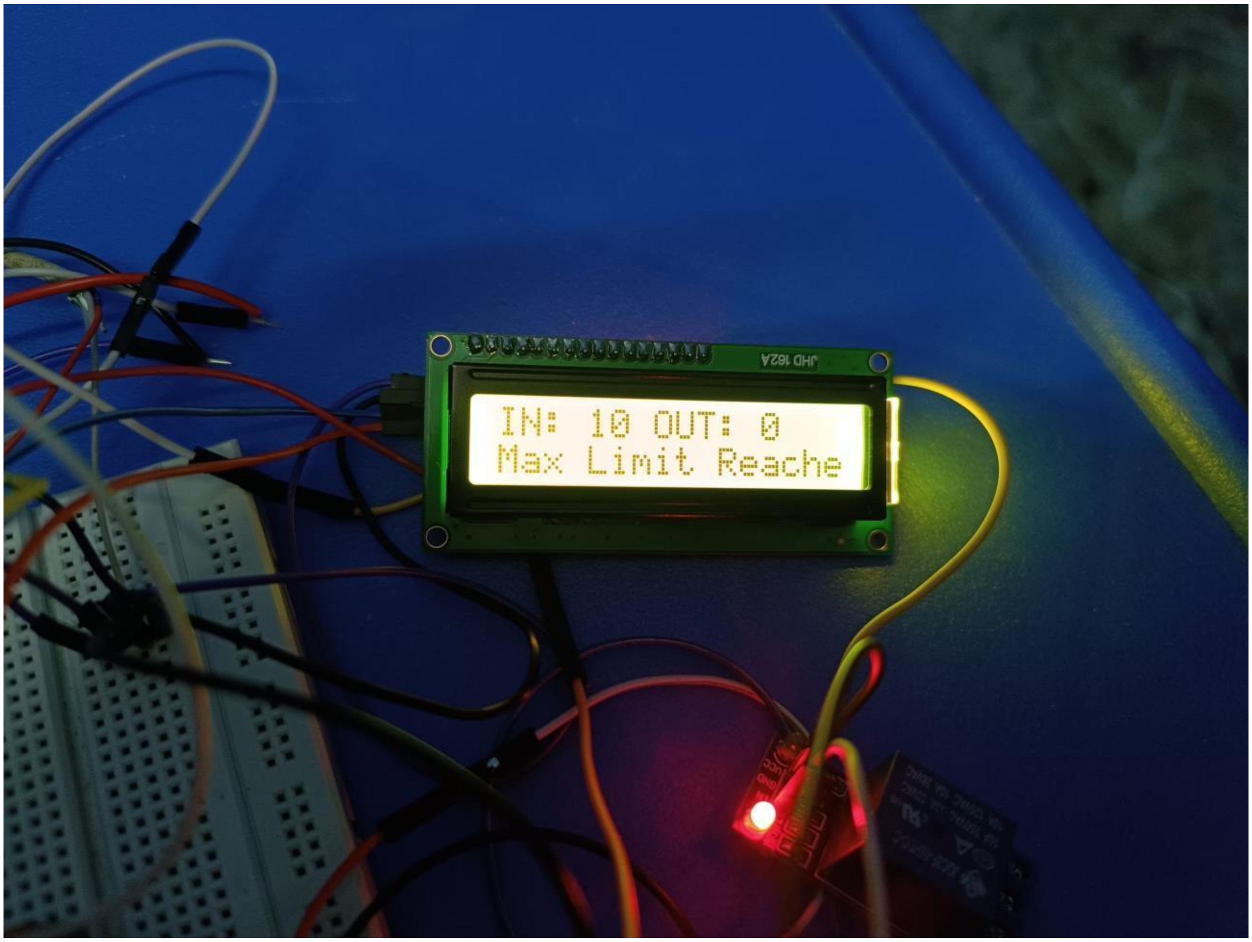
VIII .RESULTS AND CONCLUSION

The IoT-enabled Overload Monitor successfully provides real-time load monitoring, overload detection, customizable alerts, and capacity tracking, ensuring enhanced safety and efficient system management

The system proves to be an effective and adaptable solution for preventing overloads, optimizing resource usage, and offering real-time monitoring and control across various applications. Integration with IoT allows remote monitoring and control via a userfriendly interface Alert notifications, including visual and sound signals, enhance safety and proactive management.



(Fig-2 - Counter With Overload)



(Fig-3 - Counter With Overload – Working Sample)

IX . FUTURE SCOPE

Industrial Applications : Use for inventory management or production line monitoring.

Smart Home Systems : Monitor room occupancy and automate devices based on count.

Event Management : Manage crowd control and monitor venue capacity.

Traffic Control : Count vehicles/pedestrians for optimized traffic signals.

IoT Integration : Connect to the cloud for real-time data analysis and monitoring.

X .REFERENCES

Sharma, P., & Verma, R. (2022). Capacity Tracking and Monitoring Using IoT for Industrial Applications. International Journal of Electronics and Communication Engineering, 10(1), 89-96.

Gupta, A., & Jain, M. (2021). IoT-Based Alert System for Load Balancing and Monitoring. International Journal of Smart Systems, 8(4), 67-75 .