



GSM Based Smart Controller for Monitoring Overcurrent and Overvoltage

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KEYWORDS

ABSTRACT

The "GSM-Based Smart Controller for Monitoring Over current and Over voltage" is a reliable and intelligent system designed to ensure the safety and stability of electrical loads. Utilizing an Arduino micro controller as the central processing unit, the system integrates a current sensor to monitor real-time current levels and a voltage sensor to measure voltage levels. When over current or over voltage conditions are detected, an alert mechanism is triggered, and a detailed SMS notification is sent to the user via a GSM module and a GPS module is used to find the location.

To prevent damage and provide users with sufficient time to act, a grace period of 30 seconds is introduced during which the system continues operation, allowing critical data or processes to be secured. After this period, the system automatically shuts down the load to mitigate risks. Additional safety features include a buzzer alert to indicate anomalies and an LCD display to showcase real- time readings and system actions. This innovative design ensures enhanced monitoring and safety for electrical systems while providing user-friendly alerts and control.

1. INTRODUCTION

Electricity is an essential resource in modern society, powering industries, homes, and commercial establishments. However, electrical systems are often subjected to fluctuations in voltage and current, which can lead to severe damage to appliances, short circuits, fire hazards, and system failures.[1] Overcurrent occurs

when excessive current flows through an electrical circuit, leading to overheating, while overvoltage refers to a sudden increase in voltage beyond safe limits, which can damage sensitive electronic components. [2] To address these issues, the "GSM- Based Smart Controller for Monitoring Overcurrent and Overvoltage" project is designed as an intelligent monitoring and protection

system that ensures electrical safety by detecting and responding to abnormal current and voltage conditions in real time.

The system utilizes an Arduino microcontroller as its central processing unit, interfaced with current and voltage sensors to continuously monitor electrical parameters.[3] In the event of overcurrent or overvoltage, the system activates an alert mechanism, sending an immediate SMS notification via a GSM module to the user, ensuring quick awareness and response. To avoid sudden disruptions, a 30-second grace period is introduced, allowing users to take necessary actions before an automatic shutdown is triggered. The system also includes an LCD display to provide real-time readings of voltage and current levels, and a buzzer alert to signal abnormal conditions, making it a comprehensive safety solution for electrical systems.

This automated and user-friendly protection system is highly beneficial for both residential and industrial applications, ensuring that electrical loads operate within safe limits. By integrating GSM-based alerts, users can monitor and control their electrical infrastructure remotely, minimizing the risk of damage and reducing maintenance costs.[4] The system's real-time monitoring and automatic load shutdown features significantly enhance safety, making it a cost-effective and efficient solution for preventing electrical hazards. As energy management becomes a priority in smart homes and industries,

II. LITERATURE SURVEY

- **Over current Protection of Transmission Lines Using GSM and Arduino:** This study presents a micro controller- based relay system that monitors load current via a current transformer. If the current exceeds a set threshold, the system sends a tripping signal to the circuit breaker and notifies users through SMS.
- **Remote Micro controller - Based Monitoring of Substation and Control System Through GSM Modem:** This research focuses on automating substation monitoring by measuring parameters like voltage, current, frequency, and power factor. The system alerts operators to anomalies via SMS, enabling prompt responses to potential faults.
- **Over and Under Voltage Protection Using GSM Module:** The paper discusses a system that protects domestic appliances from voltage irregularities. Using

an ATmega32 microcontroller and SIM900A GSM module, the system monitors supply voltage and sends alerts if overvoltage or undervoltage conditions are detected.

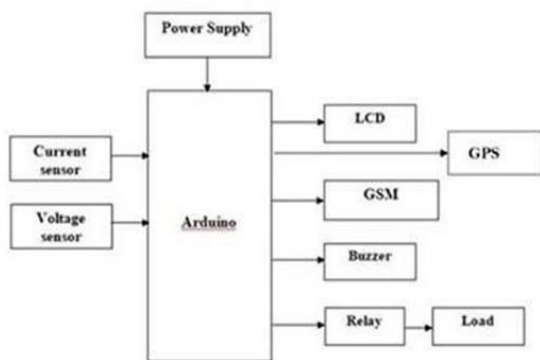
- **GSM-Based Distribution Transformer Monitoring System:** This work highlights the development of a real-time monitoring and diagnostic system for distribution transformers. It utilizes GSM technology to transmit data from remote substations, allowing for efficient fault detection and improved power availability.
- **Design and Implementation of a GSM-Based Monitoring System for a Distribution Transformer:** The study presents a system that continuously monitors transformer temperature, current, and voltage. Upon detecting anomalies, it sends alerts via GSM, facilitating timely maintenance actions.
- **Over/Under Voltage Tripping Circuit with GSM Alert Using Microcontroller:** This research introduces a system that protects distributed loads from voltage fluctuations. It employs a microcontroller to monitor voltage levels and utilizes a GSM module to send alerts during overvoltage or undervoltage events.
- **A GSM Module-Arduino-Relay Based Smart & Cost-Effective In-House Protection System:** The paper describes a system that safeguards household appliances against overvoltage, undervoltage, and overcurrent conditions. It integrates an Arduino-based controller with GSM communication to provide real-time monitoring and alerts.

III. PROPOSED METHOD

The proposed project aims to provide a comprehensive solution for monitoring and managing over current and over voltage conditions in electrical systems using a GSM- based smart controller.[6] At the core of the system, an Arduino micro controller processes data from current and voltage sensors to detect anomalies in real-time.[7] [8] When over current or over voltage conditions are identified, the system promptly sends SMS alerts to notify the user, enhancing remote monitoring and proactive responses. Additionally, the system integrates a grace period of 30 seconds before shutting down, enabling users to save critical data or address the issue, which is a significant improvement over traditional systems that lack such provisions.

To enhance user experience and operational transparency, the system includes an LCD to display all current activities and detected anomalies.[9] A buzzer provides immediate local alerts, further reinforcing safety measures.[10] This innovative approach not only mitigates risks associated with electrical faults but also offers an intelligent and user-friendly interface for system monitoring.[11] By incorporating features like automatic shutdown and remote notification, the proposed solution ensures enhanced safety, efficiency, and reliability for electrical systems, making it a highly practical choice for modern applications[12].[13] Advantages of proposed method are Remote monitoring and control, early fault detection, cost-effective, energy efficiency, reduces risk of equipment failure.

BlockDiagram:



IV RESULT

OVER CURRENT: Over current refers to a condition where the current flowing through a circuit or electrical system exceeds its rated or designed capacity. This can cause damage to equipment, overheating, and even lead to a fire.

When the current value is below 0.45 it's a normal current and if it exceeds the 0.45 value it is an Over current

OVER VOLTAGE: Over voltage on the other hand occurs when the voltage supplied to a circuit or electrical system exceeds its rated or designed capacity. This can also cause damage to equipment, insulation breakdown, and lead to a range of problems. When the voltage value is below 6 it is a normal voltage and if it exceeds the value 6 then it is an Over voltage.

GPS: GPS can be used to track the location of electrical assets, such as transformers, switch gear, or circuit breakers. GPS can be used to detect theft of electrical assets **Location-Based Alerts:** GPS can be used to send location-based alerts when an over

GSM Real-time Monitoring: GSM enables real-time monitoring of the system, allowing for quick response to over current and over voltage conditions SMS Alerts, GSM is used to send SMS alerts to users or control centers when an over current or over voltage condition is detected



Fig .1. Normal Current (on)



Fig. 2. Over Voltage



Fig.3. Over Current

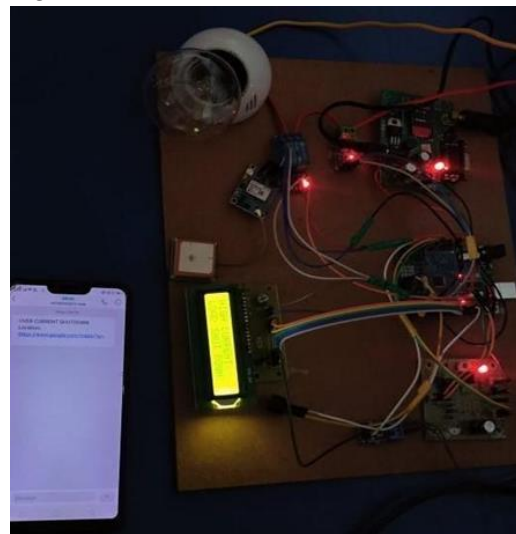


Fig.4. Shut down (Over current,Over voltage)

OVER CURRENT SHUTDOWN

Location:

<https://www.google.com/maps/?q=>

Fig.5. SMS alert

V. CONCLUSION

GSM-Based Smart Controller for Monitoring Overcurrent and Overvoltage with integrated GPS is an innovative and essential solution that ensures electrical safety and protection across various applications. By combining Arduino, current and voltage sensors, GSM and GPS modules, and an alert system, this project provides real-time monitoring and location-based tracking of electrical parameters. The system efficiently detects voltage and current abnormalities, triggering automated actions such as shutting down the load and sending SMS alerts—including precise location information—to users.

This proactive approach not only helps prevent equipment damage, fire hazards, and costly repairs but also enhances situational awareness by allowing users to pinpoint the exact location of the anomaly, making it especially valuable in distributed industrial or remote field applications. One of the key strengths of this project is its automation and remote accessibility. The GSM module enables instant notifications about power anomalies, while the GPS module adds layer of geolocation intelligence, empowering users to take immediate and informed corrective actions from any location.

Additionally, the inclusion of an LCD display and buzzer enhances user awareness by providing real-time visual and audio alerts. The implementation of a 30-second grace period before shutting down the system ensures that critical processes can be safely managed before power disconnection. Overall, this smart controller is a highly reliable and comprehensive solution suitable for industrial, commercial, and residential environments, offering advanced monitoring, protection, and location tracking capabilities.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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