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IoT-Based Remote Electrical Current Measurement System

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Abstract

This project presents a Remote Current Measuring Device designed to measure electrical current and transmit the data to a remote location for real-time monitoring. A non-contact current sensor is used to ensure safety and reliable operation. The sensed signal is processed by a microcontroller, converted into digital form, and transmitted wirelessly to a display or receiver unit. The system reduces manual inspection, improves safety, and provides accurate current measurement.

Keywords: Remote Current Measurement; Current Sensor; Microcontrolle; Wireless Communication; Real-Time Monitoring; Electrical Safety; Power Monitoring

1. Introduction

The rapid growth of electrical systems in industrial, commercial, and residential sectors has increased the need for accurate and safe current measurement. Electrical current is an important parameter for monitoring system performance and detecting faults. Traditional measurement methods require direct contact with live conductors, which can be unsafe and unsuitable for high-voltage or remote locations.

The **Remote Current Measuring Device** provides a safe and efficient solution by using a non-contact current sensor to measure load current. The sensed signal is processed by a microcontroller, converted into digital form, and transmitted wirelessly for real-time monitoring. This eliminates the need for manual inspection and improves operational safety.

The system offers advantages such as reduced maintenance effort, improved reliability, and enhanced monitoring efficiency. Its compact design, low cost, and low power consumption make it suitable for industrial monitoring, power distribution systems, and educational applications

Table 1: Overview of the Remote Current Measuring Device

Aspect	Description
Purpose	To measure electrical current safely and accurately from a remote location
Measurement Method	Non-contact current sensing to avoid direct connection with live conductors
Core Components	Current sensor, microcontroller, and wireless communication module
Key Features	Real-time monitoring, remote data transmission, high safety
Advantages	Improved operator safety, reduced maintenance, minimized measurement errors
Applications	Industrial machinery monitoring, power distribution systems, hazardous environments
System Characteristics	Compact design, low cost, low power consumption

System Architecture and Methodology

The system architecture of the Remote Current Measuring Device is designed to ensure accurate current measurement, safe operation, and reliable remote data transmission. The overall system is divided into three main units: the current sensing unit, the processing unit, and the communication and display unit. The current sensing unit consists of a non-contact current sensor that measures the load current flowing through the electrical conductor. This sensor provides an analog output proportional to the measured current, allowing safe measurement without direct electrical connection to the high-voltage circuit.

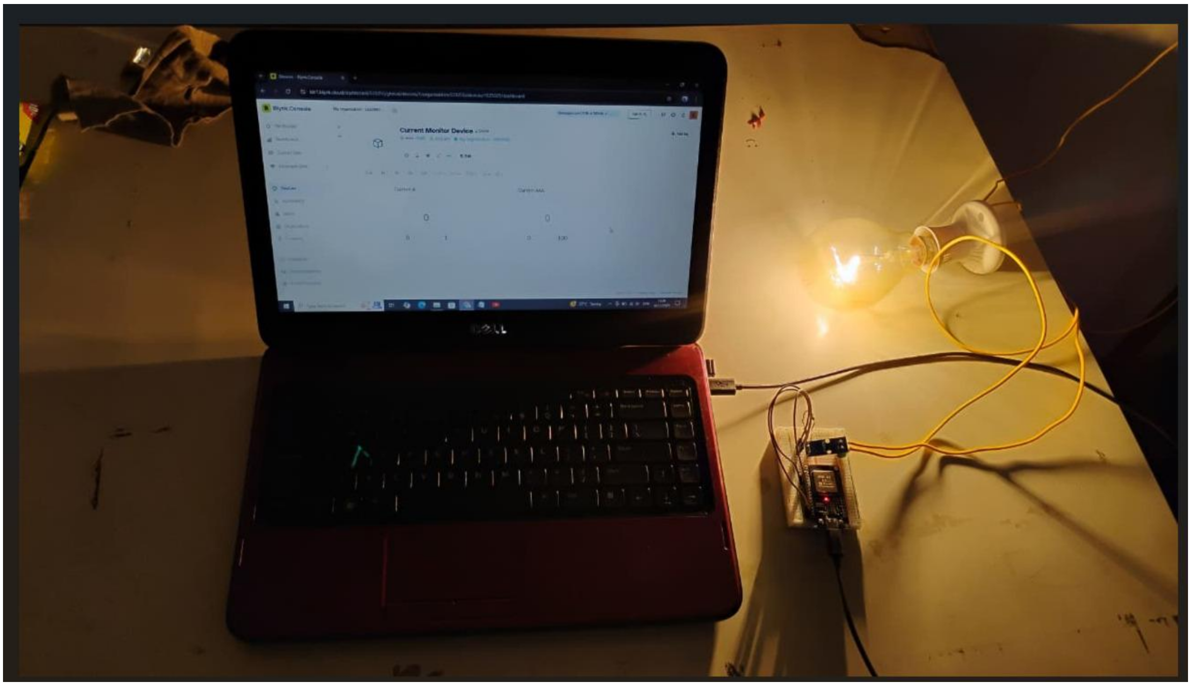
The processing unit is built around a microcontroller, which receives the analog signal from the current sensor and converts it into a digital value using an internal analog-to-digital converter. The microcontroller performs signal conditioning, calibration, and computation to determine the actual current value with improved accuracy. Once processed, the current data is formatted and prepared for transmission. In the communication stage, a wireless module is used to transmit the measured current values to a remote receiver or display system. The remote unit receives the data and displays it in real time, enabling continuous monitoring without physical presence at the measurement location. This methodology ensures enhanced safety, reduced manual intervention, and efficient monitoring, making the system suitable for industrial, power distribution, and remote monitoring applications.

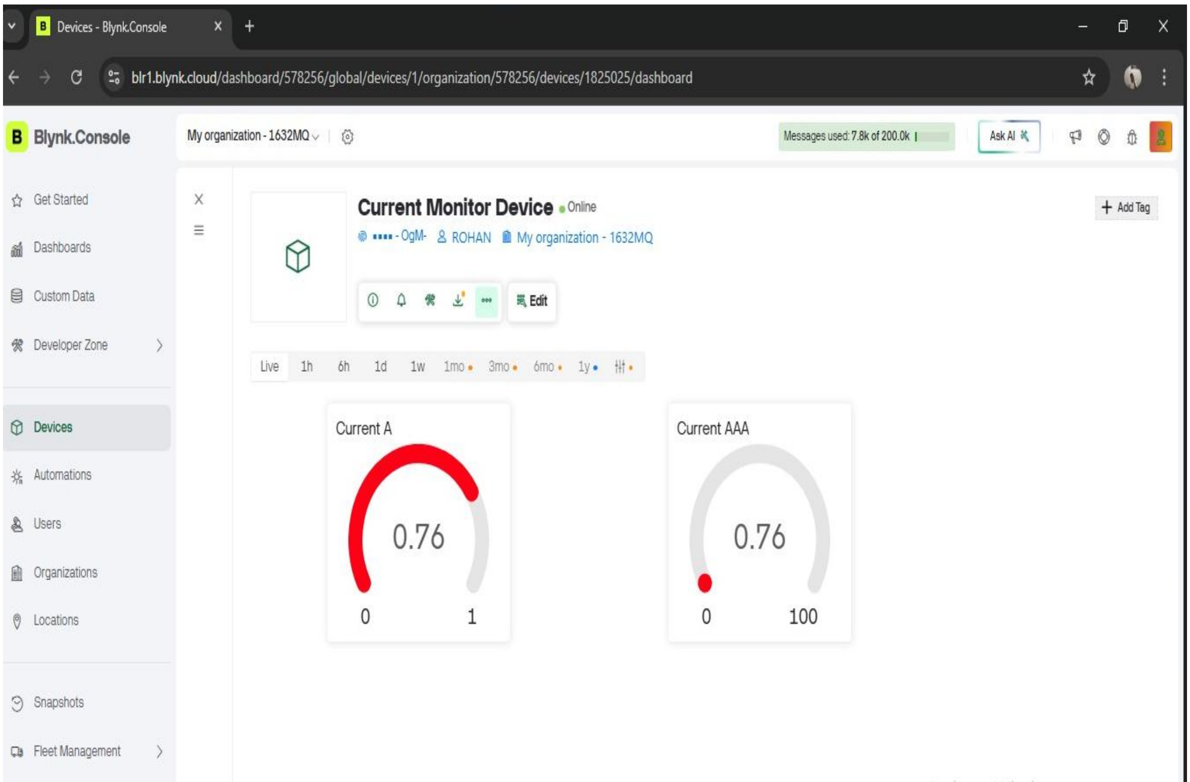
1.1. Hardware Implementation

The proposed Remote Current Measuring Device uses an ESP32 WROOM microcontroller integrated with an ACS712 Hall-effect current sensor. The ESP32 acts as the main processing unit, acquiring current data from the sensor, processing it, and transmitting the information wirelessly using its built-in Wi-Fi feature. A bulb load is connected to represent a practical current-drawing device during testing.

The ACS712 sensor measures AC or DC current without direct electrical contact and produces an analog voltage proportional to the flowing current. This output is connected to an ADC pin of the ESP32. Both the ESP32 and the sensor operate on a 3.3 V power supply. The circuit is assembled on a solderless breadboard using jumper wires, allowing easy modification and safe prototyping.

When current flows through the load, it passes through the sensing terminals of the ACS712, generating a voltage signal. The ESP32 converts this signal into digital form, calculates the current value, and sends the data to a remote monitoring platform. The system ensures safety through electrical isolation, low-voltage operation, and secure connections, making it reliable and cost-effective for remote current monitoring applications.





2. Conclusion

The Remote Current Measuring Device developed in this project successfully demonstrates an efficient and reliable method for monitoring electrical current remotely using an ESP32 WROOM microcontroller and an ACS712 current sensor. The system accurately measures load current in real time and transmits the data wirelessly, eliminating the need for manual measurement and on-site monitoring. The use of a low-cost, compact, and easily configurable hardware setup makes the device suitable for residential, industrial, and educational applications. Overall, the project proves that IoT-based current measurement can enhance safety, improve monitoring efficiency, and provide a scalable solution for modern electrical systems.

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Declaration of Conflicting Interests

I hereby declare that there are no conflicts of interest, financial or otherwise, related to the work presented in the project entitled "Remote Current Measuring Device." This project has been carried out solely for academic and educational purposes, and no part of the work has been influenced by any commercial, personal, or institutional interests.

All sources of information, technical references, and materials used in this project have been properly acknowledged. The results and conclusions presented are original and based entirely on the work carried out during the course of the project.

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References

1. Espressif Systems, ESP32 Series Datasheet, Espressif Systems Inc., 2023.
2. Allegro Microsystems, ACS712 Hall Effect Linear Current Sensor IC Datasheet, Allegro MicroSystems LLC.
3. Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, The ESP32 Microcontroller and Embedded Systems, Pearson Education.
4. R. S. Sedha, A Textbook of Applied Electronics, S. Chand & Company Ltd.
5. A. K. Sawhney and P. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co.
6. R. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, Pearson Education.
7. IEEE Standards Association, IEEE Standard for Current Measurement Techniques, IEEE Publications.
8. N. Mohan, T. M. Undeland, and W. P. Robbins, Power Electronics: Converters, Applications, and Design, John Wiley & Sons.
9. Texas Instruments, Fundamentals of Hall Effect Current Sensing, Application Report.
10. Online Technical Documentation and Tutorials related to ESP32 and ACS712 current modules.