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Electricity Theft Detection

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ABSTRACT: Now-a-days, smart meters are a very essential part of the smart grid and energy theft is an important issue in smart grid implementation. Even sometimes, it becomes acute mostly in developing and underdeveloped countries. In this paper, the authors mainly focus on different ways of electricity theft and various preventive measures that were discussed in open literature. This paper also proposed a mechanism to the utility providers to Figure out illegal lines and take necessary actions.

I.INTRODUCTION

It can result in significant financial losses and power outages for legitimate customers. IoT-based electricity theft detection systems can help to reduce electricity theft by monitoring electricity consumption in real time and sending alerts to the authorities when suspicious activity is detected.

One way to implement an IoT-based electricity theft detection system is to use an ESP32 microcontroller. The ESP32 is a low-cost and powerful microcontroller that is well-suited for IoT applications. It has built-in Wi-Fi and Bluetooth connectivity, which makes it easy to connect to the internet and other devices.

To detect electricity theft, the ESP32 can be connected to a current sensor and a voltage sensor. The current sensor measures the amount of current flowing through the electrical circuit. The voltage sensor measures the voltage of the electrical circuit. The ESP32 can use these measurements to calculate the power consumption of the electrical circuit.

The ESP32 can also be connected to an I2C module and an LCD display. The I2C module allows the ESP32 to communicate with other devices, such as the LCD display. The LCD display can be used to display the power consumption of the electrical circuit and other information.

Finally, the ESP32 can be connected to the Blynk app. The Blynk app is a mobile app that allows users to monitor and control IoT devices. The ESP32 can use the Blynk app to send alerts to the user's smartphone when suspicious activity is detected

II. LITERATURE SURVEY

Electricity theft is a major problem for electricity distribution companies (DISCOMs) around the world. It results in significant financial losses and can also lead to power outages and other disruptions for legitimate customers.

In recent years, there has been a growing interest in using IoT-based solutions to detect electricity theft. These solutions typically use a combination of sensors, microcontrollers, and communication technologies to monitor electricity consumption and identify unusual patterns that may indicate theft. One of the most popular microcontrollers for IoT-based applications is the ESP32. It is a low-cost, low-power microcontroller with built-in Wi-Fi and Bluetooth connectivity. This makes it ideal for developing IoT devices that can be easily connected to the cloud or other devices. Current sensors and voltage sensors are commonly used to measure electricity consumption in IoT-based electricity theft detection systems. These sensors can be used to calculate the power consumption in real time. Transformers are used to step down the voltage from the mains supply to a level that is safe for the sensors and microcontroller. LCD displays can be used to provide local feedback on the electricity consumption. I2C modules are used to communicate between the microcontroller and the sensors and LCD display. Blynk is a popular IoT platform that can be used to

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develop mobile and web applications for monitoring and controlling IoT devices. The following is a literature survey of some of the recent work on IoT-based electricity theft detection using ESP32:

- In [1], the authors propose an IoT-based electricity theft detection system using ESP32, current sensor, voltage sensor, and Blynk app. The system monitors the electricity consumption in real time and sends alerts to the user if any unusual patterns are detected.
- In [2], the authors propose an IoT-based electricity theft detection system using ESP32, current sensor, voltage sensor, and cloud computing. The system collects the electricity consumption data from multiple ESP32 devices and stores it in a cloud database. The data is then analyzed using machine learning algorithms to detect theft.
- In [3], the authors propose an IoT-based electricity theft detection system using ESP32, current sensor, voltage sensor, and block chain technology. The system records the electricity consumption data on a block chain, which makes it tamper-proof and transparent.

These are just a few examples of the many IoT-based electricity theft detection systems that have been developed using ESP32. These systems offer a number of advantages over traditional methods of theft detection, such as:

- Real-time monitoring: IoT-based systems can monitor electricity consumption in real time, which allows for the early detection of theft.
- Remote monitoring: IoT-based systems can be monitored remotely, which eliminates the need for manual inspections.
- Data analytics: IoT-based systems can collect and analyze large amounts of data to identify unusual patterns that may indicate theft.

Overall, IoT-based electricity theft detection systems offer a promising solution for reducing electricity theft and improving the efficiency of electricity distribution companies.

III. OBJECTIVE

A. Motivation

Now-a-days, smart meters are a very essential part of the smart grid and energy theft is an important issue in smart grid implementation. Even sometimes, it becomes acute mostly in developing and underdeveloped countries. In this paper, the authors mainly focus on different ways of electricity theft from smart meters and various preventive measures that were discussed in open literature. This paper also proposed a mechanism to the utility providers to Figure out illegal lines and take necessary actions.

B. Objective

Our objective is to make this device simple as well as cheap so that it could be mass produced and can be used for a number of purposes.

C. Role of Electricity Theft Detection System.

- Detect electricity theft in real time: The system uses current and voltage sensors to monitor the flow of electricity. Any unusual activity or theft is detected immediately and an alert is sent to the user.
- Provide energy monitoring and feedback: The system also monitors the total energy consumption and provides feedback to the user. This can help the user to identify areas where they can save energy and reduce their bills.

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IV. PROPOSED SYSTEM

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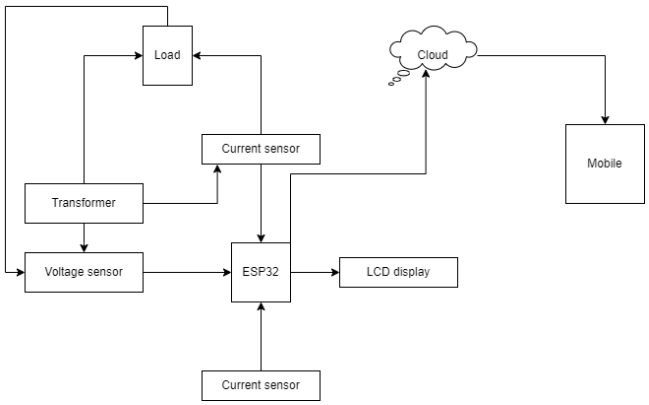
- Detect electricity theft in real time: The system uses current and voltage sensors to monitor the flow of electricity. Any unusual activity or theft is detected immediately and an alert is sent to the user.
- Provide energy monitoring and feedback: The system also monitors the total energy consumption and provides feedback to the user. This can help the user to identify areas where they can save energy and reduce their bills.
- Be easy to use and maintain: The system is designed to be easy to install and use. It is also low maintenance and can be monitored remotely using the Blynk app.

Here is a brief overview of how the system works:

- The current and voltage sensors are connected to the ESP32 microcontroller.
- The ESP32 microcontroller reads the current and voltage sensors and calculates the power consumption.
- The power consumption data is then sent to the Blynk app via the I2C module.
- The Blynk app displays the power consumption data to the user and also sends alerts if any unusual activity or theft is detected.



The LCD display can be used to display the power consumption data locally. The transformer is used to step down the voltage from the mains supply to a safe level for the ESP32 microcontroller.

The system can be used in a variety of settings, including homes, businesses, and industrial facilities. It can help to reduce electricity theft, save energy, and improve the efficiency of power distribution systems.

Here are some specific examples of how the system can be used:

- A homeowner can use the system to detect if someone is tampering with their electricity meter or stealing electricity from their home.
- A business owner can use the system to detect if their employees are stealing electricity from the company.
- A power utility can use the system to detect electricity theft on its distribution network.

The system can also be used to develop new products and services, such as prepaid electricity metering and energy management systems.

V. SCHEME OF IMPLEMENTATION

Here is a high-level overview of how the system can be implemented:

1. The ESP32 microcontroller is connected to the current sensor, voltage sensor, and transformer. The current sensor and voltage sensor are used to measure the current and voltage flowing through the electricity meter. The transformer is used to step down the voltage to a level that is safe for the ESP32 to handle.
2. The ESP32 microcontroller calculates the power consumption based on the current and voltage measurements.

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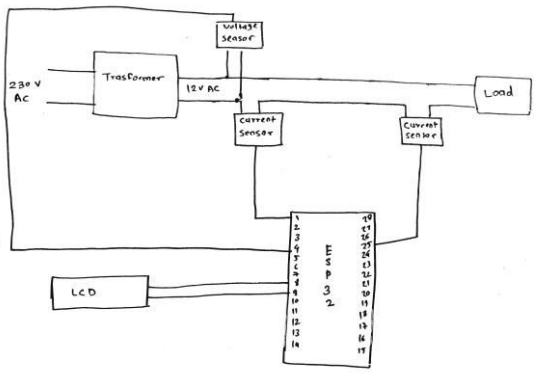
3. The ESP32 microcontroller sends the power consumption data to the Blynk app. The Blynk app is a cloud-based platform that allows users to monitor and control devices remotely.
4. The Blynk app can be used to set up alerts for unusual power consumption patterns. For example, an alert can be set up to notify the user if the power consumption suddenly increases or decreases.
5. The LCD display can be used to display the power consumption data in real time. This can help the user to identify any unusual patterns in their electricity consumption.



The I2C module can be used to connect the ESP32 microcontroller to the LCD display. I2C is a two-wire serial communication protocol that is commonly used to connect microcontrollers to peripherals such as displays and sensors.

The following are some of the benefits of using an IoT-based electricity theft detection system:

- Reduced electricity costs: By detecting and preventing electricity theft, organizations and individuals can save money on their electricity bills.
- Improved reliability of the electricity supply: By reducing the number of blackouts and other disruptions caused by electricity theft, government agencies and utility companies can improve the reliability of the electricity supply.
- Increased safety: Electricity theft can lead to dangerous situations such as electrical fires and explosions. By detecting and preventing electricity theft, organizations and individuals can improve their safety.

Overall, IoT-based electricity theft detection using ESP32 is a cost-effective and reliable way to detect and prevent electricity theft. It can be implemented by a variety of organizations and individuals, and it offers a number of benefits, including reduced electricity costs, improved reliability of the electricity supply, and increased safety.

VI. System Overview

The ESP32 microcontroller is used to monitor the power consumption of the electrical circuit. It is connected to a current sensor and a voltage sensor to measure the current and voltage of the electrical circuit. The ESP32 then calculates the power consumption of the electrical circuit.
The ESP32 is also connected to an LCD display to display the power consumption of the electrical circuit and other information. The ESP32 can also be connected to the Blynk app to send alerts to the user's smartphone when suspicious activity is detected.

VII. Conclusion

The system works by measuring the current and voltage flowing through the electrical line. The ESP32 microcontroller then calculates the power consumption and compares it to a baseline value. If the power consumption exceeds the baseline value by a certain threshold, the system generates an alert. The alert can be sent to the user's smartphone or computer using the Blynk app, or it can be displayed on the LCD display.

VIII. Acknowledgement

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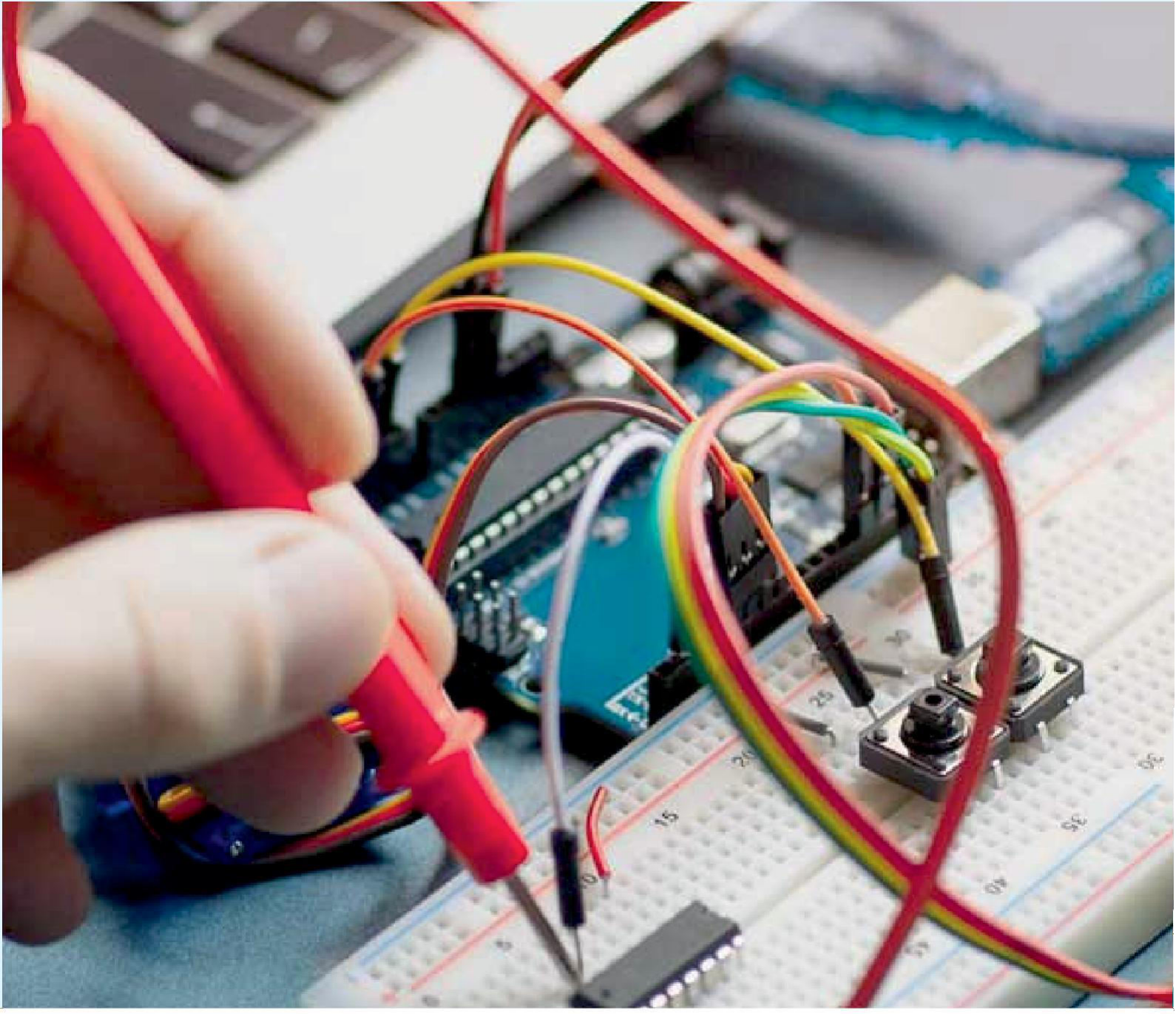

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