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Smart IoT-based Electricity Power Theft Detection System

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Abstract: *This project aims to develop a lot- based power theft detection system to identify unauthorized energy usage. Using smart energy meters, sensors, and a centralized control unit, the system monitors energy flow and compares consumption with billed usage. Discrepancies trigger real-time alerts, enabling authorities to take quick action. Smart meters installed at each lot send consumption data to the control unit, where an algorithm detects deviations. This helps reduce revenue losses, improve power quality and efficiency, and ensure reliable electricity distribution.*

Keywords: power theft detection system

I. INTRODUCTION

Electricity theft is a global challenge, causing significant financial losses to utility companies and disrupting power distribution. Traditional methods to detect power theft are inefficient and often fail to provide timely results. With the advancement of technology, IoT (Internet of Things) offers a robust solution to detect electricity theft in real-time. This paper focuses on designing a smart IoT-based electricity theft detection system to prevent unauthorized usage, ensuring efficient power distribution

II. SYSTEM COMPONENTS

The proposed system consists of the following key components:

Smart Meters:

Installed at consumer premises and distribution transformers. Measure voltage, current, and power usage accurately.

IoT Sensors:

Deployed along distribution lines to monitor real- time parameters. Detect anomalies such as unauthorized tapping or bypassing.

Communication Module:

Uses GSM, Wi-Fi, or Zigbee to transmit data from meters and sensors to a central server.

Central Server:

Analyzes data from smart meters and IoT sensors. Detects discrepancies between power supplied and consumed.

Mobile Application:

Sends alerts to utility authorities when theft is detected.

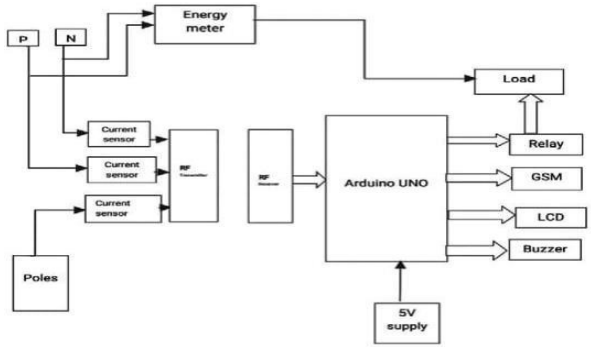

Figure 1- circuit block diagram

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III. SMART METER

A smart meter is usually an electronic device that records consumption of electrical energy in intervals of an hour less and communicates that information at least daily back to the utility for monitoring and billing. Smart meters enable two-way communication between the meter and the central system.

Prepaid Smart Meters are the new generation of energy meters that are used to record electricity consumption in real time. As they are connected to the internet, users and utilities can easily track and monitor electricity usage and get accurate bills. Their remote meter reading capabilities completely eliminate the need for manual inspection, making them highly efficient and convenient. Consumers can also receive alerts of insufficient/ low balance or for abnormal usage to best optimize their consumption on a user- friendly web portal or mobile app.

Figure 2- Smart meter

Benefits of Prepaid Smart Meters

Energy Efficient:-By keeping regular tabs on how much energy you're consuming; you will be encouraged to adjust your electricity usage and save money as well as resources.

Operational Efficiency:-The existing manual system to collect revenue for power usage is not only inefficient, it also causes huge losses to power distribution companies. By being highly accurate, prepaid smart meters would significantly reduce these losses and help utilities in improving the power supply.

Green Energy:-By taking a step closer towards a smart energy system, prepaid smart meters reduce our dependence on fossil fuels, thereby reducing our country's carbon footprint.

IV. SMART SENSOR

Smart grid sensors enable the remote monitoring of equipment such as transformer and power lines and the demand-side management of resources on an energy smart grid.

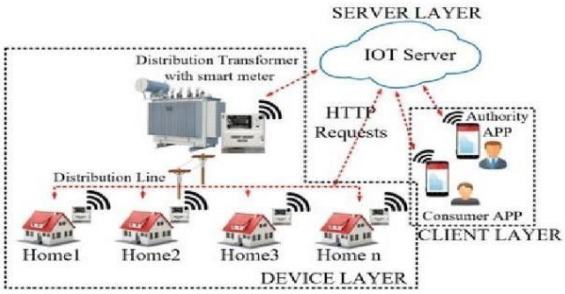

Figure 3- Smart Sensor

Working Mechanism

The system follows a streamlined process for theft detection:

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Data Collection

Smart meters and IoT sensors continuously capture voltage, current, and power flow metrics.

Data Transmission

The recorded data is transmitted to a central server via the communication module.

Data Analysis

Sophisticated algorithms evaluate the power supplied versus consumed, flagging anomalies indicative of theft

Alert Generation

Upon identifying theft, the system notifies authorities through alerts on the mobile application, enabling swift intervention.

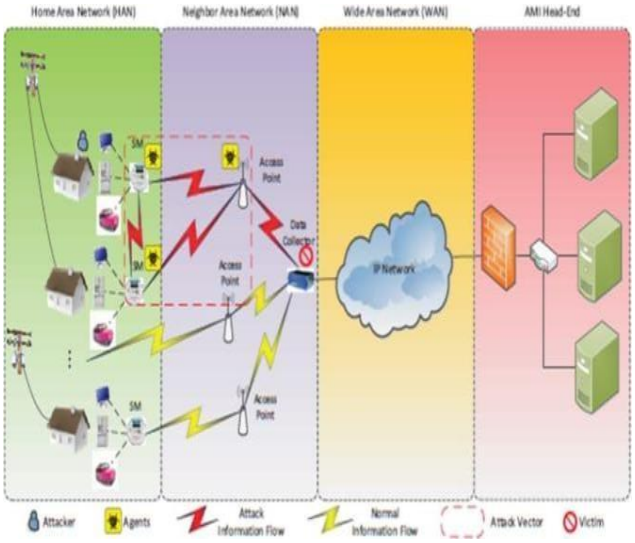

Figure 4

Features and Advantages

Features:

- Real-time monitoring of electricity usage.
- Automatic theft detection with minimal human intervention.
- Scalable and compatible with existing power systems.

Advantages:

- Reduces financial losses for utility companies.
- Improves power distribution efficiency.
- Supports smart grid technology for enhanced energy management.

V. CHALLENGES AND FUTURE SCOPE

Challenges:

- **High Initial Cost:** Deploying smart meters and IoT sensors requires significant investment.
- **Integration Issues:** Adapting IoT systems to existing power grids is complex.
- **Data Security:** IoT systems are vulnerable to cyberattacks, requiring robust security measures.

Future Scope:

- Combining renewable energy sources
- Secure data storage using block chain technology

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- Using edge computing to analyze data in real tim
- Predictive maintenance driven by AI

VI. CONCLUSION

In conclusion, a Smart IoT-based Electricity Theft Detection System helps detect and stop electricity Theft quickly and efficiently, making power usage Fairer and more secure.

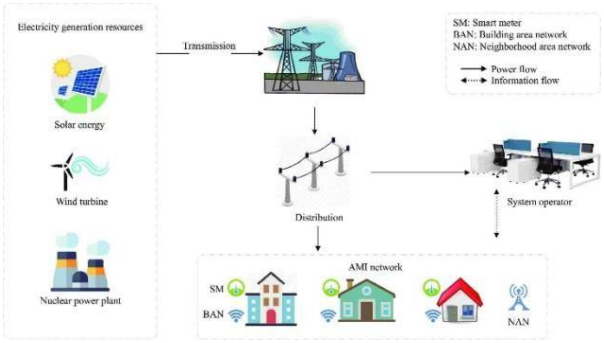

Figure 5

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