IOT BASED SMART ENERGY METER WITH THEFT DETECTION

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Abstract - Innovative solutions for various industries have been developed as a result of the proliferation of Internet of Things (IoT) devices. IoT has the potential to completely change how electricity is produced, transmitted, and used in the electricity sector. The use of IoT for detecting and preventing electricity theft is one such application. Meter tampering, also known as electricity theft, is a significant problem that affects the revenue and profitability of electricity boards. It entails circumventing meters in an unlawful manner in order to use electricity without paying for it. This not only costs government's money, but also puts consumers and the electricity grid in danger of injury or damages. In this project, we propose creating an IoT-based system to track down and stop electricity theft. Smart meters with sensors and communication capabilities make up the system, along with a central server for data processing and analysis. Electricity consumption patterns are continuously monitored by smart meters, which also send data to a central cloud-based database. The database values are utilized by the authorities when it discovers anomalies or suspicious activity upon close monitoring of the data stored in real time. The proposed system could significantly lower the number of instances of electricity theft, increasing revenue and profitability for the electricity providers while enhancing consumer safety. By offering real-time information on electricity consumption and billing, it can also assist utilities in streamlining their operations and enhancing customer service.

Key Words: Energy meter, IOT, Microcontroller, GSM Module, LCD display, WI-FI Module

I. INTRODUCTION

Internet of Things is a term used for a system where devices are given IP addresses, and everybody makes the device recognizable on the internet via that IP address. The web, which started with the internet of computers, is developing. Researchers have predicted a volatile increase in the number of sensors, devices, or "things" connected to the internet. The product network is known as the Internet of Things (IoT) . IoT has the propensity to alter people's lifestyles. People prefer to monitor things through automatic systems in today's world rather than through any manual system together with the circuitry driving the system, which are the main elements of the IoT-based electricity theft detection system introduced in this project.

Even though exporting electric power is rarely profitable, most of it is produced for domestic use. Even though only a few nations profit from the export of electric power, the majority of it is used for domestic consumption in developing nations. Most developing countries have suffered undesirable economic consequences to meet the demands of electricity for real estate and industrialization due to electricity theft. According to the World Bank's development indicator collection, the percentage of distribution and losses due to transmission in Ghana was 23% in 2014, gathered from officially recognized sources. Reducing transmission and distribution losses is the greatest challenge to power utility authorities. We can categorize the losses into technical (TL) as well as non-technical (NTL) . Technical losses are in-built into the system which is reduceable to an appreciable level; the remaining is due to power dissipated in equipment and conductions used for the distribution and transmission lines NTL happens due to inaccuracy of metering, stealing, or theft of electricity, as well as energy consumed but unrecorded by the energy meter. Electricity theft is the energy consumed by a customer that is unaccounted for or not measured by the energy meter. Theft of electricity happens due to meter tampering, meter bypassing, and service lines tapping into the customers' premises.

II. PROBLEM STATEMENT

Electricity is a crucial resource for modern society, yet inefficiencies, theft, and lack of real-time monitoring lead to significant losses in power distribution. Traditional energy meters are manual, prone to human errors, and incapable of real-time tracking, making it difficult for consumers and utility providers to manage power consumption effectively. Additionally, energy theft, which includes bypassing meters, illegal connections, and meter tampering, remains a significant issue, leading to financial losses and power instability. One of the primary challenges is the lack of transparency in energy consumption. Conventional meters require manual reading by field personnel, which is time-consuming, inefficient, and susceptible to manipulation. Inaccurate readings can result in discrepancies in billing, leading to disputes between consumers and electricity providers. Furthermore, delays in detecting power theft or abnormal consumption patterns contribute to increased losses, affecting the overall efficiency of the power grid. Another major concern is the inability of existing meters to provide real-time monitoring and control. Consumers have limited visibility into their energy usage, making it difficult to adopt energy-efficient practices. Utility companies also struggle with identifying faults, overloading, or unauthorized usage in a timely manner, leading to frequent power outages and financial losses

III. PROPOSED SYSTEM AND IT'S IMPLEMENTATION

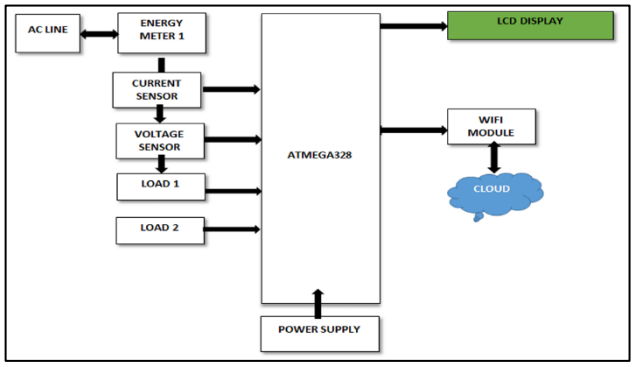

Fig-1Block-diagram

The AC power supply line is affixed with the current sensors and the voltage sensors, which passes through the power meter fixed. Each set of sensors and the power meter are treated as a node here. The single node represents an individual point of power supply which may be an individual unit of home or the point where theft occurs. The current sensors start sensing power usage in the nodes whenever a load is operational. The various readings noted by the sensors in the presence of the operational loads are then passed on to the microcontroller, which gathers the information regarding power consumption in real-time. The gathered information is then processed in user understandable formats and they are displayed up in the LCD display after which the microcontroller checks for anomalies in the power consumption and the alert for power theft is given.

IV. Hardware Requirement

ENERGY METER

A.C. Single Phase, 2 Wire Solid State (Static) Fully Electronic Energy Meter, Accuracy Class 1.0 &Current Rating 5-30 Amp. with Backlit LCD Display for 240 Volt System fitted with Pilfer Proof Meter Box. This specification covers design, engineering, manufacture, testing, inspection & supply of A.C. Single phase, two wire solid state (static) fully electronic energy meters of accuracy class 1.0 & current rating 5-30 A, with backlit LCD display for 240 Volt systems as per requirement in this specification and pilfer proof meter box (PPMB) made of engineering plastic, FR grade with self-extinguishing property suitable for single phase mete.The meter should be capable of recording & displaying energy in KWH & demand in KW for single phase two wire A.C. loads respectively for power factor range of Zero lag – unity – Zero lead. Meters should have facility/ capability of recording tamper information.

GSM Module

The GSM (Global System for Mobile Communication) module is a specialized electronic device used for communication in a wide range of applications. It enables electronic devices such as microcontrollers, computers, and embedded systems to connect to the GSM mobile network and send or receive data such as SMS (Short Message Service), calls, and internet packets. It plays a vital role in IoT (Internet of Things) systems and is often used in security, energy monitoring, automation, and GPS tracking projects..

ARDUINO UNO MICROCONTROLLER

In recent years, microcontrollers have become essential components in modern electronics and automation. Arduino Uno, being one of the most popular development boards, provides a user-friendly platform for students, hobbyists, and engineers to develop interactive and functional systems. The board is designed around the ATmega328P microcontroller and can be programmed using the Arduino IDE. This paper aims to provide a comprehensive understanding of the Arduino Uno microcontroller board, including its hardware features, programming environment, and applications. The Arduino Uno board features 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, USB connection, power jack, and ICSP header. The ATmega328P microcontroller at its core operates at 5V and provides 32 KB of flash memory, 2 KB SRAM, and 1 KB EEPROM.

PROGRAMMING LANGUAGES

As an IOT base project we using program of language C & C++ Arduino code using the **Arduino IDE**.

V. CONCLUSION

A remote cloud-based Electricity Theft Detection and monitoring system has been designed and developed with proper integration of both the hardware and the software. Without any human interface, this system provides an effective and easy way to detect electrical theft. This main feature of theft detection is done seamlessly using the integrated cloud system, which is able to detect the theft of electricity that is being drawn from the main AC line and also maintain the statistical data of that theft power. This system also helps to monitor the usage patterns of authorized power consumers over a period of time. These recorded data can be further used to study the power consumption under various sub-branches of power supply and would enable the electricity providers on the power grid upgrades and even help them to look for failure on the devices used for power transmission. The project as a whole helps to eradicate theft to a larger amount and lower the financial losses of the electricity providers, thus helping them in manifold ways.

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