Detection of Energy Theft and Fault in Transmission Lines

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Abstract. A power theft detection and protection system based on NodeMcu is designed in this study. The administration of the electric power distribution system has become more sophisticated as the demand of electric power for domestic, commercial, and industrial loads has increased. A relay is used as switching gear to isolate a power line from power theft. All device operations are controlled by NodeMcu. This system would offer a simple approach to identify and prevent electrical power theft without the need for human intervention, increase the profit margin of the power utility business and prevent overload faults. Electricity theft detection has also become possible to this system, which sends a message to a server every time a person passes by the meter. In addition to paying, this system detects and protects against power theft.

Keywords: Microcontroller (MCU), Analog to Digital Converter (ADC), RS232, Wi-Fi Module.

1. Introduction

Every year, electrical providers lose a significant amount of money owing to consumer fraud. Electrical fraud is described as the unauthorized or dishonest use of electricity equipment or services in order to avoid paying a bill. It’s difficult to tell who's being honest and who's being deceitful [1]-[6]. The impacts are loss in generation and network side as well as overall network performance, is investigated by electric utility companies. India's power sector has a total installed capacity of 329.23 Giga Watts, which comprises both renewable and non-renewable energy origin. In India,the per capita usage of electricity was 1,122 kWh. The Internet of Things (IoT) has lately gained popularity as a termto describe a global network of interconnected physical objects [7]-[12].

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2. Literature survey

The literature review outlines numerous approaches for detecting and controlling power theft.

Hybrid Grid with using Anti-Theft Alert occur in Fault Detection

Energy theft to other non-technical losses is expected to cost utilities billions of dollars per year. Utility companies are using a number of technologies utilized in modern grids to discover possible faults in the line in order to reduce relaxed power house braking meter manipulation. The main concept to determine the energy production, leading network, recovery energy, secure system, and to conclude the electrical power and maintain the main sources of energy as like Advanced of Hybrid Grid can be applying in the real time operation as they using the radio frequency identification.

Protect wireless communication by using automation grid

As utilities attempt to establish a system that is optimized for optimal power distribution, making the electric grid smarter is becoming a more important problem for them. Hardware should the key impetus, several components like SCADA system to operate transmission-level. There is no one technology that can suit all of a system manager's demands, especially when it comes to SCADA systems to complicated in employed in the like system.

3. Existing system

Traditional system

Detect energy theft and faults in remote transmission lines and report them to the Electricity Board. Using a wirelessmedia such as ZigBee that monitor several metrics such as voltage and current at the same time. In this system, the meter reading and monitoring is implemented for some street loads. The traditional system remotes transmission line immediately; theft information and it informs to the concern boards respectively. It particularly monitors the multiple characteristics like voltage, current simultaneously and transfer the data through the wireless medium. The methods that have been in those days are for detecting and preventing power theft are ineffective and insufficient, resulting in heavy revenue loss as well as damage of public property. The major cause of the power theft that significant amount of large power shortage. The power supply cannot be disconnected automatically. This method does not provide the facilities to the supplier side and can be used in the consumer end. It is difficult to pin point the exact location of the power theft, because the power line current and voltage measurement have not been attained in the satisfactory mannerto optimize it. The block diagram of the existing system and the receiver section, shown in Fig. 1 & Fig. 2.

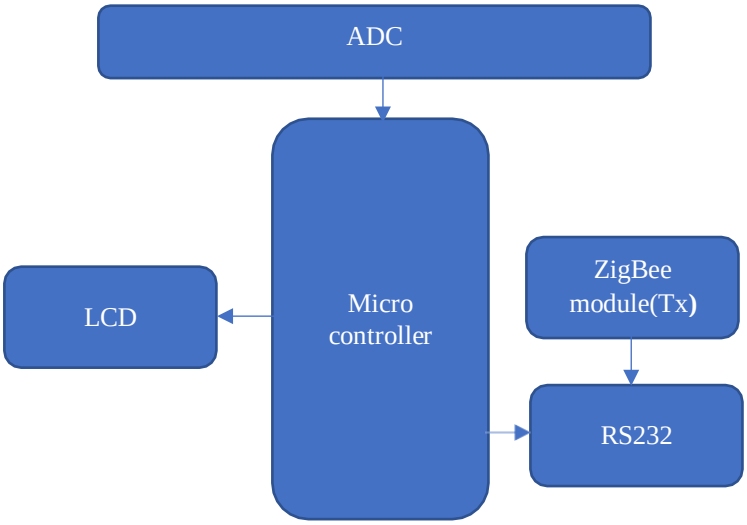

Fig. 1 Block Diagram of Existing System

Fig.2 Block Diagram of Receiver Section

4. Proposed system

Block diagram

The microcontroller is utilized smart power meter was designed with this in mind, which installed at the customer rectified the problem of detecting and save data. IOT ESP3866 Wi-Fi is used to transport this data. We focused on detecting theft, maximizing power efficiency, and communicating energy consumption data to the user in this work. The power supply meter unit and Wi-Fi can be included, and all part of theft energy can be detected and tell into the supplier side and also government sector and shown in fig.3.

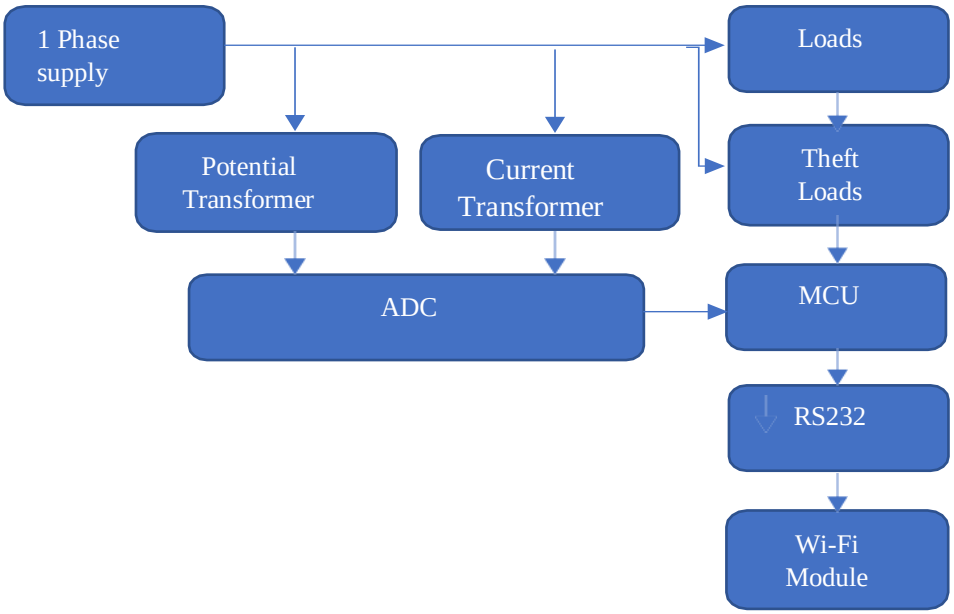

Fig.3 Block Diagram of Proposed System

5. Hardware and Software Component

Transformer

A transformer is a device that uses coupled devices like transformer coils or windings, to transfer energy end to end sides. The supply voltage is stepped down to a level for the components level of voltage. The rectifier's output is a DCvoltage. A capacitor is connected in parallel to the rectifier circuit's output as the filter circuit. This DC voltage will be in the +12volt range. Microcontrollers and their components require a 5V supply.

Regulator Section

The basic terminal kind of voltage regulator is the best option for most non-critical applications. It only has three connections (input, output, and ground) and is factory-trimmed for a fixed output. At high frequencies, the capacitor across the output improves transient response and keeps the impedance low.

Potential Transformer

The coils of a transformer are inductively connected conductors that transfer from one circuit to another. A change in current flowing through the main winding causes a changing

in the transformer's core, there is a magnetic flux resulting in a changing. In secondary winding, the winding is made up of a number of different types of wire the changing sides causes into changing the force.

Current Transformer

In the field of electrical a current transformer also used to measure electric currents. voltage transformers and potential transformers are some of the types of instrument transformers. A current transformer provides a decreased current that is precisely proportional to the circuit current and may be connected to measuring and recording devices.

Wi-Fi Module

The IoT platform NodeMcu is open source. It contains software for the ESP8266 Wi-Fi System on chip as well as hardware for the ESP-12 module, that is shown in fig.4.

Fig.4 ESP8266 Wi-Fi Module

NodeUSB

NodeUSB is a small USB-sized open IoT platform flash drive. It was created with NodeMcu (IoT) to allow for simple programming and USB support. It is perfect for Plug-and-Play solutions, allowing developers to quickly prototype their ideas. The Arduino IDE is a cross-platform programmed.

6. Features

1. The processing power timing limitations dictate the speed of the code.

2. The size of the code is determined by the amount of programmed memory available and the programming language used.

7. Results and Discussion

A Wireless Detection and Monitoring System for Electricity Theft has been conceived and developed with correct hardware and software integration. This device detects electrical theft effectively and easily without the use of a human interface. The Internet of Things (IoT) aids in realizing the multiple benefits of wireless network connectivity. Power theft is actually bypassing the energy meter, but this indicates the theft by raising the load as well, which is a cost-effective technique.

8.Experimental setup

The transformer gets the input of AC 230V and stepdown to AC 12V and that sends to the diode, from diode the 12V regulates the voltage of 5V for NodeMcu unit, because the NodeMcu requires the voltage of 5V. The CT coil is a sensor, which is used for current sensing and gets the voltage supply directly from the transformer. There are totally two loads, that is the load 1 and load 2. The load 1 is connected directly from the transformer and the load 2 is connected to the switch. If the switch is turned ON, the lamp 2 will glow, that makes the note of the theft is happeningin the transmission line.

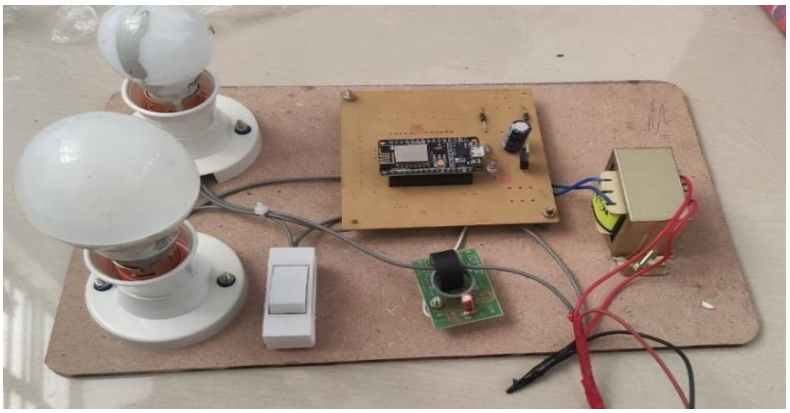

Fig. 5 Experimental Setup

In the prototype model, the theft is activated by using the webpage. The experimental setup is shown in the Fig.5.

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