Smart Transformer Protection System with Power Theft Indication

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ABSTRACT:

Electrical energy plays an important role in our day to day life and backbone for the industries. Today we can't imagine life without electricity. Because of the unnecessary actions taken by human beings, wastage, and theft of power increasing day by day. If proper actions are not taken to save electricity, future generations have no scope of living their life in light, peace, and harmony.. The objective of this project is to design a system that will try to minimize the illegal use of electricity and also reduce the chances of theft, and if theft happens appropriate actions will be taken.

Keywords:, Arduino, Temperature Sensor,Oil sensor

Introduction

The transportation of electricity is an important aspect of the power system and is usually classified as technical losses and non-technical losses. The loss of electricity can cause fires and endanger the safety of the public. Being able to detect this issue is very important for the grid's stability. Most of the time, electricity theft occurs due to physical attacks such as meter breaking or line tapping. These types of crimes have been known to cost utility companies a huge sum of money. According to the latest research it is estimated that the total theft and fraud of electricity cost the industry a very large amount of loss[2]

Energy crisis is one of the major problems that the world faces today. The energy crisis can be reduced to a certain extent by properly monitoring our energy consumption and avoiding energy wastage. Nowadays people face many problems like power theft. Power theft may be a measure crime and it also directly affects the economy of our country. This system will find energy theft easily. This IOT electricity meter is consisting of Atmega 328 microcontroller with a WIFI module for IOT connection and GSM module for mobile connection, on which users will receive information via SMS. This smart electricity meter also consists of a current sensor that sends the current reading to the microcontroller. We have to connect cell phones with the system via SMS which will help to configure with the system. In case of an emergency, the information will be shared on the configured number. We have to set costs for the unit and for which we have four buttons. With the help of buttons, we can set costs for the unit. As we start the system, it shows reading on the IOT screen. Reading will be changed with respect to time. In the case of energy theft, the theft will be caught and displayed on the IOT screen. Even the information will be received through SMS on the configured number. After receiving the alert, the operator can switch off the system using IOT to avoid theft. It also shares turn off the message of the system on the cell phone.

Objectives

- The main objective of the project is to develop a system which detects power theft and inform the officials that power theft is happened.
- Second main objective is to develop a system which will monitor the maintenance of the transformer and inform the maintenance department current condition of transformer.
- Also develop system which will monitor the over/low voltage and overload of transformer and inform the officials.

Block Diagram:
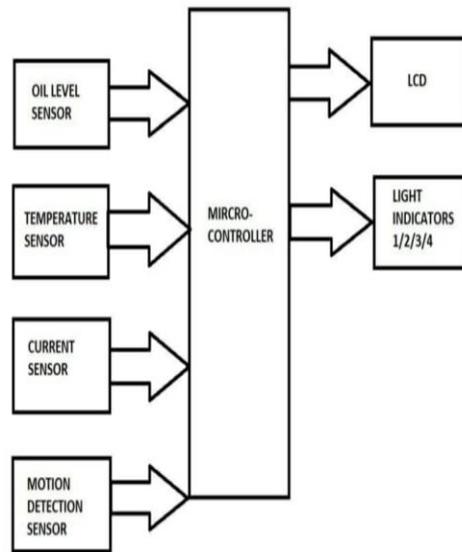
Circuit Diagram
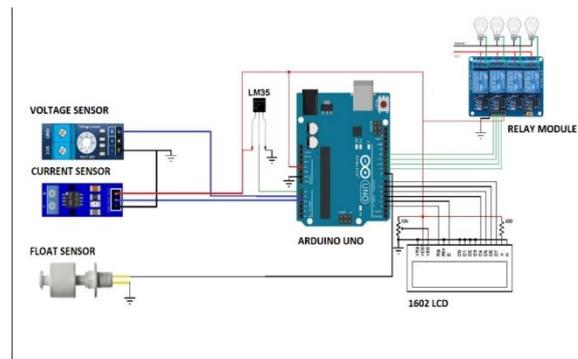
System Components

Arduino : The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital i/p & o/p pins, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started [4]

Temperature Sensor: Temperature sensors are devices that detect and measure coldness and heat and convert it into an electrical signal. Temperature sensors are utilized in our daily lives, be it in the form of domestic water heaters, thermometers, refrigerators, or microwaves.

Oil Level Sensor :Oil Level Sensor is a compact, low cost, level transmitter with analogue out-put designed to measure the level Of various non viscous, non conductive fuel oils, such. as Diesel. Measuring range is 0.2 to 2 m for rod probe version.

LCD 16X2: 16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. But the most used one is the 16*2 LCD; hence we are using it here

12V SPDT Relay: This is the 12V relay most commonly used switching device in electronics. It is commonly used in Home Automation projects to switch AC loads, To Control (On/Off) Heavy loads at a pre-determined time/condition, Used in safety circuits to disconnect the load from supply in event of failure and much more.

Working: The block diagram of the proposed system is as shown in figure.. Here 100W bulb will represent the extra load used to do the power theft. When the normal power is consumed i.e, whenever the 60W bulb is on it will indicate that there is no power theft but whenever someone tries to do direct hooking to make a power theft then that extra load will be detected with the help of the 100W bulb. Current sensor will sense the amount of flow of current and then the current sensor output will be given as the input to relay in-order to count the current pulses and the other output will be given to the 5V of the microcontroller. Hence, the power theft detection will take place depending upon the rate at which the current pulses are counted and that will get displayed on the LCD as "Power Theft" and simultaneously the alert indicator "Power Theft" will glow. In-order to monitor the health of the transformer the temperature sensor and the oil level detection sensors are used to indicate the low oil level and high temperature (a)when the oil level of the transformer goes low that information will get displayed on LCD and then "Low Oil level" indicator will glow. (b)When temperature of the transformer goes high then that information will get displayed on LCD and then the respective indicator will glow.

Advantages: Such as wastages of energy, power theft, manual billing system and transmission line fault. This Method will reduce the energy wastages and save a lot of energy for future use.

Further Scope:

1. Missing Potential This is a common connection fraud usually deployed in three phase energy meters where the voltage component for one of the phases is made zero by removing one of the phase wires from the meter terminal. This results in recording less energy consumption as consumption from one of the phases becomes zero (P = V x I where V= 0).During this condition since the voltage is absent and current is present, the logic is easily able to sense this and record as tamper event if condition persists for certain duration.

2. Automatic billing invoice By the introduction of real time clock (RTC) automatic meter reading can be designed. Which automatically evaluates the tariff of the corresponding customer and needs of task force will be eliminated. The overall combinational design leads smart metering.[13]

Conclusion:

The project is determined and done in the case of seeing the real time examples in many of the places people do power theft for their own purpose that's why this has been done. This system is an automated system and requires no human interaction for its working once the system is installed. The proposed system provides an effective and easy way to detect electrical theft and gives effective solution for problems faced by Pakistan's electricity distribution system such as power theft on distribution line. The proposed system consists of two consumer nodes which measure the amount of power consumed and creates a load profile of the consumers. The intermediate node calculates the difference in the power values and through load profile checks for power thefts. A pre- defined limit of 200W is set as threshold for theft detection. Once a theft is detected, the prevention process disconnects all legal consumers from the line and then through the tapping transformer, high voltage is fed to the line to make illegal loads in-operational. The proposed solution is cheap and effective.[12]

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