

WSN BASED SMART ENERGY METER MONITORING WITH IDENTIFICATION OF ELECTRICITY THEFT

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Abstract: One of the major problem that the world faces this moment is Energy Extremity. It can be reduced to a certain extent by duly covering our energy consumption and avoiding energy destruction. Currently people face numerous problems like power theft. This system will find energy theft fluently. This WSN electricity meter is conforming of Atmega 328 microcontroller with a WIFI module for WSN connection and GSM module for mobile connection, on which client will admit information via SMS. This smart electricity meter also consists of a current detector that sends the current reading to the microcontroller.

We've to connect cell phones with the system via SMS which will help to configure with the system. In case of an exigency, the information will be shared on the configured number. We've to set costs for the unit and for which we've four buttons. With the help of buttons, we can set costs for the unit. As we start the system, it shows reading on the WSN screen. Reading will be changed with respect to time. In the case of energy theft, the theft will be caught and displayed on the WSN screen. Indeed the information will be entered through SMS on the configured number. After entering the alert, the driver can switch off the system using WSN to avoid theft.

Index Terms - WSN, Energy meter, GSM module, Atmega 328P.

I.INTRODUCTION

Electricity is one of the most fundamental features of all matter. Electricity is used by majority of appliances for various purposes which include industrial, medical or personal use. Electricity is an essential component for overall development of a country. It is a vital source for quality of lifestyle of the public as well as industrial and agricultural development in the present society. A major part of the population depends on a stable and reliable power source on a daily basis. In this situation, it is therefore impossible to imagine a life without electricity. However, a high percentage of electricity income is lost due to unlawful theft and improper management of electricity.

The purpose of this paper is to provide an implementation methodology for

electricity theft detection which provides the status of the meter at remote location via wireless sensors. This proposal brings an implicit solution for the issues faced by electricity distribution companies such as energy theft and effective meter reading. It includes Smart Energy Meter based technology and wireless communication method to find out the electric theft and power usage done by the consumer. Moreover, collecting the meter readings for billing purposes from all consumers is a difficult and time consuming task which requires a great amount of human effort. In the proposed model, a Bluetooth based technology is used to transmit the meter reading and creates a detection alert automatically to the authorized energy provider via an alert status which eliminates the risk of false meter reading and power theft.

Conventional energy meter, wireless sensor network, Microcontroller and other simulation software merge together to form an automated power measurement system. With the advent of technology in various fields including the Wireless communication technology by the use of microcontrollers, there are many improvements in automating various industrial aspects for reducing manual efforts. The traditional manual meter reading was not an appropriate choice as it involves much human and material interference. Calculations involved in electricity consumption and noting down the electricity units may be full of errors. It is a hard task to handle and manage the power sources as per the growing needs and requirements. Paying a visit to each consumer and noting the reading becomes a cumbersome and time consuming task for the consumers as well as the companies. Moreover, the manual operator fails to detect a malpractice carried out by the consumer to reduce or alter the meter reading/power supply. The human error can be one way in which a false reading could be noted. The proposed system is considered to evaluate the meter reading and calculate the power consumed.

II. PROPOSED METHOD

The modeling is derived for a smart energy meter with the help of wireless sensor network. Smart energy meter operates by making a communication with wireless sensor network together with microcontroller to form an automated system. The smart meter sends data to the wireless sensor and it informs the utility company about the status of the meter. The smart energy monitor calculates the amount of energy which is used. It gives a detailed usage on the number of units consumed. Knowing more about how much energy things use, will help to choose the way we use them. This will bring an end to the meter readings noting and provide an accurate solution to the hassles caused by the traditional energy meters. After switching on the power, the microcontroller and the Bluetooth module, the energy meter is connected to the load. Then the Bluetooth phone screen will display the current reading at regular intervals. Impulses are received from the energy meter to the controller. The GSM screen also displays the status of

the meter (OK/TEMPERED). Its showcases “OK” then the meter is working normally. If the message is "TEMPERED”, it depicts that an attempt to energy theft has been made.



Fig 1: Proposed Hardware kit

III. SYSTEM ARCHITECTURE

The system architecture of the proposed network is shown in the figure below. In this paper, a Bluetooth module is used to transmit and receive serial data across the network.

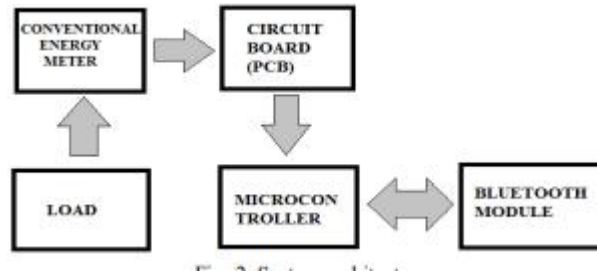


Fig 2: System architecture

There are two parts that were combined to make the system.

Firstly, a SEM is made through the conventional energy meter with the help of processing board and wireless sensor network. The energy meter proposed here deals with computation of power used by the consumer and storing it in its memory by receiving the signal pulse from the conventional energy meter. The data is stored temporarily to monitor the load and corresponding amount will be calculated and communicated to the wireless network.

A conducting wire on the circuit box of the energy meter is deployed with the seal,

when the consumer makes an attempt to temper or open the meter box, the seal will be broken with the conducting wire which will break the connection and deliver a status update of the meter to the utility company.

A. ATMEG 2560

The ATMEGA2560 is a microcontroller board with an operating voltage of 5V. Broadly used for creating and development of projects in the electronics field, the ATMEGA is programmed with Arduino software.

B. SMART ENERGY METER

Electromechanical meters are used traditionally which need manual power to note down the readings and calculate energy consumed after certain periods. It works on the counting of revolutions of the rotating wheel which is proportional to the power consumed.

It induces errors and is not a hassle free journey. Therefore keeping in mind the need to automate such system, integration of the electromechanical meter with a microcontroller and wireless sensor network will make it intelligent and error free. The smart energy meter thus formed will give an accurate reading of the energy consumed at certain set intervals with a programmed microcontroller. The SEM also offers added features like transmission of the calculated power via wireless sensor networks. It analyses the received data and then predicts the electricity theft.

C. WIRELESS SENSOR NETWORKS

In this paper we have deployed wireless technology to monitor theft in Energy meter. The proposed system uses a GSM module for wireless sensing of the data. It is a Bluetooth Serial Port Protocol module which is specifically used for clear wireless serial connection framework. It supports two modes of operation, the Data mode is used for sending and receiving of data from other Bluetooth devices. AT command mode is used to change the device settings. The device can function in either of the two modes which can be controlled by the key pin. It operates with USART port and is very simple to connect. Wireless Sensor Network via the Bluetooth Module provides a bridge between the real physical and virtual worlds. It allows the ability to observe the previously unobservable at a fine resolution over large spatiotemporal scales. They have a wide range of potential applications in industry, science, transportation, civil infrastructure and security

IV. METHODOLOGY

In accordance with the power consumption of an appliance, the pulses will be generated. A single unit of Kilo watt Hour is consumed in 1 hour by an appliance. Assuming our meter generates 3200 pulses per KWH.

$$3200\text{Pulses/KWH}=0.0003125\text{KWH/pulses}$$

Hence, Power consumed by a pulse will be 0.3125W. Power will be calculated by the multiplication of the number of pulses generated in one hour and the power consumed by each

pulse. The LED of the energy meter will glow bright for each pulse. Data through the LED will be taken to the microcontroller and further calculations are done through the pre-defined logic.

$\Sigma P_{\text{delivered}} = \Sigma P_{\text{consumed}} + \text{Loss}$ (implies No Energy Theft)

$\Sigma P_{\text{delivered}} \neq \Sigma P_{\text{consumed}} + \text{Loss}$ (Energy Theft Occurs)

Where $P_{\text{delivered}}$ is the power sent to the consumer and Consumed is the amount of power utilised by the consumer. Power theft occurs due to the fraudulent actions of the consumers. The pin of the microcontroller is used to monitor the status of theft being tempered or OK. Hence, when an attempt to theft is made or any abnormal touching of the meter is done, the circuit breaks and the message of theft being done is sent to the concerned utilities via GSM module.

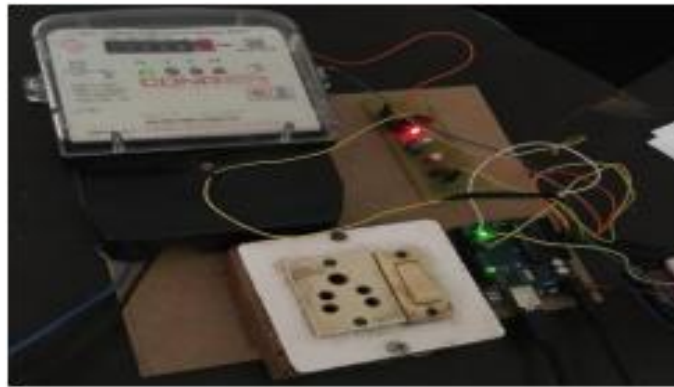


Fig 3: Hardware Design

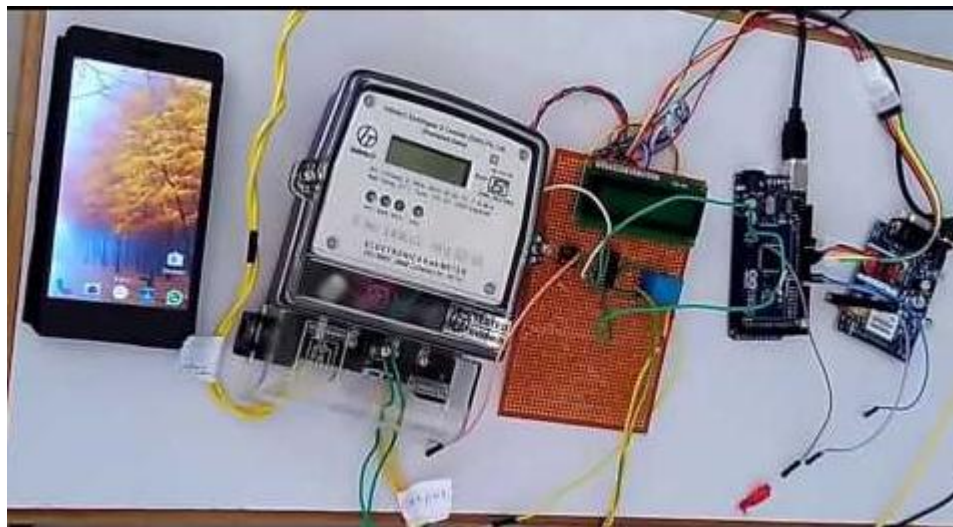


Fig 4: Hardware Design 2

V. CONCLUSION

The proposed system will allow us to know the status of the smart energy meter and hence help in controlling electricity theft to large extent by deploying Conducting wire with the seal on the circuit box of the energy meter. This paper successfully depicts that the smart energy meter along with the wire integrating technology which will eventually help in monitoring power usage and detects power theft via wireless sensors in an efficient way.

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