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IoT based detection of power theft and electricity billing using GSM enabled embedded system

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ABSTRACT

The proposed method describes Arduino based design and implementation of energy meter using IoT and GSM techniques. In this method, consumers can monitor the energy consumption in units from a web page by providing IP address. Theft detector unit connected to energy meter can inform client aspect once meter meddling happens in energy meter and it will send theft detection information through the Ethernet shield and also to the line worker through GSM. By using this method, power theft can be minimized and the consumer can pay the amount for which power consumed by them. It avoids the excess amount paid by the consumer and human involvement in electrical maintenance.

Keywords: IoT, GSM, MAX232, Power theft, ESP 8266 WiFi module, Arduino microcontroller

1. INTRODUCTION

Power theft is the major problem in recent days, which cause the loss to the electricity board. Theft of electricity increases cost paid by the customers and have serious safety consequences. It leads to mis-allocation of cost among suppliers and also supply theft is monitored with the help of the energy meter. The electricity is required to be protected for power distribution to the user as a result of electricity is inevitable to domestic and industrial development. The usage is continuously monitored and if the theft is detected, the information will send to the line worker through GSM. The main objective of the proposed method is to monitor and maintain the electricity system.

In the Internet of Things (IoT) model, many of the living and non-living things that encircle us will be on the internet in one form or another. Driven by the recognition of gadgets authorize by wireless technological innovation such as Wireless Bluetooth, Radio Frequency Identification, Wireless-Fidelity, embedded sensor, IoT has got rid of from its starting stage and it is really on the sting of changing the present fixed internet into a well featured upcoming Internet. Currently there are virtually nine billion interconnected gadgets and it is calculated to touch almost fifty billion gadgets by 2020.

2. EXISTING METHOD

In the Existing system, consumers can do power management by knowing energy usage time to time. The IOT is connected to the meter and it counts the pulses from it and displays it over the LCD display. Also the current drawn by the loads is calculated by the current transform which is connected in series with the load which will be displayed on the LCD. This data is then transmitted to the server unit at MSEB. The data is received from an Internet and it is displayed over the LCD. In this system, the theft information is sent to the web server and it cannot send the information to the nearby line worker via message.

3. PROPOSED METHOD

In proposed method, the meter reading for home is monitored and displayed in the web page by using Internet of things (IoT). Cost of the power used by the consumer is displayed in the web page. In this system the meter reading is monitored to detect the power theft occurred or not. If the power theft occurred, immediately it will send the information to the line worker in the EB office. The power theft information will be displayed LCD. The Consumer can be able to know the energy meter reading and cost of the power consumed and also the power theft information by providing the IP address.

4. BLOCK DIAGRAM

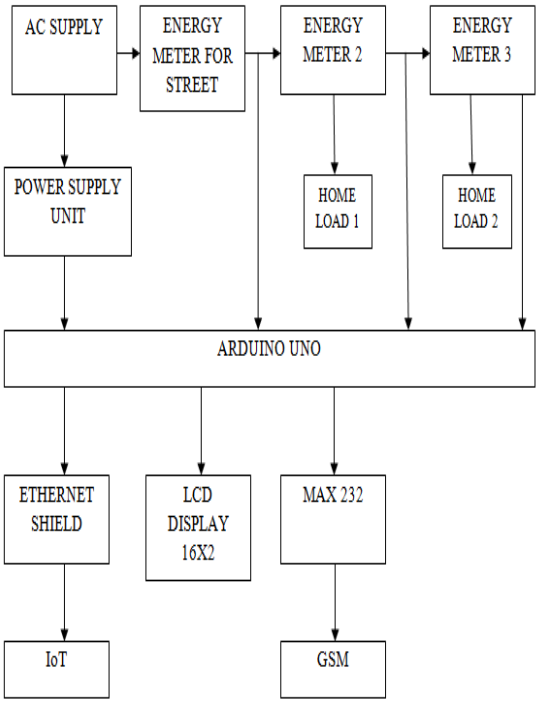

Figure 4.1 Block diagram

Here there are three energy meter measurements taken at different positions such as the street light system, home 1 and home 2. Here the Arduino with Atmega328 is used as the main controller that controls and coordinates all the devices associated with the system. The power supply unit is the block that supplies the required power for the controller unit. The incoming AC is transformed to DC by using rectifier circuit and followed by a filtering circuit. By using 7805 voltage regulator, the converted DC voltage is regulated to 5Volt. The voltage and current measurement of the energy meter of the two homes are taken and given to the ADC of the Arduino. The analog to digital conversion takes place at the ADC pins of the Arduino. These readings are then processed by the Arduino based on the written program.The data is transferred via the IoT. In case of any power theft of abnormal usage of power, it will be indicated on the devices connected via the CLOUD. Also an alert SMS is directed to the user via the Global System for Mobile communication (GSM) module. The bill is generated and it is also conveyed via SMS by the GSM. An LCD system is attached to the Arduino that shows the parameters instantly in the system.

5. HARDWARE DESCRIPTION

5.1WiFi ESP8266

Any microcontroller access to the specific wifi network is achieved by the ESP8266 WiFi module which is self contained SOC with integrated TCP/IP protocol stack. Hosting any of the applications or offloading all WiFI networking functions for another application processor is achieved by using the ESP8266 WiFi module.

5.2 MAX232

The MAX232 is a dual transmitter/dual receiver featuring an on-board DC to DC converter. It is typically used to convert RX,TX,RTS,CTS. The driver provides TIA232 voltage level output from a single 5v supply by on chip charge pumps and external capacitor. The driver's slew rate is set internally and it eliminates the need for external slew rate and filter capacitor.

5.3 GSM

GSM is a digital cellular technology used for transmitting mobile voice and data services. It operates at various frequency bands such as 850MHz, 900MHz, 1800MHz and 1900MHz. It is developed as digital system using time division multiple access (TDMA) technique for communication purpose. GSM modem is interfaced with microcontroller through MAX232. It has a capability to carry 64 Kbps to 120Mbps of data rate. It is used to send the alert message to the user if power theft occurs.

5.4 LCD DISPLAY

A Liquid Crystal Display (LCD) is an electronic visual display, and it uses the light emitting properties of liquid crystal (LC). It is used to display the power consumption and display the information of theft if the power theft is occurred. The display used here is 16*2 which indicates 16 columns and 2 rows.

7. EXPERIMENTAL RESULT

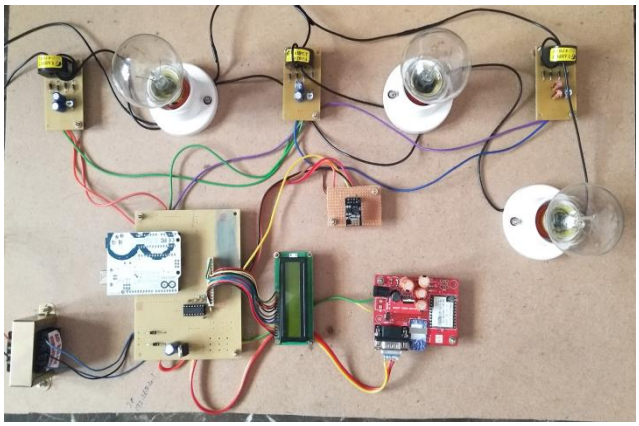

Figure 7.1 Experimental setup

Figure 7.2.a LCD display with power theft alert

Figure 7.2.b LCD display with units

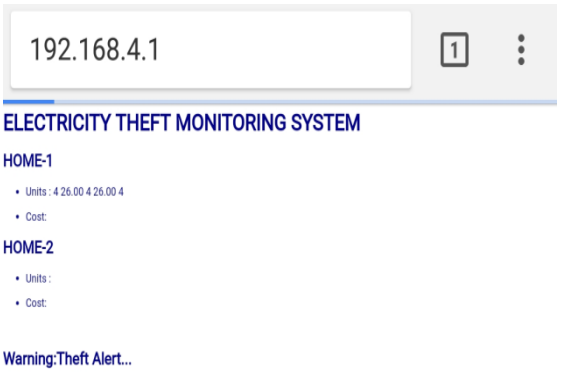

Figure7.3.a Web page display with theft alert

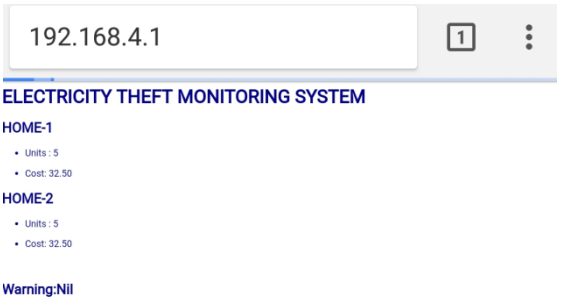

Figure 7.3.b Web page display with units

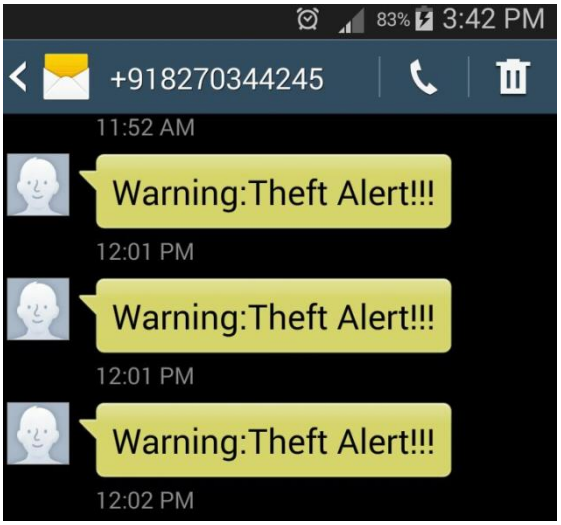

Figure 7.4 SMS display

6. CONCLUSION

This paper has achieved its objectives and provides a system that could monitor the meter reading and report when there is a power theft occurs. The power theft information is identified and the information is sent through IoT and also to the EB office through GSM. So, that they can take instant action to prevent the theft. The theft information also displayed in the LCD. It is developed with a potential to detect power theft and notify GSM modem to send SMS to the intended person in charge and also send the data to the IoT via Ethernet Sheild.

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