Design and Implementation of Digital Power Monitoring System using IoT

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Abstract - This article proposes and analyses a system, which is used for energy meter billing and monitoring. The system is fully based on Internet of Things (IOT) and highly desirable in the field of energy. Here, consumer can do power management by knowing energy usage time to time. The customer has to pay the bill on schedule; if not the electric power, connectivity will be turned off automatically from a distant host. This article discusses about the basic components and their functions such as IOT and its working, Wi-Fi controller (ESP8266 12E) and its architecture, USB to TTL Converter and its features, Relay and LCD display and its interfacing with Wi-Fi controller
In Nigeria, the current prepaid meters use smart card for their energy re-loading or recharging. The main drawback in this system is consumers need to travel a long distance to the utility company, wasting their time to get their energy meter activated when out of energy credit .By using IOT, the bills could be paid anywhere at any time.

Keywords - IOT, Energy Meter Billing, ESP8266 12E, Relay, USB to TTL Converter.

I. INTRODUCTION

The Existing domestic Energy meter reading systems faces many problems, in difficulty of construction, too narrow bandwidth, too low rate, poor real time, etc. To solve above problems, Automatic Meter Reading system uses wireless technology, which in turn provides the communication between the Electricity Board section and the consumer section using Internet of things (IOT) for transmitting the customer's electricity consumption and bill information that is calculated using ARM7 microcontroller. The voltage sensor monitors power fluctuations and current sensors are fed to the microcontroller. Depending on the power generation, the household devices are controlled automatically. It provides the information of the bill amount and payment to the consumer via Global System for Mobile communication. IoT is used to transmit the details of bill and electricity consumption to the user using ARM7 microcontroller. Whenever a power theft is identified, Electricity Board section will cut the supply to the customer. From thorough review of rigorous works by many researchers Power Line Communication (PLC) and IoT, it is observed that PLC and IoT can improve the efficiency of power system and can help to analyse the loss of power in different areas.

II. RELATED WORK

In the existing system, GSM technology is used to intimate the consumers about the consumption of power and alert them to the recharge, if it reaches the minimum amount. It provides post-paid billing to the customer at the end of the month on how much power is consumed. Consumer has no knowledge on power usage time to time. The consumers are growing exponentially fast and load on power providing divisions is rapidly rising. The main problem faced by the consumers is that they have to stand in queue to pay their bill. Tampering can be also done easily.

III. IMPLEMENTATION OF PROPOSED SYSTEM

In the proposed scheme, network model is initiated with set of sensor nodes to identify the location of sensor node with high power efficiency. In second phase, cluster topology is formed based on minimum power consumption of all cluster member nodes. In the proposed system, consumer knowledge of power management time to time. The customers can pay their electric current at any time in prepaid manner. They could recharge at any time using mobile app. The customer can track the usage of current .

Figure 1 shows the illustration of proposed working model. The planned model has the PIC microcontroller as Central process Unit. The full system is interfaced with PIC microcontroller. The GSM electronic equipment is serially

connected with the controller that is that the major communication module between User and supplier.

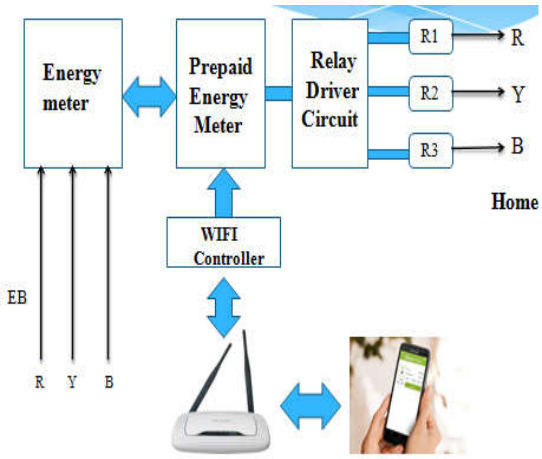

Figure 1. Schematic of Proposed System

The GSM uses its own network for the transfer of data. Special cryptography in embedded C is employed for programming PIC microcontroller based hardware system along with MP-LAB IDE package. The relay acts as change device to chop off and restore power offer. The alphanumeric display is interfaced to microcontroller victimization interface association. During this project, the Microcontroller primarily based system unceasingly records the readings and therefore the live meter reading may be sent to the Electricity department for the asking. This method disconnects the ability offer to the house just in case of non-payment of electricity bills. Passionate GSM electronic equipment with SIM card is needed for every energy meter. The microcontroller pulls the SMS received by phone, decodes it, acknowledges the Mobile no. then switches on the relays connected to its port to manage the appliances. Once eminent operation, controller sends back the acknowledgement to the user's mobile through SMS. The cryptography technique reduces human labour however will increase the potency in calculation of bills for used electricity. The user can have Associate in universal variety and that they will recharge retailers of electricity board .the acknowledgement of recharged coupon detail can come back to note of the patron and conjointly can get displayed in alphanumeric display module. Thus this method can bring an answer of making awareness on excess wastage of power and can tend to scale back wastage of power. This module can scale back the burden of energy providing by establishing the association simply and no stealing of power can takes place. The liquid crystal display can display the used quantity and balance quantity that may be used.

A relay is a switch which is attached anywhere on home Wi-Fi controller will count the usage of current. Customer can recharge their account if they did not, then their balance count becomes zero Wi-Fi controller will turn off the relay in the meter and energy supply will interrupted to the customer. The energy consumed is displayed in terms of units. Thing speak web page is used for displaying the information of the system. The hardware components used in the proposed system is as below:-

- ESP8266-12E
- IOT(Internet of Things)
- Relay

IOT:

The Internet of Things (IoT) technology is deployed to improve the performance of the systems to enable network objects to improve its performance. The objects have to be sensed and controlled remotely with existing network structure using IoT. The relationship between physical world and computer based systems can be created to provide high efficiency, potential benefits and accuracy. The wide variety of devices can be attached with IoT such as heart tracking pumps, transponders and automatic electric alarms. It collects the information from various technologies to improve the data flow between other communication devices.

WIFI MODULE:

ESP8266EX wifi module provides a entire and self operating network solutions to host the application or to reload the data from other networking processor. It hosts the real time applications and speeds up the external flash. The system performance can be improved using cache. A Wi-Fi adapter can be accessed with any micro-controller based interfaces to ensure proper connectivity. It is one among the integrated chip which can work with low noise power amplifier, balun. Antenna switches and external sensors.

Features

- 802.11 standards
- 32 bit Microcontroller Unit
- 10 bit Analog to Digital Converter
- TCP/IP protocol stack
- Energy management and power actuators
- Phase locked loops and regulators
- Antenna diversity can be provided
- Wireless Application Protocol WAP2
- IOS devices
- Deep sleeper
- Transmit packets less than 2 cm
- Power consumption mode
- Temperature range less than 120 C

RELAY:

A Relay is an electrical switch which uses the properties of electromagnet. It is used to separate low power electric signal to provide telegraphic circuits in long distance mode. The incoming signal from one circuit to another circuit was transmitted. Logical operations are performed using relays in telephone exchanges and recent computers.

FEATURES:

5V DC Trigger voltage and 70mA trigger current
125V AC Load Current

28V DC load current
Plastic moulded 5 pin configuration
300 ms switching time

ARUDINO COMPILER:

The 12E Wi-Fi controllers can be programmed without the presence of boot loader. The external and internal clocks are supported. Little Flash memory is enabled with this compiler. The slower internal clock options are controlled.

V. CONCLUSION

With the increasing dependencies over electricity and web, good energy meter may be developed. These meters alongside Eliot victimization the construct of paid meter and web of things may be generated. Eliot has been developed victimization wireless technology 802.11. This good energy meters may be developed to resolve several issues like over usage of electricity, great deal of work force transparency of usage and wastage of cash and resources etc. This technology permits verified customers to visualize standing of electricity usage by victimization Device number and positive identification in real time. This will be done from net application using online.

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