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Wireless Energy Meter Monitoring System with Automatic Tariff Calculation

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ABSTRACT: The fundamental point of this anticipates is to remote checking and control of computerized vitality meter. This framework empowers the power office to peruse the meter perusing routinely without the individual going to inside every house. This can be accomplished by the utilization of Microcontroller unit that persistently screen and record the Energy Meter perusing in its permanent(no unstable) memory area. This framework makes use on a RF Transmitter for remote observing and control of Energy Meter. The Microcontroller based framework ceaselessly record the perusing and the live meter perusing can be sent to the Hand held gadget on solicitation. The recipient end contains RF beneficiary, which get the information from the transmitter. The information got at the recipient end is nourished to microcontroller, which is available at accepting end .The microcontroller at the less than desirable end is furnished with a LCD interfacing furthermore few control switches for tax choice. The microcontroller consequently assume the liability of figuring the bill both information got from the RF transmitter which is available with the vitality meter, and duty gave by the administrator and showcases the same on the LCD. The primary point of interest of this framework is making utilization of RF module which help for a remote transmission and the utilization of duty catch make the gadget qualified to work for both local charging and modern charging and accordingly there is no necessity of utilize a different gadget for mechanical charging.

KEYWORDS: Current transformer, Potential transformer, microcontroller (Atmega 16), LCD, Transmitter, Receiver

I. INTRODUCTION

Remote Energy Meter (WEM) is the innovation of naturally gathering information from vitality meter and exchanging that information to a focal database for charging and/or investigating. This spares worker treks, and implies that charging can be founded on real utilization as opposed to on an appraisal in light of past utilization, giving clients better control of their utilization of electric vitality. Vitality Monitor is an individual from a group of sensors, controllers and foundation that is utilized to Transmit particular vitality related data from different areas into a main issue or accumulation focus in the office in this very case an utility recipient. With the quick advancements in the Wireless correspondence innovation with the utilization of the microcontrollers, there are numerous changes in mechanizing different mechanical perspectives for diminishing manual endeavors. The conventional manual Meter-Reading was not reasonable any more as it spends much human and material asset and achieves extra issues. In gathering the readings and charging physically. Presently a-days the quantity of Electricity buyers is expanding in an awesome number. It got to be trying in both creating and keeping up the force according to the developing necessities. Keeping up the force is likewise a vital assignment as creating the force right away; the human administrator goes to the customer's home and delivers the bill according to the meter perusing. In the event that the shopper is not accessible, the charging procedure will be pending and human administrator again needs to return to the pending houses. Setting off to every single buyer's home and creating the bill is a difficult errand and requires part of time. It turns out to be exceptionally troublesome particularly in blustery season. In the event that any purchaser did not pay the bill, the administrator needs to go to their homes to detach the force supply. These procedures are redundant and take so much time. In addition, Human administrator can't discover the Un-approved associations or acts of neglect did by the purchaser to diminish or stop the meter perusing/power supply. WEM (remote vitality meter) puts more control under the control of both utilities and shoppers by giving them more nitty gritty data about force utilization. This permits utilities to better control supply. WEM can tackle above troubles. Along these lines, remote WEM and administration through sorts of system advances has turned into a pattern now.



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II. MOTIVATION

Thorough exploration has been done on the Numerous frameworks have been produced utilizing Wireless Sensor Networks which comprises of a few sensor hubs in closeness and having information transmission and gathering capacity amongst hubs and focal base station for extensive variety of utilizations. Despite the fact that underlying organization expense might be high, the operational expense of information correspondence inside the framework is immaterial. With the quick advancements in the Wireless correspondence innovation by the utilization of microcontrollers, there are numerous enhancements in mechanizing different modern perspectives for lessening manual endeavors. The customary manual Meter Reading was not reasonable for more working purposes as it spends much human and material asset. It gets extra issues estimation of readings and charging physically. Presently a-days the quantity of Electricity purchasers is expanding in incredible degree. It turned into a hard errand in taking care of and keeping up the force according to the developing necessities. Without further ado upkeep of the force is likewise an imperative errand as the human administrator goes to the buyer's home and delivers the bill according to the meter perusing. On the off chance that the purchaser is not accessible, the charging procedure will be pending and human administrator again needs to return to. Heading off to every single customer's home and producing the bill is an arduous assignment and requires parcel of time. It turns out to be exceptionally troublesome particularly in blustery season. On the off chance that any purchaser did not pay the bill, the administrator needs to go to their homes to detach the force supply. These procedures are tedious and hard to handle. In addition, the manual administrator can't discover the Un-approved associations or acts of neglect completed by the purchaser to diminish or stop the meter perusing/power supply The human blunder can open an open door for debasement done by the human meter peruser. So the issue which emerges in the charging framework can get to be incorrect and wasteful. The accessibility of remote correspondence media has made the trading of data quick, secured and precise. The computerized execution brought on the quick use of gadgets, for example, PCs and telecom gadgets. Correspondence media like the web, GSM systems, and so forth exists all over the place. Remote meter perusing puts more control under the control of both utilities and shoppers by giving them more nitty gritty data about force utilization [1]. This permits utilities to better direct supply. In this way, remote meter perusing framework and administration sorts of system innovations has turned into a pattern now. In the work exhibited here, a system has been created to peruse power meter readings from a remote server naturally utilizing the current GSM systems [3] for PDAs. This procedure can be connected for gas or water meters also. The meters send the meter readings like kilo-watt-hour (kWh), voltage, current, bill, and so on by SMS to a focal server. The focal server then stores the data in database for examination and sends the bill to the client cellular telephone. The SMS based information gathering should be possible rapidly and effectively. Information can be gathered after any fancied time interim, for example, hourly, every day, week by week, or month to month premise. As there is no human mediation in the whole procedure, there is no possibility of human mistake and defilement. In the greatly awful climate conditions like overwhelming snow, downpour, storm, and so on the framework won't hamper on gathering information the length of GSM systems are steady. The advancement expense of the SMS based remote meter will be higher than traditional meter however the electric supplier income will increment in the progressive months since it will kill the likelihood of defilement done by the client or starting a peruser. Remote meter can be utilized as a part of private flats and particularly in mechanical buyers where mass vitality is expended.

III. RESEARCH OBJECTIVES

1. To design low cost intelligent embedded system based remote monitoring system using Zigbee.
2. To provide flexibility to use any energy meter for remote monitoring. .
3. To implement a simple embedded system as a proof of concept.

IV. LITERATURE REVIEW

[1] History of Meters

With the development of country's economy and the improvement of National power, the power requirement is still ever increasing due to use of improper power management systems and the conventional energy metering system. Over the past years, metering devices have gone through much improvement, and are expected to become even more sophisticated, offering more and more services. Meters in the past, and today in a few countries, were



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electromechanical devices with poor accuracy and lack of configurability. Theft detection was also a challenge. Such meters are limited to providing the amount of energy consumption on site. Generally, there are two types of Energy Meters

- i. **Analog Energy Meter**
- ii. **Digital Energy Meter**

[2] Analog Energy Meter

Analog energy meter is the first intentional meter starting from the Thomas Alva Edison. Up to 2005 the analog energy is used. That energy meter is having many disadvantages are as follows,

- I. Ageing of magnet.
- II. Low accuracy.
- III. Low efficiency.
- IV. No sensing & indication of low meter.
- V. Analog energy meter can be made.
- VI. We can slow down the resourcing speed of the energy meter.

[3] Digital Energy Meter

Digital energy meter is the second generation of analog energy meter or modified meter. Instead of Analog meter LED indicator is used this meter has the current sensing element are used. That energy meter is having many disadvantages are as follows,

- I. Highly Person dependant.
- II. Human errors cannot be avoided.
- III. Accessibility of meters in rural/ Agricultural zones.
- IV. Energy Audits performed based on bill collection which is highly inaccurate.
- V. Billing done mainly on estimated/ monthly average basis
- VI. Inability to monitor and control discrete loads

V. WEM MECHANISM

The purpose of this project is to remote monitoring and control of Domestic Energy Meter. This system enables Electricity Department to read meter readings regularly without the person visiting each house. This can be achieved by use of the Microcontroller unit that continuously monitors and records the Energy Meter reading in its permanent (nonvolatile) memory location. This system also makes use of RF transmitter remote monitoring and controlling of Energy Meter Recent developments in this direction seem to provide opportunities in implementing energy efficient metering. Technologies that are more precise and accurate, error free, etc. The implementation of WAMRS provides with many vital features as compared with the analog utility meter reading with man power. Some of these features are listed below

1. Higher speed.
2. Improved load profile.
3. Automatic billing invoice.
4. Real time energy cost.
5. Load management.
6. Alarm warning.
7. Remote power switches on/off.
8. Tamper detection.
9. Bundling with water and gas.

VI. METHODOLOGY USED

1. Medias for Wireless Communication:

There are many ways are available for communication such as:-

- 1 RF Communication
- 2 Wi-Fi Communications



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3 Bluetooth Communications

4 Zigbee Communications

Out of which every communication is having its own advantages and disadvantages. The Bluetooth and Wi-Fi are widely used for wireless communication. This project can be done using RF and Zigbee also but it deals with the Zigbee Wireless communication system. But we use a zigbee technology for doing this project because the RF technology is having the following disadvantages.

2. Power Needs

Like most other forms of electronic communication, radio requires the presence of electricity, both at the point of the transmission and the point of reception. While battery-powered radios are common, these power needs are more cumbersome than those of land line telephones, which can operate using electricity already in the lines to make calls even during periods of emergency or power outages. A powerful radio transmitter, such as a regional broadcast station, requires large amounts of electricity at all times to send out its signal.

3. Bandwidth

Finally, radio communication relies on a very limited spectrum of bandwidth frequencies. This is why commercial radio stations sometimes seem to overlap or blend together, and why the Federal Communications Commission strictly regulates the use of all publicly-owned airwaves. Radios require a relatively large amount of bandwidth relative to the amount of data they transmit, leading to more and more air space being allocated for cell phone networks and wireless Internet networks.

Due to above disadvantages of RF communication this project is done by using a Zigbee also the Zigbee will have the following advantages over RF communication

1. Power saving, as a result of the short working period, low power consumption of communication, and standby mode
2. Reliability: Collision avoidance is adopted, with a special time slot allocated for those communications that need fixed bandwidth so that competition and conflict are avoided when transmitting data. The MAC layer adopts completely confirmed data transmission, that is, every data packet sent must wait for the confirmation from the receiver
3. Low cost of the modules, and the ZigBee protocol is patent free
4. Short time delay, typically 30 ms for device searching, 15 ms for standby to activation, and 15 ms for channel access of active devices
5. Large network capacity: One ZigBee network contains one master device and maximum 254 slave devices. There can be as many as 100 ZigBee networks within one area
6. Safety: ZigBee provides a data integrity check and authentication function. AES-128 is adopted and at the same time each application can flexibly determine its safety property.

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VII. WORKING OF THE PROJECT

General working of WEM can be easily explained by using block diagram shown below

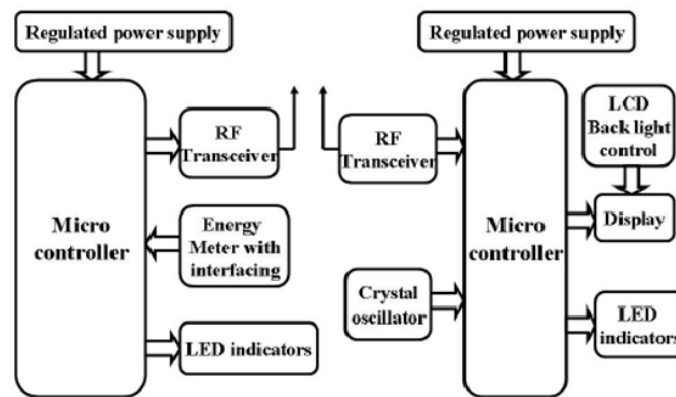


Fig 1: Block diagram of WEM

EXPLANATION-

The microcontroller based system continuously records the readings and the live meter reading can be sent to the Electricity Department on request. The receiver end comprises of RF receiver which receives the data from the transmitter. The data received at the receiver end is fed to the microcontroller which is present at the receiving end. The microcontroller at the receiving end is provided with a LCD interfacing and also few control switches for tariff selection (domestic agricultural, industrial) can be done dynamically by the operator. The microcontroller automatically takes the responsibility of calculating the bill with the data received from the RF transmitter which is present with the energy meter and the tariff provided by the operator and displays the same on LCD. The major advantage of this system is making use of RF module which helps for a wireless transmission and the use of tariff buttons makes the device eligible to operate for both domestic billing and industrial billing and therefore there is no requirement to employ a separate device for industrial billing.

It is mainly divided into two parts.

1. Transmission Panel.
2. Receiver Panel.

1. Transmission Panel:

Transmission section is fitted in customer's house. In this section the Energy Meter is interfaced with microcontroller. Now microcontroller performs the action of recording and storing energy meter reading in its memory location. Digital Energy Meter generates a pulse whenever a unit is consumed or energy is recorded in pulsating signal. This pulse is given to microcontroller. Then this analog data which is in form of electrical pulses is converted to digital output through ADC operation performed by controller itself. The generated digital output is then transmitted by using RF technique. To perform such operation controller needs required supply which is suitably provided through power supply unit. LED is used as indicator to check whether trans-receiver transfer is proper. Microcontroller is also connected to display unit which continuously shows energy reading.

2. Receiver Panel:

Receiver section is mobile i.e. it can be taken wherever required. It's main purpose is to collect Energy Meter readings from all customers hence it is for electricity distribution utility. Basic architecture of receiver panel is similar to that of transmission panel. Receiver generates all ranges of frequencies to collect data from customer panels. After receiving readings, this digital data is again converted back to analog form by microcontroller application through DAC. Charge per unit of consumption is already programmed in receiver panel microcontroller. So energy bill is generated by same microcontroller by performing simple arithmetic operations.



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VIII. CONCLUSION

Current human advancement would be pushed to the brink of collapse, if an emergency of power shortage ever lingers. The cusp of society would crumple. Accordingly, the unquestionable requirement for uninterrupted power is the prelude to improvement of any country on the planet today. Step by step, the power buyer gathering is extending as more individuals are accessing power. In lieu to this rising interest, there additionally emerges the dire requirement for an exceedingly effective observing framework that can consider the changing utilizations of the buyer people. This anticipates has hence given a basic, exact and valuable arrangement as the remote advanced vitality meter. In spite of the fact that a model, it showed the simplicity of estimation using programming and in this manner killing human blunders. The strength and straightforwardness of programming extra components is an incredible point of interest of this meter. It additionally is a temperate decision forward, as the expense of usage is not exactly other comparative sorts of remote vitality meters. This anticipate, hence, comes one stage nearer to a definitive long for having a completely mechanized vitality utilization checking framework, in which a PC can give all important data and consolidate extra components as regarded vital without anyone else's input. A further approach could be that once every day collected information is sent from the Household to the vitality supplier. This gives the vitality supplier the chance to better ascertain the required. The venture might be further stretched out by including an extra component of installment of the power bill from home itself utilizing some prepaid keeping money cards or such systems. By expanding the scope of ZigBee Tran recipients we can build the quantity of zones under one control room. With wide range accomplishment of this anticipate soon, we may change from ZigBee to Internet administration for remote correspondence since it is costlier than Zigbee.

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