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DESIGN AND IMPLEMENTATION OF A SMART ENERGY MEASUREMENT SYSTEM

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Abstract: Everyday not only the household items, the electronic gadgets used by work from home people as well as students during this pandemic covid-19 period utilizing more electrical energy. Usually, the energy consumption can be monitored by the use of an electrical device called energy meter. But in the proposed system the conventional energy meter is converted as a smart meter with additional sensors added to monitor not only the energy in units, but usage of voltage and current is also monitored and displayed. Thus,the measured and monitoreddata are senttocloudforlateruse ofbilling purpose. This paper discusses the IoT technology incorporated in this real time monitoring system for measuring various parameters. Also, because of the automatic system it can easily avoid human errors occurred during billcalculation.

Keywords: Energy Meter, Sensors, Internet of Things, Micro Controller, Wifi Module.

INTRODUCTION

The whole world is now becoming more technological savvy and India is also no exception to this growth. Now a day people are working in online by the 24*7, it will be really a boon if there is a facility to monitor how much energy is consumed by them through online from anywhere on the globe. The paper mainly deals with smart energy measurement system, which utilizes the features of embedded system. The paperdiscussescomparisonofArduinoandothercontrollers, and the application of Wi-Fi modems to introduce 'Smart' concept. Arduino unit continuously monitor and records the energy consumed reading in its permanent (non-volatile) memory location. This system continuously records the reading and the live meter reading can be displayed on webpage to the consumer onrequest.

PROPOSEDMETHODOLOGY

In the conventional system a person deputed by the electricity board has to go area by area to take energy consumed reading from the meter of every house and handover the bills. Also, here it will not inform the supplier side about any theft if it is happening in the system. This can be eliminated by the proposed smart energy system. This system continuously monitors the energy consumption and the reading is displayed in the meter. It eliminates the third party between the consumer and service provider.

It is possible to obtain the pattern of consumption as well as faultiness present in the conventional system. Also, it will alert the supplier about any theft is happening in the system. It is light weight and cost effectiv**e.**

WORKING METHODOLOGY

The consumer is facing problems like receiving due bills for bills that have already been paid as well as poor reliability of electricity supply and quality even if bills are paid regularly. The remedy for all these problems is to keep track of the consumers load on timely basis, which will be held to assure accurate billing, track maximum demand and to detect threshold value. These are all the features to be considered for designing an efficient energy billing system. The proposed system addresses the problems faced by both the consumers and the distribution companies. The paper mainly deals with smart energy measurement system, which utilizes the features of embedded systems i.e., combination of hardware and software in order to implement desired functionality.

With the use of smart method, the consumer as well as service provider will get the used energy reading with the respective amount, Consumers will even get notification in the form text through this method when they are about to reach their threshold value, that they have set. Also, with the help of Wi-Fi modem the consumer can monitor his consumed reading and can set the threshold value through webpage. This system enables the electricity department to read the meter readings monthly without a person visiting each house. This can be achieved by the use of Arduino unit that continuously monitor and records the energy meter reading in its permanent (non-volatile) memory location. This system continuously records the reading and the live meter reading can be displayed on webpage to the consumer on request.

This system also can be used to disconnect the power supply of the house when needed. This method eliminates the need of human power during disconnection and reconnection of the load. Another major advantage of this method is that it will inform the supplier side about any theft that is happening in the system. Or some illegal activities that take place in the system can monitor and control system consumer and supplier. Thus, the bill payment option can be selected like pre-paid and post-paid option etc. This

method is useful for both the consumer and the supplier. This system allows the supplier to disconnect the connection from a distant server in case the consumer fails to pay their electricity bills.

The smart energy measurement system is as shown in figure. The block diagram consists of transformer, rectifier, regulator, energy meter, ESP8266, LCD display, Arduino mega, Current and voltage sensors.
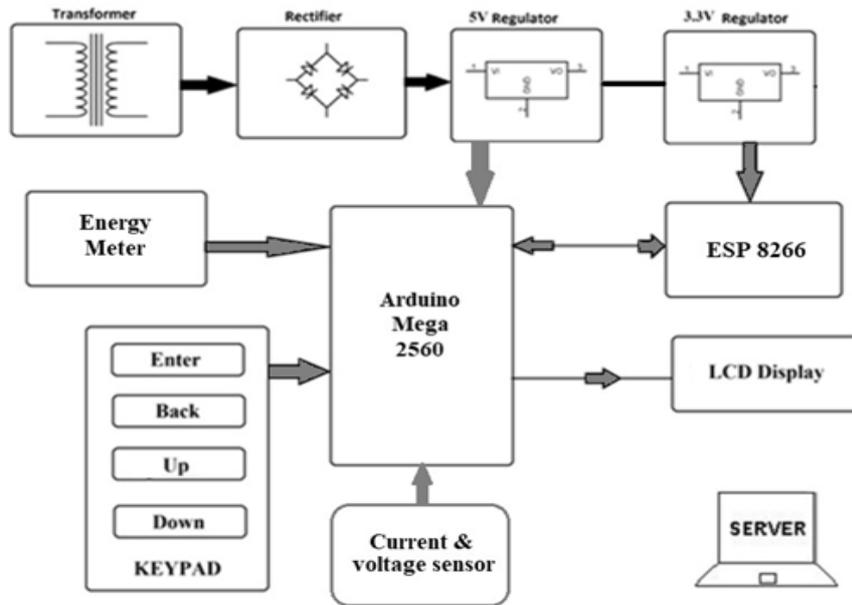

Fig.1. BlockDiagram

Smart Energy meter it is used to monitor and control consist of both hardware and software that consist of Arduino mega 2560, Single phase energy meter, current sensor, voltage sensor, etc. Arduino mega 2560 is used to process the data that received from energy meter, current and voltage sensor used for process and measured data values are send to the cloud for lateruse. Thus,theenergymeterisusedtogetinputdataregarding the consumption use ofelectricity. The current and voltage sensor are used to monitor regularly and send data to theprocessor. Processor used to control relay module switch is used to turn off, on powersupply. ESP8266 module is used send and receive the data from the cloud send instruction command to theprocessor. Thus, the Arduino mega 2560 is used to monitor the regular activities of user and send data to cloud and service provider and also used to monitor voltage or current drop from normal state.

TOOLS USED

Hardware requirements

Transformer

Step down Transformer (fig.2) reduces voltage and hence used in almost all household electrical appliances. Our present-day electronicsisheavilydependentonit.Inthispost,wewilltry to understand what is it, it's working principle, equation, types, advantages and disadvantages. A Step-Down Transformer is a device which converts high primaryvoltage to a low secondary voltage. In a Step-down Transformer, the primary winding of a coil has more turns than the secondary winding.

| Fig.2. Transformer | Fig.3. Relay | Fig.4. Energy meter |

Relay moduleswitch

A relay (fig.3) is an electrically operated switch that can be used to turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins.

Energymeter

The meter (fig.4) which is used for measuring the energy utilizedby the electric load is known as the energy meter. The energy is the total power consumed and utilized by the load at a particular interval of time. It is used in domestic and industrial AC circuit for measuring the power consumption. The meter is less expensive andaccurate.
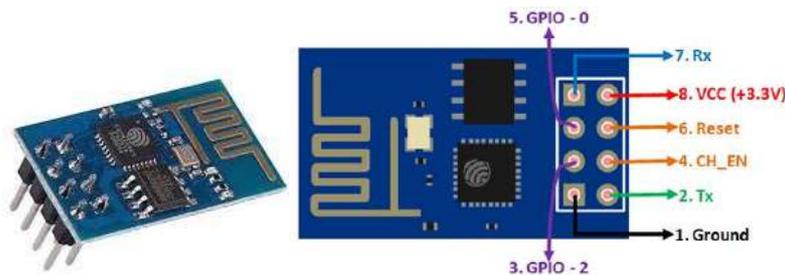
ESPModule

Fig.5. ESP8266 Wi-Fi Module and Pin Configuration

ESP8266 (fig.5) is a Wi-Fi networking module or solution allowing Wi-fi networking function from one host to another. The ESP8266 requires 3.3V to 5V. ESP8266 need to communicate via serial 3.3 V and does not have 5V tolerant inputs, so you need level conversion to communicates with a 5V microcontroller like most Arduino use.

Arduino Mega

The MEGA 2560 (fig.6) is designed for more complex projects. With 54 digital I/O pins, 16 analog inputs and a larger space for your sketch it is the recommended board for 3D printers and robotics projects.This gives your projects plenty of room and opportunities.

Fig.6. Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports),

a16MHzcrystaloscillator,aUSBconnection,apowerjack, an ICSP header, and a reset button. It containseverything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Mega 2560 board is compatible with most shields designed for the Uno and the former boards.

Software requirements
GOOGLE fire base

Firebase (fig.7) is a platform developed by Google for creating mobile and web applications. Firebase by Google can be used for the following: Firebase manages all data real-time in the database. So, the exchange of data to and fro from the database is easy and quick. Firebase allows syncing the real-time data across all the devices- Android, iOS, and the web without refreshing the screen.Here a smart energy meter as title by Google fire base using proteus design software is created, then go to the docs and login with their Gmail. In the left side corner by clicking on the Real time data base the Project Smart energy meter, readings will appear on the web page. Here it can be known and able to see all the data of electricity consumption that readings can be monitored and controlled. Also, the graph of the usage can be seen that is when the energy is used and not used can be easily monitored.

Fig.7. Google firebase, readings and graph

WORKING MODEL

Fig.8.Typical prototype model of the proposed system

ADVANTAGES

- IoT offers much more facilities as compared to other networking approaches like LAN, Ethernet, wired/wireless, etc.
- Another big advantage of Arduino is its library of examples present inside the software of Arduino.
- This system allows the supplier to disconnect the connection from a distant server in case the consumer fails to pay his/her electricity bill.
- This method eliminates the need of human power during disconnection and reconnection of the load.
- Another major advantage of this method is that it will inform the supplier side about any theft that is happening in the system.
- Easy to use and operate.

APPLICATIONS

- Used to control Real time Energy meter

CONCLUSIONS

A low-cost single module system is developed to sense, compute and transfer real-time data. It also provides a user- friendly platform to offer interactive experience to the customers. Further, the developed work can be extended to a large scale in order to determine the load distributed in the area. The significance of the proposed system is to reduce man powerrequirementsinassessingtheenergyreadingsandalso reduce errors caused bythem.

REFERENCES

1. A.Abdollahi,M.Dehghani,andN.Zamanzadeh,"SMS- sbasedreconfigurableautomaticmeterreadingsystem," IEEE International Conference on Control Applications (CCA 2007), Oct, 2007, pp. 1103 –1107.

2. Ashna.k and Sudhish N George,"GSM BasedAutomatic EnergyMeterReadingSystemwithInstantBilling"This project was supported and financed by NationalInstitute of Technology, Calicut, IEEE2013.

3. Chunchi Gu, Hao Zhang, Qijun Chen, "Design and Implementation of energy data collection system using wirelessfidelity(WiFi)moduleandcurrenttransformer" inIEEEInternationalConferenceonSystemScienceand Engineering (ICSSE),2014.

4. Damminda Alahakoon, Xinghuo Yu," Smart Electricity Meter Data Intelligence for Future Energy Systems: A Survey" in IEEE Transactions on Industrial Informatics (Volume: 12, Issue: 1, pp. 425- 436 Feb.2016).

5. Darshan Iyer N, Dr. K A Radhakrishna Rao, "IoTBased Electricity Energy Meter Reading, Theft Detection and Disconnection using PLC modem and Power optimization", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 4, Issue 7,2015.

6. Gobhinath.S, Gunasundari.N, Gowthami.P, "Internet of Things (IOT) Based Energy Meter", International Research Journal of Engineering and Technology (IRJET), Vol 3, Issue 04,2016.

7. Guilin Zheng, Zhifu Zhang, "Intelligent wirelesselectric power management and control system based on Zigbee technology",InternationalConferenceonTransportation Mechanical and Electrical Engineering (TMEE)Changchun, China, pp.1120-1124, December16- 18, 2011.

8. Ragul R, Karventhan P, Gowtham R, et al., (2020) "IoT BasedMonitoring&ControlofEnergyMeter"",iCS3M 2020, pp.1.6, August -2020.

9. Landi C., Dipt. d.Ing., dell inf. Secondauniv. di Napoli, Aversa Italy, Morela, P.; lannilo G, "ARM basedenergy managementsystemusingsmartmeterandwebserver,", IEEE Instrumentation and Measurement Technology confer- enceBinjiang, pp.1-5,May-2011.

10. Ravi Ramakrishnan, Loveleen Gaur," Smart Electricity Distribution in Residential Areas, Internet of Things based Advanced Metering Infrastructure and Cloud analytics" in international conference on Internet of Things and Applications (IOTA),2016.

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