

Smart Energy Meter

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Abstract— The energy consumption can be monitored by using of electrical device is known as energy meter. In this we had made some changes and modifications adding in addition of voltage and current sensor in order to monitor respected term value for different use like V, am, Unit, etc.,. Thus the monitor data is sent to cloud for later use for bill etc. And used to avoid error occurred during bill calculation.

Keywords: Energy meter, Internet of things

I. INTRODUCTION

People are today 24*7 online, it will be really a boon if they can monitor their energy consumption online from anywhere on the globe. The paper mainly deals with smart energy meter, which utilizes the features of embedded systems. The paper discusses comparison of Arduino and other controllers, and the application of Wi-Fi modems to introduce ‘Smart’ concept. 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.

II. LITERATURE SURVEY

Dr. Sreedhar, et al., (2016) in his research “Smart energy meter” has proposed about the smart energy meter.

Smart meter is a next generation meter which is highly efficient and user friendly, which provides a great way to save and control the usage of energy. The smart meter is wirelessly connected to users by the means of IoT. This means user can easily have control on the meter as per his needs. But now due to sophisticated technology, AMI the system can communicate in two ways for both data collection, billing and to control the device.

Ragul R, Karvenathan P, et al., (2020) “IoT Based Monitoring & Control of Energy Meter” has proposed about the Smart energy meter. IoT-based applications are becoming more popular and provide effective solutions for many real time problems. In this research, real-time monitoring system for residential energy meter is proposed. We can see a person standing in front of our house from electricity board, whose duty is to take read from the energy meter and handover the bills to the owner of that house every month. This is nothing but meter reading. we have come up within idea which will eliminate the third party between the consumer and service provider. In advance mode of data transfer between customer and user and day to day update.

Birendra Kumar Sahani, et al., (2017) in his research “IoT based smart energy meter reading” has proposed about the Smart energy meter. According to that reading we have to pay the bills. The main drawback of this system is that person has to go area by area and he has to read the meter of every house and handover the bills. Many times, errors like extra bill amount, or notification from electric board even though the bills are paid are common errors. To overcome this draw

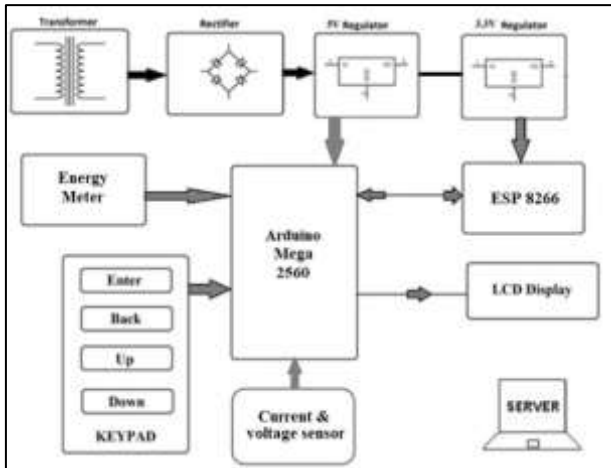
back we have come up with an idea which will eliminate the third party between the consumer and service provider, even the errors will be overcome. In this paper the idea of smart energy meter using IoT and Arduino have been introduced. In this method we are using Arduino because it is energy efficient i.e., it consumes less power, it is fastest and has two UARTS. In this paper, energy meters which is already installed at our houses are not replaced, but a small modification on the already installed meters can change the existing meters into smart meters. The use of GSM module provides a feature of notification through SMS. One can easily access the meter working through web page that we designed. Current reading with cost can be seen on web page. Automatic ON & OFF of meter is possible. Threshold value setting and sending of notification is the additional task that we are performing)

Karthikeyan S, et al., (2017) in his research “IoT based real-time residential energy meter monitoring system” has proposed about the Real-time residential energy meter monitoring system. IoT-based applications are becoming more popular and provide effective solutions for many real time problems. In this research, real-time monitoring system for residential energy meter is proposed. The presented system provides ubiquitous and continuous access to energy consumption to the consumer by exploiting the advancement of IoT technology. The proposed system is cost effective as it requires a simple upgrade on the existing meters than complete replacement. Further, it is light weight and compact with the usage of SoC for 4 control and communication. Through the experimental analysis, it is found that from the collected data, it is possible to obtain the pattern of consumption as well as faultiness present in the existing system. The presented work can also be extended to large scale from which load distributed in the area can be estimated so that the system can be strengthened to enhance performance.

III. PROPOSED METHODOLOGY

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

IV. BLOCK DIAGRAM



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 process and data send to cloud for later use.
- Thus, the energy meter is used to get input data regarding the consumption use of electricity
- The current and voltage sensor are used to monitor regularly and send data to the processor
- Processor used to control relay module switch is used to turn off, on power supply.
- ESP8266 module is used send and receive the data from the cloud send instruction command to the processor.
- Thus, the Arduino mega 2560 is used to monitor the regular activities of user and send data to cloud and services provide.
- Also used to monitor voltage or current drop from normal state.

A. Transformer



Step Down Transformer reduces voltage and hence used in almost all household electrical appliances. Our present-day electronics is heavily dependent on it. In this post, we will try to understand what is it, it's working principle, equation, types, advantages and disadvantages. A Step-Down Transformer is a device which converts high primary voltage to a low secondary voltage. In a Step-down Transformer, the primary winding of a coil has more turns than the secondary winding.

B. Relay module switch



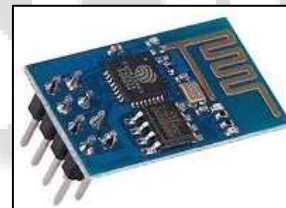
A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins.

C. Energy meter



The meter which is used for measuring the energy utilizes by 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 and accurate.

D. ESP Module



ESP8266 is a Wi-Fi networking module or solution allowing Wi-fi networking function from one host to another. The ESP8266 requires 3.3 v 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.

E. Arduino Mega



The MEGA 2560 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. 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), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything

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 Due milanove or Diecimila.

F. Final Result



V. 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 research is to reduce man power requirements in assessing the energy readings and also reduce errors caused by them.

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REFERENCES

- [1] A. Abdollahi, M. Dehghani, and N. Zamanzadeh, "SMS-based reconfigurable automatic meter reading system," IEEE International Conference on Control Applications (CCA 2007), Oct, 2007, pp. 1103 – 1107.
- [2] Ashna.k and Sudhish N George, "GSM Based Automatic Energy Meter Reading System with Instant Billing" This project was supported and financed by National Institute of Technology, Calicut, IEEE 2013.
- [3] Chunchi Gu, Hao Zhang, Qijun Chen, "Design and Implementation of energy data collection system using wireless fidelity (WiFi) module and current transformer" in IEEE International Conference on System Science and Engineering (ICSSE), 2014.
- [4] Dammina 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, "IoT Based 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 wireless electric power management and control system based on Zigbee technology", International Conference on Transportation Mechanical and Electrical Engineering (TMEE)Changchun,China,pp.1120-1124, December16-18, 2011.
- [8] Ragul R, Karventhan P, Gowtham R, et al., (2020) "IoT Based Monitoring & Control of Energy Meter", iCS3M 2020, pp.1.6, August -2020.
- [9] Landi C., Dipt. d.Ing., dell inf. Secondauniv. di Napoli, Aversa Italy, Morela, P.; Iannilo G, "ARM based energy management system using smart meter and web server," IEEE Instrumentation and Measurement Technology conference Binjiang, 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.