

DYNAMIC DOMESTIC ENERGY UTILITY MONITORING AND MANAGEMENT USING IoT

Karthikeyan L¹, Mangaiarkarasi R², Meciya M³, Abirami S⁴

^{1,2,3}Department of Electronics and Communication Engineering, SRM Valliammai Engineering College, Tamilnadu, India.

⁴Assistant Professor, Department of Electronics and Communication Engineering, SRM Valliammai Engineering College, Tamil nadu, India.

Abstract - The Digital India program is a flagship program with a vision to rework India into a digitally authorized society and data economy. Thus for supporting it, we a part of the contribution by this project that creates the energy meter reading digitally getting to update in the IoT server via microcontroller in absence of unit reading workers. Normally once sixty days the electricity board involved officer will mark and tell the energy meter unit reading of explicit house and this method drawn-out so to beat from it. Our system is helpful for each electricity department and therefore the house owner. The unit reading for explicit meter can get updated within the IoT server. This project is straight forward and luxurious for the public to take care of the budget EB and economical too.

Key Words: IoT, microcontroller, economical, Budget eb, absence of unit reading workers, digital enery meter reading

1. INTRODUCTION

India stands in the third-largest producer of electricity in the entire world with 4.8% of the world share. Out of the whole power generated renewable energy constituted about 28.43% and the non-renewable energy constituted about 71.57%[1]. Electricity is an important requirement for leading a comfortable life. It should be properly utilized and managed. At present, the human operator from the Electricity Board visits the resident to obtain the readings from the energy meter and produces the bill for the specific month manually. The idea is being proposed to scale back the human interference to collect the monthly reading and to minimize the technical issues concerning the billing method. From the electricity board section, the data regarding the payment of the bill and the pre-planned power shut down details are communicated to the client. If the client doesn't pay the bill in time, the user is informed through a message using IoT. It provides pre-intimation of power cut details and also the energy consumption for every 5 minutes. It provides an alert if the energy consumption exceeds beyond the particular limit.. it is an efficient method of greater accuracy, improved billing. In flats, the energy meter is far away from the residents therefore an LCD is placed in every residential house in the lodging to inform about the messages relating to the power cut, energy consumption details. These features are implemented through the Arduino NodeMCU (esp8266) microcontroller. Esp8266 chip is the wifi module that helps in transferring the data through the web.

2. EXISTING SYSTEM

The energy meter is a device that has been existing in these days. The person from the EB office is assigned to check the energy meter of houses in the surrounding locality. The bill will be then generated based on the power consumed by the people for two months.

2.1 CHALLENGES FACED IN THE EXISTING SYSTEM:

- It is a very time-consuming process.
- There is a chance for the improper functioning of the energy meter.
- The bill generated by the human may have certain errors and theft.
- There is a possibility to send a wrong bill to a particular person.
- The check and balance and verification procedure of this meter reading are not present.



ANALOG METER



DIGITAL METER

Fig -1: Existing meters

3. PROPOSED SYSTEM

A smart energy meter is an electric device having an energy meter chip for electric energy consumed measurement. Wireless Protocol is used for Data communication and Peripheral devices are used for data showing and meter controlling. Our Embedded controller is interfaced with GSM modem and it is controlled using IoT. Readings will be automatically updated to the server. A smart energy monitor shows you how much energy used in the home per minute. Smart meters send accurate, regular information about your energy use. The bills will be accurate and there will be an end to submit meter reading.

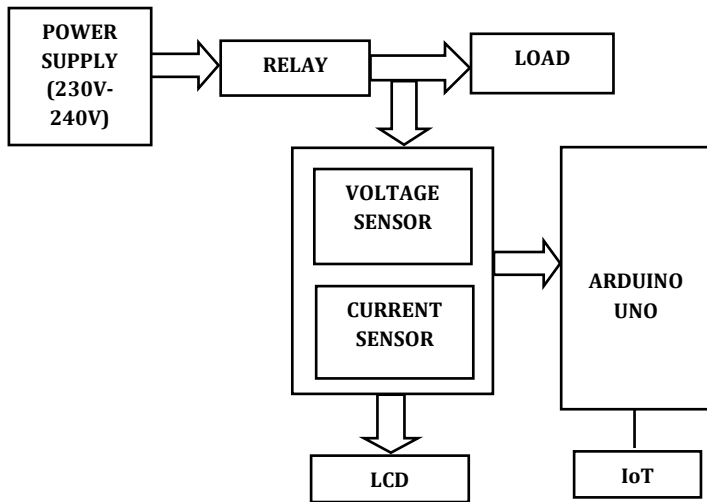


Fig -2: Block diagram of the proposed system

3.1. SYSTEM DESCRIPTION

In our system, a unique Id is provided for each energy meter. This unique Id number is interlinked with the customer's unique mobile Id number. It constantly monitors the energy meter. The energy consumption from each house is given to the control station with the help of the web server and the billing and power cut details are sent from the control station to the residential energy meter.

A. Energy consumption for every 5 minutes

In the existing energy meter, the meter shows the energy consumed from the date of installation. In this system, the daily energy consumed is calculated using the Arduino microcontroller and it is displayed in the LCD. It is also communicated to the consumer's mobile using IoT.

B. Billing And Payment Through IoT

The billing detail for energy consumption is communicated to the consumer every 5 minutes through the web server using IoT. The payment is also made through the webserver. This helps in the elimination of manual dependency to collect the reading.

C. Pre-Intimation of Shut Down

The sudden power cut causes major problems in hospitals, industries, and public sectors. To make safety precautions in hospitals, the power cut is announced in advance. The power-off details are sent from EB web server to the consumer's unique ID using IoT. The details are also displayed on the LCD.

E. Power Disconnection through a message

When the residents are out of the station and if they have forgotten to off the power, it can be disconnected by sending a message through the GSM module. This helps to prevent the wastage of energy if any equipment has been forgotten to off.

4. COMPONENT REQUIREMENTS

Table -1: Components needed

HARDWARE	SOFTWARE
Voltage sensor Current sensor Arduino uno Relay Lcd IoT	Arduino IDE MySQL PHP

Internet of Things (IoT) is an environment within which objects, animals or individuals are given distinctive identifiers and ability to transfer data over a network without requiring human to human or human to computer interaction. The IoT permits objects to be sensed and/or controlled remotely across existing network infrastructure, making opportunities for more direct interaction of physical world into computer based systems and leading to improved potency, accuracy and economic profit. Data is also updated to a selected website or a social network by which user will be able to access data.

A **current sensor** (CT1270) is a device that detects electric current (AC or DC) in a wire and generates an output proportional to it. A voltage drop occurs when a current flows through a wire or in a circuit. A magnetic field is also generated surrounding the current-carrying conductor. Thus, there are 2 types of current sensing: direct and indirect. Direct sensing relies on Ohm's law, whereas indirect sensing relies on Faraday's and Ampere's law. Indirect Sensing involves measuring the magnetic field surrounding a conductor through which current passes. Direct Sensing involves measuring the voltage drop associated with the current passing through passive electrical components. Direct sensing is used here.

AC voltage sensor is based on the principle of Magnetic Modulation and is designed for the measurement of AC voltage. The output of this sensor is proportional to the input AC voltage. It can be used for monitoring continuous ac voltage of the system.

Arduino Uno used here is a microcontroller board which is based on the ATmega328P. It has fourteen digital input/output pins (of which six are often used as PWM outputs), six analog inputs. A sixteen MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button.

The **Arduino IDE** (Integrated Development environment) is a cross-platform application that is written in functions from C and C++. It is used for writing and uploading programs to Arduino compatible boards. The Arduino IDE provides a software library from the Wiring project, that provides several common input and output procedures.

MySQL is an open-source relational database management system(RDBMS). The expansion of SQL is structured query language. The MySQL server software and the client libraries use dual-licensing distribution. MySQL is a database management system(DBMS) that allows you to manage relational databases.

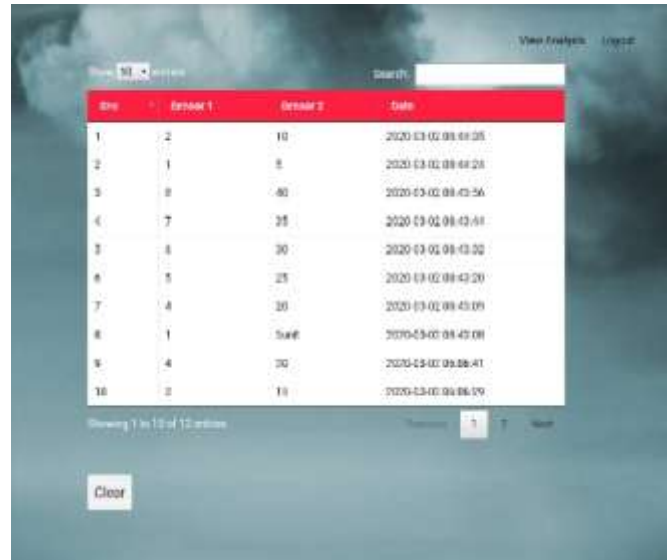
PHP is a general-purpose scripting language that is popularly used which is especially suited for web development. PHP code can be executed with a command-line interface (CLI), embedded into HTML code, or used in combination with various web template systems, web content management systems, and web frameworks.



Fig -3: Circuit connection of the proposed smart meter



PHP login page



SNo	Breaker 1	Breaker 2	Date
1	2	10	2020-03-02 09:44:05
2	1	5	2020-03-02 09:44:20
3	0	40	2020-03-02 09:43:56
4	7	25	2020-03-02 09:43:44
5	5	30	2020-03-02 09:43:32
6	5	25	2020-03-02 09:43:20
7	4	20	2020-03-02 09:43:09
8	1	Start	2020-03-02 09:43:00
9	4	30	2020-03-02 09:42:41
10	0	10	2020-03-02 09:42:19

PHP Output

Fig -4: Resulting output

5. CONCLUSION

The Arduino esp8266 microcontroller is programmed to perform the objectives with the help of IoT. It is proposed to overcome all the disadvantages in the already existing energy meter. All the details are available to the consumer through the IoT and it is also displayed in the LCD. It is a time-saving process and it helps to eliminate human interference.

REFERENCES

- [1] D. MohanaPriya, R. Reshma, D. Priyadharshini, Swathi Vinod, "IoT Based Automation of Electricity Consumption in Smarthomes", System Computation Automation and Networking (ICSCAN) 2019 IEEE International Conference.
- [2] Mohammad Mahdavyfakhr, Seyyedmilad Ebrahimi, Hanqing Lin, Juri Jatskevich, "An Effective Economical Hierarchical Control Scheme for Low-Voltage AC Microgrids", Technology Electronics and Mobile Communication Conference (IEMCON) 2019 IEEE 10th Annual Information.
- [3] Guido Cavarro, Emiliano Dall'Anese, Andrey Bernstein, "Dynamic Power Network State Estimation with Asynchronous Measurements", Signal and Information Processing (GlobalSIP) 2019 IEEE Global Conference .
- [4] Samet Tonyali, Kemal Akkaya, "A scalable protocol stack for IEEE 802.11s-based advanced metering infrastructure networks", Consumer Communications & Networking Conference (CCNC) 2018 15th IEEE
- [5] Fenghua Peng, Feifei Feng, Bo Yan, Jie Zhang, "A random access scheme based on dynamic allocation of PRACH resources for smart grid communication", Communication Software and Networks (ICCSN) 2017 IEEE 9th International Conference.

- [6] Angel Recalde, Iván Endara, Marco Quim, Cristian Romero, "Operational framework proposal for ESPOL university 2.0 smart campus implementation", Ecuador Technical Chapters Meeting (ETCM) 2017 IEEE.
- [7] S.Visalatchi and K Kamal Sandeep, "Smart energy metering and power theft control using arduino & GSM", Institute of Electrical and Electronics Engineers (IEEE), 2017.
- [8] V.Preethi and G.Harish, "Design and implementation of smart energy meter", Institute of Electrical and Electronics Engineers (IEEE), 2016.
- [9] H. Arasteh, V. Hosseinneshad, V.Loia, A.Tommasetti, O.Troisi, M.Shafie Khan, P.Siano, "IoT Based Smart Cities: A survey"(IEEE),2016.
- [10] Md.Masudur Rahman, Noor-E-Jannat, Mohd. Ohidul Islam and Md. Serazus, "Arduino and GSM based smart energy meter for advanced metering and billing sytem", Institute of Electrical and Electronics Engineers (IEEE), 2015.
- [11] Sahana M N, Anjana S, Ankith S,K Natarajan, K R Shobha, "Home energy management leveraging open IoT protocol stack ", 'Recent Advances in Intelligent Computational Systems (RAICS)', (IEEE) 2015.
- [12] Himshekhar Das and L.C.Saikia, "GSM enabled smart energy meter and automation of home appliances", Institute of Electrical and Electronics Engineers (IEEE), 2015.
- [13] Amit Bhimte, Rohit K.Mathew, Kumaravel S, "Development of smart energy meter in labview for power distribution systems"(IEEE), 2015.
- [14] J. Widmer, Landis," Billing metering using sampled values according lEe 61850-9-2 for substations" (IEEE), 2014.
- [15] Cheng Pang,Valierry Vyatkin,Yinbai Deng, Majidi Sorouri, "Virtual smart metering in automation and simulation of energy efficient lightning system" , (IEEE) 2013.