International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

An Energy Monitoring System Using IOT

[1]Mr.S.Muthukumar, [2]Mrs.W.Sherinmary, [3]Gokul R , [4]Manoj Kumar V, [5] Sambath Kumar K

[1]Asst.Professor, Department of ECE, Adithya Institute of Technology, Coimbatore ,India, muthukumar_s@gmail.com
[2] Asst.Professor, Department of ECE, Adithya Institute of Technology, Coimbatore ,India, sherinmary_w@gmail.com
[3]UG Scholar, Department of ECE, Adithya Institute of Technology, Coimbatore ,India, gokul.r@gmail.com
[4]UG Scholar, Department of ECE, Adithya Institute of Technology, Coimbatore ,India, manojkumar.v@gmail.com
[5]UG Scholar, Department of ECE, Adithya Institute of Technology, Coimbatore ,India, sambathkumar.k@gmail.com

A B S T R A C T

Electricity plays a cardinal role in our day to day life. India is the third largest consumer of electricity China and USA with 5.5% global share as per statistics in 2016. The per person energy use rate in India is closer to 0.7 KW. India's share with global energy demand will rise to 9% by 2035. Electricity is one of the most basic requirements for our living. Without energy, life is almost paralyzed. In our project we have designed and implemented a low-cost IoT energy monitoring system which can help understand energy usage levels and can limit the wastage of energy. This system can be used in many applications, such as electricity billing system, energy management in smart grid and home automation. Experimental results confirmed that the developed power monitoring system can successfully measure voltage, current, power and power factor. Internet of Things (IoT) is an emerging field and IoT based devices have created a revolution in electronics and IT. The foremost objective of this project is to create awareness about energy consumption and its efficient use.

Keywords— IOT (*Internet of things*); power monitoring; electricity billing; energy consumption; home automation

INTRODUCTION

Severe Electricity pricing can motivate organizations to reduce energy use. The key to reducing electricity bills is to provide customers with a better understanding of when and where electricity is consumed, a key benefit of smart power meters. The energy usage data from these devices can also be used to improve the facility and limit the loss of energy. The installation of power meters helps residential customers to have an understanding of energy usage in home. Wireless displays in these power meters can display real time costs of energy usage and can help customers to budget the energy usage. Organizations can choose among many ways to reduce energy costs. Using power meters to detect power transients occurring in an event of start or stop of a device is relevant in this study of smart power meters. Start and stop information is used to calculate the operation time and duration. This data can be used in for scheduling of heating, ventilation and air conditioning (HVAC) to optimize energy usage of the organization.

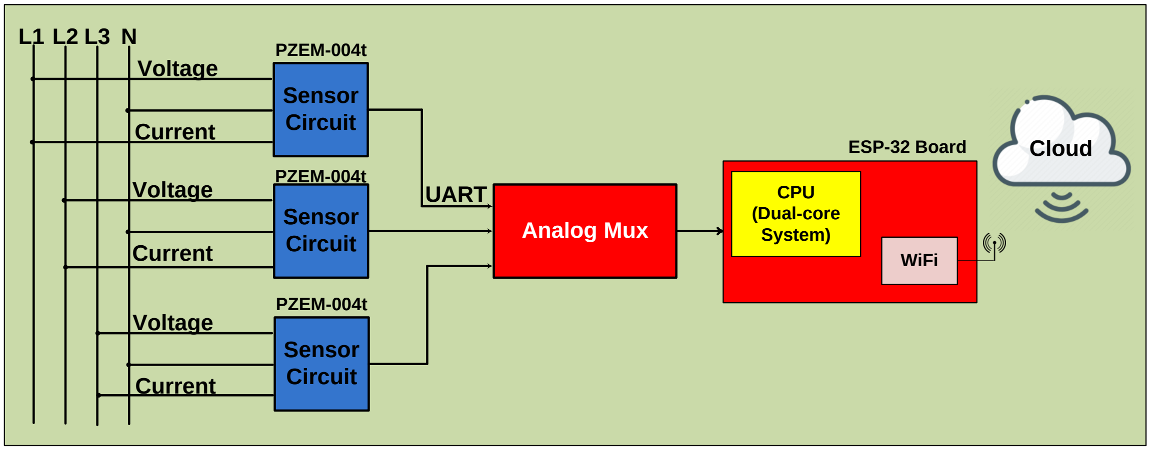
PROJECT OBJECTIVE

The proposes system implements a low-cost IoT energy monitoring system which can help understand energy usage levels and can limit the wastage of energy. Figure-3.1 represents the block diagram of the proposed system. This system can be used in many applications, such as electricity billing system, energy management in smart grid and home automation. Experimental results confirmed that the developed power monitoring system can successfully measure voltage, current, power and power factor. Internet of Things (IoT) is an emerging field and IoT based devices have created a revolution in electronics and IT. The foremost objective of this project is to create awareness about energy consumption and its efficient use. The proposed system can show a visual illustration of the facts that make it easy to deal with any kind of device problems

PROPOSED SYSTEM

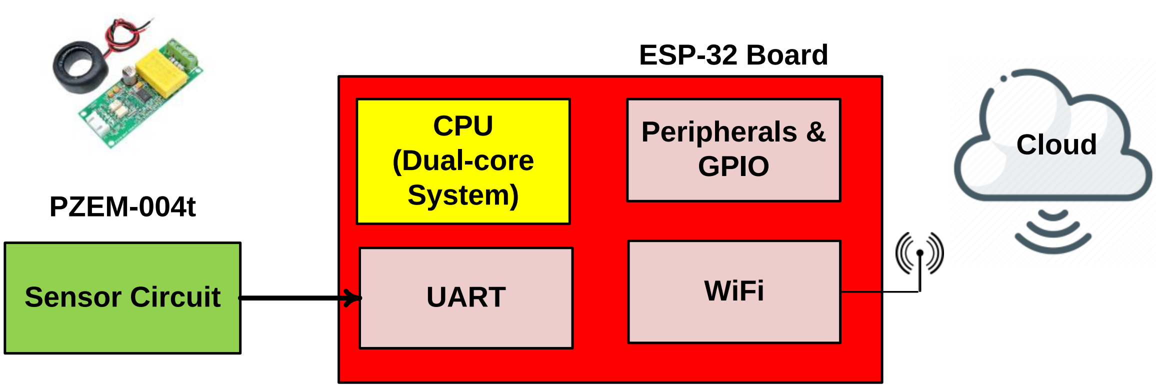
The design is based on a low-cost PZEM-004T, using non-invasive CT sensors, for retrieving data from sensor nodes and sending data to server via internet.

- **BLOCK DIAGRAM**



- **HARDWARE IMPLEMENTATION**

This section provides the detailed design of the hardware used for prototyping. The complete hardware prototype is developed and implemented using ESP-32 development board. A Hardware prototype was built using ESP-32 Development and Sensor kit (PZEM-004t) as shown

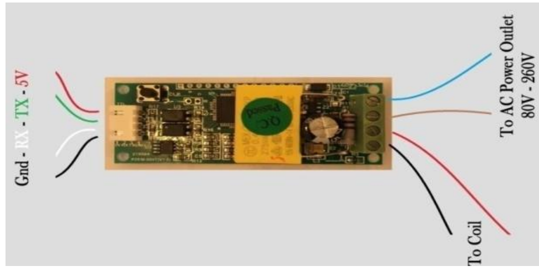


Internal Architecture Of Our Proposed System

PZEM-004T ECG Sensor

The wiring information of the PZEM is shown below Figure-4.13. The PZEM004T will return "-1" to everything unless it is connected to power on both sides. That means GND and 5V DC on the data side and 80V-260V AC on the measuring side

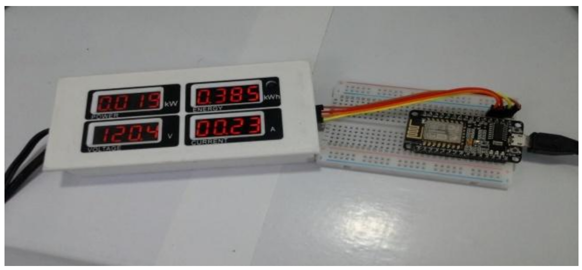
Data side connection is achieved through software serial port. This because most Arduinos come with only one hardware serial and its shared with the upload / serial monitor. Power is enabled by connecting the red wire on the data side to your 5V on the Arduino and the black wire on the data side to your GND.If the Arduino is 3.3V we can use either of the 2 methods Power the data side with an external 5V power supply and (if needed) use a logic converter to shift the serial signal voltage or replace R17 (resistor located just below the serial port) with a 510 Ohm resistor which enables the PZEM004T to operate at 3.3 Volts.



PZEM

OUR PROTOTYPE

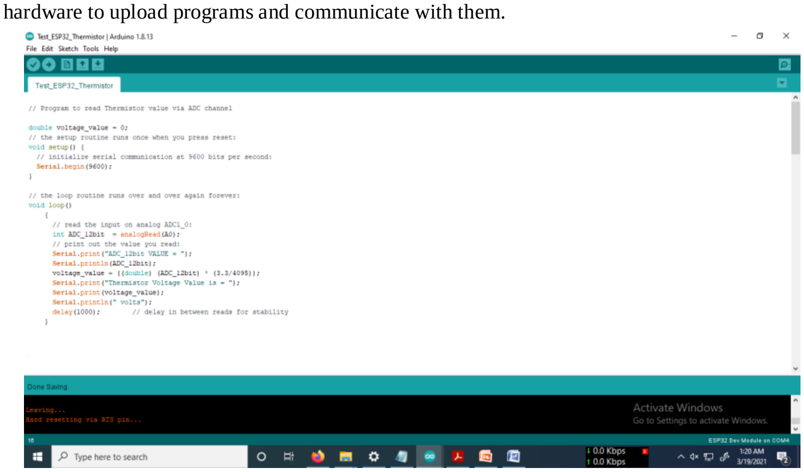
The developed hardware prototype using ESP-32 board, sensor (PZEM-004T)and signal acquisition circuit is shown in Figure



Prototype developed using ESP-32 board

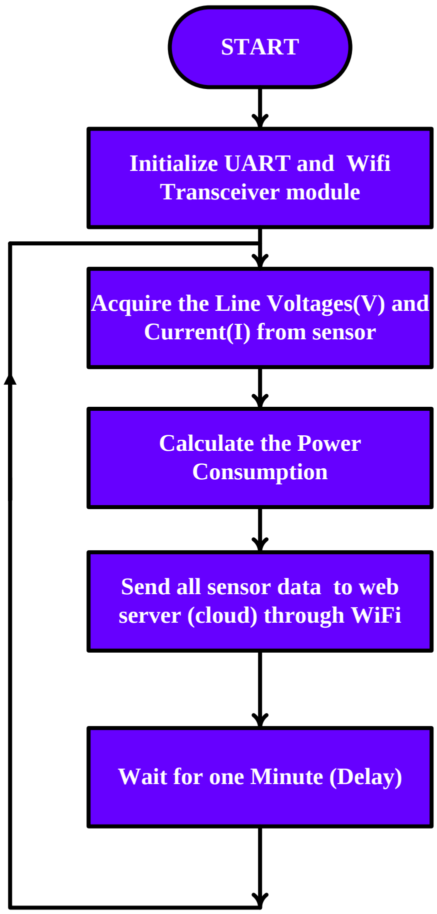
- **SOFTWARE IMPLEMENTATION**

The developed hardware prototype was programmed using C/C++ Language. The Software implementation of this framework includes libraries, which provide building blocks for the design. The work-flow details of the software implementation are discussed in the following sections use a software development kit (SDK) provided by Espressif or one of the platforms listed on WiKiPedia. Fortunately, the amazing ESP32 community recently took the IDE selection a step further by creating an Arduino add-on. The complete program for the proposed architecture was written using C/C++ languageArduino is fundamentally a C/C++ environment, while Processing's underlying language is Java.TheArduino Integrated Development Environment - or Arduino Software (IDE) contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and ESP-32 hardware to upload programs and communicate with them.



- **Program Execution flow**

The execution flow start with acquiring Voltage (V) and Current (I) samples, determines the power consumption and then send the data to web server (cloud) is represented in the flowchart shown in Figure



CONCLUSION

We have implemented our project on an IoT-based embedded platform using ESP-32 development board PZEM 004. This developed IoT device measures the voltage, current, power and energy of a three-phase four-line power line in a home or small office. This was a low-cost IoT device comprising of three electrical energy sensor modules, a microcontroller and a serial-to-wifi module. The IoT device was tested for collecting data to support efficient energy management over a whole week and found to be well working since smoothly yielding reliable data.

REFERENCES

[1] F. Benzi, N. Anglani, E. Bassi, and L. Frosini, Electricity Smart Meters Interfacing the Households, IEEE Transactions on Industrial Electronics, vol. 58, no. 10, pp. 4487-4494. (2011).

[2] R. Rashed Mohassel, A. Fung, F. Mohammadi, and K. Raahemifar, A survey on Advanced Metering Infrastructure, International Journal of Electrical Power & Energy Systems, vol. 63 pp. 473-484. (2014).

[3] Komkrit C., Kraison M. Design of an IoT Energy Monitoring System, Faculty of Engineering Nakhon Phanom University Nakhon Phanom, Thailand.(2018)

[4] R. Rashed Mohassel, A. Fung, F. Mohammadi, and K. Raahemifar, “A survey on Advanced Metering Infrastructure,” International Journal of Electrical Power & Energy Systems, vol. 63, pp. 473-484, 2014

[5] [A. M. Vega, F. Santamaria, and E. Rivas, “Modeling for home electric energy management: A review,” Renewable and Sustainable Energy Reviews, vol. 52, pp. 948-959, 2015.

[6] E. Taktak and I. B. Rodriguez, “Energy Consumption Adaptation Approach for Smart Buildings,” in 2017 IEEE/ACS 14th International Conference on Computer Systems and Applications (AICCSA), 2017, pp. 1370-1377.

[7] M. Beaudin and H. Zareipour, “Home energy management systems: A review of modelling and complexity,” Renewable and Sustainable Energy Reviews, vol. 45, pp. 318-335, 2015.

[8] K. Athira, A. R. Devidas, M. V. Ramesh, and V. P. Rangan, “User centered energy management scheme for smart buildings,” in 2017 International Conference on Advances in Computing, Communications and Informatics (ICACCI), 2017, pp. 1296-1302.

[9] H. G. R. Tan, C. H. Lee, and V. H. Mok, “Automatic power meter reading system using GSM network,” in 2007 International Power Engineering Conference (IPEC 2007), 2007, pp. 465-469.

[10] M. Wasi-ur-Rahman, M. T. Rahman, T. H. Khan, and S. M. L. Kabir, “Design of an intelligent SMS based remote metering system,” in 2009 International Conference on Information and Automation, 2009, pp. 1040-1043.

[11] L. Labib, M. Billah, G. M. S. M. Rana, M. N. Sadat, M. G. Kibria, and M. R. Islam, “Design and implementation of low-cost Universal smart energy meter with demand side load management,” IET Generation, Transmission & Distribution, vol. 11, no. 16, pp. 3938-3945, 2017.