ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)

Vol 8, Issue 9, September 2021

IoT Based Smart Energy Meter

[1] Vishal Kumar, [2] Tanishq Sharma, [3] Abu Farhan

[1][2][3] Undergraduate Student, Dept. of Electronics & Communication Engg., IIMT College of Engineering, Greater Noida
Email: [1] vk5361489@gmail.com, [2] tsharma8nov@gmail.com, [3] abufarhan.iimt@gmail.com,

***Abstract*--- The term "INTERNET" refers to the vast category of applications and protocols built on top of sophisticated and interconnected computer networks, serving billions of users everywhere in the world in 24/7 fashion.[1] We all realize that electricity energy meters are installed in everyone's house or offices to count the electricity consumption based on traditional technology. At the end of each month, many folk get worried about the high electricity bill and that we need to check out the energy meter once in a while. But what if we can monitor our electricity use from anywhere in the world just using our smartphones? It sounds crazy but It is possible. So in this project we are designing a smart energy meter where we can monitor our appliances' load consumption in real-time. Here we are building an IoT-based Project of Energy Meter where we are using an esp8266 wi-fi module to connect our energy meter with the internet. Through this device, it will become easier to control all our devices as per the power they are consuming and have control over money.**

***Keywords*--- Current sensor, ATMEGA-328p(Arduino), ESP 8266 Wi-Fi Module**

I. INTRODUCTION

IoT is also identified as an enabler for machine-to-machine,human-to-human and human-with-environment interactions.[1] The Internet of things (IoT) concept enables us to attach the traditional day-to-day devices with one another over the internet. The devices connected through the IoT concept can be analyzed remotely. The IoT concept provides the essential infrastructure and opportunities to make a connection between the physical world and computer-based systems [2]. The concept has been gaining importance with more and more wireless devices that are increasing rapidly within the market. Hardware devices are connected with one another over the web(Internet). The ESP-8266 Wi-Fi module used in the system provides connectivity with the internet in the system. Nowadays the demand for electricity is increasing at a constant rate in the population and is being utilized for various purposes viz, agriculture, industries, household purposes, hospitals, etc. So, it is becoming more and more complicated to handle electricity maintenance and requirements. Therefore there's an instantaneous requirement to save lots of the maximum amount of electricity as possible. As the demand from the newer generations of population for electricity is increasing so along with it the technology improvement is needed. The proposed system provides a 180 degree technical curve to the traditional energy meters using IoT technology. Also, there are other issues that we've dealt with like power theft which successively generate economic loss to the Country. Monitoring, Optimized power usage and reduction of power wastage are the main objectives that lie ahead of a far system[2]. A energy meter based on new technology using a Wi-Fi system that has three major objectives. They are:

i. To provide automated load energy reading over an immediate basis.
ii. To use the electricity in an optimized manner and very cost effective.
iii. Reduce power wastage. The system basically can be monitored through the consumer end. The data from the system is displayed on a webpage that can be accessed by the consumer.

The system is designed on an ESP-8266. It is a low-cost wifi microchip, with full TCP/IP protocol stack and microcontroller capabilities.This small module allows microcontroller to connect with Wi-Fi network and therefore the most vital role is played by the Wi-Fi unit to send the data from the controller over the web. The ESP-8266 controller is programmed on the Arduino software IDE (Integrated Development Environment) which is a prerequisite to operate on the Arduino board. Its code is derivative of the C language.

II. LITERATURE SURVEY

In this paper, we described a low-cost real-time IOT based energy management system as proposed[4]. It is conceived as part of a distributed system that measures the main power system quantities and gives the possibility to manage the whole power plant. An integrated Web Server allows the gathering of the statistics of power consumptions, power quality and is in position to interface devices for load displacement. The device is characterized by quick access to the data and the combination of a smart meter and digital communication capability allows local and remote access. In this way, it is possible to manage the power consumption by the electrical appliances and also

ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)

Vol 8, Issue 9, September 2021

check the amount of power consumed by our appliances in terms of money. The power system resulted in an overall reduction in energy consumption and costs.

Approach for energy saving in Smart Grids using Smart-

In this paper, described the worldwide energy demand is increasing and hence necessity measures need to be taken to reduce the energy wastage with proper metering infrastructure in the buildings.

Arduino UNO uses ATMEGA-328P microcontroller and this controller comes preloaded with a Arduino UNO bootloader[6]. The aim of this work is to realize real time pricing. This solution is

economical and eco-friendly. Presently electronics energy measurement is continuously replacing existing technology of electro-mechanical meters especially in China and India. By the year 2004, digital meters started replacing electromechanical meters in Singapore. A wireless digital energy meter would definitely offer greater convenience to the meter reading task. Wi-Fi technology is chosen as a possible wireless solution to the present issue. In this paper, we present the planning, design and implementation for the Wi-Fi-enabled energy meter and also overcome the problems with traditional energy meters. The energy reader can collect the energy consumption reading from the energy meter wirelessly based on Wi-Fi technology.[7]

This paper describes Arduino uno Microcontroller based design and implementation of energy meter using IoT concept. The proposed system design eliminates the human involvement in Electricity maintenance. The Buyer must buy the usage of electricity on schedule, just in case that he couldn't pay, the electricity transmission can be turned off autonomously from the distant server. The

user can monitor the energy consumption in units from a 16*2 LCD. An IoT based real time energy measurement and actuating framework is proposed and may be easily integrated with home monitoring systems. The Wi-Fi unit performs the IoT operation by sending energy meter data to the cloud which may be accessed and

displayed on an LCD screen.

III. BLOCK DETAILS-

The smart electricity meter using a Wi-Fi module can be easily described in two parts. The first part being the physical part and the second one being the Webpage. It

consists of ESP 8266 Wi-Fi module, current sensor (ACS-712),16*2 display, and power supply.

3.1 Block Diagram-

The device is characterized by easy access to the data and therefore the combination of a smart meter and digital communication capability allows local and remote access. In this way, it is possible to manage the power consumption by the electrical appliances and also check the amount of power consumed by our appliances in terms of money.

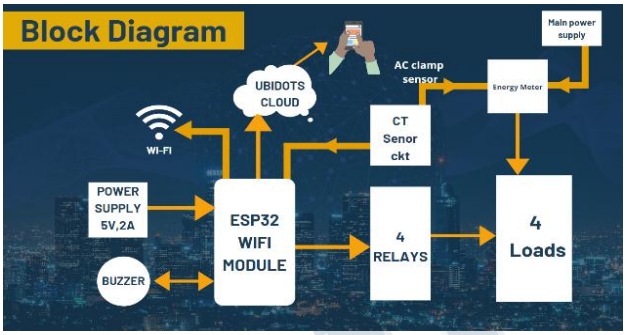


Fig 1-Block diagram of the system

IV. HARDWARE IMPLEMENTATIONS

4.1 Current sensor-

The ACS712® is a fully integrated hall-effect based linear current sensor that provides economical and precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for quick implementation by the customer. The device isn't intended for automotive applications.It simply put forth as a current sensor that uses its conductor to calculate and measure the quantity of current applied in any electrical device.This device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die.

The current flows through the inbuilt hall sensor circuit in its IC. The hall effect sensor detects the incoming through its magnetic field generation.

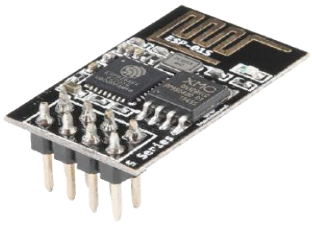
Once detected, the hall effect sensor generates a voltage proportional to its magnetic field that's then used to measure the amount of current.A precise, proportional voltage is provided by the low-offset, chopper-stabilized Bi CMOS Hall IC, which is programmed for accuracy after packaging.. The Interior resistance of this conductive path is 1.2 mΩ typical, providing low power loss.

ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)

Vol 8, Issue 9, September 2021

4.2 ESP-8266 Wi-Fi module



ESP8266 is a Wi-Fi enabled system on chip (SoC) module developed by Espressif system. It is frequently used for development of IoT (Internet of Things) embedded applications. It employs a 32-bit RISC CPU supported by the Ten silica Xtensa L106 running at 80 MHz (or overclocked to 160 MHz). It consists of a 64 KB boot ROM, 64 KB instruction RAM and 96 KB data RAM. External non-volatile storage is often accessed through SPI. ESP8266 module advantage is a low-cost standalone wireless transceiver that can be used for end-point IoT developments.

To communicate with the ESP8266 module, the microcontroller must use a group of commands. Microcontroller communicates with the ESP8266-01 module using UART having specified Baud rate.

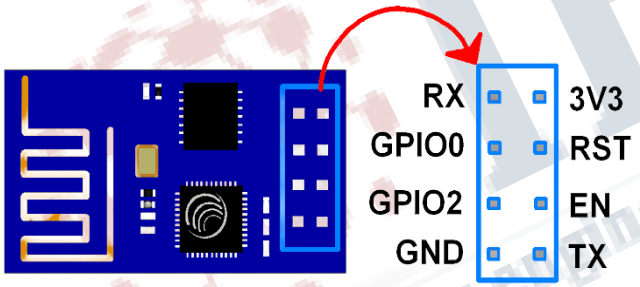
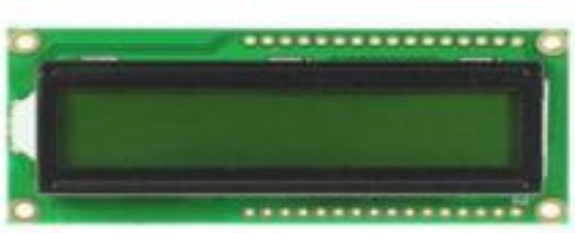


Fig 2- Pin diagram of ESP-8266

4.3 16*2 LCD display

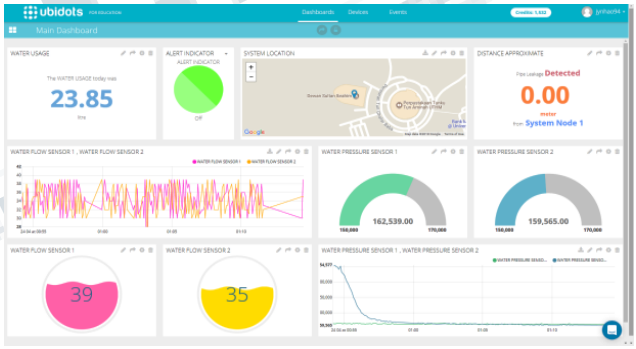
LCD (Liquid crystal display) screen is an electronic display module and finds a huge range of applications. 16*2 display means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in the 5*7 -pixel matrix also has 11, 12, 13 and 14 pins of the display that are used as data pins for Arduino interfacing. These displays are mainly preferred for multi-segment Light-emitting diodes and seven segments.

The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc[5].



V. WEB PAGE(UBIDOTS)

The proposed system can be used to display load energy usage reading in terms of Watts along with money drawn by the devices. The data would be accessed by each and every user from anywhere in the world. Ubidots.com is one such webpage which takes the help of the MathWorks MATLAB analytics to present the device information in a more detailed analysis in both description and visualization.Ubidots.com provides the user to add any number of channels to at least one account and in each account information are fed into 8 fields . An account may be assigned at least one division of an area and n channels are often created to a set of n meters within the locality. The analytics can be viewed by both the consumer and service provide.



VI. PROBLEM STATEMENT

Since IOT is cost effective compared to traditional methods , monitoring of energy usage at lower cost is possible. Daily consumption reports are generated which can be monitored by the user through an Android application and/or web portal. It is a more reliable system and accurate reading values are collected from energy meters using devices. Live readings of devices can be viewed using an Android application. Also, the readings can be viewed online. Human interference is avoided and everyone's values are kept maintained in the central server. The communication medium is secure and tampering of energy meters or theft of electricity can be identified easily. If a mistake occurs within the system, the value in the central server will not be updated. Since the values are

ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)

Vol 8, Issue 9, September 2021

stored within the central database, the reports are made accessible from anywhere on the world. Also, the server is online 24x 7 available [3].

VII. UBIDOTS GRAPHIC INTERFACE

The Internet of Things provides access to a broad range of electronic devices(specially embedded devices) and web services.

Ubidots is one of the free IoT platforms empowering innovators and industries to prototype and scale IoT projects to production.Ubidots offers a REST API that allows you to read and write data to the resources available:data sources, values ,events and insights. location-tracking applications, and a social network of things with status updates.

Ubidots delivers a secure, white glove experience for our users with device friendly APIs that provide a simple and secure connection for sending and retrieving data to/from our IoT data performance optimized time series backend(cloud).

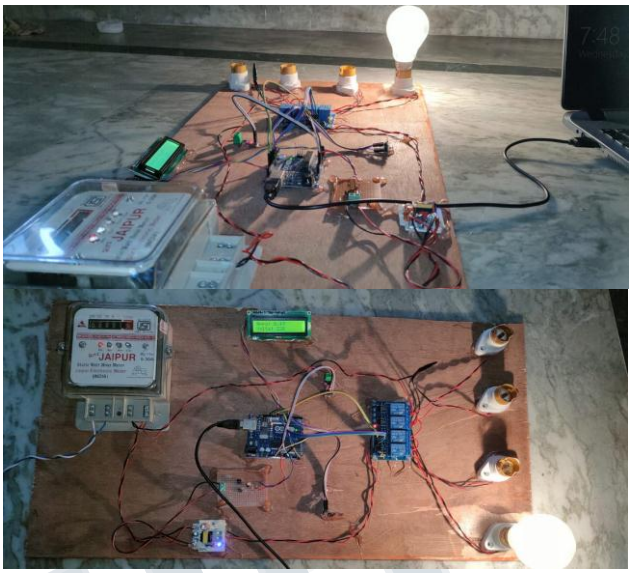
VIII. RESULT

Firstly we have to switch on the main power supply. Current sensor senses the power which can be utilized by the load. Which gives output in analog form. The output of the sensor is supplied as input to the analog input pins in the Arduino-Uno Board. Arduino board has inbuilt analog to digital converter which converts analog input of power to digital output. This digital output is displayed on an LCD display in the form of Watts and also these digital values can be converted in to rupees by using formula-

(220v*(current(arduino-uno)*7.5)/60000)

where ,7.5 is rupees/unit(1kWh)

The ESP-8266 is used to connect the internet with the monitoring hardware system. The power utilized by the load is displayed in the LCD screen and also monitored from the webpage. It shows time to time power utilization of the load/loads connected to the system.



IX. CONCLUSION

Energy Monitoring using IOT is a very innovative application of the internet of things which plays a vital role in upcoming years.It is used to control home appliances remotely over the cloud from anywhere in the world. In the proposed project current sensor is used to sense the current and display it on the web using IoT. The system updates the information every 4 to 3 seconds because it has some delay due to the relay module connecting with the appliances to make the appliances home automated[8].

In this new system, load consumption of the appliances is accessed using Wi-Fi technology and it will help consumers to avoid unwanted use of electricity.[9] An IoT system where a consumer can monitor energy consumption and pay the bill Online. Also, a system where a user can receive SMS, when he/she crosses the threshold of electricity usage slab can be equipped.We may further enhance this system where a consumer receives text message whenever someone is trying to steal the electricity within a 100m of area. Also using cloud analytics we will predict future energy consumptions.This system can also perform home automation which is another advantage of making this project[10].

REFERENCES

[1] Internet of things (principal and paradigms) Edited by-Rajkumar buyya & Amir Vahid Dastjerdi.

[2] Internet of things is a revolutionary approach for future technology enhancement Prayag Tiwari & Mikhail Zymbler

[3] IEEE internet of things Vision Of IoT: Applications, Challenges, And Opportunities With China

Perspective Shanzhi Chen;Hui Xu;Dake Liu;Bo Hu;Hucheng Wang

[4] Darshan Iyer N, Dr. KA Radhakrishnan Rao, "IoT Based Energy Meter Reading, Theft Detection & disconnection using PLC modem and Power optimization.

[5] (2008 Oct. 29) Specifications of LCD [Online] Available: https://www.sparkfun.com/datasheets/LCD/ADM1602K -NSW-FBS-3.3v.pdf

[6] WORKING PRINCIPLE OF ARDUINO AND USING IT AS A TOOL FOR STUDY AND RESEARCH Leo Louis Department of Electronics and Communication Engineering, Gujarat Technological University, Ahmedabad, India

[7] Foundation Elements of an Iot solution (The Edge, The cloud and The application development) by Joe Biron & Jonathan Follet.

[8] C.-H. Chen, C.-C. Gao, and J.-J. Chen, Intelligent Home Energy Conservation System Based On WSN, presented at the Internation-al Conference on Electrical, Electronics and Civil Engi-neering,Pattaya, 2011.

[9] Basma M. Mohammad El-Basioni1, Sherine M. Abd El-kader2 and Mahmoud Abdelmonim Fakhreldin3, "Smart Home Design using Wireless Sensor Network and Biometric Technologies" at Volume 2, Issue 3, March 2013

[10] Nicholas D., Darrell BSomsak S., "Home Automation using Cloud Network and Mobile Devices", IEEE Southeastcon 2012, Proceedings of IEEE.