

Design of Raspberry Pi Web Based Energy Monitoring System for Residential Electricity Consumption

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ABSTRACT

Electric power is the basic requirement of human beings, which is used for domestic, industrial and agricultural purposes. In the process of energizing, the electric current must flow through electronic circuits of the equipment. This flow of electric current can be controlled and monitored by a Smart Meter, which has an electronic chip for monitoring the energy consumed and a wireless module for data communication.

The entire setup consists of an automated metering device, Raspberry Pi, PZEM Module and buzzer is used. The energy being utilized and its will be sent to cloud server.

INTRODUCTION

Electric energy utilization manages the use of electric energy for home-grown, horticultural, modern purposes. All out power consumed by total populace in 2012 was assessed to be 20,900 Terawatt-hour (TWh). Worldwide power request rose by 4% increment in 2018 and it's the most elevated beginning around 2010. Despite the fact that the larger part interest for electric power is met by atomic sustainable power sources, there is an expansion in arrangement of coal, internal combustion plants which drives CO₂ discharge undeniably.

The complete energy created in India expanded from 154.7 GW to a surprising 345.5 GW in 2018, making the world's third biggest electric energy maker falling behind China, United States. No matter what this amazing advancement, India faces a far reaching interest for power. International Energy Agency estimates that interest for power in India will significantly increase somewhere in the range of 2018 and 2040. Electric energy interest in India expanded to 65 TWh in 2018 which is in lower rate contrasted with the earlier year; the increment of force request comes from structures, where cooling is most extreme essential. This undertaking targets bringing down the use of power by productive unique power the executives utilizing IoT.

LITERATURE SURVEY

S.NO	JOURNAL WITH YEAR	TITLE	AUTHOR	LEARNING OUTCOMES
1.	IEEE Transaction (2018)	Smart meter for the IoT	F. Abate	This paper shows the primary arrangement of tests led on a minimal expense brilliant meter. It features the great presentation of this approach, utilizing the calculation portrayed in this paper. The meter, with his remote connection point, could be coordinated in a 169MHz organization, spreading and sharing data about energy utilization for the brilliant network.
2.	IEEE Transaction (2018)	Brilliant Energy Meter Surveillance Using IoT	M. Prathik	It is proposed to conquer every one of the burdens in the generally existing energy meter. Every one of the subtleties are shipped off the customer's portable through the IoT and the GSM module and it is additionally shown in the LCD. It is an efficient interaction and it assists with killing the human impedance.

SYSTEM ANALYSIS**EXISTING METHOD**

In existing systems, we have power consuming details and the user can check the power consumption but it doesn't have adding of additional units of power and controlling of loads from long distances. In this system we are monitoring the house loads by using PZEM module based on these values the person can know how much power he is using and can reduce the power consumption. The values are displayed on cloud server. The main microcontroller used in this project is Raspberry Pi which is a Wi-Fi based controller.

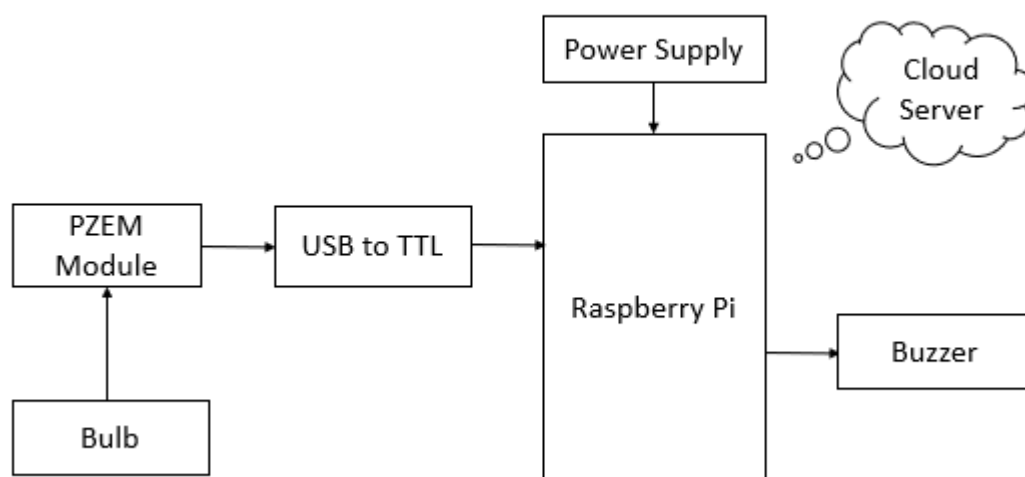
DRAWBACKS

In the existing system meter tampering can be done easily
Manual Work is more and errors may happen

PROPOSED METHOD

In this proposed system we are monitoring the house loads by using PZEM module based on these values the person can know how much power he is using and can reduce the power consumption. The values are displayed on cloud server. The main microcontroller used in this project is Raspberry Pi which is a Wi-Fi based controller.

BLOCK DIAGRAM



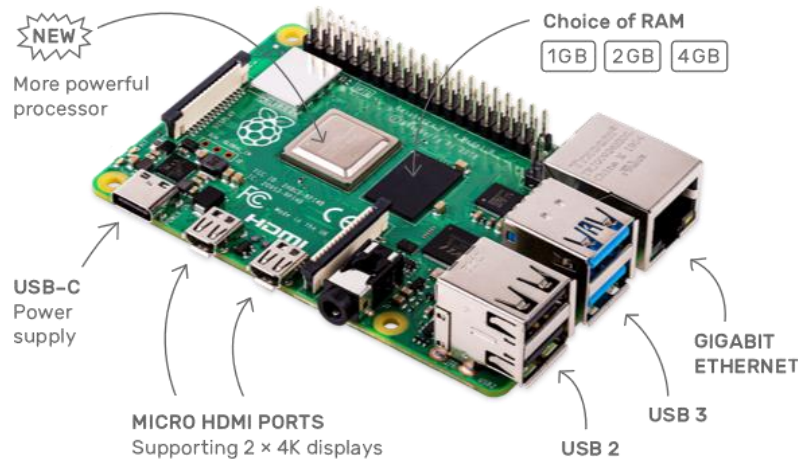
REQUIREMENT SPECIFICATIONS

HARDWARE REQUIREMENTS

- Raspberry Pi 4
- PZEM-004T Sensor
- Buzzer

Raspberry Pi 4

Raspberry Pi is bit estimated PC used Linux working framework. It is more modest than expected size PC used generally to run greater and brilliant projects to rapidly achieve yield. Raspberry Pi 4 B+(RP4) is endured model made by association, which has every one of expected latest wired and remote correspondences frameworks utilized in a large portion of savvy projects. Solitary Raspberry Pi 4 comes to Quad-Core processor however it has 3 distinct renditions which give 3 unique sizes of RAM. Raspberry Pi 4 purposes smaller than normal HDMI, additionally it has 2 ports for two 4K presentations.



Current Correspondence Support

Raspberry Pi 4 is generally current correspondence frameworks. It has interior WiFi and Bluetooth for remote information correspondence. It tends to be utilized with inside at anyplace with no unsettling influence. The Pi can be moved effectively inside a similar organization because of quick WiFi support.

RPi other Main Supplementary

USB: There are four USB ports in Raspberry Pi 4. Two ports have 2.0 help just however the leftover two are 3.0. These 3.0 help gives clients to rapidly move information.

PoE Header: Due to build the use of Raspberry Pi in IoT and other savvy projects the PoE Header has additionally drawn near the Pi. The one board PoE permits the clients to pass the capacity to the gadget through Ethernet Wire. On account of PoE, an outer PoE HAT will be required.

Camera: The gadget has camera support. It has a two-path MIPI CSI camera port which can be utilized to interface the pi straightforwardly with the cameras and use them with next to no third connection point.

Show: The Raspberry Pi 4 can be associated with an outside LCD. It doesn't utilize the development header to speak with LCDs like different gadgets. It has a different 2 path MIPI DSI port which can be utilized to speak with outer viable LCD.

Sound: The sound information can be make a trip from pi to the showcase gadget through HDMI however it has a different 4 shaft sound port that can be utilized to convey and get a sound message. The sign from the gadget can be utilized by the interior program or some other gadget at the extension header.

SD CARD: SD CARD is required piece of the Raspberry Pi 4. The Operating System of the Raspberry Pi 4 will be put inside the SD card, afterward card will be utilized through the SD Card opening.

Buzzer

The most effective method to utilize a Buzzer

Sign is little yet useful part to add vibrant components to endeavor/structure. It is little limited 2-pin structure can therefore conveniently used on breadboard, Per Board, shockingly, on PCBs which turns this into comprehensively elaborate the majority of electronic applications. 1's that 2 sorts are signals that are regularly available. One showed here is an essential chime

which when filled will create a Consistent Beep.... sound, the other kind is known as a readymade signal which will appear larger than this will convey a Beep. Blast. Blast. vibrant because of the internal influencing circuit that is there. However, given that it will typically be used as shown below, it is most frequently utilized revamped with help of various circuits to fit actually in our submission.



This sign can be used by basically controlling it using a DC power source with a range of 4 to 9 volts. A clear 9V battery can in like manner be used, yet it was endorsed to use a controlled +5 or +6 Volts DC supply. Chime is consistently associated using a circuit that changes turn ON or switch OFF the ringer at called for speculation, require length.

Usages of Buzzer/ Ringer

- Disturbing Circuits, where client should be terrified about subject.
- Correspondence equipment's.
- Car equipment.
- Versatile gear's, as a result of its more modest size.

PZEM Module

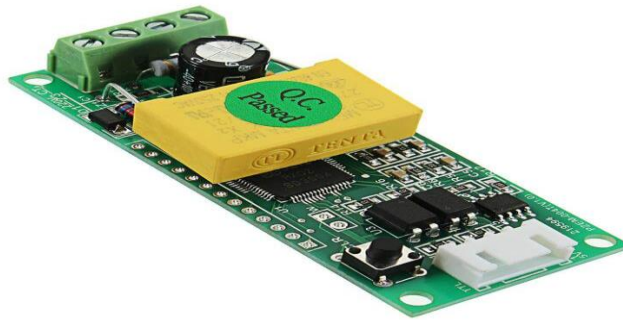
This Peacefair PZEM-004T Multi-capability AC Power Monitor is extremely well known in electrical utilization estimation projects. It is fit for estimating four interrelated electrical factors as voltage, flow, power, and energy.

This small PZEM-004T circuit is perfect for estimating AC (RMS) voltage, current, and power (single-stage). Just power the board with a power supply (or you can utilize the AC source you are estimating) and interface the round sensor to the board. Run the wire through the roundabout sensor and you're prepared to begin estimating the voltage, current, and power. The circuit likewise accompanies a TTL to USB connector wire for simple association with a PC or microcontroller.

- There is Reset Energy Knob on V2.0
- V3.0 is capability to Reset Energy utilizes programming, so there is no press knob for Reset Energy.
- V3.0 is redesigned adaptation of V2.0, so the degree exactness is better.
- Change/Perusing time on V3.0 is quicker than V2.0
- The convention utilized for information correspondence is different between the two.

PZEM-004T programming

PZEM-004T is extremely simple to utilize in programming using different kinds of microcomputer sheets, for example, Arduino, ESP8266, STM32, WeMos, NodeMCU, Raspberry Pi 4 and so on in light of the fact that it utilizes TTL sequential correspondence.



SOFTWARE REQUIREMENTS

- NOOBS
- Advanced IP Scanner
- VNC Viewer
- Python 3 IDLE

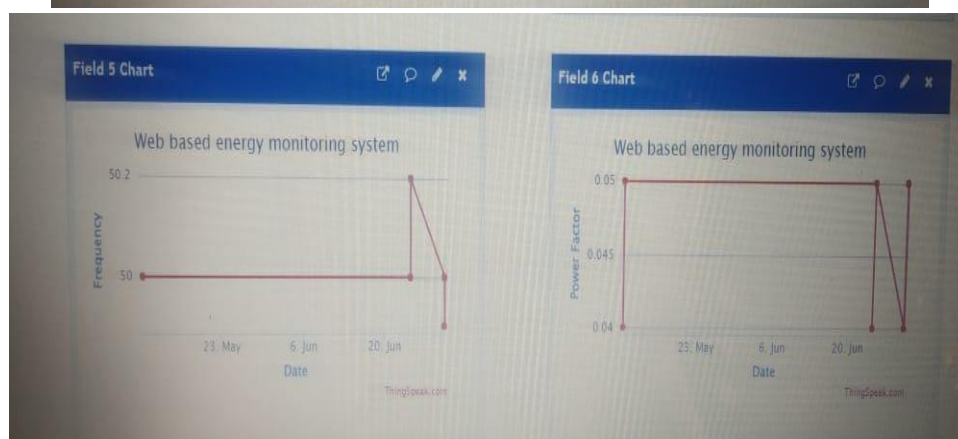
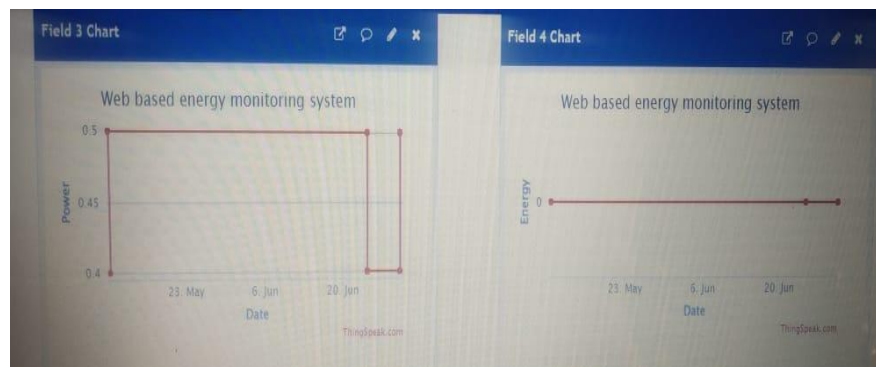
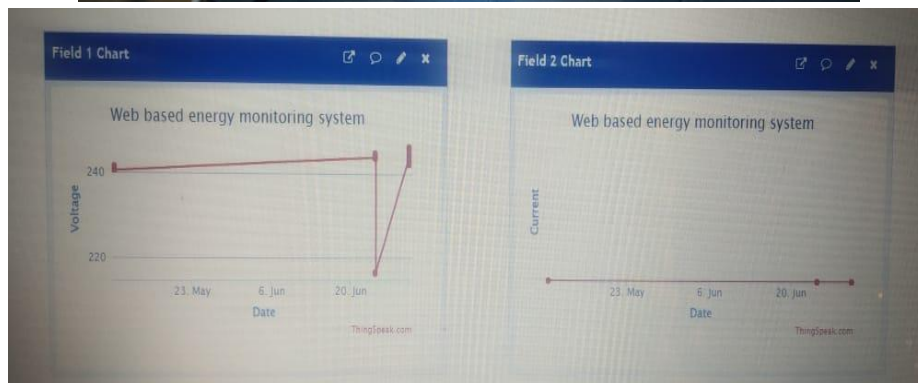
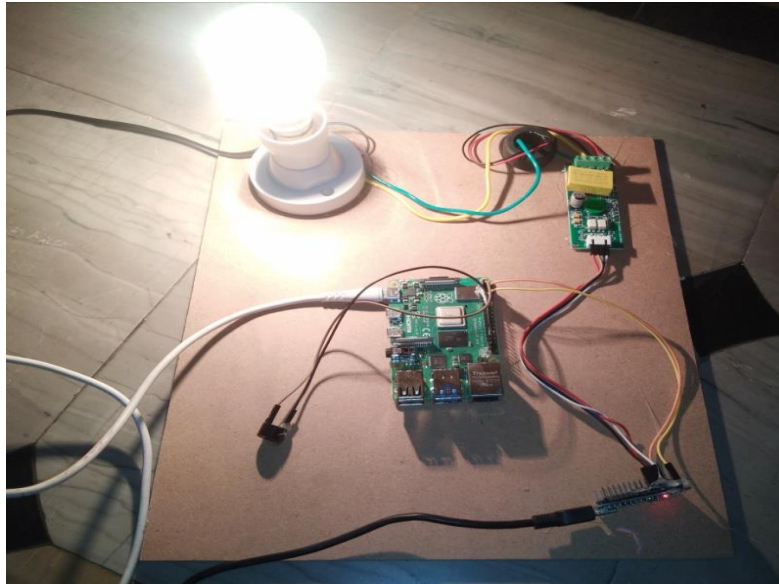
WORKING AND RESULTS

Power up the Raspberry Pi board by connecting an USB to the laptop. Also, make sure the laptop is connected to the power supply. Install Advanced IP Scanner and VNC Viewer in the laptop. Connect the Type-c cable to the Raspberry Pi with the 5 volts adapter which we have to give to the power supply. Switch ON the mobile Hotspot and ensure that the MAC address of the Raspberry Pi is detected in the Hotspot connected devices in mobile.

Open Advanced IP Scanner in laptop and press on the scan icon. Copy IP address of Raspberry Pi and paste it on VNC Viewer. Raspberry Pi Operating System appears. Press on the icon and select yolo_test.py. Select Python 3 IDLE and run code by clicking on the run module. And then in the Thingspeak we will get a 6 chart that is voltage, current, power, energy, frequency, power factor.

RESULTS

The below figure displays prototype of the project with title. It consists of all the Software and Hardware components that are described in the previous chapter that is a combination of both hardware and software.



ADVANTAGES

1. It is not difficult to work.
2. Practical.
3. One more benefit of the prepaid framework is that the human blunders in taking meter readings and handling bills can be diminished generally.

APPLICATIONS

- In Houses
- In Workplaces
- In Factories

CONCLUSION

In this task, a productive unique power the executives framework for family consumables utilizing Internet of things is introduced, proposed work is made utilizing Raspberry Pi, and its related peripherals, the framework cautions the client once the current or voltage scopes to greatest, it closes down power naturally with auto shut down element, resumes power once qualities become typical.

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