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MULTIPURPOSE SMART ENERGY SAVING ELECTRIC SYSTEM

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Abstract:
This project is to design and implement the multipurpose smart energy saving electric system in house and many public places. In existing system, the major disadvantages are it takes time to upload the data depending on the internet speed and module baud rate. For monitoring and keeping track records of your electricity consumption may be tedious task. To automate, we use the web application. In our advanced electric system, ESP32 Module monitor data on the blynk application. It saves time and money by automating remote data collection. It enables consumers to directly review there electric usage individually, even applicable to different appliances. And major part implemented in our electric system is directly connected to the energy meter and we can able to track live consumption of energy through a blynk application. ZMPT101B AC single phase voltage sensor is to measure 250V AC voltage. SCT-013 Current sensor is to detect current either in the form of analog voltage or digital output. Software designed by using Arduino IDE and embedded C.
Keywords—Arduino IDE, Power supply, Microcontroller, Voltage sensor

I. Introduction

From the past still now we are facing many challenges in energy meter, but we are overcoming all those problems such as power theft and also by avoiding manual monitoring, devoleping application for monitoring and payment through smart phone. But we are still now needs to travel to the meter room and track down readings and also it takes time to upload the data , depending on the internet speed and module baud rate. To overcome all these problems, we designed multipurpose smart energy saving electric system. In this system we can track live consumption of energy for each and every household appliances individually and also we can able to see the live power consumption of energy meter, that is still now how much power have been consumed in our house and public places. It also designed for industrial machines. By connecting ESP32 wifi module with the smart phone blynk application we can easily track the consumption of energy. ZMPT101B AC single phase voltage sensor

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is to measure 250V AC voltage. SCT-013 Current sensor is to detect current either in the form of analog voltage or digital output. Software designed by using Arduino IDE and embedded C.

II. Existing System

There is manual monitoring of the energy consumption. It require employee to monitor. No specialized app or web page for monitoring. In Present technology needs to travel to the meter room and tack down reading. It takes time to upload the data depending on the internet speed and module baud rate.

Disadvantages:

1. The system takes time to upload the data depending on the internet speed and module baud rate.
2. Charges may be applicable for network use and for SMS sending.
3. System cost increases by new metering technology

III. Proposed System

It eliminates manual meter readings.It is a smart automated functioned process. Wastage of energy is diminished and only required energy will be consumed.This multipurpose device calculate every appliances individual consumption of energy. The consumption of energy can be seen at any time in our advanced electric system.ESP32 Module monitor data on the blynk application. It saves time and money by automating remote data collection. It enables consumers to directly review their electric usage individually, even applicable to different appliances.And major part implemented in our electric system directly connected to the energy meter and we can able to track live consumption of energy through our blynk application relates software.

Advantages

1. In fraction of seconds, the energy consumption of voltage and current sensor displayed in Blynk application.
2. No need of any applicable network chargers usages.
3. No need to intimate the consumption of energy in SMS.
4. It displays both Vrms and Irms value the power and kwh value increases according to the time consumption of energy and the kwh value depends upon the power

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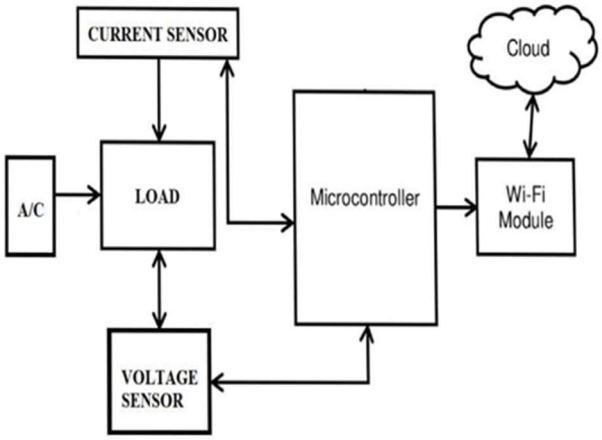
IV. Blockdiagram



Hardware Requirements:

1.ESP32 module
2.Voltage sensor
3.Current sensor
4.Resistor
5.Capacitor

Software requirements:

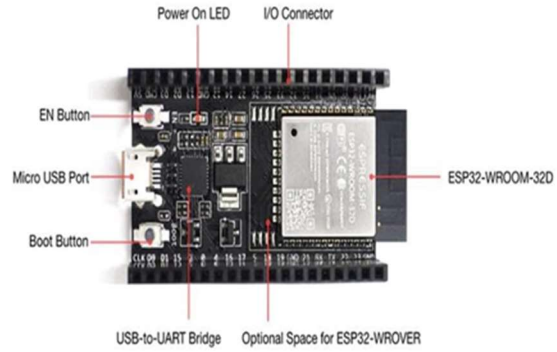
1.Arduino IDE
2.Embedded C

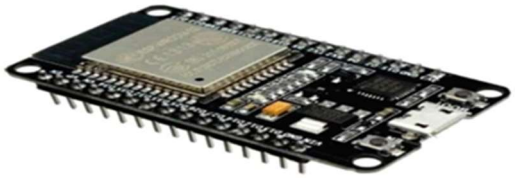
V. Module Description

Hardware requirements:

1. ESP32 MODULE:

ESP32 is a series of low-cost, low-power system on a chip micro controllers with integrated Wi-Fi and dual-mode bluetooth.ESP32 is created and developed by Espress if systems, a Shanghai – based Chinese company, is manufactured by TSMC using their 40 nm process. It is a successor to the ESP8266 micro controller. The ESP32 series employs a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations and includes built-in antenna switches, RF balun, power amplifier,low-noise receive amplifier, filter and power management module.





ESP32 is an evaluation board designed by Espressif Systems. ESP series of microcontrollers are very powerful controllers with very high clock speeds, camera interfaces and wireless connectivity .It also has common peripherals and supports protocols like I2C,SPI,ADC,UART.As a whole, it is one step below the computer. It also supports different boot loaders. you can also install circuit python which is a python version especially used to program microcontrollers. This evaluation board might look similar to Node MCU, but it is entirely different when coming to specifications. This board has a 5V to3.3V voltage regulator,CP2102 USB to UART converter which is used to program the ESP32.ESP32 is available in many versions .The most widely used version is ESP32-WROOM.It is a very compactly packed SOC with EEPROM ,Antenna, filtering circuits and oscillators.ESP32 is made up of ESP32-DOWDQ. ESP32 is also reliable to use at places where the product need to qualify EMI (Electro magnetic interface)/EMC (Electro magnetic compliance) testing (for industry grade certifications).The special features of ESP32 are the architecture of microcontroller and the number of wireless connectivities embedded in it.ESP32 has Wi-Fi, classic.Bluetooth and Bluetooth low energy(BLE) connectivity features in it .All of these can happen through the same chip antenna on board.ESP32 comes with inbuilt low-noise amplified (LNA) filtering and impedance matching circuits making it extremely easy for makers and developers to design applications. It has two cores, which means multiple task can be performed at the same time making it extremely powerful. For instance, you can use Bluetooth on one core and simultaneously control a motor on the other core without any interruption.

2. Voltage Sensor:

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This is an ideal choice to measure the AC voltage using Arduino or ESP32.The Modules can measure voltage within 250V AC voltage& the corresponding analog voltage. Output can be adjusted. The module is simple to use and comes with a multi-turn trim potentiometer for adjusting and calibrating the ADC output.ZMPT101B AC Single Phase voltage sensor module is based on a high precision ZMPT101B voltage transformer. ZMPT101B AC Voltage sensor is the best for the purpose of the DIY project.

This is the ideal choice to measure the AC voltage using Arduino. The active phase AC output voltage transformer module. Onboard precision op-amp circuit, the signal sampling and appropriate compensation for precise functions. Modules can be measured within 250V AC Voltage. ZMPT101B Voltage sensor is to measure accurate AC Voltage with the voltage transformer. This is an ideal choice to measure using arduino like an open source platform. In many electrical projects, engineer directly deals with measurements with few basics requirements like high galvanic isolation, wide range, high accuracy, good consistency.

On board precision miniature voltage transformer, the active phase AC output voltage transformer module. Onboard precision op-amp circuit, the signal sampling and appropriate compensation for precise functions. Modules can be measured within 250V AC Voltages, the corresponding analog output can be adjusted. It is brand new, good quality high performance.

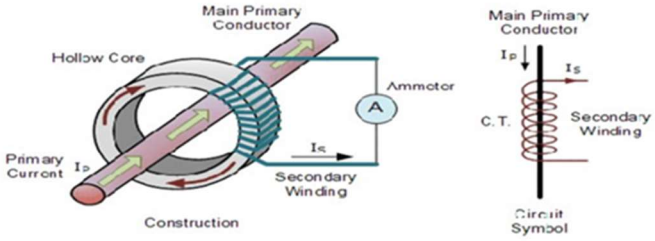
3. Current Sensor:

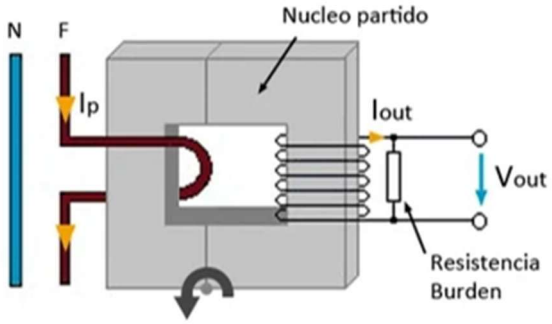
A current sensor is a device that detects and converts current to an easily measured output voltage, which is proportional to the current through the measured path. There are a wide variety of sensors, and each sensor is suitable for a specific current range and environmental condition.

The SCT -013 is a Non –invasive AC Current Sensor Split Core Type Clamp Meter Sensor that can be used to measure AC current up to 100 amperes.

Current transformers (CTs) are sensors are for measuring alternating current. They are particularly useful for measuring whole building electricity consumption. The SCT -013 current sensors can be clipped straight either to the live or neutral wire without having to do any high voltage electrical work.

The SCT-013 sensors are current transformers, instrumentation devices that provide a measurement proportional to the intensity that a circuit crosses. A current transformer is similar to a voltage transformer and is based on the same operating principle.



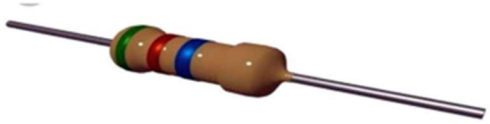


A current transformer seeks to generate an intensity in the secondary that is proportional to the intensity that passes through the primary. For this, it is desired that the primary is formed to reduced number of turns. The SCT-013 sensors are small current transformer. Current transformers are instruments widely used for measuring elements.

4. Resistor:

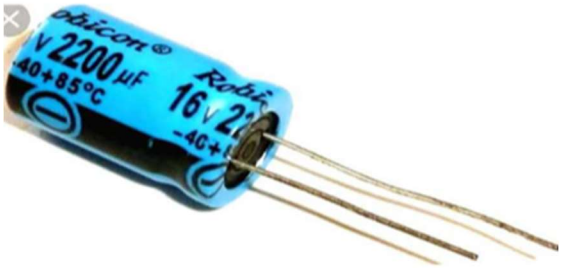
A resistor is an electrical component that limits the flow of electric current. A resistance a passive element in a circuit that provide resistance to the flow of current. Resistance is measure of the opposition to the flow of current in a resistor. The unit of resistance is ohm. It is a passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuit. It is made up of copper wires, which is coiled around a ceramic rod. The outer part of the resistor is coated with an insulating paint. The main purpose of resistor is to reduce the current flow and to lower the voltage in any particular portion of the circuit. When 1Volt potential difference is applied across a resistor and 1Amp of current flows through it. The resistance of the resistor is said to be equal 1ohm. A resistor is one of the most fundamental circuit elements in electrical and electronics engineering. The most essential requirement of a resistor is that its value of electrical resistance should not vary with temperature even with large temperature fluctuations. The temperature coefficient of resistance must be minimized. There are several type of resistor exist, but most of them

are made up of carbon and insulating material, such as ceramic. The current flows in one end and the remaining current flows out the other. The resulting current is inversely proportional to the resistance. This is defined in ohm's law, which states that the current (I) is equal to the voltage (V) divided by the resistance (R).Resistors are often color-coded to visually represent their resistance level. A typical axial –lead resistor is cylindrical in shape and has several colored stripes.Resistor are represented in a circuit by an jagged line. Resistor may not display the value outside, but it can be calculated through color pattern. PTH (plated-through hole) resistor uses a color-coding system.



5. Capacitor:

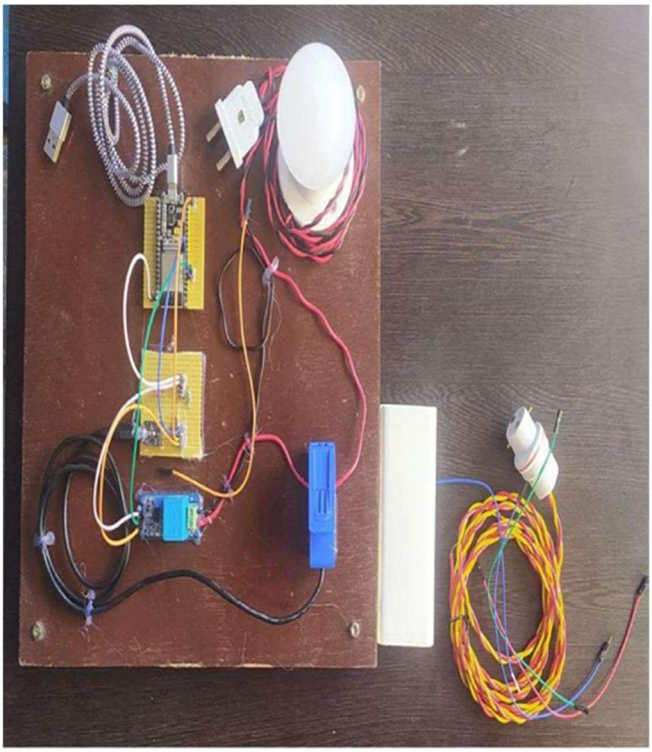
A capacitor is a device that is used to store charges in an electrical circuit. A capacitor works on the principle of a conductor increases appreciably when an earthed conductor is brought near it. Hence a capacitor has two plates separated by a distance having equal and opposite charges. A capacitor is a device that stores electric charge in an electric field. The effect of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit. The capacitor was originally called as condenser.



A capacitor is an electronic component that stores and releases electricity in a circuit. It also passes alternating current without passing direct current. A capacitor is an indispensible part of electronic equipment. The capacitor is a component which has the capacity to store energy in the form of an electrical charge producing a potential difference across its plates, much like a small rechargeable battery. This material allows each plate to hold an equal and opposite charge. The capacitor consists of two or more parallel conductive plates which are not connected or touching each other, but are electrically separated either by air or by some form of a good insulating material such as waxed paper,

mica, ceramic, plastic or some form of liquid gel are used in electrolytic capacitors. The insulation layer between a capacitors plate is commonly called as an Dielectric.

VI. Output



The output generated by giving power supply to the load, the current voltage value can be verify using the standard multimeter. The output data can be monitored in blynk application and the voltage current and the power value displayed in numerical format.

The energy meter data is uploaded to the blynk application in 2 to 3 seconds.

VII. Conclusion

Internet of things saves money by automated data collection. By linking Current and Voltage Sensor in ESP32 Wi-Fi module and sync the Power in kilowatts.

Some of the advantages of this electric system are: -

1. Calculating the live consumption of energy.
2. This system performs their function at any load and energy meter.
3. It enables using Wi-Fi module so the net current value can be easily updated.

VIII. Future Scope

Development in web-based system by using wi-fi and global system for mobile communication system. implementation of artificial intelligence industrial based upgrading for the future works. Remote recharging can be implemented through telephone line. This will help to recharge the meter from anywhere just by sending a simple message or through internet.

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