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Smart Energy Meter using IOT

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ABSTRACT

The wireless monitoring system of energy meter using Blynk application via smart phone. In addition, the over consumption of energy notification as an optional Features embedded in this system. Due to the advance recent technology in tandem with the Internet of Things (IoT) can be also applied in advance as an application of Artificial Intelligence (AI)into a manual device, transitional to an automated device such as smart meter that helps the smart cities to have an efficient energy management system as an ewconcept. This system used ESP32 as a micro- controller board with WiFi module to provide IoT communication with IoT platform such as Blynk application. The prototype designed intends to monitor daily energy consumption in the smart phone application interfaced with Blynk server and also provide awareness to save electricity through notification using Blynk features by the smart phone application. We need to select the current sensor as well as the voltage sensor so that the current & voltage can be measured and thus, we can know about the power consumption & total power consumed.

Keywords— Energy meter, Blynk application, Internet of Things (IoT)

1. Introduction

Energy crisis is one of the major problems that the world faces today. The energy crisis can be reduced to a certain extent by properly monitoring our energy consumption and avoiding energy wastage. This system will be monitoring the input voltage, current in KWH and will be display on LCD also sending these values into the BLYNK app though IOT.

The energy meters are connected to the Arduino UNO through an optocoupler. The optocoupler sensor gives an interrupt each time the meter LED ashes to the programmed Arduino and Arduino process this data to the ESP8266 WI-FI module then WI-FI module sends this data to the BLYNK app. This system will be monitoring the input voltage, current in KWH and will be display on LCD also sending these values into the BLYNK app though IOT. By using mobile user can access this device from anywhere in the world and control the load accordingly. In this system, an Arduino is interfaced with an energy metering circuit, current sensing circuit, voltage sensing circuit, WI-FI communication and Relay. In this project we are connecting loads through relay and CT. Here relay works as switch to on/off the power supply which is connected to the load. The main controlling device of the project is Arduino which is programmed by Embedded C language.

The suggested energy meter monitors the amount of power utilized and uploads it to the Thing speak cloud, where the reading may be viewed by the person concerned. ESP 8266, a Wi-Fi module, can be used to send the power reading to the cloud. The optocoupler analyzes the power reading from the digital wattmeter and feeds it digitally to the Arduino. As a way, it uses IoT to automate the process of measuring energy usage at households. Smart Energy Meter has attracted a lot of attention from all over the world. In this paper a design and prototyping a low-cost IoT energy monitoring is presented, which may be utilized in a variety of applications such as power billing, smart grid energy management, and home automation. The system is based on a low-cost ESP32 microcontroller that is interfaced non-invasive Current Transformer (CT) sensors, and voltage sensor to get data from sensor nodes and deliver it to a Blynk server over the internet.

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2. Energy Meter

The meter which is used for measuring the energy utilises by the electric load is known as the energy meter. The energy is the total power consumed and utilised by the load at a particular interval of time. It is used in domestic and industrial AC circuit for measuring the power consumption. The meter is less expensive and accurate.
The construction of the single phase energy meter is shown in the figure below.

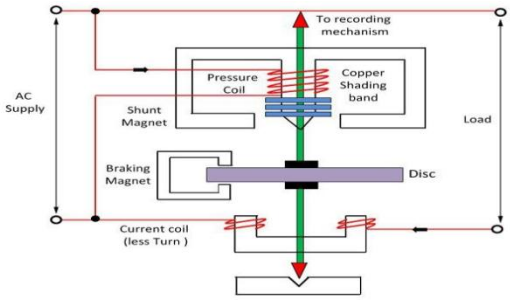

Fig 1: single phase Induction type energy meter

3. Digital Energy Meter

An electric meter or energy meter is an essential device that goes with consumption of commercially distributed energy. It enables systematic pricing of energy consumed by individual consumer as it measures the amount of electrical energy consumed by a residence, business, or an electrically powered device [1]. They are typically calibrated in billing units, the most common one being the Kilowatts hour, which is equal to the amount of energy used by a load of one kilowatt over a period of one hour, or 3,600,000 joules.
Some meters measured only the length of time for which charge flowed, with no measurement of the magnitude of voltage or current. These were only suited for constant-load applications. Neither type is likely to be used today. In addition to metering based on the amount of energy used, other types of metering are available. Meters which measured the amount of charge (coulombs) used, known as ampere-hour meters, were used in the early days of electrification. These were dependent upon the supply voltage remaining constant for accurate measurement of energy usage, which was not a likely circumstance with most supplies.
The digital energy meter working principal operates by continuously measuring the instantaneous voltage (volts) and current (amperes) and finding the product of these to give instantaneous electrical power (watts) which is then integrated against time to give energy used (Joules, Kilowatt-hours etc.). Meters for smaller services (such as small residential customers) can be connected directly in-line between source and customer. For larger loads, more than about 200 amps of load, current transformers are used, so that the meter can be located other than in line with the service conductors .

4. Voltage and Current Sensor

Majority of faults, incidents, and accidents associated with electrical equipment and systems are as a result of undervoltage and overvoltage. It is important to know the exact amount of current and voltage is a particular system and application as it enables the engineer or technician to make and implement safety-critical decisions. In addition, knowing the amount of current or voltage in a system allows one to gauge the performance of the various subcomponents in a system.
There are two primary types of current sensors, direct and indirect sensors. The direct sensor applies Ohms Law and Halls Effect. It has an integrated coil. By placing the coil around a current-carrying conductor, there in an induced voltage, which is proportional to the current in the system. By using

various amplifiers such as shunt and operational amplifiers, as well as a user-friendly interface, it is then easy to detect and measure the current in the system.
The primary function of voltage sensors is to detect and measure AC and/or DC voltage levels. When the presence of voltage is detected, the sensors provide an output in the form of analogue voltage signals, current levels, frequency and modulated frequency outputs or audible sounds.

5. Arduino

Arduino is an open-source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. Its hardware products are licensed under a CC BY-SA license, while the software is licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1] permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially from the official website or through authorized distributors.
Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (for prototyping) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs. The microcontrollers can be programmed using the C and C++ programming languages, using a standard API which is also known as the Arduino Programming Language.

6. Internet of Things

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.
A thing in the internet of things can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that can be assigned an Internet Protocol (IP) address and is able to transfer data over a network.
Increasingly, organizations in a variety of industries are using IoT to operate more efficiently, better understand customers to deliver enhanced customer service, improve decision-making and increase the value of the business. An IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analyzed or analyzed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices -- for instance, to set them up, give them instructions or access the data.

7. Results

Fig 2: Smart Energy Meter Using IoT When No Load

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The figure 2 shows the Smart Energy Meter Using IoT When there is no load turned on using Blynk app. In the Blynk app we are able to control the load that is we can turn on and off the load. We are able to find the amount of Power consumed by the Load through the Blynk app.

Fig 3: When There is No Load

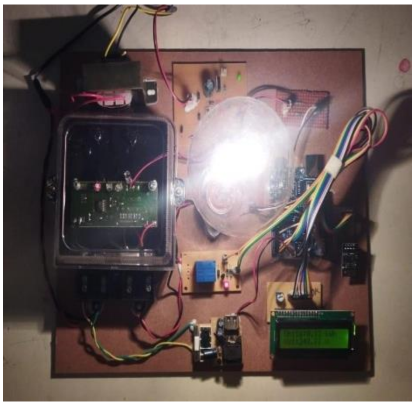

Fig 4: Smart Energy Meter Using IoT When Load is ON

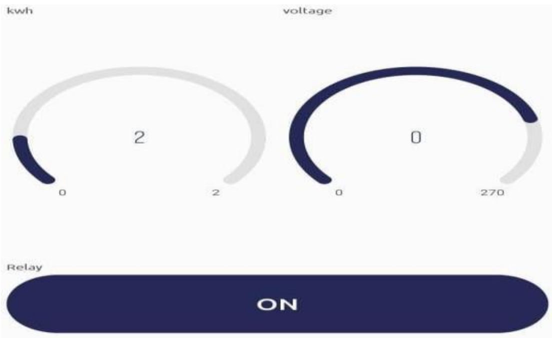

Fig 5 When Load is on

Fig 6 LCD Display with Readings

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The above figure shows the number of units consumed by the load when it is turned on and the voltage getting to the energy meter.The mechanism involved in our project smart energy meter using iot is when a supply of 230v ac is given to the circuit the energy meter works with the given voltage while the arduino is unable to withstand with the voltage. So as to make the arduino to withstand with the given voltage we converted the 230v ac supply into 12v ac by using step down transformer. The 12v ac is again given to the regulated power supply to convert the voltage to dc. The regulated power supply converts the 12v ac into 12v pulsating dc. The pulses are removed by using a capacitor. The capacitor circuit is placed next to the regulated power supply.

CONCLUSION

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's, with the help of growing technology, the project has been successfully implemented. Thus, the project has been successfully designed and tested.

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