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IOT Based Smart Energy Meter

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ABSTRACT

In this project the main intention is to measure the electricity consumption and calculate its price using IoT. The readings of voltage, current, the power consumed, no. of units and the corresponding price are calculated.The effort of collecting electricity utility meter reading. Internet of Things (IoT) present an efficient and co- effective to transfer the information of energy consumer wirelessly as well as it provides to detect the usage of the electricity.This paper proposes a system which eliminates manpower by self-regulating meter readings and bill generation reducing the flaws which are one of the major cause for energy-related corruption.

Keywords— Internet of Things, Arduino uno, ESP8266 Wifi module.

I. INTRODUCTION

The energy consumption can be monitored by using an electric device called energy meter. The cost and the regular usage of Power consumption are informed to the user to overcome high bill usage. The Energy meter shows the amount of units consumed and transfers the data to both the customer and to the electrical board so this helps in reducing man-power. The user can check their Power usage from anywhere and at any time interval. This system continuously monitor the reading and the live meter reading can be displayed on the web page to the consumer. The objective of this system is to monitor the amount of electricity consumed and calculate the unit price.

II. LITERATURE SURVEY

Bibek Kanti Barman, et al., [1] proposed "smart meter using IoT"on efficient energy utilization plays a very vital role for the development of smart grid in power system. Hence proper monitoring and controlling of power consumption is a main priority of the smart grid. The energy meter has many problems associated to it and one of the key problems is there is no full duplex communication to solve this problem, a smart energy meter is proposed based on Internet of Things. The smart energy meter controls and calculate the consumption

of energy using ESP 8266 12E, a Wi-Fi module and send it to the cloud from where the consumer or customer can observe the reading. Therefore, energy examine has been by the consumer becomes much easier and controllable. This system also helps in detecting energy loss. Thus, this smart meter helps in home automation using IoT.

Himanshu K Patel et al., [2] demonstrated “Arduino based smart energy meter” that removes human intervention in meter readings and bill generation thereby reducing the error that usually causes in India. The system consists the provision of sending an SMS to user for update on energy consumption along with final bill generation along with the freedom of reload via SMS. The disconnection of power supply on demand or due to pending dues was implemented using a relay. The system employs GSM for bidirectional communication.

Gonbinath.S, et al., [3] proposed “Internet of Things Based Energy Meter system", In this system we reduce the human participation in electrical energy maintenance. The theft of the electricity increases the costs paid by customer. Hence this system is used for the detection of theft. The Arduino checks the main meter and sub meter reading. If the difference between the main meter and sub meter is occurred then that theft has occurred message will be display on the LCD display and also display on the thingspeak. Customer can be access the thingspeak from anyplace. By using the consumer number it can be access on the globe at the anytime.

Koay et al., [4] explained "Design and implementation of Bluetooth energy meter" described around the year 2004, digital meter has started to replace the electromechanical meters in Singapore. A wireless digital power meter would offer greater convenience to the meter reading task. Bluetooth technology is a possible wireless solution to this issue. The power reader can collect the power consumption reading from the energy meter wirelessly based on Bluetooth. Two methods that can retrieve the meter reading with little human intervention, are added and implemented in the targeted applications, they are Automatic meter reading(AMR) and the Automatic polling mechanism(APM). Some commercial applications are applied for the Bluetooth-enabled energy meter.

Mohammed Hosseiu et al., [5] presented a paper titled “Design and implementation of smart meter using IoT” describing the growth of IoT and digital technology. The future energy grid needs to be implemented in a distributed topology that can dynamically absorb different energy sources. IoT can be utilized for various applications of the smart grid consisting power consumption, smart meter, electric power demand side management and various area of energy production. In this paper, the Smart Energy Metering(SEM) is explained as the main purpose of SEM is necessary for collecting information on energy consumption of household appliances and monitor the environmental parameters and provide the required services to home users

Anitha et al., [1] proposed “Smart energy meter surveillance using IoT” about IoT, internet of things as 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. efficient use of home appliances for energy savings. Due to manual work, existing electricity billing system has major drawbacks. This system will give the information on meter reading, power cut when power consumption exceeds beyond the specified limit using IoT. The Arduino esp8266 micro controller is programmed toper form the objectives with the help of GSM module. It is proposed to overcome all the disadvantages in the already existing energy meter. All the details are sent to the consumer’s mobile through the IoT and the GSM module and it is also displayed in the LCD.

III. PROPOSED METHODOLOGY

The IOT based smart energy meter system is shown in figure 1. The block diagram consists of Arduino, SMPS, wifi module, voltage sensor, current sensor, relay, LCD display. In the system SMPS is used to convert 230V AC power supply into 12V dc power supply. This system uses Arduino Uno micro-controller as the main controlling unit.For the microcontroller is interfaced with a voltage sensor and a current sensor.

Then the voltage and current sensor is to measure the AC voltage and current. The mainline wires are connected to the sensors and the readings from voltage and current sensors are noted on the serial monitor. The values are noted and the units are measured with the corresponding values and thus price is calculated. The output obtained is shown on the 16*2 LCD module.

BLOCK DIAGRAM

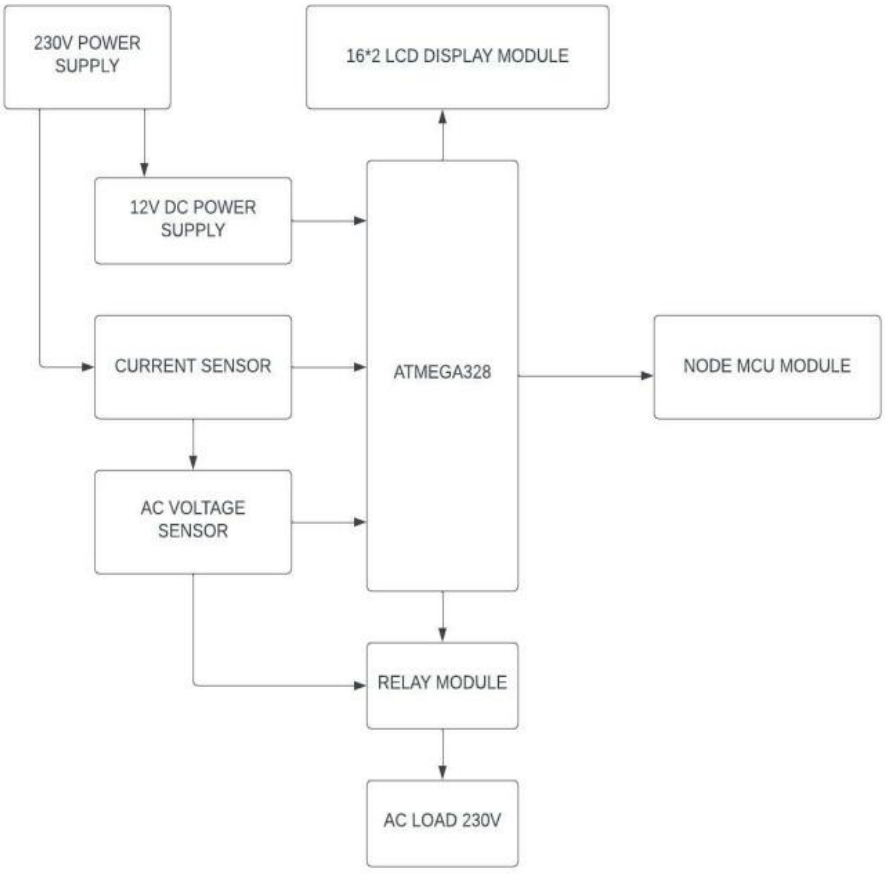


Fig.1 Smart energy meter

NodeMCU is a Wi-Fi device which has a microcontroller in it. This connects the local router through IoT. The status of these parameters can be obtained through mobile or laptop. WIFI is used for data communication. WIFI is configured with Arduino. All the loads are connected to the relay module which is interfaced with the microcontroller.

A. SMPS

Fig.2.SMPS

A SMPS (Switched mode power supply) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. The switching mode power supply for the isolation industrial grade built in power supply over current protection and short circuit full protection, AC110~24OV wide voltage input, high and low voltage isolation, DC12V/1000m A and DC5V/500m A dual isolated output voltage, with input and output EMI filter circuit, with mounting holes. This SMPS is especially designed to interface directly with arduino and sensors.

B. Arduino

Fig.3.Arduino Uno

In the given system the arduino acts as the main control unit.The Uno is a microcontroller board based on the ATmega328P.It has 14 digital input/output pins (of which 6 can be used as PWM output),6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and reset button.It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it wuth an AC-to-DC adapter or battery to get started.

C. ESP8266 Wifi Module

Fig.4.ESP8266 WiFi Module

The ESP-12 Lua Nodemcu wifi dev board internet of things with ESP8266 is an all-in-one microcontroller + wifi platform that is very easy to use create projects with wifi and IoT (Internet of Things) applications. The

board is based on the highly popular ESP8266 Wifi module chip with the ESP-12 SMD footprint. This wifi development board already embeds in its board all the necessary components for the ESP8266 (ESP-12E) to program and uploaded code. It has a built in USB to serial chip upload code, 3.3v regulator, and logic level converter circuit so you can immediately upload codes and connect your circuits. This board contain the ESP-12E chip with a 4MBa flash memory so no worries for your long project codes.

D. Voltage Sensor

Fig.5.Voltage Sensor

The proposed system uses the voltage sensors for calibrating the number of units consumed. It is based on a high The ZMPT101B is a voltage transformer used to measure AC voltage .It can measure AC voltage up to 250 volts by using this module .The output of this sensor is analog.It precision voltage transformer with accurate AC voltage measurements. It is a light weighted sensor module and can measure up to 250 volts. Its supply voltage varies from 5V to 30V with operating temperatures from 40°C to 70°C.

E. Current Sensor

Fig.6.Current Sensor

A current sensor is a device that detects and coverts current to an easily measurable output voltage, which is proportional to the current through the measured path. Onboard precision micro current transformer, which can transform AC signal of large current into small amplitude signals. The maximum current that can be reach 5A and the present current signal can be read via analog I/O port. The proposed system use the current sensor for calibrating the no of unit consumed.

F. Relay

Fig.7.Relay

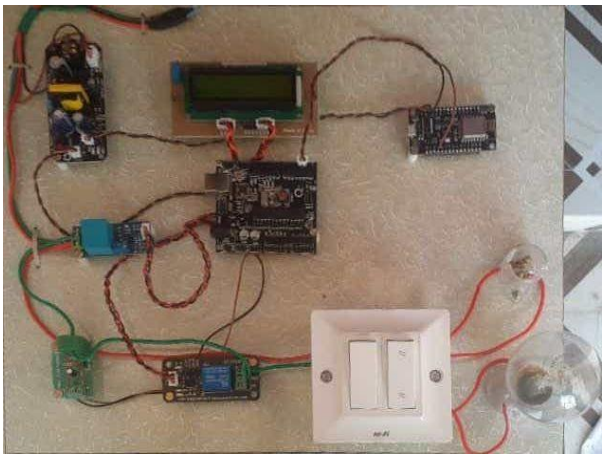
It is a 1-channel relay interface board with photoelectric isolation, which can be controlled directly by a wide range of microcontrollers such as Arduino, AVR, PIC, ARM, PLC, etc. The system proposed here uses a separate electromechaical device for remote switching which can be controlled by the lower,voltage.

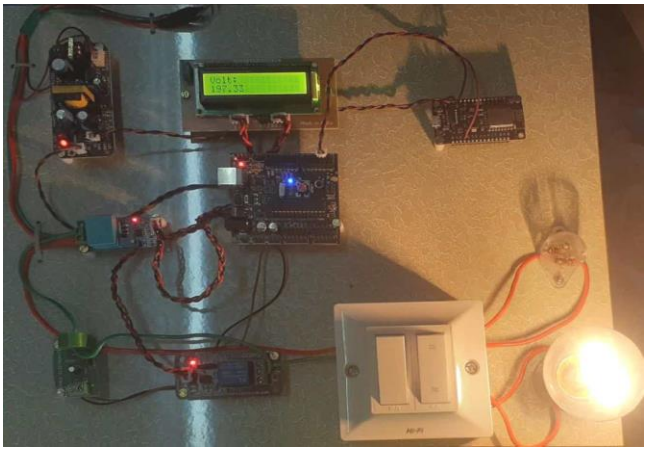
G. LCD Display

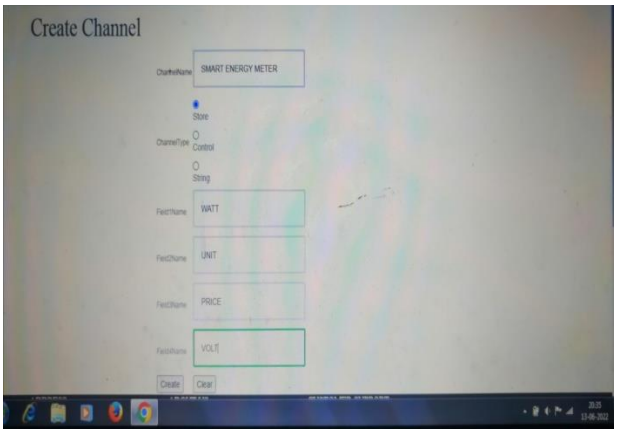
Fig.8.LCD Display

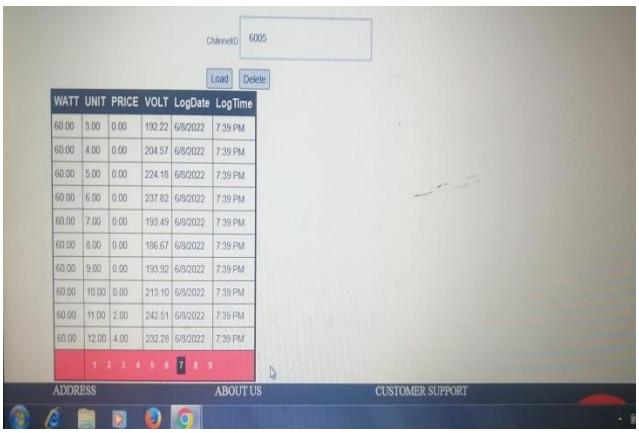
A liquid crystal display is used in the system for displaying the voltage value, current sensor value, units and price. A 16*2 electronic display is a low-cost optical device. with 16 pins. It has 32 characters with each character of 5*8-pixel dots.HD44780 IC on the LCD gets command data from MCU.

IV. FINAL RESULT









V. CONCLUSIONS

IOT based smart energy meter system was proposed in this paper. The system provides many significant advantages, such as wireless data transmission, low-workload, and less-expenses. The system would provide a simple way to collect the meter reading without any human involvement. The use of embedded microcontroller and Wi-Fi module increases the stability of wireless data transmission. By using this system the customer can anytime check their consumed unit and price. In future, the project can be integrated to form smart cities using Internet of Things based sensors as done globally.

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