

POWER SAVING SMART ENERGY METER

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CHAPTER 1

The advancement of the Internet of Things has been emerging day by day. The Internet of Things (IoT) revolves connection between M2M that embedded with electronics, software, sensors, actuators that assist users in monitoring and controlling devices remotely and efficiently. In the IoT based system object and living being are provided with unique identifiers with the ability to transfer data. The area of IoT has amplified from the convergence of wireless technologies, microelectromechanical systems and the Internet. Nowadays IoT technology is being applied in many areas like electricity, gas, water etc. to make our life automated. Nowadays due to the excessive use of the internet, these areas become computerized and online payment system makes possible. But accessing meter reading is a manual process and has the possibility of error which causes high revenue cost [3]. Automatic Meter Reading (ARM) technology facilitates the assessment of energy consumption and analysis of data for billing and payment. ARM technology requires to bring the device online and connecting device with the internet which is in other term Internet of Things. ARM technology using

wireless communication is cheaper than wired medium. Hence, WiFi is more suitable for the proposed system as it is very common in every residence.

CHAPTER 2

2.1 Articles Reviewed

In recent years enormous research and papers have proposed the design and development of Energy meter monitoring system. In the author proposed a Wi-Fi based single-phase smart meter based on IoT. The author used a digital meter, ESP8266 Wi-Fi module and a web application for the user interface.

The ESP8266 Wi-Fi module has attached into the meter. The ESP8266 Wi-Fi Module has been implemented by TCP/IP protocol has the means of Communication between the meter and web application. The proposed system is secured and open source but costly. In an Automatic Meter.

Reading (ARM) based Power Meter with Wi-Fi Communication Module scheme has been proposed and developed software based on Linux. In the author presented a survey report on the utilization of smart electricity meters and some key aspects of the metering process. As well as opportunities arising due to the advent of big

data and the increasing popularity of the cloud environments challenges are highlighted by the author. In [10] the author proposed a system where Arduino Uno has been developed with an Ethernet shield that can monitor all the necessary activities in the flow of electricity, the use of current and Electricity costs and mentioned hope of reducing the problems associated with payment, calculate the cost of the unit of electricity. In the author proposed a real-time monitoring system for residential energy meter. The presented system provided inclusive and continuous access to energy consumption to the consumer by exploiting the advancement of IoT technology.

CHAPTER 3

SYSTEM DESCRIPTION

3.1 BLOCK DIAGRAM OF PSEM

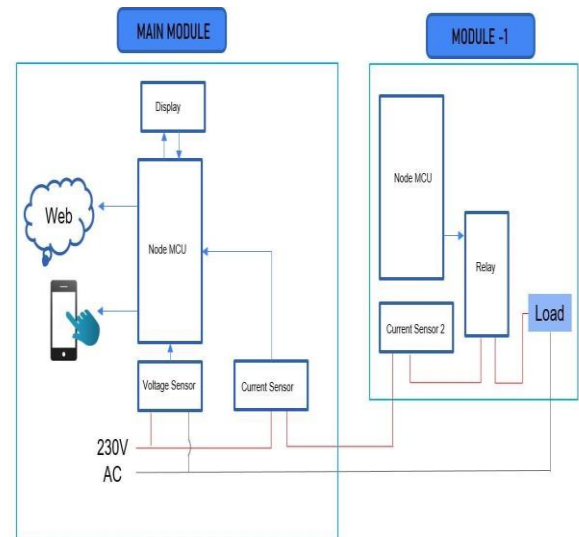


Fig. 3.1 BLOCK DIAGRAM OF PSEM

3.2 CIRCUIT DIAGRAM OF PSEM

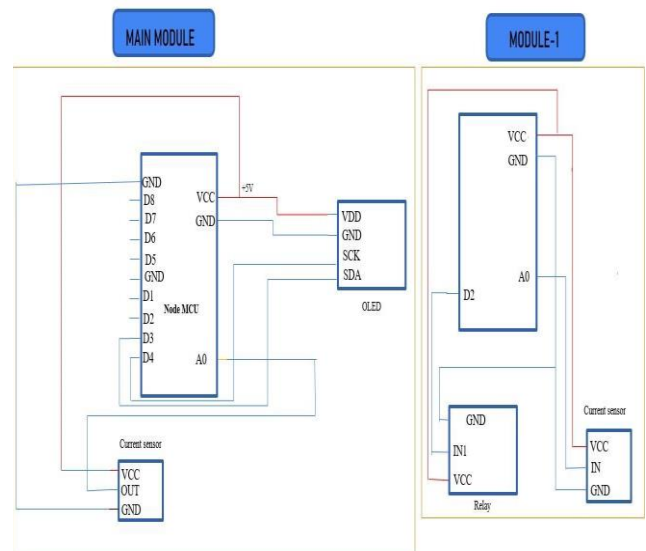


Fig 3.2 CIRCUIT DIAGRAM OF PSEM

Here, The Node MCU is powered up with the 5V input volt and the Node MCU is powering up the Current sensors, voltage sensor, multiplexer, and OLED and those Node MCU pins are connected with the Respective

pins of each sensors and components and mobile app called Blynk is virtually connected with Node MCU and a Web application is also Connected. The Input current will be passing through the voltage sensor and also with respective current sensor. And multiplexer is used to get input of multiple inputs and to convert the inputs into a single analog input. The input of NodeMCU will be through the A0. Finally all calculation will be done internally and the and the output will be displayed in the OLED Display. The Total watts consumed and the watts consumed to each load will be displayed.

CHAPTER 4

HARDWARE REQUIREMENTS

4.1 NODE MCU

Node MCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. Later, support for the ESP32 32-bit MCU was added. Node MCU is an open source firmware for which open source prototyping board designs are available. The name "Node MCU" combines "node" and "MCU" (micro-controller unit). The term "Node MCU" strictly speaking refers to the firmware rather than the associated development kits. Both the firmware and prototyping board designs are open source. The firmware uses the Lua scripting language. The firmware is based on the Lua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects such as lua-cjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented. The prototyping hardware typically used is a circuit board

functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially based on the ESP-12 module of the ESP8266 which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications.

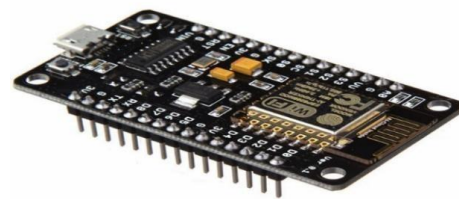


Fig.4.1 Node MCU

4.2 5V Relay Module

This is 2 Channel 5V Relay Board Module for Node MCU PIC AVR DSP ARM. A wide range of microcontrollers such as Arduino, AVR, PIC, and ARM and so on can control it.

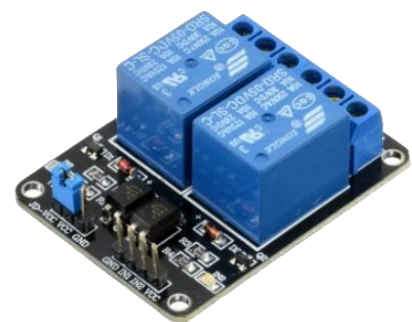


Fig 4.1 5V Relay Module

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4.3 5 Amps Current Sensor

Current flowing through a conductor causes a voltage drop. The relation between current and voltage is given by Ohm's law. In electronic devices, an increase in the amount of current above its requirement leads to overload and can damage the device.

Measurement of current is necessary for the proper working of devices. Measurement of voltage is Passive task and it can be done without affecting the system. Whereas measurement of current is an Intrusive task which cannot be detected directly as voltage.

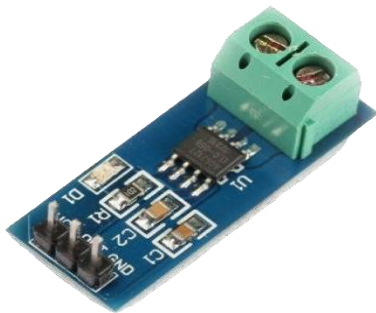


Fig 4.2 5 Amps Current Sensor

For measuring current in a circuit, a sensor is required. ACS712 Current Sensor is the sensor that can be used to measure and calculate the amount of current applied to the conductor without affecting the performance of the system. ACS712 Current Sensor (5A) is a fully integrated, Hall-effect based linear sensor IC.

This IC has a 2.1kV RMS voltage isolation along with a low resistance current conductor.

4.4 230V VOLTAGE SENSOR

This sensor is used to monitor, calculate and determine the voltage supply. This sensor can determine the AC or DC voltage level. The input of this sensor can be the voltage whereas the output is the switches, analog voltage signal, a current signal, an audible signal, etc. Some sensors provide sine waveforms or pulse

waveforms like output & others can generate outputs like AM (Amplitude Modulation), PWM (Pulse Width Modulation) or FM (Frequency Modulation). The measurement of these sensors can depend on the voltage divider. This sensor includes input and output. The input side mainly includes two pins namely positive and negative pins. The two pins of the device can be connected to the positive & negative pins of the sensor. The device positive & negative pins can be connected to the positive & negative pins of the sensor.

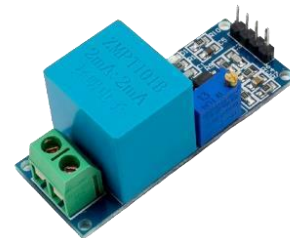


Fig 4.3 Voltage Sensor

The output of this sensor mainly includes supply voltage (Vcc), ground (GND), analog o/p data. Voltage sensors are used to monitor or measure, calculate and determine the supply of voltage. With the help of this sensor, user can determine the AC or DC voltage level. The input of this sensor can be voltage. While the output can be output switches, analog voltage signal, a current signal, audible signal, etc.

4.6 OLED

OLED technology is still relatively new compared to similar, long-established technologies such as LEDs and LCDs (both of which were invented in 1962). Broadly speaking, user can use OLED displays wherever you can use LCDs, in such things as TV and computer screens and MP3 and cellphone displays. Their thinness, greater brightness, and better color reproduction suggests they'll find many other exciting applications in future. They

might be used to make inexpensive, animated billboards, for example. Or super-thin pages for electronic books and magazines. How about paintings on your wall people can update from your computer or Tablet computers with folding displays that neatly transform into pocket-sized smartphones, Or even clothes with constantly changing colors and patterns wired to visualizer software running from your iPod.

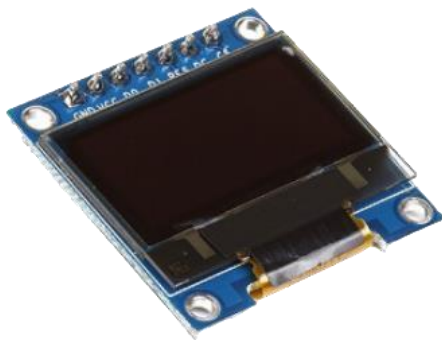


Fig.4.4 OLED

4.7 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 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.

CHAPTER 5

SOFTWARE DESCRIPTION

5.1 Arduino

The Arduino Integrated Development Environment (IDE) is a crossplatform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards

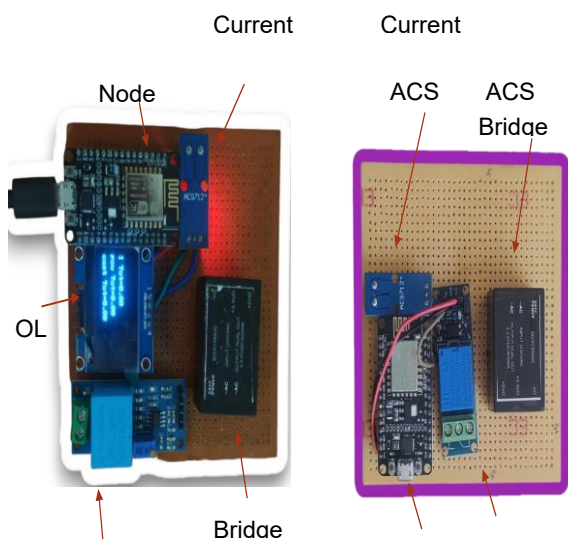


The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main()

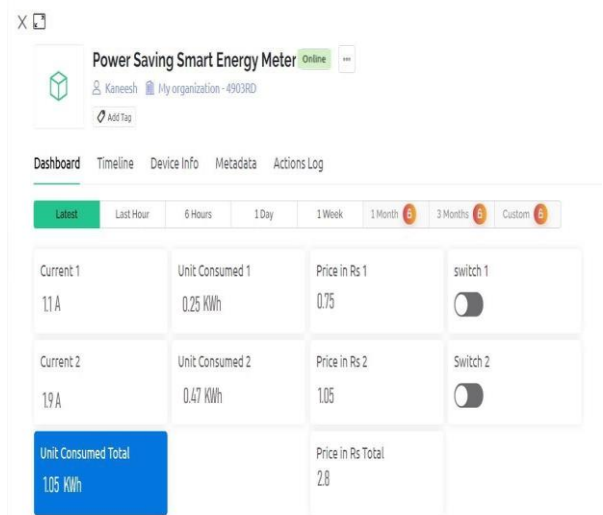
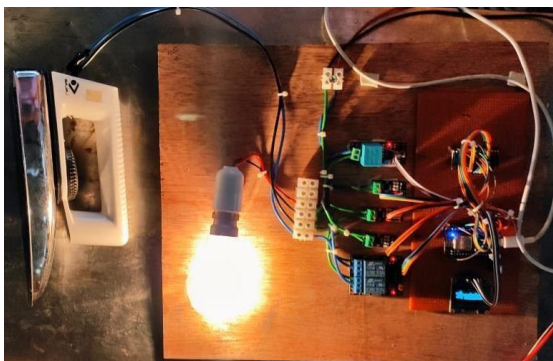
into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program argued to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards.

When the load is connected and when the load is turned on. The module-1 will be the main parent module which will be monitoring all the power which is consumed by the all loads. The sub-module also called as. Module 1 Will be monitoring the power consumption of each loads.

EXPERIMENTAL RESULTS



WORKING PROTOTYPE DEMO



Web Dashboard Output of PSEM

CONCLUSION

The proposed system is able to reduce the sufferings of the customer and make users concern about the excessive consumption of electricity as well as faulty devices at home. Through this system, customers can easily view total pulse, total units and total costs of electricity. The system is easily readable and reliable. The data stored in the cloud has great importance in future energy meter data mining. In a large sense, energy distribution company such as DPDC able to observe the pattern of consumption of an area. Consequently, this observation can help in load distribution in a certain area.

The user receive monthly energy consumption from a remote location directly to centralize office. In this way this project reduce human effort needed to record the meter reading which are till now recorded by visiting the home individually.

Conference on Smart Energy Grid Engineering 2018.

Himanshu kpatel “arduino based smart energy meter” 2nd Int'l Conf.on Electrical Engineering Engineering and Information & Communication Technology ICEEICT) 2018.

7. FUTURE SCOPE:-

The Project is intended to calculate the Electricity bill and to control the load specifically and Each.The Limit will be given to the NodeMCU when the load reaches the limit the load will be automatically tripped. Smart energy monitoring system includes Arduino, WI-FI, energy meter. The system automatically reads the energy meter and provides home automation through an app developed and power management done through this application. The proposed system consumes less energy and it will reduce manual work. The user can receive monthly energy consumption from a remote location directly to centralize office. By using this project reduce human effort needed to record the meter reading which are till now recorded by visiting the home individually

REFERENCES

- Anitha.k ,prathik, “Smart Energy Meter surveillance Using IoT” Institute of Electrical and Electronics Engineers(IEEE), 2019.
- Devadhanishini, et.al” “Smart Power Monitoring Using IoT”5th International Conference on Advanced Computing & Communication Systems ICACCS) 2019.
- Mohammad Hossein Yaghmaee “Design and Implementation of an Internet of Things Based Smart Energy Metering” 6th IEEE International