# SMART POWER MONITORING AND CONTROLLING THROUGH IoT

**T. sireesha[1], D. Dharani Bharath[2], K. Bhavani[3], K. Kedareswar Kumar[4], D. Sai Kiran[5]**

*[1]Assoc. Professor, Departments of Electronics and Communication Engineering, Potti Sriramulu Chalavadi Mallikarjuna Rao College of Engineering and Technology, Vijayawada, India.*
*[2,3,4,5]student, Departments of Electronics and Communication Engineering, Potti Sriramulu Chalavadi Mallikarjuna Rao College of Engineering and Technology, Vijayawada, India.*

---

**Abstract—** *Energy saving is one of the most challenging issue in these days. IoT is the evolving technology where the significance and utilization are increasing with each passing day. By combining these a Smart Power monitoring system designed that detects and controls the domestic electricity consumption. This paper describes the digitization of energy to control the power usage and reduce unnecessary power wastage. Several sensors are used to gather the consumption data that needs to be send to cloud using IoT. The wi-fi section performs IOT operation by sending to the cloud. This system includes programmable power output where user can limit the power usage along with a motion sensor used for automation to reduce unnecessary power leakage.*

**Keywords—**internet of things, power monitoring system, Wi-Fi, programmable power output.

## 1. Introduction

The Internet of things (IOT) concept enables us to connect the day to day devices with each other through internet. The devices connected through IOT can be monitored remotely. The IOT provides a connection between the physical world and computer-based systems. The concept has been increasing importance with more and more wireless devices that are increasing in rapid manner. hardware devices are connected with each other through the internet. The Wi-Fi module provides the connectivity with the internet.

The system is designed on an STM micro controller. It can be structurally differentiated into four parts viz., controller, monitoring unit, controlling circuit and a Wi- Fi unit. The controller performs the required calculations and processes the power data. Power monitoring circuit provides data about appliances power reading and provides the user interface to collect the power limit from the user. the Wi-Fi unit plays most important role that send the information from the controller over the Internet. The micro controller is programmed on the keil micro vision software IDE which is a prerequisite to operate on the STM board.

Smart power monitoring and controlling using Wi-Fi system is designed based on three major objectives.

They are:

1. To provide power reading over a real-time basis.

2. To utilize the power in effective manner.

3. Reduce the power wastage. .

## 2. LITERATURE SURVEY

Dr. shreedhar A joshi et.al [1] proposed a smart energy meter that can store and measure the power consumption in small amount of time of usage pricing. The objective of this system is user can set the limits of consumption and crossing of this limit will generate warning message to the user . Based on the rotations of meter, device will calculate the number of units and bills on a monthly basis and limit the consumption.

Devadhanishini.Ay et.al.[2] prepared smart power monitoring system can be monitoring the power consumption using power meter. This power monitoring system uses GSM module to send the data from microprocessor to user mobile. This system controls the mains or home appliances from mobile phone app by Wi-Fi module. The purpose of this system is monitoring the amount of power consumed and total power consumption to be paid.

Landi.c et.al.[3] prepared a system is part of distributed systems that measures the main power An integrated Web Server enables to gather the statistics of power usage, quality of power and able to interlink the devices for load displacement. the device is designed for access to the data communication enables local and wireless access.

Garrab.A et.al. [4]. Explains that security of the communication and the greenhouse gas emissions, leads to introduce a Smart Grid. Smart Meters are one of the best solutions for the Smart Grid. In this paper, an AMR solution which provides enhanced two way communicated application. It is supported an energy meter with low-power microcontroller. The microcontroller consists an energy metering module. The main purpose of this paper is to monitor the real time pricing of electricity.

Darshan Iyer N, et.al.[5] proposed system that eliminates the human intervention in power maintenance. The Buyer needs to pay for the usage of electricity on schedule, in case that user could not pay, the power supply can be turned off automatically by the electricity board. The user can monitor the power consumption in units from a web page by providing system IP address. Theft detection section connected to energy meter will notify company.

when meter tampering happens in energy meter and it will send theft detect data through PLC modem and theft detected will be displayed on the terminal window of the company side.

B. S. Koay et.al.[6] prepared a paper "Design and implementation of Bluetooth energy meter", 2012. In this paper described such as presently electronics energy measurement is continuously replacing existing technology of electro-mechanical meters. A wireless digital energy meter definitely offers greater convenience to the meter reading task. Bluetooth technology is chosen as a possible wireless solution to this issue. In this paper, presents the design and implementation issues of a Bluetooth-enabled energy meter. The energy reader can collect the energy consumption reading from the energy meter wirelessly based on Bluetooth.

## 3. PROPOSED SYSTEM

The power data from the sensors is sent to STM32 board than Wi-Fi module sends to the user's mobile phone. In this system the user can turn on/off the mains or home appliances from their Android smart phone application. The WIFI module is receives the information from cloud and sends to micro-processor and the STM32 controls the relay to turn on and off the appliances.

### 3.1 BLOCK DIAGRAM

The block diagram consists of stm32l4r5zi microcontroller board connected with ESP8266 Wi-Fi module (nodeMCU), relay, 16*2 LCD display, Buzzer, power and current sensors, 4*3 keypad matrix, PIR sensor.The system input 230V is supplied to relay, relay act as a controller of appliances and it is connected to the STM32 board .STM32 performs as both transmitter and receiver and it is connected to the PIR sensor, voltage and current sensors, relay, Wi-Fi module.

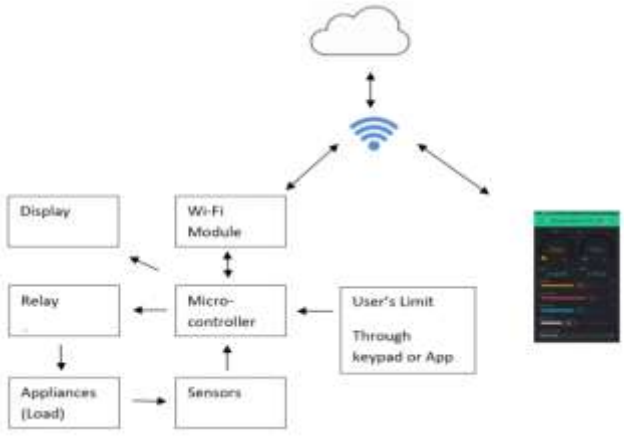


**Fig.1:** Block Diagram of the system

The relay is used to reduce the power consumption by the user, the PIR motion sensor is used for automatically ON/OFF of the appliances where the human motion is not detected. The WIFI module is receives the information from cloud and sends to microprocessor and vice-versa.

### 3.2 FLOW DIAGRAM

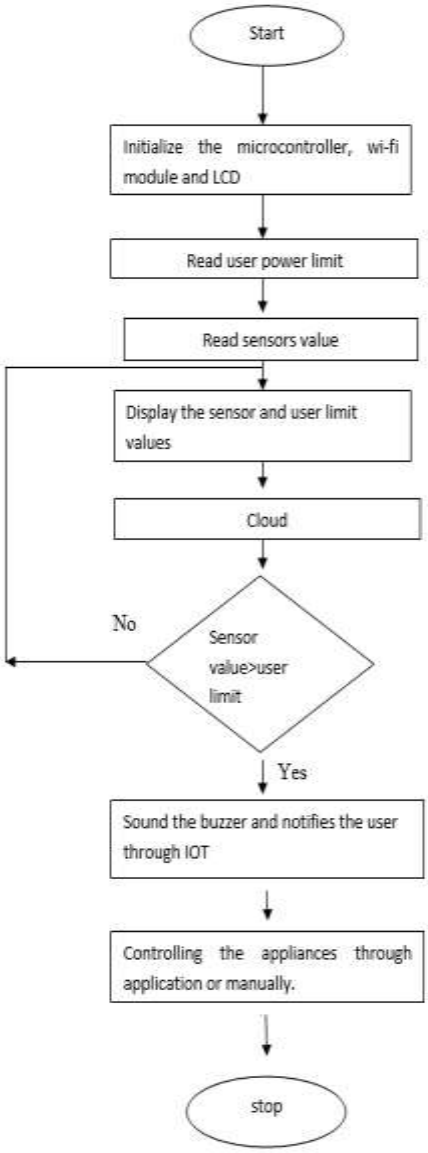


**Fig.2** Flow chart of the smart power meter system

## 4. HARD WARE IMPLEMENTATIONS

### *4.1 Voltage sensor*

The Voltage Detection Sensor Module allows the analog input of a micro-controller to monitor voltages much greater than it capable of sensing. Micro-controller analog input voltages up to five volts, the voltage detection module input voltage not greater than 25V (if using 3.3V systems, input voltage not greater than 16.5V).

### *4.2 Current sensor*

This sensor handles high side current measuring up to +26VDC even though it is powered with 3 or 5V. The main advantage of using INA219 Current Sensor is that is can

measure both AC and DC current and it also facilitate the isolation between the Load (AC/DC load) and Micro-controller.

*4.3 ESP8266 Wi-Fi Module (NodeMCU)*

The ESP8266 Wi-Fi Module is a SOC based on TCP/IP protocol stack that provide microcontroller access to your Wi-Fi network. This module ESP8266 module is pre-programmed. This module provides internet connection to the system.

*4.4 PIR SENSOR*

A passive infrared sensor is measures infrared (IR) light radiating from objects in its field of view. PIR motion sensor is used for automatically ON/OFF of the appliances where the human motion is not detected.

*4.5 RELAY*

Relay is a electromagnetic switch that has three high voltage terminals (NC, C, NO) which connect to controller. Relay has another three pins with low voltage (ground, Vcc and signal) those connect to the STM32. When relay receives a HIGH signal at signal pin, electromagnet coil becomes charged and moves contacts than the switch opened or closed.

*4.6 Keypad Matrix*

A Matrix keypad is the commonly used input device for micro-controller, A matrix keypad contains a set of push switches are placed in a matrix format of rows and columns. This keypad is used to fix the power input power by the user.

## 5. EXPERIMENTAL RESULTS

The Hardware setup of the project is shown in Fig.3.

**Fig.3** Providing security by authentication password

The voltage and current values are displayed in LCD display in real-time basis shown in fig,4.

Fig.4. voltage and current values in real-time.

The DC voltage ,current, AC voltage and AC frequency were monitored through Blynk application which provide accessibility for user.


## 6. CONCLUSION

The system provides many advantages, such as wireless communication, remote monitoring and controlling, anti power theft mechanism and less-expenses. The system would facilitate a way to collect the power reading and detect an electrical power theft without any human involvement. The use of embedded micro-controller and Wi-Fi module provides the stability of wireless data transmission. Programmable power output provides the required amount of power to the particular appliance or location so unnecessary power usage is reduced. By using this system the user can monitor their consumed power anytime using Internet.

## 7. REFERENCES

[1] Devadhanishini. Ay, MalasriR.K, danipriya. N,Subashini.V,P.G. Padma Gowri,"Smart power monitoring system Using Iot" . International Conference on Advanced Computing & Communication Systems (ICACCS 2019)

[2]Dr, shreedhar A joshi, srijay Kolvekar, Y.Rahul Raj and ShanshankSingh."IoT Based Smart Meter".bonfrig international journal of research in communication engineering.2016

[3] Landi, C.; Dipt. di Ing. dell''Inf., Seconda Univ. di Napoli, Aversa, Italy ; Merola, P. ; Ianniello, G, "ARM-based energy management system using smart meter and Web server", IEEE Instrumentation and Measurement Technology Conference Binjiang, 2011

[4] Garrab, A.; Bouallegue, A.; Ben Abdallah, "A new AMR approach for energy saving in Smart Grids using Smart Meter and partial Power Line Communication", IEEE First International Conference on Renewable Energies and Vehicular Technology (REVET), 2012

[5] Darshan Iyer N, Dr. KA Radhakrishnan Rao, "IoT Based Energy Meter Reading, Theft Detection & disconnection using PLC modem and Power optimization ",IRJET, (2015)

[6] "B. S. Koay, S. S. Cheah, Y. H. Sng, P. H. Chong, P. Shum, Y. C. Tong, X. Y. Wang, Y. X. Zuo and H. W. Kuek" , "Design and implementation of Bluetooth energy meter", 2012.