International Journal of Future Generation Communication and Networking
Vol. 13, No. 4, (2020), pp. 871 – 877

Design of Smart Power System

Muthunivedha R.[1], Pragadhe S.[2], Susma S.[3], Tharunika S.[4] & Ms Revathi R.[5]

[1-4]*Department of Electrical and Electronics Engineering, KPR Institute of Engineering and Technology*, Coimbatore, Tamilnadu, India.

[5]*Asst. Prof. (Sr.G.), Department of Electrical and Electronics Engineering, KPR Institute of Engineering and Technology*, Coimbatore, Tamilnadu, India.

Abstract

The main motive of the Smart Power System is to conserve energy in this modern world. Electricity plays a vital role in today's world, at the same time conservation of electricity is also very much important as it needed for future use. The Smart Power System helps to monitor the power consumed at each phase; the data is stored and updated meanwhile. It identifies the fault when overload occurs and controls it automatically. The data of both monitoring and identifying the fault is stored. By the application of Internet of Things, the stored data is notified to the public. This method is designed to track the power consumption of any electrical devices or appliances across powerful and real-time wireless networks. The sensor is designed to feel the current and voltage. By using the measured voltage and current, power can be computed. Control characteristics are put away in the database of cloud data along with the system giving the user the notification of the power consumed status and producing the datasheet.

Index Terms*—Power monitoring, identifying fault, controlling IoT, notification, datasheet.*

1. Introduction

Electricity is characterized as the movement of negatively charged particles known as electrons. Electricity is the most significant source in today's world and plays a crucial role in human life. Without energy, people cannot survive. Nothing is possible without electricity from early morning till late night. As the value of electricity is growing day by day, therefore, the conservation of electricity is done. People know the power usage as a whole, but they are often dissatisfied with their energy bill due to the lack of knowledge of the power consumed by each appliance.

If the power consumed is informed, it can allow the user to use the electricity efficiently. Also, if an unused or unwanted appliance with high power consumption is automatically managed, it will help to save power. If the power consumed is tracked and modified, it will help the consumer to know the consumption on a regular basis. This monitoring and control can be done easily by IoT.

The Internet of Things (IoT) plays a major role at the present time, the value and jobs are growing every day. IoT may be a system of reticulate computing devices, mechanical and digital machines with distinctive identifiers and thus the ability to transmit information over a network without needing human or human contact with a laptop. IoT is connecting the full world with none affiliation between any of the appliances.

It links billions of devices worldwide and is employed to send and receive information everywhere the globe. Internet of Things (IoT) makes everything easier and faster. It's several uses and applications in several fields and domains. Internet of Things (IoT) interconnects numerous physical objects with embedded system, sensors, software system etc. Owing to IoT several things became smarter.

A microcontroller may be a tiny laptop on a microcircuit. In a trendy word, it's a chip system or a soc. A microcontroller includes one or more CPUs with memory and programmable input / output peripherals. Program memory in the form of Ferroelectric RAM, NOR flash or OTP computer storage (ROM) additionally usually enclosed on a chip, in addition to a limited amount of RAM. Microcontrollers are built for embedded applications, in distinction to microprocessors used in personal computers or alternative general purpose applications consisting of a range of separate

ISSN: 2233-7857 IJFGCN

chips. Instead of separate microchip victimization, storage devices, input or output devices, the use of microcontrollers provides additional cost-effective multi-device digital management.

There are many microcontrollers, such as Altera, Fujitsu, Holtek, Infineon, etc. Power bill makes the customer terribly dissatisfactory because it doesn't reveal the facility that every appliance consumes. The predicted technology is used to establish an awareness of the power consumed by each system and is updated on a regular basis. ATmega328p is used to control and monitor the system.

This makes it efficient for the consumer to save resources. It needs to be thought about in order to take care of the constant flow of energy load. If load management is feasible with a limited space or a single network does not give control. This technique includes detective work units that identify and control electrical appliances used on a daily basis. This reduces the price for customers.

2. **Literature survey**

A. Power monitoring system and control

This project is about a case study of wireless sensor network (WSN) to support power management. This power management is done by using web services. The integration of WSNs with internet or web service communication to acknowledge the power management and provide information using Internet of Things is the design of this proposed system. The concept of gathering energy information is based on various wireless devices working with different communication requirements.

New technologies such as developments in information technology, sensors, meeting, transmission, distribution as well as energy storage are versatile for both customers and suppliers in applications of daily household monitoring and control by WSNs of electricity.

B. Power consumption monitoring and home automation using IoT

For the sensible home framework for residential construction, there are many implementation targets to construct it extra cost-effective day after day. Actually, however, mainly VB (visual basic) and PLCC are used for a day. Several researchers are introducing the sensible home to maximize the higher outcome and to improve the technology for less energy usage. In houses, schools, offices and museums, it is the control of energy use and therefore the dominant environment by victimization of various types of sensors and actuators that control lighting, temperature and humidity. If the buyer is not aware of the edge warning, then the meter will go off mechanically. Then the buyer needs to visit the webpage once more and increment the edge worth.

C. Technique for estimation of power monitoring

In this project, a world power consumption and observation system was designed that constantly tracks customer consumption. In this case, if this use is on the far side of the metre limit, it brings the capacity offer of the maximum room to a halt. The complete method is based on the law of Ohm, which states that "the electrical power in watts associated with a complete electrical circuit or part of a circuit reflects the rate at which energy is transferred from the electrical energy of moving charges to some other form, such as heat, mechanical energy, or energy stored in electrical fields or magnetic fields." The capacity is supplied by the merchandise of applied voltage and therefore the electrical current for an electrical system in an extremely D C Circuit. The skill will be measured here, taking a voltage as predefined information and on the standardization of current. The problem of outlawed use of energy is solved electronically at this period of technical advancement with no human management alongside the meter square measure linked to the IoT thinking of web maltreatment. IoT square measure ideas are used to send the metre standing data wirelessly from the location wherever the metre is mounted to the server from where it sends the data to most of the station or station. Via disconnection and reconnection of the load, this approach removes the need for human power.

3. Proposed System

The current system only tracks the energy consumed and is therefore unable to control the power consumed by each computer. The introduction of power monitoring along with fault control using IoT is done in order to address the disadvantages of different methods of power consumption

ISSN: 2233-7857 IJFGCN

problems. The relay circuit is used to locate the fault, and control of the system is also implemented and modified when overload occurs. The consumer should evaluate the consumption of power and this helps to save power.

4. Methodology

The 230V AC source is connected to the phase and neutral voltage sensor and current sensor, respectively. For the calculation of power consumption, the phase and neutral points are related to the various loads. The microcontroller is equipped with an analogue signal from the voltage and current sensors. To boost the power from the output of the microcontroller to the load, the driver circuit is used. The ESP module is used to transmit a message to the user's computer. A load is also sensed by turning ON and OFF and the message is sent to the user. The fault is detected and informed of the occurrence of the fault. The amount of power consumed is noted when an ability is exceeded. The current and voltage measured by the current and voltage sensor is translated into power by the microcontroller and the data is stored in the SD card reader. The detailed working of the project is given in the block diagram as shown in Fig.4.1.

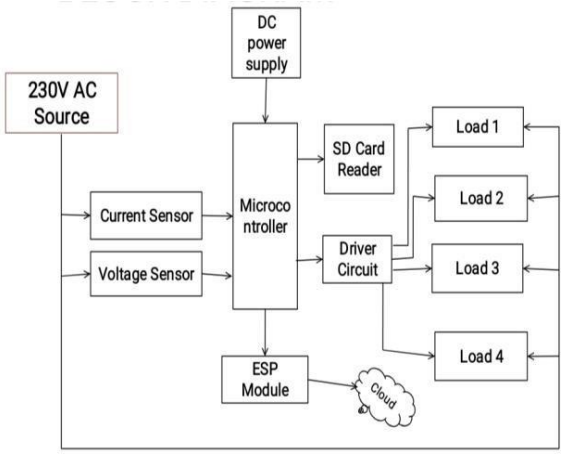

Fig.4.1. Block diagram of Smart Power System

Hardware Architecture

Arduino MEGA328p

Arduino Uno could be a microcontroller board supported the ATmega328. It's fourteen digital input/output pins (of that half dozen area unit typically used as PWM outputs), half dozen analog inputs, a sixteen megahertz quartz, a USB association, a power jack, associate ICSP header, a switch and it's shown in Fig.4.2. It contains everything needed to support the microcontroller; just connect it to a laptop with a USB cable or power.

Fig.4.2. Arduino MEGA 328p

Relay 5V

Relays in natural philosophy are the most commonly used transfer instruments. This relay has a trigger voltage of 5V. Fig 4.3 displays the relay circuit. Since the relay has a trigger voltage of 5V, we have used a +5V DC to provide at least one coil end and thus the separate end to ground via a switch. This switch can range from a small electronic transistor to a microcontroller or a microchip that can operate the switch, that could jointly find a diode connected across the relay's coil, which is called the Fly Back Diode. The aim of the diode is to shield the switch from high voltage spike which will

ISSN: 2233-7857 IJFGCN

created by their lay coil.

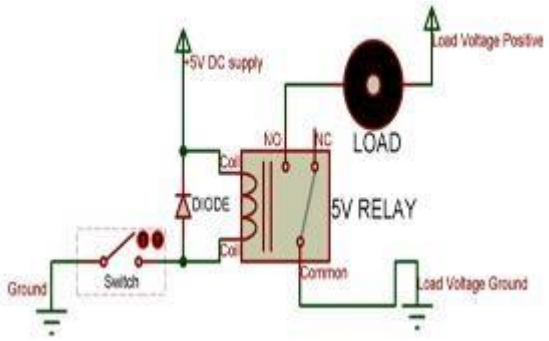

Fig.4.3 Relay 5V

Current sensor

The ACS712 current detector is used in this project to calculate this voltage and it is shown in Fig.4.4. For any AC and DC signal, it provides proper current operation. Such square wave tests responsive sensors for system metering and overall power consumption operation of devices. This detector generates a related output voltage which is directly proportional to the current detected.It operates on the Hall effect theory. 5V should be given to the ACS712 break board's Vcc and additionally the GND should be the 0v of give negative. When it is high-powered, the Vcc can demonstrate the output voltage that reflects the sensing pads' current demand. While the load is in the OFF state, the detector generates Vcc/2 voltage (no load voltage). ACS712 is used to calculate current throughout a mix of directions in a grip. Output voltage over a .5V (Vcc/2) attempt suggests current in one direction and voltage, but a .5V attempt reveals current in another direction. 3.5-inch colour screen, support 65K colour show, show created colors.320x480 HD resolution for clear show.

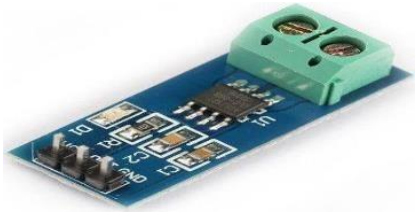

Fig. 4.4 Current Sensor

As shown one end of the load may be connected to the Common pin and therefore the different finish is either connected to NO or NC. If connected to NO the load remains disconnected before trigger and if connected to NC the load remains connected before trigger.

Voltage sensor

A voltage system made of the ZMPT101B voltage electrical device may be the ZMPT101B voltage device module. Its high precision, fair voltage and power calculation quality and can serve up to 250V AC. It's easy to use and comes with a potentiometer for changing the ADC output with multi flip trim. The specification of the voltage system is that, as shown in Fig.4.5, the output is Analog 0-5V. In DC 5V-30V, it is in operating voltage. Live at 250V AC intervals and its rated input current is 2mASize: 49.5 mm x 19.4 mm, the corresponding sum will be modified to acceptable consistency for voltage and power measurement on board micro-precision.

ISSN: 2233-7857 IJFGCN

Fig.4.5 Voltage Sensor

GSM Module

A chip OR gate that is used to create communication between a mobile device or a data processor and a GSM or GPRS system may be a GSM module or a GPRS module. GSM electronic equipment may be a device which might be either mobile or electronic equipment device which might be accustomed to create a pc or the other processor communicate over a network and is shown in Fig.4.6. A GSM electronic equipment needs a SIM card to be operated and operates over a network vary signed by the network operator.

Fig.4.6 GSM Module

Power Supply5V

Step down transformer

It is of great significance to pick an appropriate electrical unit. A critical issue may be this rating and also the secondary voltage of the electrical system. This electrical system rating depends on what is necessary for the load to be powered. The input voltage of the 7805 IC should be at least 2V greater than the 2V output defined, so it requires a minimum of AN input voltage on the stage point of 7V. So, a 6-0-6 electrical device with current rating 500mA is chosen (Since6*√2=eight.4V).

Fig.4.7 Step down Transformer

Optocoupler

The Opto-isolators is embedded in an exceedingly single device, associated has the looks of an microcircuit (IC) or a semiconductor device with further leads. Optocouplers are also used to separate low-power circuits from higher-power circuits and to eliminate signals from electrical noise. However, the most appropriate Optoisolators for digital signals can also be used to move analogue signals. High speed is taken into account in isolating any rate of very one Mb / sec. The Optocoupler displays Fig.4.8. For digital and analogue opto-isolators, the most common speed on the market is

ISSN: 2233-7857 IJFGCN

one Mb / sec, while ten Mb / sec and fifteen Mb / sec digital speeds are also on the market. For many trendy digital applications, Optoisolators are considered too sluggish, but since the Nineties, researchers have developed alternatives. High-speed Optoisolators are used in communications in power supplies for servers and telecommunication applications — as an example, power over LAN (PoE) technology for wired LAN LANs. Optoisolators parts also can shield LAN and fiber optic cables from electrical surges. In VoIP phones, electrical signals are often isolated employing a semiconductor device output Optocoupler.

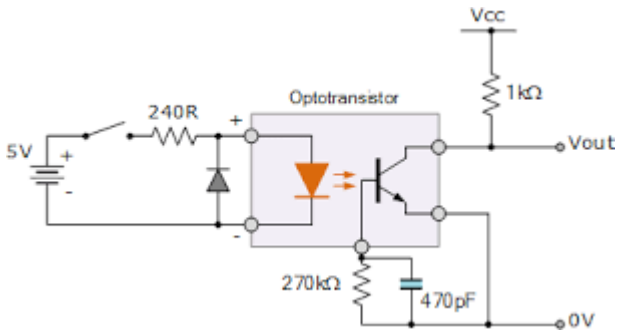

Fig.4.8 Optocoupler

Rectifying circuit

A full wave rectifier is the strongest and its advantage is that DC saturation is a smaller quantity than the action of diodes in each loop. Fig.4.9 displays the circuit rectifier. Higher electrical appliance Question of use (TUF).1N4007 diodes area unit used as it is capable of withstanding a better reverse voltage of 1000v whereas 1N4001 is 50V.

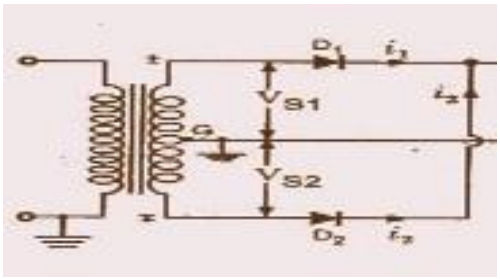

Fig.4.9 Rectifying circuit

5. **Conclusion**

The Smart Power System was successfully introduced using IoT to track power usage and regulate the fault. In order to incorporate an intelligent building, a smart power monitoring and control system was planned and developed. This system remotely tracks and manages the power usage of devices through the use of wireless networks. And shield the load from high voltages as well. The entire device is designed to be easy to build and consume less power on an embedded platform, offering compact size at low cost. Thus, it is possible to observe the continuous monitoring of electrical appliances through a website as well as an Android app. In addition, this work can be applied to assess the energy usage of whole buildings and electricity bills.

Reference

[1] Ahmed El Shafee, Karim Alaa Hamed, Design and Implementation of a Wi-Fi based mostly Home Automation System, International Journal of Computer, Electrical and Automation, Control and Information Engineering Vol:6, No:8, 2012.

[2] Zanella A, 2014, web of Things for good Cities, IEEE IOT-J, Vol1, Issue 1, ISSN: 2327-4662.

[3] B.Saikiran, R.Hariharan, 2014, Review of strategies of power felony in installation, International Journal of Scientific & Engineering analysis (IJSER), Volume 5, Issue 11, 276 ISSN 2229-5518.

[4] G. L. Prashanthi, K. V. Prasad, 2014, Wireless electric meter observation with power felony

ISSN: 2233-7857 IJFGCN

detection and intimation system exploitation GSM and Zigbee networks, IOSR Journal of physical science and Communication Engineering (IOSR-JECE) e-ISSN: 2278-2834,p- ISSN: 22788735.Vol 9, Issue 6, Ver. I (Nov - Dec. 2014), PP04-08.

[5] Maninder Kaur and Sheetal Kalra, 2016, A Review on IOT based mostly good Grid, International Journal of Energy, info and Communications Vol.7, Issue 3,pp.11-22.

[6] Andrea Zanella, Senior Member, IEEE, Nicola Bui, Angelo Castellani, Lorenzo Vangelista, Senior Member, IEEE, and Michele Zorzi, Fellow, IEEE, "Internet of Things for good Cities", IEEE web of Things Journal, vol. 1, no. 1, pp. 22-32,February 2016.

[7] Harsha Khandel, Suchitra Pandey, D. Reynolds, 2017, web of Things based mostly Power felony Detection System, International Journal of Advanced in Management, Technology and Engineering Sciences (IJAMTES), Vol.8, No.3.

[8] Landi, C.; Dipt. diIng. Dell"Inf., SecondaUniv.di Napoli, Aversa, Italy; Merola, P; Ianniello, G, "ARM-based energy management system exploitation good meter and net server", IEEE Instrumentation and measuring Technology Conference Binjiang, pp. 1 –5.

[9] International analysis Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 07 | July 2018 WWW.irjet.net.

ISSN: 2233-7857 IJFGCN