

VIGILANT WIRELESS SENSOR NODE OPERATED ENERGY MANAGEMENT

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ABSTRACT

In the recent scenario everybody is becoming dependent on latest new innovations and technologies to make their life easier and in a better way. Since life becomes easier, people don't care about the resources wasted especially power resources. To avoid this situation, a person is needed to monitor and control the appliances when they are away from homes. The aim is implementation of the controlling mechanism of appliances in different ways. This system principally monitors electrical parameters such as voltage and current and simultaneously calculates the power consumed. Mobiles phones are the most necessary device in this situation, therefore, to find a cost effective and secure solution, mobiles phones will be a better solutions. The real-time monitoring of the electrical appliances can be viewed through mobile. The system can be extended for monitoring the whole smart building. The development system is a low cost and flexible in operation.

Keywords: Power management, home automation, Zigbee, GSM.

1. INTRODUCTION

In today's world, various technologies are available for home automation but these technologies are incompatible with each other. Home automation is the use and control of home appliances remotely or automatically. Home automation is defined as a method of doing something without the help of human. Instead of doing the work by our self we are letting the automated system to do the work for us. There are several ways of controlling a home automation system. These can be divided into two major methods as hardwired methods and wireless methods. Early home automation began with labour-saving machines like washing machines which reduced the work

and time of the people. Some home automation appliances are stand alone which do not communicate, such as a programmable light switch, while others are are networked for remote control and data transfer. The programmable light switch is controlled by the programs that are already loaded. Now the home automation is done by using both hardwired and wireless control for efficient smart homes.

The other way of controlling the household appliances is by calculating the power consumed. At present, only the total units consumed by the appliances can be viewed in the energy meter but the energy consumed by each separate device cannot be determined through that. So it will be helpful for energy management when this information is known by us. The energy management can be achieved using various sensors like voltage, temperature & motion detection sensors. So the home automation and the energy management can be made through the android mobile phones. The power consumed by each separate device can be viewed in the mobile phone so that the electricity pricing can be done by us and also the units consumed and its price can be tallied easily. And also the electrical appliances can be turned off and on by using the android application developed in mobile phones.

2. RELATED WORK

The related works include smart home system based on the wireless technology. The first microprocessors emerged in the early 1970s and were used in embedded systems like calculators and microcomputers In 1975, X10 the first general purpose Home automation network technology was developed. It is a communication protocol for electronic devices. It primarily uses electric power transmission wiring for signaling and control, where the signals involve brief radio frequency bursts of digital data.

By 1978, X10 products included a 16 channel command console, a lamp module, and an appliance module. Soon after came the wall switch module and the first X10 timer.[1] The main objective is to design and

construct a microcomputer based system to control electric appliances such as light, fan, heater, washing machine, motor, TV, etc. There are two major approaches to control home appliances. The first involves controlling home appliances using timer option. The second approach is to control home appliances using voice command [2]. Moreover, it is also possible to control appliances using Graphical User Interface. The parallel port is used to transfer data from computer to the particular device to be controlled.

An interface box is designed to connect the high power loads to the parallel port. This system is very helpful for the elderly and physically disabled people to control their home appliances in intuitive and flexible way. In [3] the prototype design of ZigBee based integrated remote control is discussed. Such architecture scheme has ability to control all appliances without any additional hardware. In general connecting all appliances through a single home network is difficult because communication protocols are different. The integrated remote control is composed of three components namely integrated remote controller, ZigBee to infrared converter, and ZigBee power adapter. ZigBee power adapter is used for those appliances that even do not have infrared remote device in order to connect with the home network. Gill *et al.* [4] projected a ZigBee-based home automation system. This system consists of a home network unit and a gateway. The core part of the development is the interoperability of different networks in the home environment. Less importance is given to the home automation. Pan *et al.* [5] recommended a WSN-based intelligent light control system for indoor environments, such as a home for a reduction in energy consumption. In this paper, wireless sensors are responsible for measuring current illuminations and the lights are controlled by applying the model of user's actions and profiles.

3. PROPOSED SYSTEM

In our proposed system, mobile application is developed to control the household electrical appliances. The android application is developed using the java coding. The various sensors are connected to the appliances which continuously monitor the environment and keep the appliances in active and inactive modes. The power units consumed by the devices can be viewed through the developed application and the notification will be displayed in the phone as a reminder. Hence power consumption can be reduced manually once the tariff is known. So during

peak electricity hours our system will be more helpful to reduce power usage. So when we are away from homes we can easily monitor and control the appliances. The tariff

database can be viewed through the phone itself and it is done by using zigbee module.

4. HARDWARE DESCRIPTION

4.1 PIR & MICROWAVE SENSOR

A PIR (Passive infrared) is an electronic sensor that is used to measure the infrared light radiating from objects. This works by the principle of detecting the infrared radiation emitted or reflected from the objects. Usually all the objects with the temperature above absolute zero will emit heat energy in the form of radiation and this radiation is invisible to human eye because of its infrared wavelengths. A PIR based motion detection is used to sense movement of people, animal or other objects. Whenever a moving object such as humans, animals etc., passes in front of background such as a room wall, the temperature at that definite point in the sensor's field of view will rise from normal room temperature to the body temperature and then it will back again to previous temperature. The sensor will convert the resulting change in the incoming infrared radiation into a change in the output voltage and thus triggers the detection. Combining multiple sensing technologies into one detector will help reduce the false triggering, it does so at the expense. If both PIR sensor and a microwave sensor are combined into one unit then the false triggering can be avoided. In order to detect the motion both sensor must be triggered together. This will reduce the probability of false alarm since heat and light changes may make the PIR to work but not the microwave sensor. Similarly, the trees may trigger the microwave but not the PIR sensor. A passive infrared sensor can be designed to ignore animal up to a particular wait. The dual technology motion sensor will help to ignore a large animal and multiple small animals without setting off any false alarm.

4.2 LDR SENSOR

Light dependent resistors play a vital role in any electric circuit which is to be turned on and off automatically according to the level of ambient light – for example, solar powered garden lights, and night security lighting. A Light Dependent Resistor (LDR) is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive device. LDR is also known as photo resistor, photo conductors or simply photo cells. When the light having enough energy strikes on the device, more and more electrons are existing to the conduction band which results in large number of charge carriers. Hence more amount of current starts flowing through the device when the circuit is closed and it is said that resistance of the device is decreased. This is the principle of LDR Sensor.

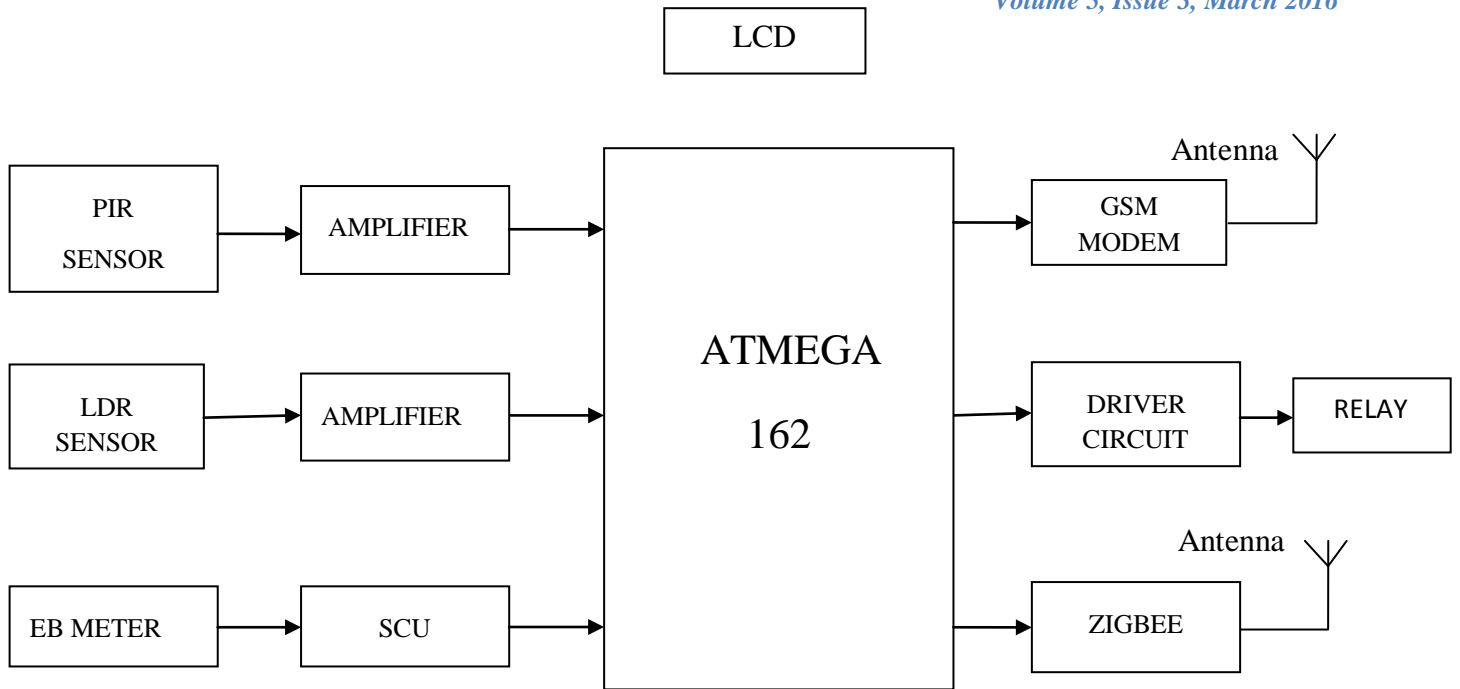


Fig 4 Block Diagram of our proposed system

4.3 EB METER

Electric meter or energy meter is a device that measures the amount of electrical energy consumed by a residence, business, or an electrically powered device. Electric meters are typically calibrated in billing units, the most common one being the kilowatt hour. Periodic readings of electric meters establish billing cycles and energy used during a cycle. In settings when energy savings during certain periods are desired, meters may measure demand, the maximum use of power in some interval. In some areas, the electric rates are higher during certain times of day, to encourage reduction in use. Also, in some areas meters have relays to turn off nonessential



Fig 4.3 Unit of measurement



4.4 LCD

A liquid-crystal display (LCD) is a flat-panel display or other electronic visual display that uses the light-modulating properties of liquid crystals. Liquid crystals are designed in such ways that do not emit light directly. The LCD monitors uses a native-supported resolution for obtaining best display effect. The CRT (Cathode Ray Tube) is less energy efficient when compared with the LCD screen and hence it is preferred mostly. Since LCD consumes only less power enables it is used in low power electronic equipment more efficiently. It is an electronically modulated optical device which is made up many number of segments especially for controlling a layer of liquid crystals and that is arranged in front of a light source or

reflector to produce images either in color or monochrome form. Liquid crystals were first discovered in 1888[6]

4.5 ATMEGA162

The ATmega162 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. It is 40 pins dual in line package .By executing powerful instructions in a single clock cycle, the ATmega162 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed. The ATmega162 provides the following features: 16K bytes of In-System Programmable Flash with Read-While-Write capabilities, 512 bytes EEPROM, 1K bytes SRAM, an external memory interface, 35 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundary-scan, On-chip Debugging support and programming, four flexible Timer/Counters with compare modes, internal and external interrupts, two serial programmable USARTs, a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and five softwares electable power saving modes.

4.6 ZIGBEE

ZigBee is a open standard network which is of low-cost, low-power, wireless mesh network standard targeted at the wide development of long battery life devices in wireless control and monitoring applications. Zigbee devices have low latency, which further reduces average current. ZigBee chips are normally integrated with radios and microcontrollers that lies between 60-256 KB flashes memory. ZigBee is operated in the industrial, scientific and medical (ISM) radio bands 2.4 GHz in most jurisdictions worldwide, 784 MHz in China, 868 MHz in Europe and 915 MHz in the USA and Australia. Data rates vary from 20 kbit/s (868 MHz band) to 250 kbit/s (2.4 GHz band).The ZigBee network layer natively supports both star and tree networks, and generic mesh networking. Every network must have one coordinator device, tasked with its creation, the control of its parameters and basic maintenance. Within star networks, the coordinator must be the central node. The communication at the network level can be increased by using both tree and meshes.

4.7 GSM

GSM (Global System for Mobile communication) is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses a multiple access techniques like time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA). GSM works by digitalizing and compressing the data, then information is send down to the

channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band. Since many GSM network operators have roaming agreements with many foreign operators and hence users can often continue to use their mobile phones when they travel to other countries. SIM cards (Subscriber Identity Module) holding home network access configurations may be switched to those will metered local access, significantly reduces roaming costs while experiencing no reductions in service. GSM along with other technologies, is a part of the evolution of wireless mobile telecommunications that mainly includes High-Speed Circuit-Switched Data (HCS D), General Packet Radio System (GPRS), Enhanced Data GSM Environment (EDGE), and Universal Mobile Telecommunications Service (UMTS).

4.7 EXPERIMENTAL RESULTS





Fig 4.7 Manual Control of Electric Loads

The above fig describes the expected result of our project. The user will be given a separate member ID login and password. They need to login into the account and can look over the appliances and control them manually. Any number of devices can be connected.

5. CONCLUSION

A smart power monitoring and control system has been designed as an android application in the smart phones. The developed system effectively monitors and controls the electrical appliance usages at homes. Thus, the real-time monitoring of the electrical appliances can be viewed through a phone. The system can be extended for monitoring the whole intelligent building. We aim to determine the power consumption of each devices and control them manually. This study also aims to assess consumer's response toward perceptions of smart grid technologies, their advantages and disadvantages, possible concerns, and overall perceived utility. The developed system is efficient and flexible in operation. In future, the system will be integrated with co-systems like smart home inhabitant behavior recognitions systems to determine the wellness of the inhabitant in terms of energy consumption.

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