POWER MANAGEMENT BY SMART SENSORS IN BUILDING USING GSM

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Abstract− **Reducing energy demand in the residential and industrial sectors is an important challenge worldwide. In this paper, the power monitoring and controlling system in real time has been reported. The system monitors electrical parameters of household appliances such as voltage and current. The measurement of electrical parameters is done by interfacing with fabricated sensing modules. Using LDR and PIR sensors we can adjust the power consumption according to the environment and light condition. PIC16F877A is used to control the sensors and home appliances according to the users need. Mode selection includes automatic control remote control and manual control. GSM technology is used for communicating with user with the help of mobile phone. Hence the system can save electricity expense of the consumers.**

Keywords− **Energy management, GSM module, LDR and PIR sensors, Relay driver unit.**

I. INTRODUCTION

Due to increase in population, there is a energy demand worldwide. Power consumption by people plays a major role in energy demand. In order to reduce this demand, wireless sensor network have been applied to conserve energy to household appliances. Here GSM is used as a wireless sensor network. It gives the current status of the power consumption by the user via wireless communication using mobile phone.

Here PIR and LDR sensors are used. PIR sensor is Pyro electric Infra Red sensor which is acting as a motion sensor in which it senses the movement of the human beings. LDR sensor which is Light Dependent Resistor which senses the environmental light intensity.

The output of those sensors are given to micro controller. Here PIC16F877A is used, hence it performs in both analog and digital out coming signals. PIR and LDR sensors are connected along with the micro controller. With these arrangements we can save power through three modes by mode selection unit.

This paper shows the design and accurate measurement of whole low power and low cost WSN to achieve power saving through mode selection. Mode selection includes automatic control, manual control and remote control.

II. COMPONENTS

1. TRANSFORMER

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled wires. The transformer works on the principle of electromagnetic induction. According to the size of the primary and secondary windings, transformer is classified as step up and step down transformer. Here step down transformer is used to convert high voltage to low voltage.

Fig.1 Transformer

2. SENSORS

- LDR sensor

LDR sensor is Light Dependent Resistors are very useful in light/dark sensor circuits. Normally the resistance of an LDR is very high as 1000000 ohms. When the light level is low the resistance of the LDR is high and vice versa. This prevents the flow of current.

Fig.2 LDR sensor

- PIR sensor

PIR sensor is Pyro electric Infra Red sensor which is an electronic device that measures infrared light radiating from objects in its field of view. All objects emit black body radiation. It is usually IR radiation that is invisible to human eye but can be detected by electronic devices. The effective range of PIR sensor is about 10 meters (30 feet) and a field of view less than 180 degrees.

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Fig.3 PIR sensor

3. LCD

A Liquid Crystal Display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. It uses very small amount of electric power. The LCD module comes with a 16 pin connector.

Fig.4 LCD

4. BUZZER

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical or piezoelectric. The main purpose of buzzer is to denote the high usage of electricity over the limit.

Fig.5 Buzzer

5. MODE SELECTION

The users can have the options of switching the device ON/OFF in three different modes. The three different modes are given as follows:

- Automatic control

This type of control is used during electricity peak hours. This can be regulated with the help of smart software and it is updated at regular intervals.

- Manual control

This mode has the higher priority to bypass the automatic control. The user has more flexibility by having manual control because the ON/OFF switch is directly intervene with the device.

- Remote control

This mode helps the user to keep the appliances on while away from building. The user also has flexible

remote control mechanism through secured internet web connection.

6. RELAY DRIVER UNIT

A relay is an electrical switch that opens and closes under the control of another electrical circuit. The switch is operated by an electromagnet to open or close one or many sets of contacts. A relay is able to control an output circuit of higher power than the input circuit, so it is considered as an electrical amplifier. It also acts as a switching device.
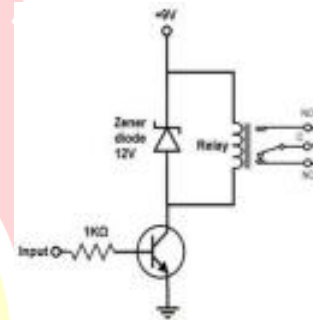

Fig.6 Relay driver unit

7. GSM

Global System for Mobile communication (GSM) is a cellular network where mobile phones connect to it by searching for cells in the immediate vicinity. GSM has four different frequency ranges. 2G GSM networks operate in the 900 MHz or 1800 MHz bands. 3G GSM network operate in the 2100 MHz frequency band. Mostly GSM operates in 900MHz. The channel data rate is 270.833Kbits/sec.

8. POWER SUPPLY

A power supply unit is a device or system that supplies electrical or other types of energy to an output load or group of loads. It is commonly applied to electrical energy supplies, less often to mechanical ones and rarely to others.
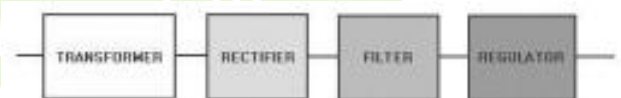

Fig.7 power supply

9. PIC MICROCONTROLLER

It consists of five ports. Each port has its own specific operations. Harvard architecture has the program memory and data memory as sprat memories and is accessed from sprat buss. This improves bandwidth over traditional von Neumann architecture in which program and data are fetched from the same memory using the same bus.

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To execute an instruction, a von Neumann machine must make one or more accesses across the 8-bit bus to fetch the instruction. Then data may need to be fetched, operated on, and possibly written.

III. SYSTEM DESCRIPTION

The system has been designed for measurement of electrical parameters of household appliances. Voltage and current is the key parameter of various appliances in a house from the view of customers point. The system is developed to monitor electrical parameters and control appliances based on the consumers need. The measurement of electrical parameters of home appliances is done by interfacing with fabricated sensing modules. The output signals from the sensors are integrated and connected to the microcontroller. Fig.1 indicates the transformer, which is a step down transformer. The power supply unit consists of the rectifier and the filtering unit which is used to obtain constant output. LDR sensor and PIR sensor are used in order to reduce the power consumption.
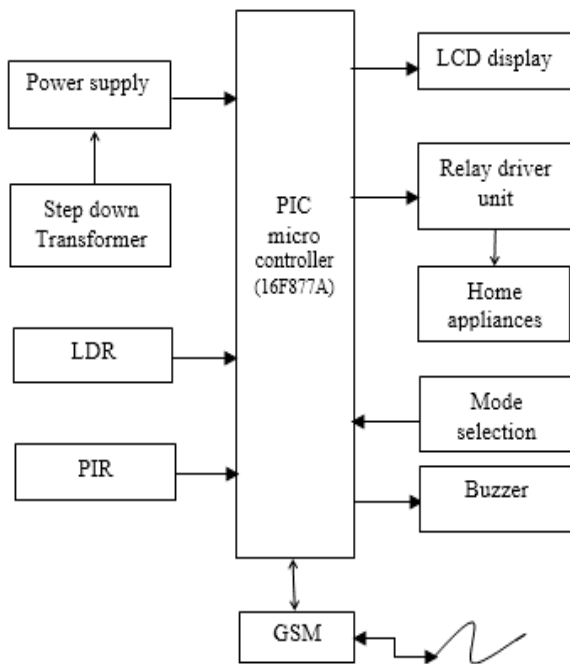

Fig.8. Transmitting section

Fig.2 represents the LDR sensor which senses the environmental light intensity. When the light level is low the resistance of the LDR is high and hence the supply is stopped. LDR sensor is used to sense the environmental light intensity. PIR sensor is used to detect the movement of the human beings. All object emits black body radiation. The output of LDR and PIR sensor are connected to the microcontroller. Fig.4 represents the LCD display unit. LCD display is connected to the microcontroller. Output from those sensors are processed and displayed in the LCD display. By analyzing the power from the system, energy consumptioncan be controlled.

Relay driver unit is connected along with the household electrical appliances. Fig.6 shows the relay unit. The GSM is used in order to get the signal from the user to

operate worldwide. User can set a range of unit to be used, in case of it exceeds the buzzer sound will be produced. Fig.8 shows the transmitting section using GSM module.
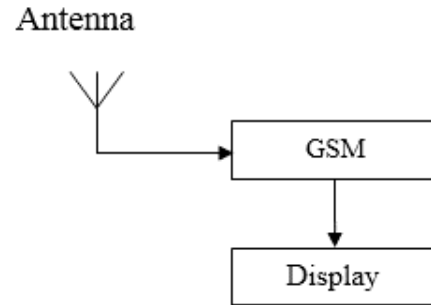

Fig.9. Receiving section

The receiving section consists of the display which may be a mobile phone. Fig.8 represents the transmitting section where the output signal is given to the receiving section. Thus the power consumption can be reduced.

IV. RESULT AND DISCUSSION

A smart power monitoring and control system has been designedand developed toward the implementation of a building. The developed system effectively monitors and controls the electrical appliances usages.The appliances which are tested room heaters, microwave, oven, toasters, fridge, television, audio device, battery chargers, and water pump.The developed system is robust and flexible in operation.

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