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Implementation of Intelligent Energy Conservation System in a Building

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ABSTRACT

Like many other fields, the demand of prudent energy having required a re-evaluation of lighting design and practices. Energy conservation is the most important factor in the recent human life. More wastage of energy is caused by the inefficient use of energy by the customers. This paper is used to collect and analyze some cases of the construction of electric consumption and electric facilities of a building. We are in need to save the electricity so the power wastage has to be reduced. The power generated cannot be stored in large amounts as we do not have proper storage devices and thus, it has to be conserved. By close investigation of parameters such as lighting power density using Light Dependent Resistor (LDR), temperature using Temperature Sensor and human detection made by Ultrasonic sensor, it helps to understand the energy conservation concept. The result of this investigation is used to come up with some ideas of saving energy in buildings and this is done without compromising the worker performance or comfort. The aim of the paper is to save the energy by using various sensors for controlling and measuring various parameters values such as speed of a fan and luminance of a light. The control circuit is designed using micro-controller. The output of the micro-controller is used to drive the LCD display, so that the value of each parameter can be displayed. In addition to the LCD display micro-controller outputs are also used to drive a circuit automatically and according to the condition of the parameter the sub-meter measure the energy consumed.

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I. INTRODUCTION

Electricity is one of the core requirements for development of a country planned or unplanned electricity interruptions always result in terms of economic lose. The economic development of a modern society is strongly dependent on energy. Production and supply of goals and energy consumption has strong effect on the environment at the local and global level. It demands a good balance between the use of energy for development of social welfare and the preservation of environment, as overuse may lead to negative environmental impacts. So management of energy is essential at this point of time, since the conventional be exhausted resource will surely be exhausted within few years.

In existing system, the energy conservation was made by replacing T8 fluorescent lamps by T5 fluorescent lamps and single star appliances. In proposed system Energy Conservation is in existing system, the energy conservation was made by replacing T8 fluorescent lamps by T5 fluorescent lamps and single star appliances. In proposed system Energy Conservation is made, when the appliances are in working condition and unnecessary usage of appliances by Modern Electronic System.

The aim of the paper is to save the energy or power, used in places like buildings where lighting

is very important and buildings will be well illuminated with many lamps.

At the same time when people are not present at a particular room the lighting can be made off by using ultrasonic sensor and when people come to that area, according to the LDR,lighting can be made sufficiently brighter. By using this system, we can also adjust the speed of the Fan according to the room temperature using temperature sensor. By this method energy is conserved in the long run through yearly consumption.

1.1Recommendation of Energy Efficient Appliances

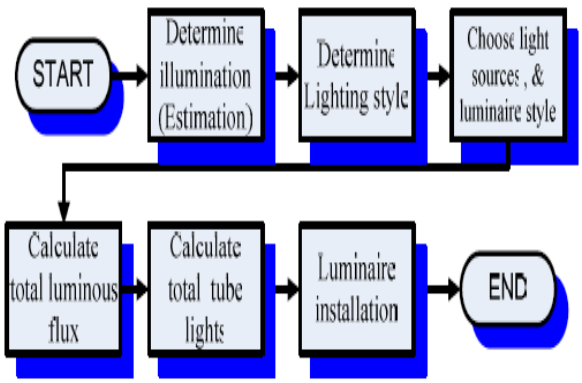
The star rating label of Bureau of Energy Efficiency (BEE) signifies the product"s energy performance in the form ofenergy use, efficiency & cost and rate the product on a comparative scale. The energy-efficient appliance saves moneyin the long run, considering the longevity of major appliances /equipment between 10 and 20 years. A more efficient appliance pays the additional cost back soon. The concerned appliances are ceiling fan, fluorescent lamp and air conditioner.

II. EXISTING METHODOLOGY

The illumination of the T8 fluorescent lamp were measured by the LUX meter and the energy conservation was observed.

The T8 lamps were replaced by the T5 lamps and again the energy consumption was observed and it was found to be less than the T8 lamps. Thus the energy is conserved.

In the existing system, for an example to collect and analyze some cases of the constructions of electric consumption and electric facilities of the official buildings. The lighting system was changed for energy conservation by reducing power consumption.



Reduction of energy consumption using modern electronic system is shown in the table I and II.

Table I

SAVING OF POWER COMSUMPTION WITH 5 STAR APPLIANCES

Electrical appliances	Qty.	Power rating (watts)	Power consumption (watts)	Power consumption with existing appliances (watts)	Saving in Power Consumption (watts
5 Star Ceiling Fan	4	50	200	320	120
5 Star Fluorescent Lamp	4	28	112	200	88
5 Star Air Conditioner (2 ton)	1	2130	2130	2500	370
Total			2442	3020	578

Table II

TABLE POWER COMSUMPTION OF GADGETS AND APPLIANCES

Item	Electrical gadgets and appliances	Qty.	Power rating of each gadget (watts)	Installed capacity (watts)	Actual power consumption (watts)
1	Ceiling Fan	4	60	240	320
2	Fluorescent Lamp	4	40	160	200
3	Air Conditioner (2 ton)	1	2000	2000	2500
4	Desktop	2	200	400	500
5	Laptop	1	100	100	150
Total					3670

This concept presents a very simple idea on energy conservation. In order to verify the idea described in this paper, a room of size (25`x30`) belong to the faculty members of Electrical Engineering accommodating four faculty members has been considered as a case study. Inside the room there are four ceiling fan, four fluorescent lamp, one air conditioner of 2 ton capacity, two desktop computer and one laptop. The table I shows the gadgets and appliances in the room and their power consumption. The power rating of each gadget, the installed capacity and the actual power consumption is also given.

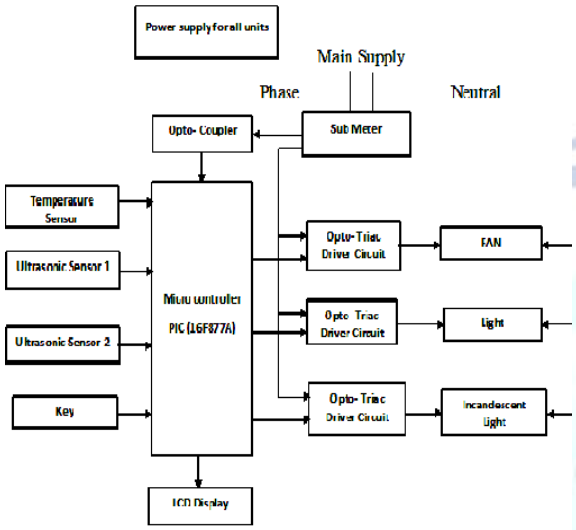
III. IMPLEMENTATION OF SENSOR SYSTEM

In proposed system three sensors are used namely, LDR sensor, temperature sensor and ultrasonic sensor. By implementation of these three sensors further reduces the power consumption made in existing system. Thus the energy conservation is improved in buildings.

The ultrasonic sensor is used to monitor the presence and absence of human activity in a room and to switch ON/OFF the appliances automatically during the presence and absence of human respectively. The temperature sensor monitors the temperature of the room and any change in the temperature is reflected in the variation in the speed of the fan according to the temperature variation in the sensor by the method of voltage control. The LDR senses the intensity of the natural light and brings variations in the

illumination of the lamp by controlling the voltage. The sub-meter calculates the energy consumption without the sensor network and with the sensor network. The comparison of the energy consumption shows the energy conservation.

BLOCK DIAGRAM:



IV. DESCRIPTION OF SENSORS

4.1TEMPERATURE SENSOR -LM35

It has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/ºC . The LM35 does not require any external calibration or trimming and maintains an accuracy of +/-0.4 ºC at room temperature and +/- 0.8 ºC over a range of 0 ºC to +100 ºC.

Another important characteristic of the LM35DZ is that it draws only 60 micro amps from its supply and possesses a low self-heating capability. The sensor self-heating causes less than 0.1 ºC temperature rise in still air. The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

Temperature Sensor

4.2 LDR:

It is relatively easy to understand the basics of how an LDR works without delving into complicated explanations. It is first necessary to understand that an electrical current consists of the movement of electrons within a material. Good conductors have a large number of free electrons that can drift in a given direction under the action of a potential difference. Insulators with a high resistance have very few free electrons, and therefore it is hard to make the them move and hence a current to flow. An LDR or photo resistor is made any semiconductor material with a high resistance. It has a high resistance because there are very few electrons that are free and able to move - the vast majority of the electrons are locked into the crystal lattice and unable to move. Therefore in this state there is a high LDR resistance. As light falls on the semiconductor, the light photons are absorbed by the semiconductor lattice and some of their energy is transferred to the electrons. This gives some of them sufficient energy to break free from the crystal lattice so that they can then conduct electricity. This results in a lowering of the resistance of the semiconductor and hence the overall LDR resistance. The process is progressive, and as more light shines on the LDR semiconductor, so more electrons are released to conduct electricity and the resistance falls further. LDRs are very useful components that can be used for a variety of light sensing applications. As the LDR resistance varies over such a wide range, they are particularly useful, and there are many LDR circuits available beyond any shown here. In order to utilize these components, it is necessary to know something of how an LDR works, which has been explained above.

TABULATION:

S.NO	QTY	ELEC. LOAD	POWER RATING	ACTUAL POWER CONSUMPTION	POWER CONSERVED
1	2	FAN	100 W	160 W	60 W
2	2	LAMP	80 W	100 W	20 W

Light Dependent Resistor

4.3 ULTRASONIC SENSOR:

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:
(1) Using IO trigger for at least 10us high level signal,
(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
(3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high level time×velocity of sound (340M/S) / 2,
Wire connection direct as following:

- 5V Supply
- Trigger Pulse Input
- Echo Pulse Output
- 0V Ground
- Electric Parameter Working.

Ultrasonic Sensor

V CONCLUSION

Intelligent energy saving system is not limited for any particular application, it can be used anywhere in a process industries with little modification in software coding according to the requirements. This concept not only ensures that are work will be unstable in the future but also provides the flexibility to adopt and extend, as needs change. In this paper we have studied and implemented a complete working model using a PIC microcontroller. The programming and interfacing of PIC microcontroller has been mastered during the implementation. This work includes the study of energy saving system in many applications. In our paper we connect all the sensors to microcontroller with the wires. This sensor will activate the microcontroller with signals and it can be implemented in a building without affecting the worker performance.

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