An Energy Conservation using 360 Degree PIR Sensor by Arduino Microcontroller

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***Abstract*-Electrical Energy consumption of a nation is an indicator of the economic and social growth of the country. With the increasing demand for non-conventional energy resources, the conservation of energy is an important domain in current research .Energy Conservation can be the best solution for the rising energy demand .Utilizing electricity efficiently and reducing its wastage as much as possible is an important criterion considering the depleting natural reserves of fossil fuel traditionally used its generation. This paved way for developing appliance based automation for energy conservation. This paper presents a mechanism which includes light control relative to natural light in the room, Fan control relative to room temperature and motion detection for determining absence of occupants in the room. The PIR sensor provides an alternative method to save power consumption by detecting human movement.**

Keywords–Energy Conservation, PIR Sensor, Occupancy Detection, Light Dependent Resistor, Temperature Sensor.

I. INTRODUCTION

India's population is expected to increase from 1.13 Billion in 2050 to 1.66 Billion by 2050. India's central electricity authority assessed that the long- term electrical energy requirement could increases to 3710 TWh by the end of the 15 th five year plan (2031- 2032). India is increasing electricity production by very impressive rates with coal playing the most important role.

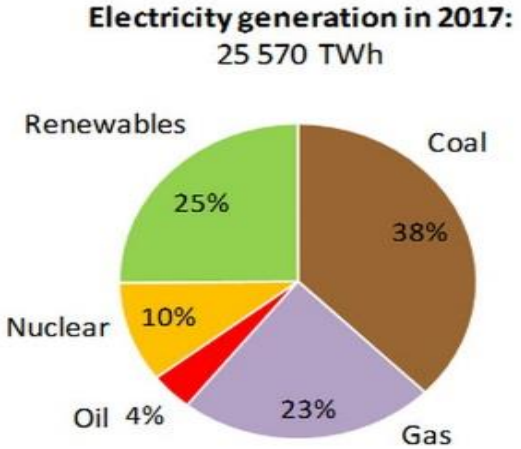


Fig 1: Electricity generation in 2017

India is the world's second largest producer of coal, with 692.4 million tonnes produced yearly. Despite this large production, India is still required to import high volume of coal due to the large demand for coal in the country. United States uses 30 % of coal for electricity production and the 3 rd largest producer of coal. On the other hand, hydro-electric power plants are ineffective due to water scarcity.

Table I: Water Demand in India

Year	Population (Million)	Per Capita Water Availability (m^3 / Year)
1951	361	5177
1955	395	4732
1991	846	2209
2001	1027	1820
2025	1394	1341
2050	1640	1140

During the process of nuclear power generation, large volumes of water are used. A 2011 study by the National Renewable Energy Laboratory found that nuclear plants with cooling towers consumed 672 gal/MWhr. Hence to reduce the usage of non –renewable energy in Power Production we have to conserve the electricity.

Energy conservation lowers the use while providing the same level of service. Energy conservation reduces unnecessary energy use .Traditionally, mechanical switches are used for energy management but the desired objectives were not efficiently achieved due to nonchalant attitude and negligence of humans as efficient energy management was dependent on human consciousness. In order to address the pitfalls of using mechanical switches, sensor based automatic switches are now being used.

Sensor based switches are used for automatic control of electrical loads in order to conserve energy consumption. There are 2 major classes of such sensors which are occupancy and daylight sensors. Occupancy sensors are designed to turn on/off loads depend on whether the room is occupied or not. Lightning systems tend to consume large units of energy in daily life. It is so vital to use the smart lightning system by automatically switching on/off the lights when needed without disturbing the normal operation of the working environment. Utilizing electricity efficiently implies using appliances, which consume comparatively less power and regulating the use of appliances by switching them off when they are not in use. Energy conservation provides environmental protection and utility bill savings.

II. LITERATURE REVIEW

The electric switch boards located in different rooms of our home make it difficult for the members in the home, especially the elderly and physically handicapped to operate them [1]. Lighting systems tend to consume large units of energy in daily life [3]. The PIR sensors are most frequently

found in motion detection and object tracking systems [2]. By using the PIR –light sensor, the light can be controlled without affecting the normal working habitat which helps for electricity conservation by switching on/off the light only when needed.[3]. We use the PIR sensor circuit to detect whether someone is passing through the detection area or not .If a human body enters the detection area, the PIR sensor receives the variations of temperature made by infrared energy emitted to the surroundings, and if necessary produces the variations of electric changes by means of Pyro -electric effect [4].

III. BENEFITS OF THIS PROJECT:

- Help to meet the increasing electricity demand.
- Through efficient energy management, cost of power generation, transmission and consumption of electrical energy can be reduced.
- Life span of power system components and consumer appliances.

IV. PROPOSED BLOCK DIAGRAM

Figure 1 shows the Block Diagram of Energy conservation using 360 degree PIR Sensor. It consists of 360 degree Passive Infrared Sensor (PIR Sensor),LDR Sensor, Temperature sensor, IR Sensor, Arduino Uno, 2 –channel relay and electrical loads. This automation system has four modules. Each module will be having one PIR Sensor, one

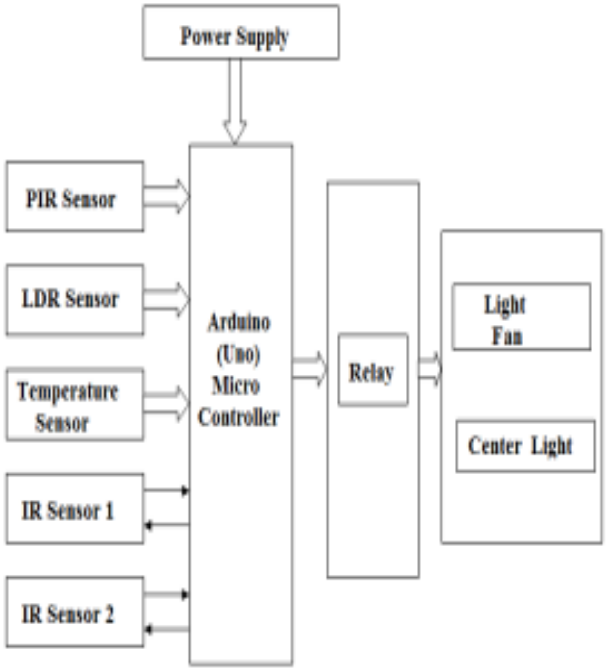


Figure 2: Proposed Block Diagram

LDR Sensor, one Temperature Sensor all connected to Arduino Uno microcontroller. The passive infrared sensor (PIR) passively detects the infrared radiations coming from the human body in the surrounding area. When people walk into the sensor range and the sensor can detect the spectral change of the human body infrared ray, during this time, the switch will connect the load automatically until the person leaves the sensor range;

LDR Sensor is used to measure light intensity in the room and gives high signal to the Arduino. When Arduino receives signal from LDR sensor, the light will glow. Temperature sensor LM35 senses the temperature and converts it into an electrical (analogue) signal, which is applied to the MCU through an analogue-to-digital converter (ADC). The analogue signal is converted into digital format by the ADC. Sensed values of the temperature and speed of the fan are displayed on the LCD. Temperature and monitoring using Arduino. The MCU on Arduino drives the motor driver to control fan speed. Two IR sensors are placed in the door for counting the number of persons in the room. If the count is above 1 the light in the centre of the room will be turned on, while if the count is 0 the centre light will be turned off. Arduino acts as the heart of the system for decision making (automatic turn on/off the lights).

V. CIRCUIT DIAGRAM:

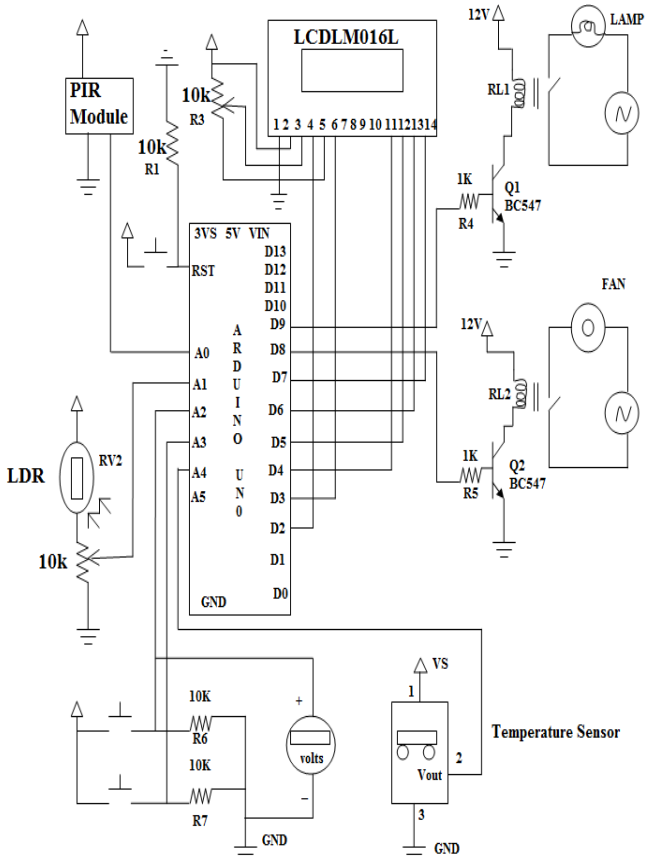


Figure 3: Circuit Diagram

In this circuit, two infrared (IR) sensor modules are used each for up and down counting, respectively. Whenever an interruption is observed by the first IR sensor, it increments
the counter value. Similarly, when the second sensor detect s an obstacle, the count is decremented. The count value is calculated depending upon the sensor input sensor. The sensor would observe an interruption and provide an input to the controller which would run the counter in up/down mode depending upon the selector setti

ng. Thus, in this way if the count is less than or equal to one, the light in the center of the room will be turned on and if the count is 0, the center light will be turned off.

If a person entering to the monitored area ,the PIR sensors activates and sense the person, gives to the Arduino microcontroller. The Infrared energy emitted from the living body is focused by a Fresnel lens segment. Then only the PIR sensor activates. After sensing the person, LDR checks the light intensity of the monitored area, whether it is bright or dark. Depending on the LDR output, the lamp may be ON/OFF providing illumination to the room (ON). By using this system, we can adjust the speed of Fan according to the room temperature measured by temperature sensor (LM35), which is connected to the Arduino.

VI. WASTAGE IN A HOME:

Table II: Statistics of Electricity Wastage (Minimum Probability)

DIFFERENT PLACES	NO. OF ITEMS	POWER RATING OF ELECTRICAL APPLIANCES (WATTS)	NO. OF HOURS WASTED			ELECTRICITY WASTED PER DAY		ELECTRICITY WASTED PER MONTH		ELECTRICITY WASTED PER YEAR	
			PER DAY(hrs)	PER MONTH(hrs)	PER YEAR(hrs)	Wh /DAY	KWh /DAY	Wh /MONTH	KWh /MONTH	Wh /YEAR	KWh /YEAR
HALL	1	40	3	90	1095	120	0.12	3,600	3.6	43,800	43.8
BEDROOM	1	40	2	60	730	80	0.08	2,400	2.4	29,200	29.2
KITCHEN	1	40	4	120	1460	160	0.16	4,800	4.8	58,400	58.4
STUDY ROOM	1	40	1	30	365	40	0.04	1,200	1.2	14,600	14.6
REST ROOM	1	15	4	160	1460	60	0.06	2,400	2.4.	21,900	21.9
HALL	1	80	3	90	1095	240	0.24	7,200	7.2	87,600	87.6
BEDROOM	1	80	2	60	730	160	0.16	4,800	4.8	58,400	58.4
STUDY ROOM	1	80	1	30	365	80	0.08	2,400	2.4	29,200	29.2

The paper proposes a simple idea on reducing the energy consumption.For the case study, a home with 5 rooms is considered. There are 4 Fluorescent lap, 1 CFL lap, 3 ceiling Fans. The following table shows the statistics of electricity wastage in a home (minimum probability).

It is evident from the table that energy is wasted in every home due to nonchalant of human being. In a home, electricity is wasted for 20 hrs. Consuming 940 watts (0.94 Kw/h) per day. Similarly, per month the electricity wastage is 28,800 watts (26.4 Kw/h) and for a year it is 3, 43,100 (343.011).Then the cost per day has been calculated as Rs.2.82, at the rate of Rs.3/unit (average residential rate as per TANGEDCO). Similarly for a month, the cost is Rs.79.2 and for a year ,it is Rs.1029.03.In order to minimize the energy consumption and to reduce the electricity bill, Proposed sensor based switching model can be used to switch ON/OFF the lights and fans when required

VII. SCHEMATIC DIAGRAM:

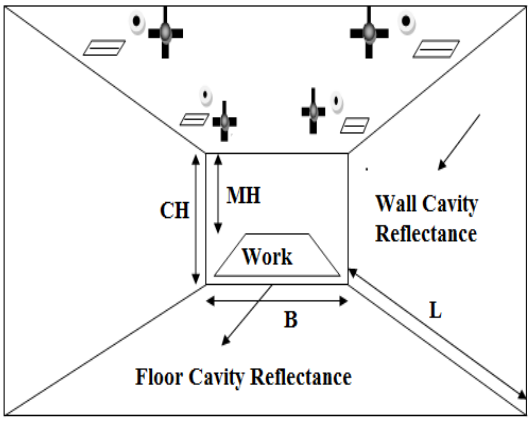
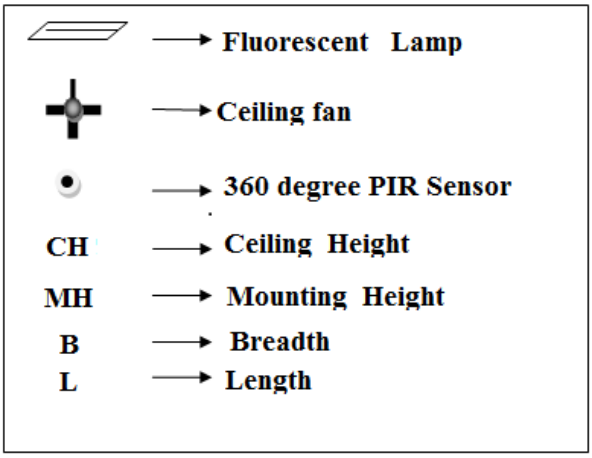


Figure 4: POSITION OF SENSORS



CONCLUSION:

In 2014, an electrified Indian household consumed about 90 units (kwh) of electricity per month on an average enough to run 4 tube lights,4 ceiling fans, a television, a small refrigerator, a small kitchen appliances with typical usage hours and efficient levels in India. A novel system to control the light and fans according to occupancy, light control relative to light intensity, fan control relative to temperature is proposed. This method requires sensors interfaced with Arduino for effective control of appliances and the average power consumption is reduced efficiently. This promises to be a relevant energy conservation model for both the developing and developed countries.

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