Automatic Intelligent Lighting System and Cooling System for Power Saving

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***Abstract*-This paper proposes automatic intelligent lighting system. This system will monitor, sense the environment, surrounding, co-ordinates with neighbors and control lighting system for energy efficiency. The system may comprise various sensors such as light detector, temperature sensors, motion detectors. These sensors are integrated into one element control unit and feed into the controller circuit. All lightings are equipped with the energy-saving function which will turn itself to the dimming level automatically for example, after the visitors leaving the area automatically lightings dimmable to minimum intensity and automatic control of speed of fan depending on the temparature**

Keywords—Light emitting diode; energy efficiency, LED illumination.

I. INTRODUCTION

Energy efficiency is the goal of efforts to reduce the amount of energy required to provide products and services. For example, Installing fluorescent lights or natural skylights reduces the amount of energy required to attain the same level of illumination compared with using traditional incandescent light bulbs. Compact fluorescent lights (CFL) use one-third the energy of incandescent lights and may last 6 to 10 times longer, while Light Emitting Diodes (LEDs) use one tenth of the energy of CFL and last 6 to 10 times longer. Improvements in energy efficiency are most often achieved by adopting a more efficient technology or production process.

Today India is facing significant growth in electricity demand as year by year .so we need to find the solution to minimize demand .there are two way is possible in front of every one either we should make increase more power plant generation unit or to make energy consumption less by adopting some technology into our electricity utilization, first way is very tough for government to implement plant by spending corer together money and it is very tough also to spend huge amount of money, instead of doing that we should concentrate on utilization of electricity very smartly. Now world has become more technological world, we have a technology for every thing, we should make utilization of that to make less electricity consumption to our daily life.

Lighting accounts for 19% of the world's electricity consumption. Significant savings between 50-70% are possible simply by switching to energy-efficient lighting technologies such as LED. On a global level these savings amount to €128 billion in reduced electricity cost, 670 million tons of CO_2, or the equivalent of 642 power plants (in itself representing a €1,300 billion saving in reduced need for power infrastructure – virtually making this an economic necessity in these times of national budget deficits[1]. In addition to their capacity to slash energy bills and avoid greenhouse gas emissions, flexible LED lighting solutions offer exceptional freedom in terms of controlled lighting effect – color, dynamics – and design. This capability is driving a shift from 'quantitative' functional lighting towards 'qualitative' intelligent and sensitive lighting that transforms urban environments, offering city residents and visitor's safety and spectacle, uplifting and inspiring experiences.

The paper, automatic intelligent lighting system adopts intelligent and advanced technology to improve energy efficiency. The papert aims at designing and developing an intelligent lighting service using solid-state lights (LEDs) in order to reduce energy consumption. Potential saving in energy expected to be around 70% which is significant especially in applications where illuminating devices stay lit for maximum number of hours such as traffic lights, road/street lights, offices,

hotels, common areas and corridor of buildings/apartments etc.

The system also aims at optimizing all efficiency factors to see more with less light and thus generating
a significant energy saving. Apart from the saving in energy, LED-based illumination offers many other advantages, such as:

- The high efficacy of LEDs makes them useful in battery powered or energy-saving devices.
- The pleasant and cool appearance and lights
- LEDs can emit light of an intended colour without the use of colour filters that traditional lighting methods require.
- The solid state lighting (SSL) can be designed to focus its light without use of reflector as in conventional lighting.
- LEDs can be used for dimmer applications without change in colour
- They have low or no maintenance cost
- They have very long life.
- They can be switched ON/OFF at very high speed and used for data communication simultaneously
- They can be controlled effectively and efficiently, and many more.

However, LED-based illumination has the disadvantage of high initial cost. But this initial cost can easily be returned within 18-20 months of
installation. A mere replacement of existing conventional lights with the LED-based lights may result in a minimum of 50% saving in energy and around 80% saving in maintenance cost [2]. Furthermore, adding intelligence to the illuminating devices offer additional energy saving. Intelligent devices such as motion sensors, light detector etc, will able to provide information about the availability of a person in office, ambient lights and so on, thereby lights, fan can be switched off/on or regulated accordingly. Such coordinated signal processing can save an additional amount of energy. However, this will cost additional capital. But still the payback period will not increase further. In order to achieve significant energy savings, the proposed solution In order to do so, a set of embedded sensors such as ambient light, temperature, motion and others measure/sample the data. The collected data is then processed by the embedded intelligence in order to achieve optimum regulation of light levels. Relies on the dimming of the LED-based lanterns depending on the environment conditions. Once implemented the concept can easily be extended to our institutions, offices, hostels, vigilance lights, and road and street lights.

This paper is organized as follows, section I describes the introduction and need of system. Section II describes the detailed architecture of proposed system. Section III describes the experimental setup and Analysis. Section IV describes the result and discussion. Section V concludes the paper.

II. SYSTEM ARCHITECURE

Our system architecture under following sections.

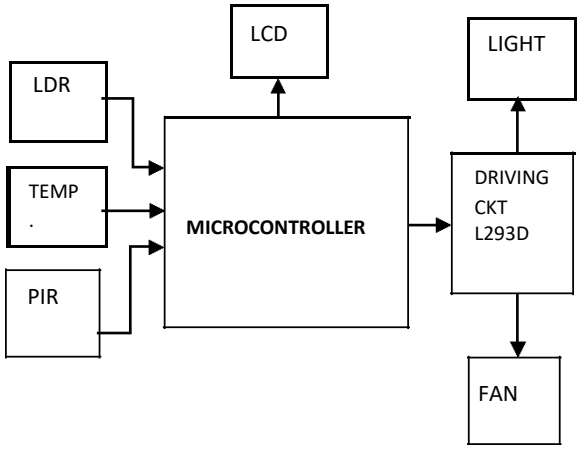

Figure 1. System Architecture

The proposed system consists of sensors like motion detectors, light sensors, temperature sensors, etc. White smd Package LED bulb can be used because of LED lighting the illumination will be better, this system transform area into energy saving opportunity. By analysing the surrounding area it is perform occupant and environment it turns off/on the light and required dimming of light. LEDs are providing better energy consumption that is helpful for power shortage countries and consume less resource in comparison to others due to the highest operational lifespan among all. So, the rate of manufacturing is much lower than the other lighting bulbs. It only requires higher initial installing cost than others which can be recovered from annual power saving and maintenance costs.

A. CONCEPT OF PULSE WIDTH MODULATION

Pulse Width Modulation, abbreviated as PWM, is a method of transmitting information in the form of modulating pulses i.e. variable width of the pulses. It is the modulation technique for generating variable width pulses to represent the amplitude of an input signal. PWM is generally based on the principle that is the average power delivered is directly

proportional to the modulation duty cycle. PWM is a technique for getting analog results with digital means. Duty cycle is defined as the percentage of the ratio of the ON time to the total time i.e. ON + OFF time, in a fixed period of time.

$$Duty\ Cycle = \frac{On\ Time}{Total\ Time}\ x\ 100 \qquad \text{------ (1)}$$

Take an example, an LED is connected with a 9V battery and a switch forming a closed circuit. They implement the PWM on this circuit and calculate the output power across the LED. The figure 1 shows the 50% duty cycle as the output which is roughly gives out 50% of the average power means 50% of the 5V i.e. 2.5V as the output power. The LED in the circuit will glow with 50% duty cycle means half of the power supply will be used in the output i.e. 2.5V compared.

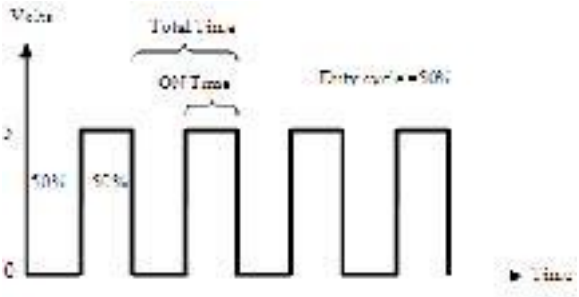

Figure 2. Waveform of 50% duty cycle

When they apply this 25% duty cycle of PWM across the LED circuit, the LED will glow with 25% of the total power i.e. 1.25V. The brightness of the LED will be very dim due to the 25% of the total power used i.e. 1.25V across the LED due to decrease in duty cycle of the waveform as shown in figure 3.

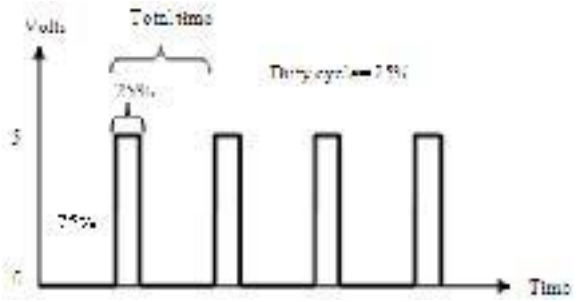

Figure 3. Waveform of 25% duty cycle

Figure 1. Shows the overall system which comprise of microcontroller, different sensors, driving circuits, lighting module, fan. Overall system works on the principle of Pwm concept defines the method of transmitting the information in the form of modulating pulses i.e. variable width of pulses. It is capable of doing the variation in the illumination level occurring. System works on principle of PWM concept. PWM concept defines the method of transmitting the information in the form of modulating pulses i.e. variable width of pulses.PWM is a technique for getting analog results with digital means. These input it is capable of doing the variation in the illumination level occurring.

PIR motion sensors consist of differential sensing elements which are differentially illuminated by human IR emission when in motion. Otherwise, the output of the differential elements is zero. PIR sensors are sensitive to all radiation in the human emission band, so animals are also detected. This system provides an option to set sensitivity level of the sensor so that small animals are ignored. The sensors have a tested detection distance of 20 feet and cover an area of 15×15 feet.

LDR sensor is for each input changes corresponding changes of duty cycle assigned. As duty cycle changes power delivers to load will be changes, so there is a continuation variation in the output it can switch contentiously using programming technique. LDR sensor continuously sense the environment condition i.e. natural light available to the controller then using this

Temperature sensor is used to measure the environment temperature and depending on the temperature there will be continuous variation in the speed of fan this will also works on the principle of PWM concept we are making different duty cycle to each change in input. For each input changes corresponding changes of duty cycle assigned. as duty cycle changes power delivers to load will be changes, so there is a continuation variation in the output it can switched continuously using programming technique.

White LED based systems can be dimmed to arbitrary levels, which is taken advantage of and this is also configurable. Traditional lamps, on the other hand, are standard amenable only for on/off kind of control, but give higher wattage capability and are much cheaper as of today.

B. L293D LED DRIVING CIRCUITS

Driving circuits used here to drive the light source and fan of required voltage. In this system we are making use of L293D circuits which is capable of driving the 12v suplly.it consists of various pin assignments and pinout details as shown in the figure 4.

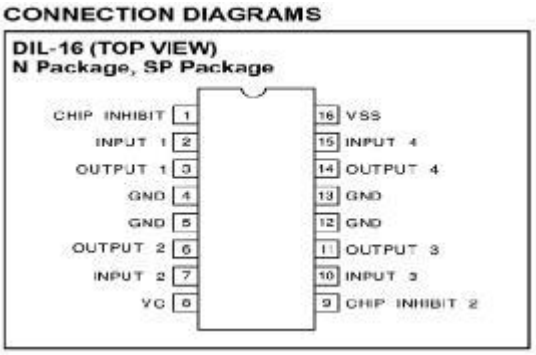

Figure 4. L293D pin details

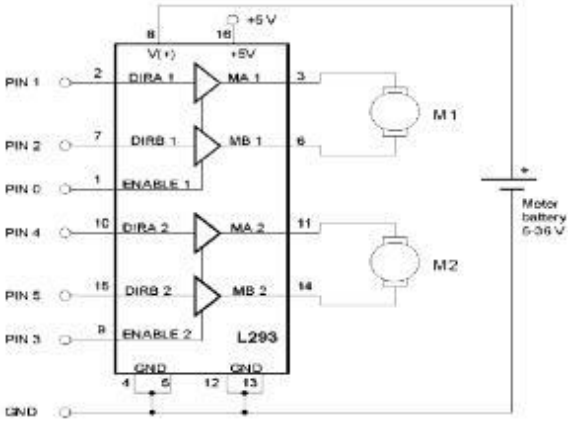

Figure 5. The pinout for the L293 in the 16-pin package.

C. WHITE LED DOWN PANEL

Even with the leaps and bounds that have taken place in power LEDs in recent years, a single device is rarely enough to provide all the light needed for general illumination. More than one LED will be needed if goal is to light a space formerly occupied by at the light bulb. Various white LEDs are arranged in a definite order to form a white LED down panel. Placing the LEDs in series guarantees that the same current flows through each device. In series combination, if any of the LEDs fail and create an open circuit, the entire white LED down panel goes dark. In addition, this configuration leads to highest output voltage, which translates into larger, more expensive circuit components and more requirements for safety. Thus, LEDs must be arranged in a series-parallel array. This arrangement has the advantage of using a lower output voltage and reducing the hazard of electric shock. If one LED fails open circuit, the other two branches continue to operate. The dimmable white LED lighting only needs the information of brightness, or dimming [3] [4]. White LED down panel, shown in below figure, has a series-parallel array i.e. it consists of 4 parallel branches with each branch having 4 LEDs in series. Voltage across each LED in series combination is 3V resulting in grand total of 12V across each parallel branch of the white LED down panel. LED driver, being a current source, will force current I/4 current, I is the current drawn through the LED driver, through each parallel branch.

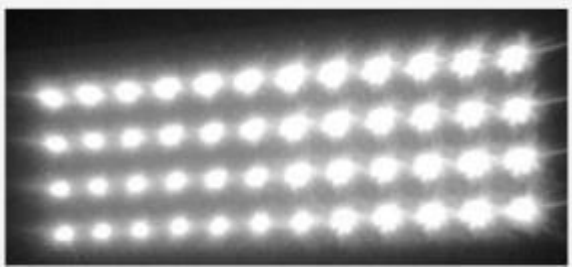

Figure 6. SMD package led of 12v

III. EXPERIMENTAL SETUP AND PERFORMANCE ANALYSIS

Our proposed lighting module is as shown in the figure 8. This experimental setup consists of various sensors like motion sensors, light sensors, temperature sensors and smoke sensors. These sensors are integrated into one another and feed to the micro controller depending on these inputs corresponding in output level. In this we have considered conditions results are given in the Table 1. Here we have considered that to glow 10x10 room of one light needs 2000 lumens, operating of 8 hours per day to whole year according to that various lighting inputs have taken with Led system.

Table 1. Performance of proposed system

Other lighting system	Incandescent	Fluorescent	CFL	LED
	350.4 Kwh/year	233.6 Kwh/year	105.12 Kwh/year	93.44 Kwh/year
Proposed system	40.86 Kwh/year	40.86 Kwh/year	40.86 Kwh/year	40.86 Kwh/year
Annual Savings	309.54 Kwh/year	192.74 Kwh/year	64.26 Kwh/year	52.58 Kwh/year
Annual savings @ $ 0.17kwh/year	$52.62	$32.76	$10.92	$8.93

PIR sensor is monitor the status of visitor inside room or building or office etc. depending on the movement in the surrounding it sense the movement input will be feed into the controller and controller will take action as turn on the light and light will be in maximum illumination level after that it checks the natural light available condition using LDR sensor it make the illumination level to required level of intensity as according to the surroundings. As changes in the environment natural light there is continuously a change in illumination level. Temperature sensor is used to measure the variation in the environment condition temperature depending on the temperature speed of fan will increases or decreases and this is also based on the

principle of PWM concept and this will continuously switched.

IV. RESULT AND DISSCUSION

In this section, we compare the performance of the proposed system with the reference system by calculations.

For comparing the different lighting system with our proposed system various data sheet of lighting system is analyzed, by analyzing all the lighting system datasheet calculations of result is carried out. Here we have considered that to glow 10x10 room of one light needs 2000 lumens, operating of 8 hours per day to whole year according to that various lighting inputs have taken with Led system At last we came to know that our proposed system can perform better with compared to other lighting system. For doing result all calculations are made on basis of real values obtained from system, same assumption are made for all lighting system.

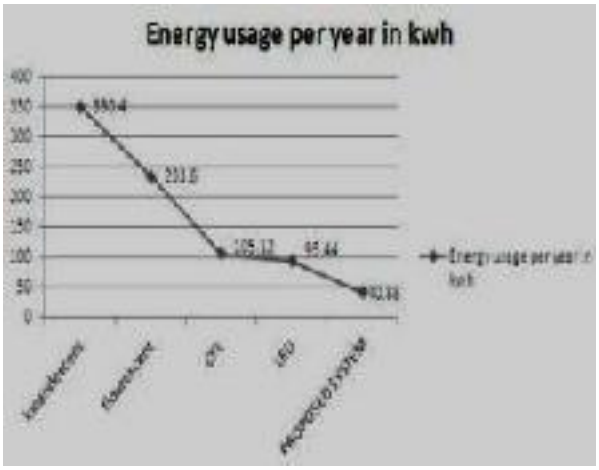

Figure 7. Graph showing the energy usage

V. CONCLUSION

This proposed system is based on pwm concept with microcontroller to achieve the desired task of dimming white LED panel according to environmental condition.

This proposed system is based on Pwm concept with renesis microcontroller to achieve the desired task of dimming white LED panel according to environmental condition. This result shows when using LDR sensor input but if we consider the motion detector still it consumes less energy because when no one in the surrounding means the LED goes to energy saving mode. The PWM strategy, discussed above, has the ability to control the intensity of lightning emitted by the LED panels and can save power to a great extend. It can help the developing countries facing shortage of power supply and the power cuts being faced by people. This technique can be implemented in offices or homes to lower power consumption, ultimately reducing the power bills to a great extend and by implementing PWM (Pulse Width Modulation) strategies to control the intensity White LED panels on the basis of environment requirement, more energy and maintenance costs can be saved.

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