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INTELLIGENT LIGHITING CONTROL SYSTEM BASED ON MEMS

SMART BULB TECHNOLOGY

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***Abstract*—Intelligent lighting control system (INLICS) is an automatic lighting controller it reduces the power consumption by minimum use of artificial light and also it takes advantage of natural lighting i.e. Light from sunlight is taken to control the intensity of artificial CFL (Compact Fluorescent Lamp).**
Main aim of this project is to control the emission of hazardous substance from CFL. Also it can reduce the cause of migraine disease (severe headache leads to memory loss, vision error, muscles weakness etc.) for human.

Keywords—INLICS, energy efficiency, lighting control, migraine disease.

I. Introduction

Major problem is facing by the middle class people is power consumption. Now a days most of the peoples were using compact florescent lamp (CFL) for lighting. Because it is cheapest and low power consumption compare with other bulb. But the hazardous emission will increase by using compact florescent lamp than in florescent lamp. This emission cause a severe migraine disease, a disease which cause a severe headache, memory loss, vision problem, muscle weakness etc.

Peoples were using electrical lamp in dark time and forget to switch it off the artificial lamp while there is no use of light and also even in day time. This leads to increase in power consumption and reduce the life time of artificial lamp. Also it may affect the human beings. It lead to a migraine disease. Some industries, companies and peoples were using the light even in day time. The high intensity of light is not necessary in day time. This may increase the hazardous emission from the compact florescent lamp.

Ancient peoples like homosapiens (over 150000 years ago) use firewood for light in dark time. Because of technology development artificial lights were discovered in later centuries.

Lighting control system is working with automatic switching the light by detecting the presence of human, this can be achieved by using thermal sensor. And light intensity can be controlled by lux sensor

II. Florescent Lamp

A fluorescent lamp tube is filled with a gas containing low pressure mercury vapor and argon, xenon, neon, or krypton. The pressure inside the lamp is around 0.3% of atmospheric pressure. The inner surface of the lamp is coated with a fluorescent (and often slightly phosphorescent) coating made of varying blends of metallic and rare-earth phosphor salts.

The fundamental means for conversion of electrical energy into radiant energy in a fluorescent lamp relies on inelastic scattering of electrons when an incident electron collides with an atom in the gas. If the (incident) free electron has enough kinetic energy, it transfers energy to the atom's outer electron, causing that electron to temporarily jump up to a higher energy level. The collision is 'inelastic' because a loss of kinetic energy occurs.

Fluorescent lamps produce light by passing an electric arc through a mixture of an inert gas (argon or argon /

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krypton) and mercury (a tiny amount). The mercury radiates ultraviolet energy that is transformed to visible light by the phosphor coating on the bulb.

Fluorescent lamps are more efficient at producing light compared to standard incandescent or even halogen. In fact, their efficacy is 4-8 times that of the filament sources. Fluorescent lamps have life ratings from 7,500 hours to 24,000 hours, with a few even beyond that. Life is dependent on many variables such as lamp type, ballast type, operating environment and how often they are switched on and off.

Florescent lamp contain an average of 5mg mercury. Breaking an unused lamp can expose 300 times in excess of safety level. Also cause serious health problem and also affect the nervous system and can result in permanent damage especially for children.

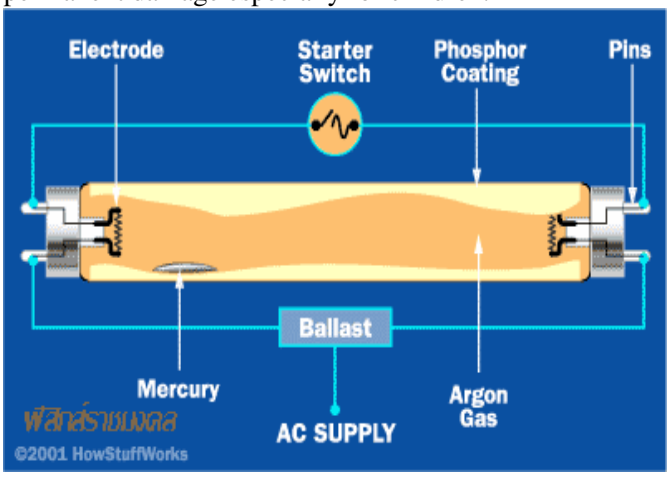

FIGURE 1

III. Existing Solution

Pyro electric infrared sensor is used previously to solve this problem. Pir sensor detect only when the object in a moving position nor in stationary position. But PIR sensor detect the temperature while the object in moving position. If the object is stationary it decides no one present inside.

FIGURE 2: PIR SENSOR

The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change.

The IR sensor itself is housed in a hermetically sealed metal can to improve noise/temperature/humidity immunity. There is a window made of IR-transmissive material (typically coated silicon since that is very easy to come by) that protects the sensing element. Behind the

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window are the two balanced sensors.

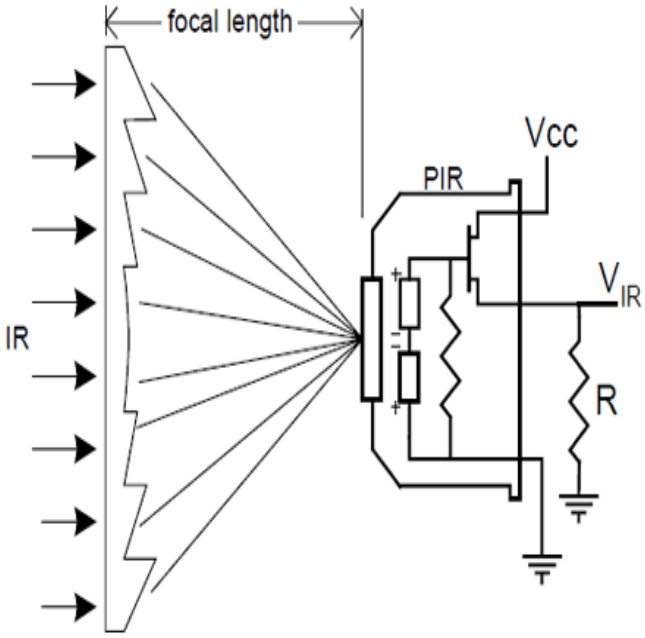

FIGURE 3

IV. INLICS

Intelligent lighting control system is used to detect the presence of human with the help of MEMS based thermal sensor D6T-44L and intensity of light can be controlled by lux sensor.

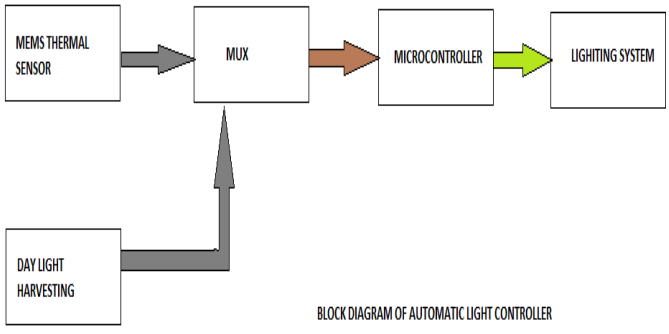

FIGURE 4: BLOCK DIAGRAM

Lighting control system is works with two strategies, they are detecting the presence of human and day light harvesting.

A. *Occupancy Detecting*

It is method of detecting the person whether they are present or not. If the person is present in the room it gives information to the microcontroller and switch on the light. If there is no person or persons are leaving the room it switch off the light by giving information to the microcontroller.

1. *D6T THERMAL SENSOR*

D6T-44L THERMAL SENSOR is mems based non-contact thermal sensor. The silicon lens collects radiated heat (far-infrared ray) emitted from an object onto the thermopile sensor in the module. The radiated heat (far-infrared ray) produces an electromotive force on the thermopile sensor. The analog circuit calculates the temperature of an object by using the electromotive force value and a measured temperature value inside the module. This sensor can be used to detect the presence of human. It is often superior than PIR sensor because it detects the human even in stationary position. It is shown in a below figure 5

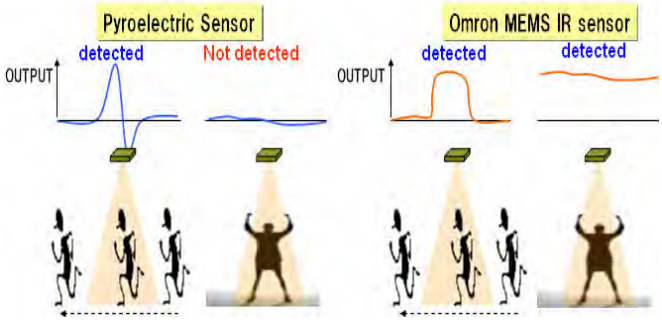

FIGURE 5

Therefore easy to capable monitor area for people (energy saving, people safety, security).

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FIGURE 6

MEMS Thermal sensor (D6T-44L) is used to detect the presence of human by sensing the temperature variation. This sensor consist of three layer silicon lens is a topmost layer. And second layer is thermopile array, it transduce the infrared radiation into electrical signal. Third layer is temperature converter it convert the electrical senor signal into digital output.

Silicon lens in the sensor receives infrared radiation from human and allow it fall on thermopile sensor which is kept inside of it. Thermopile consist of series of thermocouple which generates the voltage if any one of conductor subjected in to temperature gradient, is called seebeck effect.

2. Day Light Harvesting

It is a technique used to control the intensity of light with respect to natural light. It takes advantage of natural sunlight. Light depending resistor (LDR) or LUX sensor is used to detect the intensity of sunlight, if sunlight intensity is more it send signal to the microcontroller to reduce the intensity of artificial light. The day light harvesting is shown in figure 7.

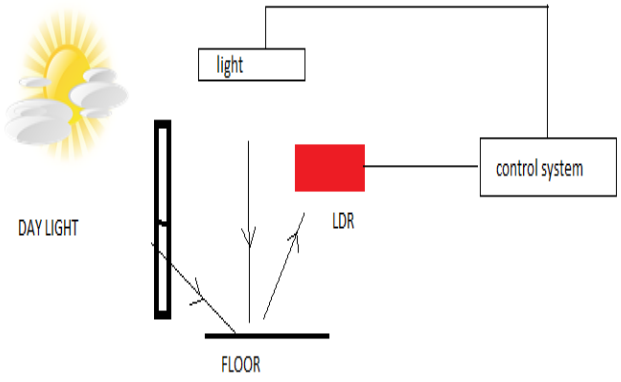

FIGURE 7

For this process BH1750 lux sensor is used. Lux is the unit of light intensity.

FIGURE 8

v. Conclusion

Intelligent Lighting control system takes advantage of natural sunlight light. Main theme of this project is to reduce the power consumption, increase the life time of electrical light and the main thing is to control the hazardous emission into atmosphere. Future idea of this project is to develop green house with full of renewable energy.

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