

Intelligent Household LED Lighting System considering Energy Efficiency and User Satisfaction Based on the Technology of PoE

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Abstract— Now a day saving energy has become one of the most significant points. Particularly, a light accounts for a great part of the total energy consumption. Now a day market can be introduced various light control systems because the installed lighting systems are old and energy-inefficient. However, due to structural limitations, the existing light control systems cannot be successfully involved to home and office buildings. Hence, recommends of new intelligent household LED lighting system considering energy productivity and user comfort. The recommended LED lighting system can autonomously adjust the minimum light intensity value to enhance both energy productivity and user comfort. The recommended LED lighting system decreases total power consumption. The technology of Power over Ethernet can take sufficient electricity to LED lighting system. Depending on the understanding knowledge of the current illumination and the whole persons in a room, the system can automatically distinguish and utilize a predefined brightness. Therefore, it overcomes the limitations of a traditional light control system. At the same time system can transfers DCpower and data through Ethernet, reduce the power adapter failure which caused by data network failure and promotes the application of the low power network equipment.

Keywords- PoE technology, LED, energy-savings, intelligent lighting system.

I. INTRODUCTION

India government can be demanded a large amount of in electricity demand then it can be certain required energy saving lighting systems. The lighting system can be consumption electricity load in our nation is very high about 20-22% of whole electricity load. By improving the efficiency of lighting system then it can be required vital energy saving and reducing in a peak load lighting system. Then it can be necessary required the lighting system which can be overcome the electricity demand up to 25% to 30 % of the morning and evening peak demand.

In a present day building lighting system can be required to satisfy the dual aim of maximum occupant comfort and minimum energy consumption. When certainly recommended system can be successfully realized then it is suitable for the environmental policy brings to develop both capacity building within a nation's human resources and environmental awareness within the community. Energy conservation solution in buildings not only saves the money but also helps to preserve the ecosystem and natural resources Now a day user can be used large quality of lighting systems such as day lighting control and LED which can be used some new methodologies which are useful for reducing the and energy impact on environment and future generations.

A lighting system can be utilized for around 20 percent of the world's overall whole energy consumption. The new implementation of a light emitting diode (LED) is significantly reduced the energy consumption of a light, because the LED lighting system can be utilizes 50 percent of the energy consumption as compared to the incandescent lighting device (high-pressure sodium) and fluorescent lighting device (low-pressure sodium).

Now a day several embedded lighting system can be entered which can change the lighting levels automatically according to the time of day, available light level. The recommended system of the new intelligent lighting system can be controlled automatically such as occupancy sensors, dimming, lighting control panels, and Building Management Systems. To save the energy became increasingly crucial in the recent year because environment obstacles such as global warming and climate change. Environmental obstacles are the very important aspect in these days, these environment problems are largely introduced by the unnecessary use of energy.

Recently, a new intelligent lighting control system can be used several communication modules and sensors such as PIR sensor and illumination sensor. The PIR sensor can detect the human interaction in the room and automatically adjust ON-OFF room LED light according to user movement. The illumination sensor can be working according to environmental changes such as when room inside brightness is high then illumination sensor has high resistance and it can adjust the low LED light brightness inside the room. When room inside brightness is low then illumination sensor has low resistance and it can adjust the high LED light brightness inside the room. Means it can adjust room light intensity according to external environmental changes.

However, the conventional lighting control systems can maintain for an only dimming controller or simple on-off according to user movements or brightness of surroundings because of this reason this lighting system is hard to suitable for the complex environments such as house or office. Thus the complex environment means it can be required a variety of control because of the presence of a variety of users.

In The Recommended System design the Domestic such as house and commercial such as industrial LED Lighting System

considering low power consumption with an illumination sensor, motion detection sensor and wireless communication interface.

When proposed system can be designed by using any processor it cannot be used PoE module because PoE module cannot support any other controller, it can be supported only for an Arduino controller. Because of this reason when another controller can be connected any sensor it can be required external power supply, this controller cannot provide any internal power supply but these recommended system can be used Arduino with PoE module, when PoE module can be connected to the Ethernet board and can be connected any sensor then it cannot be required any external power supply because PoE can provide the internal power supply of any sensor module. Hence by using the PoE module power consumption can be reduced.

By examining all these things, design Recommended of new intelligent LED lighting control system are as follows:

- Proposed system can be Design to control based on the situation awareness and adjust the brightness of LED light inside the room.
- Proposed system can be Design Autonomous control based on user movement and simply ON-OFF LED lights.
- Proposed system can be Design to maximum the utilization of a LED.
- Recommended system can be Design to have the communication capability.
- Reduction in power consumption and Saves energy.
- Improves the life of devices.
- Proposed system can be designed to enhance both user satisfaction as well as energy efficient.

II. RELATED WORK

This study focus on the advanced technology of the new intelligent LED lighting system which can be reduce the energy consumption and also suitable for the environment parameter by various way.

Zhizhong Tu et al. Proposed system can be present the extensive measure of vitality waste is presented by not effective utilization of the buyer electronic. The proposed framework can be use remote correspondence innovation and multi sensors keeping in mind the end goal to control a LED light framework as per the client fulfillment and vitality effectiveness. The proposed arrangement of the new LED lighting framework can consequently control and least light power quality to enhance both client fulfillment and vitality effectiveness [1]. F. Leccese et al. The proposed uses ZigBee-based remote gadget which empower more proficiency street light system organization, as a result of a pushed interface and control outline. It uses a sensor blend to control and guarantee the proposed structure parameters the information is traded point by point using ZigBee transmitters and recipients and is sent to a control terminal used to check the state of the street lights and to take legitimate measures if there ought to be an event of disappointment [2]. Byoungjoo Lee et al. Proposed system present with the change of Internet of Things, development of Power over Ethernet can take enough energy to LED lighting structure. Contingent on the identified information of the present splendor and the amount of persons in a room, the

structure can normally perceive and apply a predefined brilliance [3].

Wuhua Li et al. Proposed system present in the Power over Ethernet (PoE) system, the traditional controlled gadget (PD) with two sets outline can simply give power underneath 20W burdens, which exceptionally restricts its applications in various regions. A kind of four sets plan with an info current balance limit for the PoE system is proposed structure upgrade the force level, and additionally perform the high transformation effectiveness [4]. A. Moreno-Munoz et al. The proposed structure concentrate on the joining of Digital Addressable Lighting Interface (DALI) gadget in remote sensor frameworks. Since different makers generally oversee one a player in building robotization. The essential explanation behind these structure is to give the end purchaser a temperate totally structure in which home machines are control by remote sensor framework [5]. C. Lee et al. The proposed system presents customer client vitality proficient control plan for street lights. The structure utilizes ZigBee innovation to execute remote cross segment arrangement of street lights. The proposed system includes LED lights and organization programming that offer remote checking and control of the lights [6].

J.J. Lukkien et al. Proposed system present Standard road lighting systems are old and should be supplanted with structures which can sense their environment. To appreciate these necessities, subjective investigations should be coordinated in a sensible testbed, similar to our own. we first present the best in class plans in the written work. By then, we depict the structure configuration of our testbed sent on a real street nearby the preliminary investigations [7]. I. Lee et al. The proposed structure can be depicts more capable home vitality organization system to lessening power usage in home region. We consider the room viably controllable with an IR remote control of a home apparatus. The room has electrical fittings, a light, and a ZigBee focus point. The ZigBee focus point has an IR code learning work and instructs the IR remote control indication of a home machine connected with the electrical attachment. The ZigBee focus focuses in each room talk with the home server and report the power use information to the home server [8]. K. Horneman et al. Proposed system present the vitality use issue in the portable business has gotten to be urgent. For the supportable improvement of the portable business. The fact is to get a prevalent understanding of vitality use and recognize key vitality adequacy research issues in remote access frameworks. Gathering framework vitality sparing innovations into the time, recurrence, and spatial spaces, the central plans in each region are depicted quickly [9].

S. Park et al. The proposed system can be presented Self-changing shrewd structure used for giving building control and vitality sparing organizations in structures. Our system contains a portal (self-adjusting canny door) and a sensor (self-modifying smart sensor). Hence, also propose a vitality proficiency self-bunching sensor system (ESSN) and a hub sort pointer based directing (NTIR) tradition that considers the necessities of WSNs, for instance, framework lifetime and structure assets organization [10]. B. Lee et al. Proposed system present customary systems are intended for force lessening of the customer hardware. The propose structure can be accessible a power careful LED light enabling operator with

light sensors, development sensors and framework interfaces. The proposed structure can be accessible a flexible middleware supports the learning framework which separates the edification and the customer development, and controls the LED lights exactly when customers exist around the contraptions [11]. S.M. Mahmud et al. The propose structure can be accessible a system with arrangement sparing electrical vitality by controlling the force of fake light to an acceptable level and getting use of the daylight when conceivable with the best exertion for vitality sparing. The structure uses Controller Area Network (CAN) as the media of correspondence with the sensors and the actuators. The structure is measured and can be stretched out to traverse extensive structures [12].

M.F. Silva et al. Proposed system present One of the huge troubles at this moment is the change of the present street lighting structure. These systems are seen as out of date due the nonappearance of correspondence capacities, not allowing structure info. This work plans to add correspondence abilities to the structures starting now being utilized, through the compromise of a ZigBee flawless handset to the photoelectric exchange used to turn the HPS lights on/off. This change will change each contraption into a center point of a broad remote framework over the city [13]. H. Hrasnica et al. Proposed system present Given the vitality waste issue in contemporary families and the resulting necessity for perfect vitality use, this article shows a novel framework designing that is blandly suitable on nearby devices, for example, white merchandise, and fluctuating media and correspondence equipment, and is fit for performing progressing organization of their essentialness use [14]. S.H. Hong et al. Lighting control structures give distinctive focal points in building organization, and Building Automation and Control Network (BACnet) is an all-inclusive standard data correspondence tradition for building motorization and control frameworks. We introduce a reference model for BACnet-based lighting control structures and survey its execution using an exploratory model [15].

III. SYSTEM DESIGN

The system design based on Arduino controller is used intelligent household LED Lighting system and various sensor used in this system such as PIR sensor, LDR sensor. These all the sensor analog output is an interface to a controller by using analog to digital converter and signal conditioning circuit. As shown in fig 2. By gathering all the information from sensors the LED lighting system can be controlled the room LED light intensity and also controlled ON-OFF LED lights. And all the output of this sensor showed in PC through RS232 serial communication in visual basic software. The PIR and LDR sensor are interfaced to a controller by using pin configuration interface. Zigbee module is used for transmitting and receives the signal from PIR and LDR sensor. Zigbee module can be connected to central control such as the computer by using USB to serial cable such as RS-232 cable. Both Zigbee module can be work as the transmitter as well as receiver module.

The working of this proposed system such as it can be used PIR sensor and PIR sensor can be work when human or any animal interaction can be introduced in the room. When human activities can be introduced in the room then the PIR sensor module output become high level and LED light should be ON. When there is no human interaction can be introduced in the room then the PIR sensor module output becomes low level and LED light should be OFF. The working of LDR sensor

such as LDR sensor can adjust the LED light intensity according to room light intensity. When room sunlight intensity is low then LDR sensor can adjust the LED light intensity and increase the LED light intensity. When room sunlight intensity is high then LDR sensor can adjust the LED light intensity and decrease the LED light intensity.

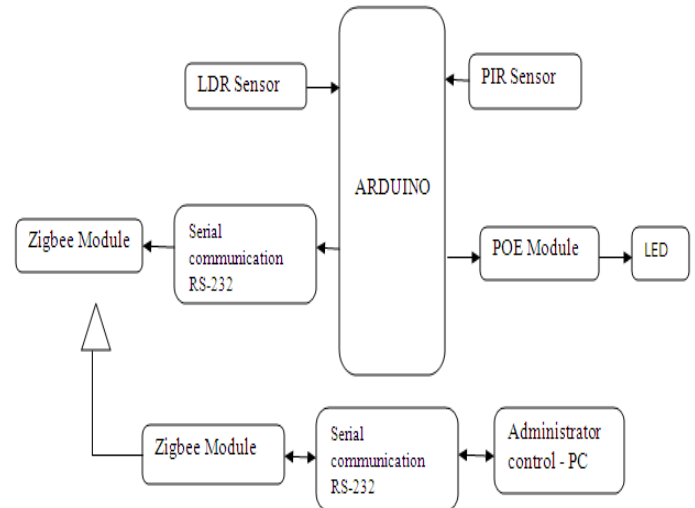


Figure 1. Block Diagram of the system

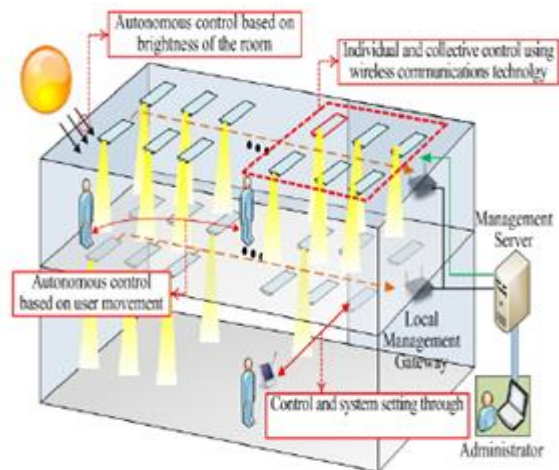


Figure 2. Overview of the proposed system

When both sensors such as LDR and PIR sensor can be satisfied the given condition then LED light should be ON, otherwise LED light should be OFF. Both sensor conditions should be given below,

- Condition -1] When a person is available and light intensity high then LED bulb is OFF and according to room condition LDR sensor adjust a LED light intensity.
- Condition -2] When a person is available and light intensity low then LED bulb is ON and according to room condition LDR sensor adjust a LED light intensity.
- Condition -3] When a person is not available and light intensity high then LED bulb is OFF and according to room condition LDR sensor adjust a LED light intensity.
- Condition -4] When a person is not available and light intensity low then LED bulb is OFF and according to room condition LDR sensor adjust a LED light intensity.

IV. HARDWARE DESCRIPTION

1. ARDUINO Controller

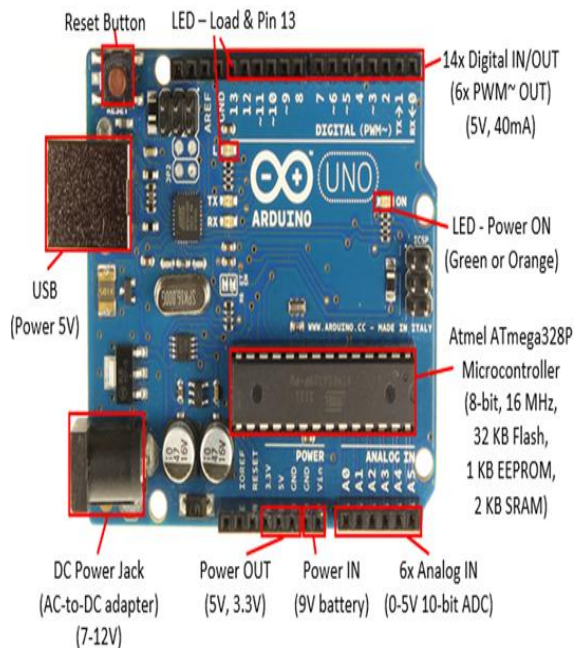


Figure 3. ARDUINO Controller Board

The Arduino Ethernet shield with PoE Module is based on the Wiznet W5100 ethernet chip. Thus Wiznet W5100 provides a network stack capable of both transmission control protocol (TCP) and user/ universal datagram protocol (UDP). TCP and UDP can support less than four simultaneous socket connections. In the TCP protocol, a message can be transferred through the internet from one computer to another computer. Thus the TCP is suitable for application that required high reliability and transmission time is relatively less critical. But the speed of TCP is slow as compared to the UDP. TCP also provide the reliability such as, data can be sent in any format then the same format can receive the data. TCP can provide header size up to 20bytes. In the UDP protocol, a message can be transferred through the wireless by using load on a packet. UDP is suitable for application that needs fast, efficient transmission such as a game. UDP is Useful when servers can be entered that answer small queries from a huge number of clients. UDP is faster as compared to TCP because there is no error checking for a packet. Thus the UDP not provides reliability such as, there is no guarantee that the message or packets sent would reach at all. UDP header size is 8 bytes. When proposed system can be designed by using any processor it cannot be used PoE module because of this reason when it can be connected any sensor it can be required external power supply ,this processor cannot provide any internal power supply but in these proposed system can be used a PoE module, when PoE module can be connected to the Ethernet board and can be connected any sensor then it cannot be required any external power supply because PoE can provide the internal power supply of any sensor module. Any other controller cannot support PoE module but only Arduino controller can be supported PoE module. Hence by using the PoE module power consumption can be reduced.

2. PIR Sensor

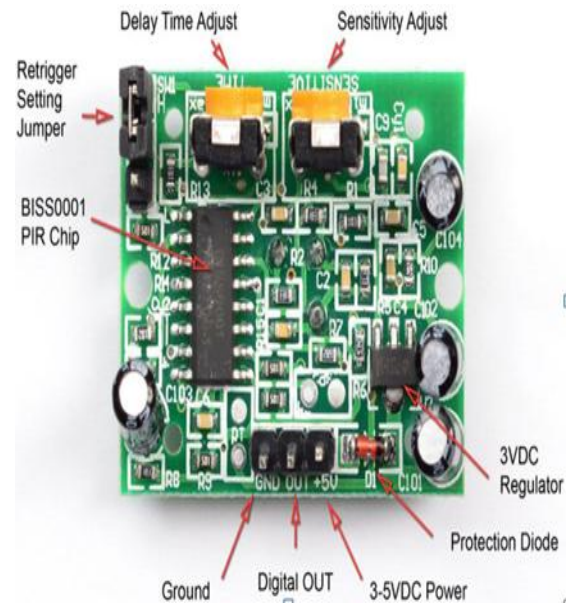


Figure 4. PIR Sensor

The passive infrared sensor can be work when human or any animal interaction can be introduced in the room. When human activities can be introduced in the room then the PIR sensor module output become high level and LED light should be ON. When there is no human interaction can be introduced in the room then the PIR sensor module output becomes low level and LED light should be OFF.

3. LDR Sensor



Figure 5. LDR Sensor

Illumination sensor can adjust the light intensity value according to room inside internal environment Means it can adjust room internal light intensity illumination according to room internal environment brightness. When internal environment brightness is low then the illumination sensor resistance is very small and it can increase the room light intensity illumination value. When internal environment brightness is high then the illumination sensor resistance is very high then it can be automatically decrease the room light intensity illumination value.

Illumination sensor can be collects the information of room light intensity through the Ethernet cable and send an electrical signal to the control system. Then the control system can be collect the information and it can analyze the collected information and sent the instruction to the power over Ethernet

(PoE) controller. According to the collected information LED lighting system of PoE controller can be automatically adjust the brightness of the room.

V. ALGORITHM

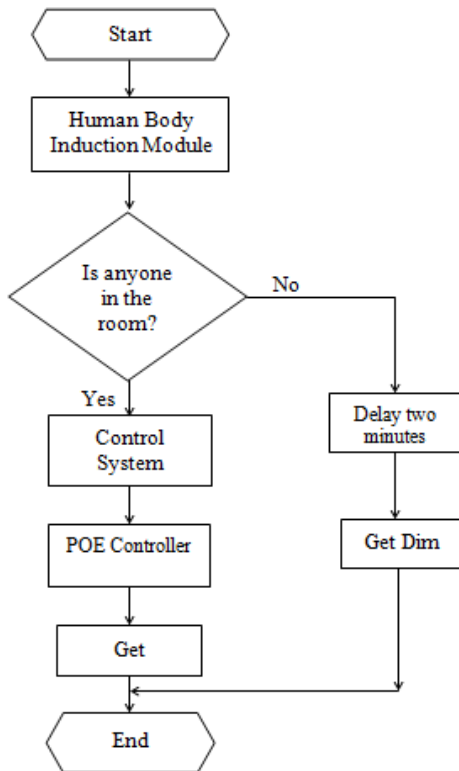


Figure 6. Algorithm of PIR sensor

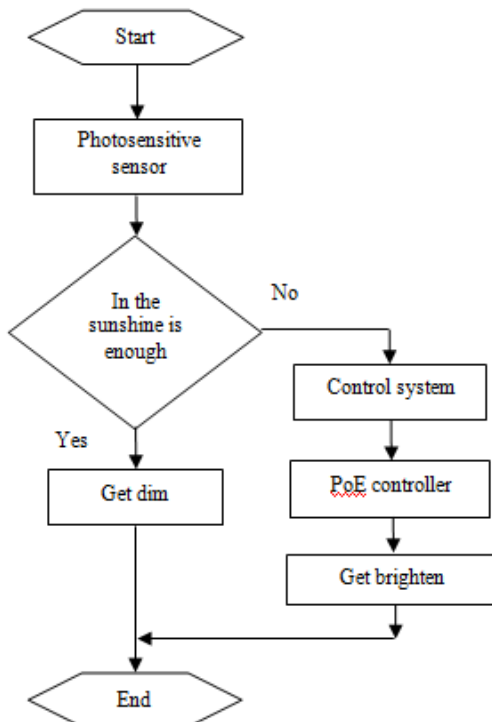


Figure 7. Algorithm of LDR sensor

VI. RESULTS

TABLE I. RESULT TABLE

Condition		LED Bulbs
PIR Sensor	LDR Sensor	
Person is available	Light intensity high	OFF
Person is available	Light intensity low	ON
Person is not available	Light intensity high	OFF
Person is not available	Light intensity low	OFF

Condition -1] When person is available and light intensity high then LED bulb is OFF and according to room condition LDR sensor adjust a LED light intensity.

Condition -2] When person is available and light intensity low then LED bulb is ON and according to room condition LDR sensor adjust a LED light intensity.

Condition -3] When person is not available and light intensity high then LED bulb is OFF and according to room condition LDR sensor adjust a LED light intensity.

Condition -4] When person is not available and light intensity low then LED bulb is OFF and according to room condition LDR sensor adjust a LED light intensity.

VII. ADVANTAGES

- Proposed system provides Autonomous control based on situation awareness and user movement
- Proposed system provides automatically control based on brightness of the room.
- Proposed system can be Design to maximum used of an LED lights.
- Proposed system can be Design to have the communication capability and Collective control using a wireless technology.
- Reduction in power consumption and Saves energy.
- Proposed system Improves life of devices.
- Proposed framework can be Design to improve both client fulfillment and Energy efficient.

VIII. CONCLUSION

Now a day saving energy has become one of the most vital points. The conventional lighting system can be acquired around 20% to 25% of the overall word energy consumption. Thus a lot of studies related to the energy saving no product can be entered in both user comfort and energy productive than the conventional lighting system cannot be successfully suitable to the office building and home. Then the recommended system can be used a wireless communication technology and various sensors which can control the LED

lighting system Depending on the understanding knowledge of the current illumination and the whole persons in a room, the system can automatically distinguish and utilize a predefined brightness. Therefore, it overcomes the limitations of a traditional light control system. The proposed system of new LED lighting system can be automatically control and minimum light intensity value to improve both user comfort and energy productivity. The proposed new LED lighting system can be reduced the overall power consumption up to 20% to 25%.

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