INTELLIGENT FAULT IDENTIFICATION IN LED LIGHTING AND SECURITY SYSTEM USING GSM

Roshan Fathima.M[1] and Vinoth.K[2]
PG Scholar & Applied Electronics[1], Assistant Professor[2]
Department of Electronics and Communication Engineering[1,2]
PRIST University,Thanjavur Campus, Tamilnadu, India[1,2]

Abstract— In this project, we propose a LDR based intelligent light control system for indoor environments. LDR sensor is responsible for measuring current illuminations at each lamp. Global Systems for Mobile Communications (GSM) based wireless technologies are used for the wireless communication, also used LED based source of light which gives the additional energy saving . Whenever the lamp gets damaged Short Message Service (SMS) is sent by using GSM which makes easy maintenance of lamp. Power saving and monitoring human activities in a building is done by using PIR sensor. Intelligent LED lighting system targets the energy saving and autonomous operation for the streets, bungalows and farms. Main objective is to achieve efficient fault detection of led lighting for quick maintenance of lamp using advanced technology Arduino platform and simulation using ISIS Proteus software tool.

Index Terms - *Lighting system, GSM, LED and Arduino*

I. INT RODUCT ION

Lighting systems are deliberate according to old standards and they often do not take advantages of the latest technologies. The two possible ways out for this- first one is to use new technologies for source of light. In this LED technology is one of the best solutions and the second one is to use a remote system that send and receives data to and from main control system remotely.

This system designs an intelligent lighting system which targets an autonomous operation and energy saving at economically affordable for the streets, bungalows and farms. Energy saving intelligent lighting system is developed with modular approach which makes it more expandable and scalable. The main control is designed through network of sensors which collect the appropriate data related to the maintenance and management of system. Data is transfer by using GSM network. This system able to integrate the latest technologies in order to describe an intelligent management and control of lighting system. It is developed using LED and GSM modem. Our work aims at the unification of the two mentioned possibilities, creating an intelligent lamp managed by a remote controlled system. It uses LED based source of light, LDR to collect the relevant information related to the vehicle detection and fault detection, PIR for human body detection and GSM network for transferring the information.

This paper is organized as follows. Section II briefly clarifies work related to existing lighting system. Section III describes the detailed design along with system architecture of the proposed lighting system. System working is described in section IV. Section V and Section VI illustrates the results and conclusions of the proposed system respectively.

II.   PROPOSED INTELLIGENT LIGHTING SYSTEM

Everywhere power cut is one of the major issues and to overcome this situation power management is very important. The specified system provides the power management; it also provides the security in bungalows and farm. This system uses the sensors like Passive Infra-Red (PIR) and Light Dependent Resistor (LDR). PIR sensor is used to identify human body and LDR is used to detect the presence of vehicle and damage of lamp. These lights can be wirelessly monitored and controlled with the help of GSM modem. GSM module is used to send SMS whenever lamp gets damage.

A. *Controlling Lamp*

The lamp station is located at each lamp consists of several modules: LDR, PIR. These devices work together and transfer data to controller. It processes the data and transfers this data to the monitoring station. Each sensor has the different task for example LDR detect the presence of vehicle. GSM module is used to send the data to the monitoring people through SMS.

1) Light Dependent Resistor (LDR): LDR is used in this system as a vehicle or fault detection. LDR is a resistor. Its resistance varies according to amount of light falling on the surface. When the LDR detect darkness its resistance will get increase, thus if it detects light its resistance will decrease. LDR is used to detect the vehicle and faulty lamps. Two LDR are used per lamp, one is for detection of presences of vehicle and another for detection of damage of lamp. The sensor must have high sensitivity in the visible spectrum, providing a photo current high enough for low light luminance levels.
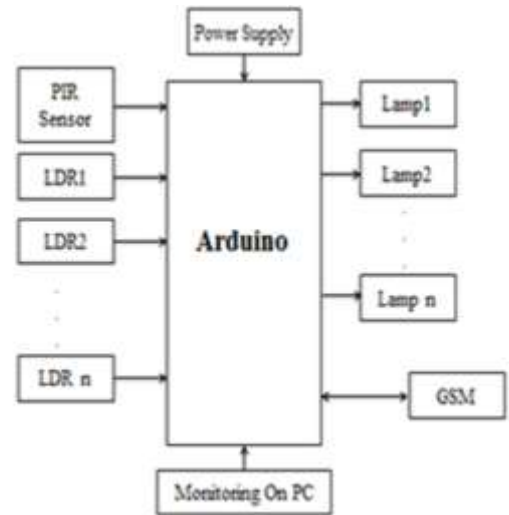

Fig. 1 Block Diagram of Lamp Station

2) Passive Infra-Red (PIR): PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

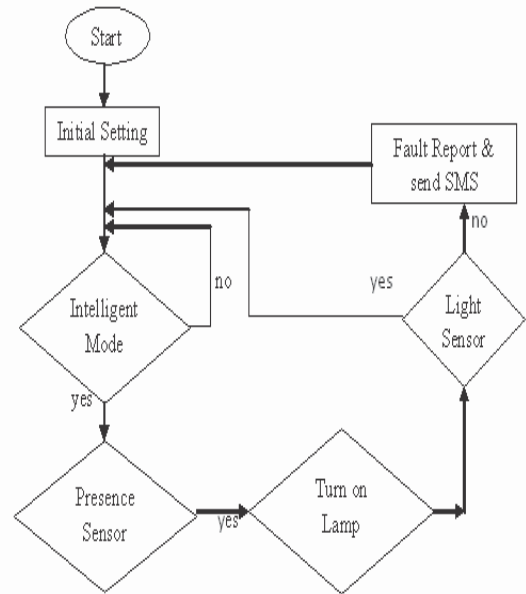

Fig. 2 illustration of PIR Sensor

PIRs are basically made of a pyroelectric sensor (which you can see above as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

C. Monitoring Module

The monitoring station is the hub of the system because it allows the visualization of the entire lighting system. The unit consists of a serial Universal Asynchronous Receiver Transmitter (UART) interface which receives data about the state of the lamps provided by a GSM device. The transmission system consists of a GSM network; Zigbee module transmits and receives data between the monitoring station and lamp station.

1) Global Systems for Mobile Communications (GSM): GSM is used to send a SMS, whenever the lamp gets damage which gives us the optimize management and efficiency of lighting systems. GSM is open digital cellular technology used for transmitting mobile data and voice services. It supports data transfer speeds of up to 9.6 kbps, with the transmission of SMS. GSM operates in the 1.8GHz and 900MHz bands in Europe and the 1.9GHz and 850MHz bands in the US. Services of GSM are also transmitted via 850MHz spectrum in Canada, Australia and many Latin American countries. The use of harmonized spectrum across most of the globe combined with GSMs international roaming capability allows travelers access the same mobile services at home and abroad.

SIM300 modem is used in this work; it can accept any GSM network. This modem operates with any SIM card and act just like a mobile phone. The advantage of this modem is that it has RS232 port to communicate and develop embedded applications.

Fig. 3 System Flowchart

D. Arduino Uno R3

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

III.   RESULTS

From our proposed system an arduino based the below figure shows the system set-up which include sensors, microcontroller, GSM module and RS232 to USB converter, & 3 lamps for the demo purpose. It contains six LDR and one PIR sensor. Three LDR are used to detect the presence of vehicle and other three are used for damage detection of lamp. Whenever the IR sensor range goes high, that is human detected then arduino will switch on the lamp, if people detected at PIR1 then arduino trigger Lamp1 to ON and this concept works on all PIR sensor fixed in the street or mall.
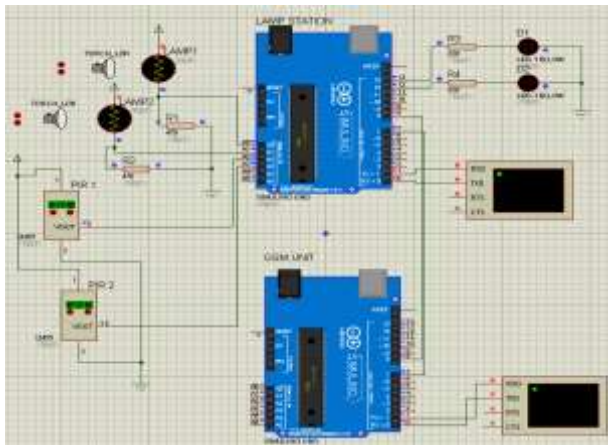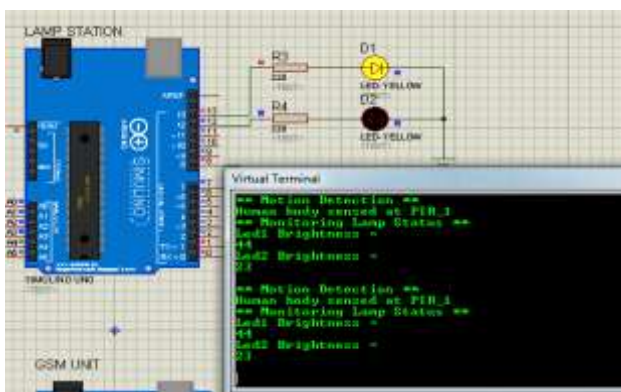

Fig. 4 shows the overall design of our proposed system

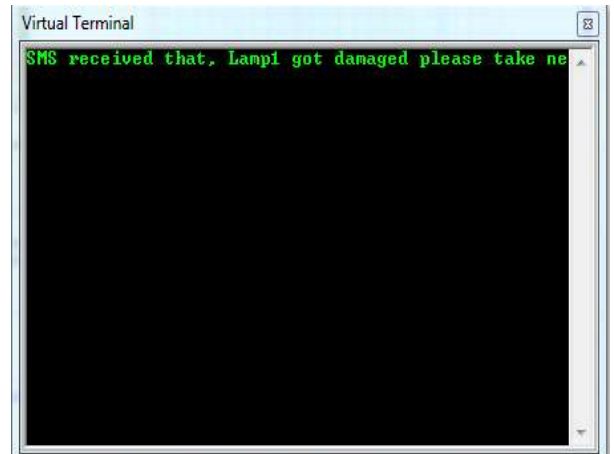**Fig 5 Shows turn ON of lamp1 when 1st PIR value get increased**

Fig 6 SMS send through serial port when lamp get damaged

In figure 4 two arduino is used to execute this project. First arduino act as a lamp station to monitor the motion status and lamps, second arduino act as GSM unit. The squared box at left side with label of PIR1 and PIR2 is used to monitor the motion of people, as per our proposed system if any motion detected in PIR1, it turn ON the LAMP1, this step is same for LAMP2.

In Fig.5 yellow LED is become turned ON because of increased value in PIR sensor 1. SMS has been sent when lamp get damaged, in this simulation work a torch based LDR sensor is used that monitor the LAMP intensity, if the lamp intensity is decreased or lamp damaged for while it will sent SMS through GSM unit as shown in figure 6.

IV.   CONCLUSIONS

Lighting system has been developed in different directions over the past few decades. The focus of this system is to produce a complete integrated system for remotely monitoring and controlling of lamps with particular emphasis on saving energy and minimizing complexity.

Intelligent lighting system integrates new technologies available in the market which offer higher efficiency and considerable savings of energy. This can be achieved using highly efficient LED, LDR, PIR,

ZigBee and GSM.. The system is designed primarily to save energy & another advantage obtained by the system is intelligent management of the lamp by sending data to and from monitoring station by ZigBee network. GSM is used to send SMS, whenever the lamp gets damaged this makes maintenance of lighting system easy. System is easily & efficiently managed from monitoring station. The system can operate in three modes allowing additional energy savings. The system is always flexible, extendible, and fully adaptable to user needs. The feature of the sensor network, simplicity of ZigBee, reliability of electronic components, easy maintenance and processing speed are features that characterize system.

REFERENCES

[1] Fabio Leccese,"Remote-Control System of High Efficiency and Intelligent Street Lighting using a ZigBee Network of Devices and Sensors ," *IEEETrans. on Power Delivery*, vol. 28, no. 1,pp. 21-28 January 2013.

[2] Soyoung Hwang and Donghui Yu, "Remote Monitoring and Controlling System Based on ZigBee Networks," *International Journal of Software Engineering and Its Applications*, vol. 6, no. 3, July 2012.

[3] P.Dhinakar, R.Pradeepraja, R.Preethilatha, M.Barani and S.Shanmathi, "Highly Efficient and Intelligent Indoor and Outdoor Lighting System Using a ZigBee Network of Devices and Sensors," *International Journal of Innovative Research in Computer and Communication Engineering*, vol. 2, issue 1, March 2011.

[4] P.S. Jadhav and V.U. Deshmukh, "Forest Fire Monitoring System Based On Zigbee Wireless Sensor Network," *International Journal of Emerging Technology and Advanced Engineering*, vol. 2, issue 12, December 2012.

[5] Meng-Shiuan Pan, Lun-Wu Yeh, Yen-Ann Chen, Yu Hsuan Lin, and Yu- Chee Tseng, "A WSN-Based Intelligent Light Control System Considering User Activities and Profiles,"*IEEE Sensors Journal*, vol. 8, no. 10, pp. 1710-1721, Oct. 2008

[6] Jose Bellido-Outeirino, Jose Maria Flores-Arias, Domingo-Perez, Aurora Gil-de-Castro and Antonio Moreno-Munoz, "Building Lighting Automation through the Integration of DALI with Wireless Sensor Networks,"*IEEE Trans. on Consumer Electronics*, vol. 58, no. 1, pp. 47- 58, Feb. 2012

[7] Giuseppe Parise, Fellow, Luigi Martirano and Simone Di Ponio, "Energy Performance of Interior Lighting Systems,"*IEE Trans. on Industry Applications*, vol. 49, no. 6, pp. 2793-2801, Nov/Dec 2013

[8] Jinsung Byun, Insung Hong, Byoungjoo Lee, and Sehyun Park, "Intelligent Household LED Lighting System Considering Energy Efficiency and User Satisfaction",*IEEE Trans. on Consumer Electronics*, vol. 59, no. 1, pp. 70-76, Feb. 2013

[9] Brandon C. Welsh and David P. Farrington, "Effects of Improved Street Lighting on Crime," *Campbell Systematic Reviews*, pp. 1-46, Sept. 2008

[10] Brandon C. Welsh and David P. Farrington, "Improved Street Lighting and Crime Prevention," *The Swedish National Council for Crime Prevention*, pp. 1-36, Sept. 2007