Vehicle Movement using Street Light Detection

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Abstract- The paper is designed for street light with auto intensity control with the help of PWM technique using solar power controlled by Raspberry Pi board. As sun is renewable source of solar energy, awareness for solar energy is increasing, and everyone is trying to use solar energy for their work. Solar panels are used for charging solar cells by converting the sunlight into electricity. The intensity of street lights is required to be kept high during traffic. As the traffic on the roads decreases in late nights, the intensity of street light can be reduced. In High Intensity Discharge lamps (HID) the intensity is not controllable because when reduction of voltage is done then discharge path breaks. But in LED lights because of PWM technique the intensity is controllable. A Raspberry Pi board is used to provide different intensities at the different situations of traffic at night time using PWM techniques, for energy saving. Intelligent street lighting system turns the light ON and OFF depending on the vehicle or pedestrian movement.

Key words- LED Lamps, Raspberry pi, Sensors, LDR, RFID card and Reader.

1. INTRODUCTION

The Street lights are the major requirements in today's life for safety purposes, to reduce crime rate and avoiding accidents during night. Providing street lighting is one of the most important and expensive responsibilities of a city. It also encourages social inclusion by providing an environment in which people feel they can walk in hours of darkness. Despite that in today's busy lifestyle no one bothers to switch lights OFF/ON when not required. Inefficient lighting wastes significant financial resources each year, and poor lighting creates unsafe conditions. Energy efficient technologies and design can cut street lighting costs dramatically.

At present, street lamps are controlled manually in most of the cities. Generally street lights are switched ON for whole night and, during the day, they are switched OFF. But at night time there is no necessity of street lights when there is no traffic. The proposed system in this paper implements smart street lighting system in which block of street lights turns ON after detection of vehicle and as soon as the vehicle moves ahead the trailing lights automatically switches OFF. Now-a-days, the street lights are working on electricity. The electricity is generated by renewable and nonrenewable sources. Nonrenewable sources are getting reduced day by day. In proposed system instead of using nonrenewable sources, renewable source such as sun is used to generate the energy to switch ON the street lights.

The paper presents an automatic street light controller using Light Dependent Resistor (LDR). By using this system manual works are removed. The street lights are automatically switched ON when the sunlight goes below the visible region of our eyes and switches OFF the streetlight when ample amount of sunlight is available, it means LDR resistance is inversely proportional to light falling on it. Whenever there is sufficient light falling on the LDR, it exhibits high resistance and acts as an insulator and in darkness the LDR behaves as low resistance path and allows the flow of electricity.

When the light falls on the LDR it sends the commands to the control circuit that it should be in the OFF state and the streetlight turns OFF.

This proposed system provides a solution for energy saving. This is achieved by sensing an approaching vehicle and then switches ON a street light ahead of the vehicle. As the vehicle passes by, the trailing lights gets dimmed automatically.

2. RELATED WORKS

Lighting can account for 10-38% of the total energy bill in typical cities worldwide. Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. The main consideration in the present field technologies are Automation, Power consumption and cost effectiveness. Automation is intended to reduce man power with the help of intelligent systems. The busy lifestyle of humans has led to untimely switching of street lights. As a result lot of power is being wasted. The advanced development in embedded system has set a platform for designing energy efficient systems. Electrical Power wastage can be reduced by using two light dependent resistors as light sensing devices or light sensors to indicate day or night time. A photoelectric sensor has been used to detect the movement of humans and vehicles on the streets. The supply to the control unit and to light the street light is being achieved by the implementation of solar panels.

Overview of the previous work done related to the vehicle movement using street light detection by different authors is explained in the literature survey. The strategic implementation of the different communication technologies and the methodology used in system is discussed briefly.

"The Smart Street Light System based on Image Processing" [1] implemented by Veena P C, Paulsy

Tharakan, Hima Haridas, Ramya K, Riya Joju, Ms. Jyothis T S in 2016 consists of LED Lamps, Raspberry Pi, Sensors, LDR, OLFC. The Smart Street Light System based on Image Processing, is a hardware application which takes video as input and detect movement of vehicles and human beings to switch ON only a chunk of street lights ahead of it (vehicle & human), and to switch OFF the trailing lights to save energy . The Object Level Frame comparison methodology is used to detect the vehicles and humans. Sensors are also included in this system to detect whether the temperature and gas are exceeding in the particular area and send a SMS immediately to the corresponding department via a GSM module. Raspberry Pi is used as the platform as it enables the number of modules to be connected to it through the various ports. A camera connected to the Raspberry Pi is the element through which input image is taken. The LDR is used to measure the intensity of light. The merits of this system are power reduction and this system is used to save energy and demerits are high initial cost and no backup plan. Because of these two demerits this system is not much efficient [1].

"An Intelligent System for Monitoring and Controlling of Street Light using GSM Technology" [2] implemented by Ms. Swati Rajesh Parekar, Prof. Manoj M. Dongre in 2015, consists of Atmega microcontroller, GSM, LED, Raspberry Pi, Sensors, Street Light. The system is designed such a way that lights sensors (LDR), RTC and Presence sensor placed in all street lights circuit will turn ON and OFF lamps automatically. When the lights are turn ON every light pole having current sensor informs about fault to the centralized system by using GSM module attached to circuit via Short Message Service (SMS). The information through SMS is received at Base station with Raspberry Pi (a compute module), analyzes the data and the status of street lamp is visualized with help of Graphical User Interface (GUI). This makes the fault detection and maintenance of system easy than the conventional system. System makes the most efficient use of the energy received from the sun to power street lights. The merits of this system are use of solar panels and this system is flexible according to need of user and demerit of this system is that this system is very expensive. Because of this the system is not useful in the rural areas where there is low budget. The rural area lighting is the main application of our project and this system does not applicable there [2].

"Design and implementation of Traffic Flow based Street Light Control System with effective utilization of solar energy" [3] implemented by M.Abhishek , Syed ajram shah, K.Chetan, K.Arun kumar used, 8052 series microcontroller, LDR, Photoelectric Sensor, Street Lights in Design and implementation of Traffic Flow based Street Light Control System with effective utilization of solar energy. In this system renewable source of energy i.e., solar power is used for street lighting. Apart from this, normal bulbs are replaced in street lighting with LEDs due to which the power consumption in reduced by 3 times. And also, IR sensors are used to detect the movement of object to activate the lighting a few meters before the object is about to reach the lighting area. Here, the IR sensors are deactivated after a timing delay of 30seconds and similarly remaining sensors are activated and deactivated after 30seconds. The process is controlled by 8052 series microcontroller. The merits of this system are power reduction and this system is used to save energy and demerits are high initial cost and no backup plan. Because of these two demerits this system is not much efficient. Because of no backup plan we cannot relia on the system totally. Because of this we have to search for other options [3].

"Internet of Things Based Intelligent Street Lighting System for Smart City" [4] implemented by Parkash, Prabu V, Dandu Rajendra in 2016. This system is implemented with smart embedded system which controls the street lights based on detection of vehicles or any other obstacles on the street .Whenever the vehicle is detected light will get automatically ON/OFF and the same information can be accessed through internet. The system architecture of the intelligent street light system consists of IR sensors, LDR, PIC16F877A microcontroller, Relay, UART and Wi-Fi Module. When a light dependent resistor is kept in dark, its resistance is very high. The vehicle which passes by the street light is detected by IR sensor (IR transmitter and IR receiver couple). Relays are used as a switch to switch on/off the street light bulb. The real time information of the street light (ON/OFF Status) can be accessed from anytime, anywhere through internet. The merit of this system is reduction of manpower, automatic switching of street lights, reduction in CO_2 emission, Reduction of light pollution, wireless communication, energy saving and demerits are initial cost and maintenance is high. Because of these two demerits this system is not much efficient. And it is not used in such areas where there is less budget to implement smart street lighting project [4].

"Smart street lighting system based on Programmable Logic Controller (PLC)" [5] implemented by Dr. D. V. Pushpa Latha, Dr. K.R.Sudha, Swati Devabhaktuni in 2014 describe about and input sensing devices. The proposed controller gives fast, reliable, and power efficient street lamp switching based on seasonal variations. The simulated results are also verified experimentally by using a Light Dependent Resistor (LDR) which senses the light. LDR is used as the replacement for the seasonal variation. This paper confirms that the proposed PLC based street lighting control system has great potential to revolutionize street lighting which in turn saves large amount of power. But PLC's are used for automation of industrial electro-mechanical processes which does not help in our proposed system [5].

3. SYSTEM MODEL AND COMPONENTS

The proposed system provides a solution for energy saving. This is achieved by sensing an approaching vehicle

and then switches ON a block of street lights ahead of the vehicle. As the vehicle passes by, the trailing light gets dimmed automatically. Thus, we save a lot of energy. So when there are no vehicles on the highway, then intensity of light becomes low.

This system is developed using Raspberry Pi along with various sensors sensing the vehicle. LDR is used to automatically switch ON the street lights when the sunlight goes below the visible region of our eyes and switches OFF the streetlight when some amount of sunlight is available. LDR is used to identify the difference between day and night. This system should have to turn ON at night time and remains OFF at day time and this is achieved with the help of LDR. To sense the vehicle IR sensors are used. Pair of IR transmitter and receiver situated on both sides of the road detects vehicles and give command to control unit to turn ON/OFF block of street light. When vehicle or any other object is sensed by IR sensor, then the street lights will glow. And if vehicle or any other object is not detected by IR sensor, then the street lights will remain in OFF state. The control unit used here is Raspberry Pi.

The energy supply required for control unit and street lights is given from the renewable source, Sun. The solar energy is taken with help of solar panel and stored in a battery. The energy stored in battery is in the form of AC but Raspberry Pi work on DC. So ADC operation is required in proposed system. Raspberry Pi cannot drive LEDs directly, so MOSFET drive is required to drive LED.

The main power supply is used as a backup plan when solar panels are not working properly or when there is insufficient solar energy. To drive Raspberry Pi +5V DC supply is required. The supply from mains is 230V, 50Hz. To convert this into +5V DC supply transformer, rectifier, filter are used.

RFID card on the car and RFID reader on the pole is placed. With help of RFID reader whole information of car can ban be displayed on LCD. The information of car is its unique plate no. and information of car owner. To avoid collision ultrasonic sensor is used. In rainy season sometimes there may be condition that the driver may not see beyond some limit. So in such situation the ultrasonic sensor may help the driver to get the information about the vehicles or obstacles ahead of him. There may be some another situations too, so to drive safely in such tricky condition is very difficult job. In such cases ultrasonic sensor may help the driver to drive safely. Sometimes when driver feels sleepy there is a chance of accident. In proposed system when driver lose his grip from steering, then vibrations are given to driver's chair. Because of this chances of accident reduces to some extent.

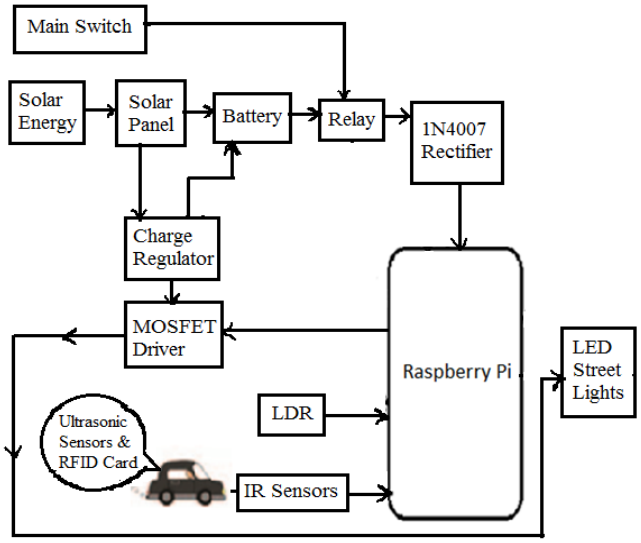

Fig -1: Block Diagram of Vehicle Movement using Street Light Detection

4. IMPLIMENTATION

Flow of the implemented system is explained with the help of following flowcharts. Fig. 2 shows the flowchart for checking day and night condition using LDR. Flowchart for vehicle detection is shown in Fig 3.

First initialize all the devices. After the initialization is done, check day and night condition using LDR. As we know the LDR is Light Dependent Resistor, it works on the internal resistance. At day time internal resistance is high and at night time internal resistance is low. When resistance is low, make street lighting system ON. When resistance is high make street lighting system OFF.

After detection of vehicle by IR sensor, IR sensor will send signal to Raspberry pi to turn ON street light. When the vehicle is not detected by IR sensor, the street light will remains OFF.

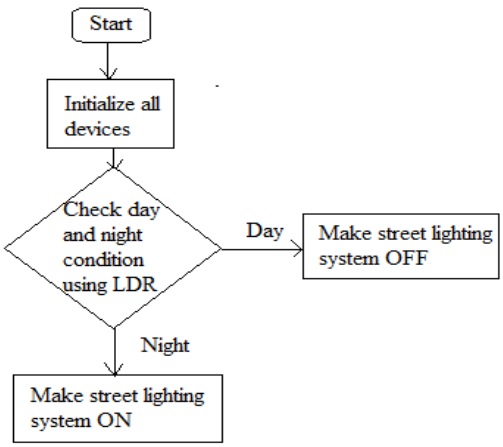

Fig -2: Flowchart for checking day and night condition using LDR

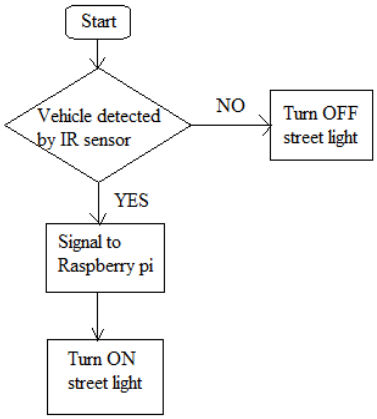

Fig -3: Flowchart for vehicle detection

5. ANALYSIS

In table 1, it shows an analysis and comparison about current systems.

Table -1: Analysis of recently proposed system

Title of Paper	Components Used	Merits	Demerits
Smart Street Light System based on Image Processing	LED Lamps, Raspberry pi, sensors, LDR, OLFC .	Power reduction , Used to save energy	High initial cost ,No backup plan.
An Intelligent System for Monitoring and Controlling of Street Light using GSM Technology	At mega , GSM, LED, Raspberry Pi, Sensors, Street Light.	Use of solar panels, Flexible according to need of user.	Expensive.
Design and implementation of Traffic Flow based Street Light Control System with effective utilization of solar energy	Microcontroller ,LDR, Photoelectric sensor.	Automatic ON/OFF mechanism of street lights.	Because of one microcontroller the controllability and operation of street lighting is difficult.
Internet of Things Based Intelligent Street Lighting System for Smart City	PIC Microcontroller, IR Sensor, Current Sensor, LDR, Intel Galileo Gen2.	Reduction of manpower.	Initial cost and maintenance is high .

6. RESULTS AND DISCUSSION

In proposed system IR sensor will detect the movement of vehicle. When vehicle is detected by IR sensor, it will inform to control unit i.e. Raspberry Pi about the presence of vehicle. Then Raspberry Pi will control the switching operation of street light. To turn ON the system we have to use LDR. LDR will check intensity of light. According to light intensity (if it is low, then system will turn ON and if intensity is high system remains OFF). The energy provided to whole system is solar energy with the help of solar panels and this energy is stored in batteries. Whenever there is absence of solar energy or failure of solar supply to the system, the main switch will give energy to whole system. To know about the information of car, RFID card and RFID reader is used and the information is displayed on LCD. To avoid collision ultrasonic sensor is used. When driver feels sleepy , to alert him and to avoid accident vibrations are provided to driver's chair.

7. CONCLUSION

The project has been studied and designed using raspberry pi. The main benefit of the present system is power saving. This initiative will help the government to save this energy and meet the domestic and industrial needs. In addition to energy consumption, another advantage it provides less maintenance cost. This project is cost effective, practical, and the safe to travel at night time. According to statistical data we can save more electrical energy that is now consumed by the highways. We have implemented a prototype of this system. The proposed system is especially appropriate for street lighting in city and rural areas where the traffic is low at night times. Independence of the power network permits to implement it in remote areas where the classical systems are prohibitively expensive. The system is versatile, extendable and totally adjustable to user need.

REFERENCES

[1] Veena P C, Paulsy Tharakan , Hima Haridas, Ramya K , Riya Joju, Ms. Jyothis T S,"Smart Street Light System based on Image Processing," 2016 International Conference on Circuit, Power and Computing Technologies [ICCPCT]

[2] Ms. Swati Rajesh Parekar , Prof. Manoj M. Dongre, "An Intelligent System for Monitoring and Controlling of Street Light using GSM Technology," 2015 International Conference on Information Processing (ICIP) Vishwakarma Institute of Technology. Dec 16-19,2015

[3] M.Abhishek , Syed ajram shah, K.Chetan, K.Arun kumar,"Design and implementation of Traffic Flow based Street Light Control System with effective utilization of solar energy," International Journal of Science Engineering and Advance Technology, IJSEAT, Vol 3, Issue 9 ISSN 2321-6905 September-2015

[4] Parkash, Prabu V, Dandu Rajendra ,"Internet of Things Based Intelligent Street Lighting System for Smart City," International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 5, Issue 5, May 2016

[5] Dr. D.V.Pushpa Latha, Dr. K.R.Sudha, Swati Devabhaktuni, "PLC based Smart S Street Lighting Control", I.J.Intelligent System and Applications, 2014, 01, 64-72.

[6] Raspberry Pi Foundation, UK registered charity 1129409

[7] Cellan Jones, Rory (5thMay 2011), Peter (3rdJune 2011), Bush, Steve (25thMay 2011), "Dongle computer solve the programming on a TV"

[8] Akula Rahul, K.Haripriya, E.Sneha, "Smart Energy Management System Based on Zigbee Technology", 11thMarch 2015.