Movement Sensing Street Lighting

Surabhi Gurav, Hardik Rathod, Heta Shah and Nilesh Rathod
MCT's Rajiv Gandhi Institute of Technology, Mumbai
Off Juhu Versova Link Road, Versova, Andheri(W), Mumbai-53.

***Abstract*—**This project aims at reducing energy consumption by minimizing the unnecessary use of energy consumed by street lights. Based on low cost microcontroller, this project incorporates a Solar power module, a Light Emitting Diode (LED) module, Light Detecting Resistors (LDR), and Infrared (IR) Sensors.The street lights are simulated using LED-based lamps, and the intensity of their illumination is varied depending upon the light in the external environment, where the changes are detected using the LDRs. The LEDs will glow the brightest when the environment is the darkest and only when there is movement detected on the street (using the IR sensors), is turned off when the environment is the brightest, and isdim otherwise. As the detected object is on the move, the leading lights are turned on, and the trailing lights are turned off, one-by-one. The solar power unit collects the solar energy during the day, and powers the project system during dark hours. As this system does not keep the street lights glowed continuously, it is an energy efficient system.

Keywords*—Energy efficient, external light detection,LDRs, LED-lamps, low power consumption, microcontrollers, movement detection, solar powered, street lighting.*

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I. INTRODUCTION

Illumination of streets is an important factor in modern cities that is used to assess the development of a nation. It is a major part of a city's infrastructure. Inclusion of street lights facilitates the safety concerns of pedestrians, vehicles, stray animals, etc. during night.

Until the last decade the number of street lights in towns and cities were small. Therefore, the street lamps were relatively simple but with the development of cities, the streets increased rapidly with high car density. In order to design a good street lighting system, there are several factors that are needed to be considered, such as night-time safety for community members and road users, provide public lighting at effective cost, the reduction of crime and minimizing its effect on the environment.

In earlier stages of street lights there were manual controls where a control switch was set in each of the street lamps. It is called first generation street light.Optical-control method was another method that has been used. The method uses high pressure sodium lamp in their system. This method is widely used in the country nowadays. This method operates by set up of an optical control circuit, change the resistance by using light sensitive device to control street lamps light up

automatically at dusk and turn off automatically after dawn in the morning. Due to the technological development

nowadays, road lighting can be categorized according to the performance and their use, installation area, for example, traffic routes lighting, subsidiaries lighting and lighting for urban center and public amenity areas.

Classification of street lights can be done on basis of lamps used such mercury vapor light, as incandescent light, metal halide light, low pressure sodium light, high pressure sodium light fluorescent light, compact fluorescent light, induction light and LED light.

LEDsystem due to its behavior and advantages is considered a promising solution to modern street lighting. Except that, the advantages of LED are likely to replace the traditional street lamps such as the incandescent lamp, fluorescent lamp and high-pressure sodium lamps in future but LED technology is an extremely difficult process because it requires a combination of advanced production tools, best quality materials and accurate-precision manufacturing process. Therefore, this paper highlights the energy efficient street lighting design using LEDs through intelligent sensor interfaces like LDR and IR for controlling and managing. proposed system

Power consumption,automation and Cost Effectiveness are the major points to be undertaken in the current electronics field and technologies related to electronics. Industry of street illumination systems are growing exponentially and going to complex with fast growth of industries and cities. To manage and maintain complex street illumination system more affordable and cheap ways are being developed. These systems are developed to control and minimize energy consumption of a city's public-sector lighting system using varied technology applications.

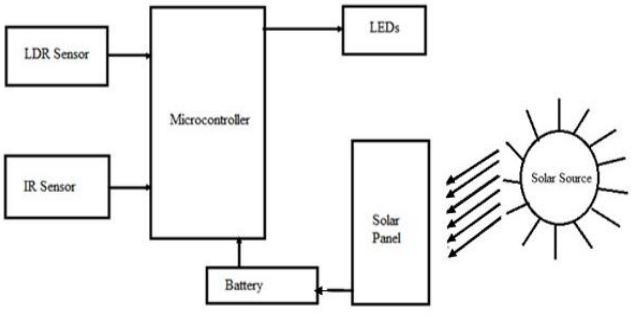

fig. (i) Block diagram of Movement Sensing Street Lighting

Instead of generally used street lamps such as High-Pressure Sodium Lamps, etc. this proposed system utilizes the latest technology for the sources of light as LED Lamps. As LED LAMPS offers several advantages over other traditional technologies like energy saving due to high current luminous efficiency, lowmaintenance cost, high color rendering index, rapid start up speed, long working lifeit is preferred.

A. Hardware Specification

The components for the proposed system have been classified on the basis of group of components, input, output and controllers. In this system we have used 3 types of inputs; clock, power supply(using solar module) and sensors(LDR & IR). The clock oscillations to the microcontroller is provided using the clock, while to power up the overall system we use the power supply. The switch for power switch on and off controls the power supply.

Including vector and non-vector type sensor we have used a total of 3 sensors. The surrounding light level is detected by use of the dark or light sensor module.To measure the light level of the surrounding environment we have used (LDR) LIGHT DEPENDENT RESISTOR. All light levels or changing is measured in lux. The IR sensor is used to detect the vehicle presence. As the vehicle cuts the IR ray it will be detected. If there is presence of rain in the environment then the sunlight intensity will be automatically decreased which will in turn be detected by the LDR and accordingly action will be taken. 8051 Microcontrollerhas been selected as the controller in this system due to the low cost, compatibility, compact size and easy interfacing over several types of other controller including Field Programmable Gate Array, Programmable Logic Controller. The accessibility to the Analog to Digital Converter (ADC) without required register location access has made the controller more user friendly for programming and interfacing with other components. Above that, the complete circuit is powered through the solar panels which makes it an independent system.

The two inputs used in the proposed system and connected to the microcontroller are obtained from the LDR and the IR. The function of LCD is to display the power consumption, voltage, raining status, number of vehicle and day or night. While, the status of the LED is dependent upon the external light its intensity depends on presence of any object. Five level of the brightest have been included in the intensity module for response the condition and sensor input including the street lamp period, raining density level, surrounding light level and numbers of vehicles.

B. Software Specifications

We need to program the microcontroller in such a way that it performs the desired tasks by taking accurate input and giving proper output. Arduino programming has been used to construct the program for the proposed design.

In this system, many stages have been added as the stage of reply for the integrated sensor. The decision for every sensor will determine the process or operation of the system. It starts with analyzing the dark sensor. The system is start by determine the level of surrounding light. Day light and night have been set as two surrounding light level. During the day light, all the lighting system is shut down or switch off.

C. Implementation Flow

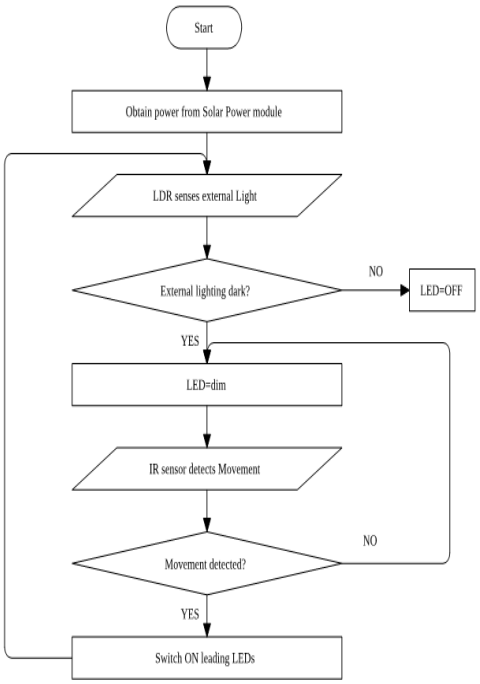

fig. (ii) Implementation flow of the proposed system

Figure (ii) illustrates the implementation flow of the system. The entire system sinks power from the solar power unit which is used as a source. The power unit collects solar energy during the bright hours of the day, and using an adapter, converts the collected solar energy into electrical energy and powers the circuit. The Light Detecting Resistors (LDRs) sense the intensity of light in the external environment. According to the external light levels, the LEDs are turned ON, dimmed or OFF, as required. If the environment is dark, the LEDs are dimmed, unless there is a movement detected by the IR sensors, in which case, the LEDs are turned ON. If the external light is not very dark and if there is no movement in the environment, the LEDs remain OFF. The LEDs are turned ON and OFF as and when the object is on the move on the street.

II. IMPLEMENTATION

The aim of this project is to design a street light control system using microcontroller, which automatically turns on or off the street lights by detecting the movement of vehicles in the dark. The implementation of the project is explained here.The IR transmitter is placed directly in line of sight with IR receiver, so that the IR receiver continuously receives infrared rays. Once the IR receiver receives infrared rays, the microcontroller will detect

Logic 1. If the infrared rays are blocked by some means, the microcontroller will detect logic 0.So, the program for the microcontroller is written in such a way that it will turn ON the LEDs, which means here the street lamp, when it detects Logic 0 and it will turn OFF the LEDs, when it detects Logic 1.Consider the two IR sensors i.e. IR Transmitter and IR Receiver are placed on the either side of the road. As per the circuit diagram, the IR receivers are connected to the PORT0 and the LEDs are connected to the PORT2 of the microcontroller.At the beginning, when there is no obstacle, the IR receiver continuously detects IR light transmitted by the IR Transmitter. When a car or any other vehicle blocks any of the IR sensor, the microcontroller will turn ON the immediate three LEDs.If the car blocks the first IR sensor, the first three LEDs are turned ON by the microcontroller. As the car moves forward and blocks the second IR sensor, the corresponding next three LEDs will be turned ON and the first LED of the previous set is turned OFF. The process continues this way for all the IR Sensors and LEDs.

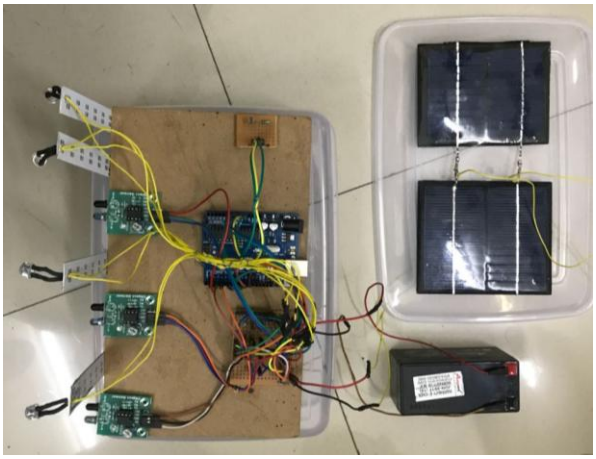

fig. (iii) Implemented System

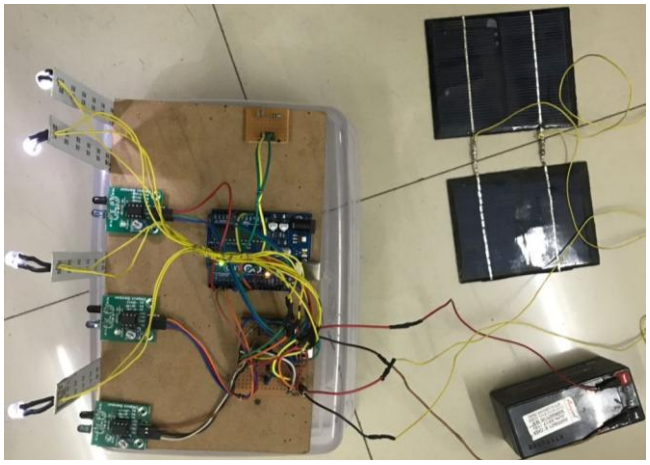

fig. (iv) System in action

III. CONCLUSION

While, during the night time the current street lights stay on for a very long time that is 7-10 hours, this proposed system will only stay on for necessary time period which depends on 2 factors which are i) the intensity of the external light in the environment. If the external light is less than 400 lux then only the LDR will signal the microcontroller which in turn will instruct the LEDs to glow.ii)presence of any object on the road. if it is day time and there is movement on the road then the LEDs will not glow but if it is night time then the LEDs will be in dimmed state and as soon as any movement or presence of any object is detected by the IR sensor. This information will be sent to the microcontroller and the LEDs will be instructed accordingly (to glow with full intensity). This proposed system will result in power conservation on a very large scale and can be used in remote areas where electricity is absent as it runs on solar power and is an independent system.The system is versatile, extendable and totally adjustable to user needs.

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