Implementation of Solar Based Intelligent Street Light Control System using IoT

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***Abstract*- Now-a-days the amount of power consumed by lighting and streets shares a major energy demand. The vehicles are passing over always and a part of places will be consisting of less density areas and even no vehicle moments itself in few areas. But during night all street lights will be on in conventional street lighting system. To overcome from this issue, a proper energy saving methods and lighting control to be implemented. The proposed work is to have two controls like, one is to switch of lights during no vehicle moments in streets and automatically switch it on when vehicles arrive and the other modes are to give less intensity light for pedestrian and to switch on bright mode during vehicle moments at sides on the roads. In this work the LED lights are used for street arrangement, the Photo diodes and IR sensors are used to sense vehicle moments. The control signals of sensors have been fed to microcontroller 8051. In the microcontroller the control logic is implemented to control lights based on vehicles and pedestrian moments with bright and dim mode of operation and to switch off lights during no vehicles and pedestrian. From the proposed method the overall energy being utilized now-a-days for lighting can be minimized. Moreover the automatic and intelligent control schemes are required to control the complex lighting system due to growth of cities and standard of living.**

***Index terms*- High Intensity Light, Low Intensity Light, Light Emitting Diode, Pulse Width Modulation**

I.INTRODUCTION

This paper shows the design to detect the vehicle movement on roadways to switch ON just a block of road lights in front of it, and to turn OFF the trailing lights to save energy. During night each one of the lights on the expressway stay ON for the vehicles, yet loss of power is experienced when there is no vehicle movement. This proposed framework satisfactorily works for energy saving. This is accomplished by detecting a vehicle moving towards the street and turns ON a block of street lamps in front of the vehicle. By doing this, a considerable amount of power is saved. So each of the road lights stay in OFF condition when there are no vehicles on the street. There is another method of operation where instead of turning OFF the lights totally, they stay ON with ten percent of the extreme intensity of the light. As the vehicle approaches, the block of road lamps change to hundred percent intensity and as the vehicle moves forward by, the trailing lights return to ten percent power once more. HID lamps are utilized for metropolitan road lights.

The intensity is not governable by any voltage diminishment technique since HID depends on the principle of gas release. White LED based lights are soon supplanting the high intensity discharge lights in road light. Intensity is likewise conceivable by PWM created by the microcontroller. The photodiode and IR LEDs delivers logic signal to microcontroller to turn ON or OFF depending upon the operation. Consequently, this progressively changing from ON /OFF sides in saving a great deal of power. This venture utilizes an 8051- arrangement microcontroller. Proposed venture can be upgraded by utilizing proper sensors for recognizing the unsuccessful road light and afterward delivery a short message service to the control division by means of GSM modem for suitable action.

II.EXISTING SYSTEM

In recent days due to the fast development of industries and urban community's connectivity, the road lighting frameworks are also developing quickly. The mechanization of effective utilization of power and cost reduction is important factor in the present day to day life. The different types of road light control frameworks are implemented to control and keep up complex road lighting systems. For controlling and diminishing energy utilization of a town's open lighting system, the effective systems are created. The current work is shows utilizing High intensity discharge lights. As of now, the HID is utilized for urban road light where power is not managed by any of the methods to reduced or switch off the lights during less density or unmanned areas. High intensity discharge lights are a kind of electrical gas release light which delivers light by methods for an electric circular segment between tungsten terminals fixed inside glassy or simple combined quartz. The gas and metal salts are loaded in tube. The gas excites the circular segment's underlying it. Once the circular segment is begins, it warms and evaporates the metal salts forming plasma which enormously builds the force of light delivered by the curve and decreases its energy utilization. High force release lights are a sort of circular segment light.

III.METHODOLOGY

A dynamic control strategy is given for the smart road control project. As per the proposed arrangement indicates, all the road lights continuously glow for a few moments and switches off. At the point when a vehicle is moving by, a block of road lights switch ON and as the vehicle moves ahead, the following block of lights turns ON whereas the preceding light turn OFF. The present HID lights are more costly then LEDs. Due to this reason, the high intensity discharge lights are replaced by light emitting diodes. The power utilization and cost can be saved in the present field of utilization of electrical gadgets and their advancements. The road lighting systems are becoming complex systems with proper energy conservation techniques due to the fast development of industries and urban areas. For controlling the complex road lighting system, the advancement techniques have been used which includes infrared sensors to differentiate the movement of vehicle after which the lights switch ON. As the vehicle passes away the sensors, the road lights, which were in switched ON condition, will turn OFF (Minimum Light Intensity) and the preceding lights will switched ON.

A. Simulation of the Proposed Work

The Simulation report (in HTML format) contains the main section in links, which you can click to navigate to the respective topic. Additionally, it displays the summary charts (only in HTML format) displaying the overall cost per process and cost per resource (and performer) used in the simulation project. For more information, see the following Viewing simulation report details section.

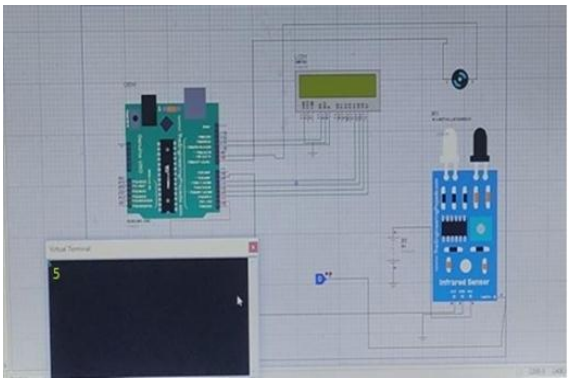

Fig. 1. Simulation Diagram

IV.HARDWARE DESIGN

The hardware model consists of fourteen light emitting diodes as street lamps and eight sets of photodiodes or infrared diodes utilized as sensors, variable resistors and transistors which work as switch. The infrared diodes are set on side of the street and photodiodes are set on the opposite side of the street, straightforwardly confronting IR diodes.

A. Ultrasonic Sensor

Ultrasonic sensors (also known as transceivers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the

distance to an object. This technology can be used for measuring: wind speed and direction (anemometer), fullness of a tank and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water.

Fig.2. Ultrasonic sensor

To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms and non-destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 20,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed. The technology is limited by the shapes of surfaces and the density or consistency of the material. For example foam on the surface of a fluid in a tank could distort a reading.

B. Arduino UNO

Fig.3. Arduino Uno

Arduino 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.

C. LCD Display

Fig.4. LCD Display

A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals. They are used in a wide range of applications including: computer monitors, television, instrument panels, aircraft cockpit displays, signage, etc. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. LCDs have displaced cathode ray tube (CRT) displays in most applications.

D. Battery

A battery is a device that stores chemical energy and converts it to electrical energy. The chemical reactions in a battery involve the flow of electrons from one material (electrode) to another, through an external circuit. The flow of electrons provides an electric current that can be used to do work.

E. Bluetooth

Bluetooth works by the simple principle of sending and receiving data in the form of radio waves. Every Bluetooth enabled device has a card-like attachment known as the Bluetooth adapter. It is this Bluetooth adapter that sends and receives data. A Bluetooth adapter has a particular range of connection.

F. Relay

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches

Fig.5. Relay

Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

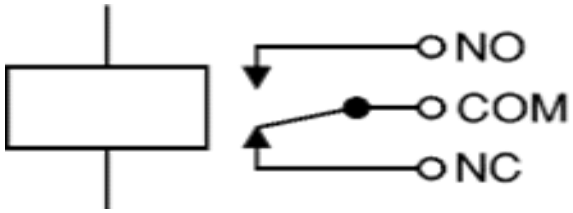

Fig.6. Relay Pins

G.GSM Modem

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. For the purpose of this document, the term GSM modem is used as a generic term to refer to any modem that supports one or more of the protocols in the GSM evolutionary family, including the 2.5G technologies GPRS and EDGE, as well as the 3G technologies WCDMA, UMTS, HSDPA.

Fig.7. GSM Modem

A GSM modem exposes an interface that allows applications such as Now SMS to send and receive messages over the modem interface. The mobile operator charges for this message sending and receiving as if it was performed directly on a mobile phone. To perform these tasks, a GSM modem must support an "extended AT command set" for sending/receiving SMS messages, as defined in the ETSI GSM 07.05 and 3GPP TS 27.005 specifications.

Consider the situation when a vehicle deters the IR radiation way. For this situation, IR radiation is blocked and consequently it doesn't fall on the photo sensor then the sensor will switched off. Consequently there is no current moving through this first transistor. Then collector moves to HIGH state. The Photodiode-IR diode match IR way is blocked. This prompts a move from ZERO to HIGH at P1.0. The microcontroller is modified such that, at whatever point the pin P1.0 goes high, at that point a frame of seven lights ahead from the vehicle movement start glows and the two pins of port 2 and port 3 go HIGH. This procedure goes ON i.e., as the vehicle advances, the road lights intensity increased to 90% and the trailing lights intensity reach to 10%.

V.RESULTS AND DISCUSSION

When the vehicle is not detected, each one of the street lights will be in OFF state. By utilization of pulse width modulation system through the program put away in the microcontroller tuning ON/OFF of street lights is accomplished. At the point when there is no vehicle on the road, the street lamps are turned ON for around one milliseconds and afterward for hundred milliseconds they are turned OFF (First two LEDs). Hence, we get street lamps with less shine. At the point when a vehicle is detected, each one of the street lamps are on for 1ms and the window of street lamps are lit up for 100ms. Therefore we have a PWM wave of 99% obligation cycle for those seven LEDs.

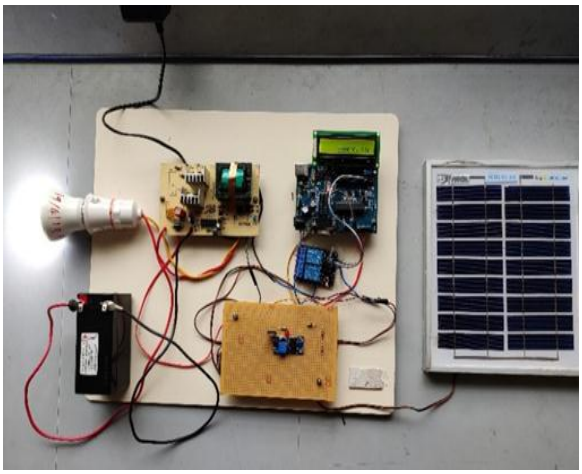

Fig.8. Hardware

VI.CONCLUSION

The implemented model is a less cost, pragmatic, ecofriendly and the most secure approach to save energy. As per the statistical information 35%-40% of electrical energy is currently utilized by the national highways, state highways and local street lights. The initial investment cost and erection may be the disadvantage, but with the bulk production of the module the overall cost of investment can be reduced further due to advancement in innovation and technology the cost of the project can be further reduced. The project has scope in different applications like providing lighting for office, building, grounds, walking paths and parking garages of large shopping centres. This can also be utilized for security surveillance in corporate buildings, businesses centres, school premises etc.

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