Smart Street Light

SHILPA SRIVASTAVA[1], AAKANSHA SINGH[2], DEEPANKAR MISHRA[3]
[1, 2, 3] *Department of ECE, ABES Engineering College, Ghaziabad, Uttar Pradesh, India*

Abstract*— Now-a-days the amount of power consumed by street lighting shares a major part of energy demand. The traffic is high in some places and in other places of less density areas traffic will be low. But during night all street lights will be ON in conventional street lighting system. To overcome from this issue, proper energy saving methods and lighting control has to be implemented. In the proposed work we have two controls like, one is to switch OFF lights during no vehicular movement in streets and automaticall y 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 vehicular movement. The control signals of sensors have been fed to microcontroller 8051. In the microcontroller the control logic is implemented to control lights based on vehicular traffic and pedestrian movement with bright and dim mode of operation and to switch off lights during no vehicular traffic and pedestrian movement. From the proposed method the overall energy being utilized for lighting can be minimized. Moreover the automatic and intelligent control schemes are required to control the complex lighting system due to energy saving implemented in development of smart cities for the future and raise the standard of living for a cleaner and greener future

***Indexed Terms*— High Intensity Light emitting diode, Pulse Width Modulation.**

I. INTRODUCTION

This paper shows the design to etect 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 expre ssway stay ON for the vehicles, yet loss of power is experienced when there is no vehicle movement. This propose d 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. As the vehicle moves forward by, the trailing lamps turn OFF on its own [8]. 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 [1, 3]. 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 [7]. 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 light s [5, 9].

The intensity is not governable by any voltage diminishment technique since HID depend s 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 [2, 4]. 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 [5].

II. PRESENT SYSTEM

In recent days due to the fast development of industries and urban communities 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 f rameworks are implemented to control and keep up complex road lighting systems. For controlling and diminishing energy u tilization of a town's open lighting system, the effective systems are created. The current work is shows utilizing High intensity discharge (HID) 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 durin g less density or unmanned areas.High intensity di scharge 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 (colourless glass made of almost pure silica or melded alumina cur ve tube). 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 em itting diodes. The power utilization and cost can be saved in the present field of utilization of electrical gadgets and their advancements. The road lightining systems are becoming complex systems with proper energy conservation techniques due tio 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 (Maximum Lig ht Intensity) as shown in flowchart below Fig. 1.

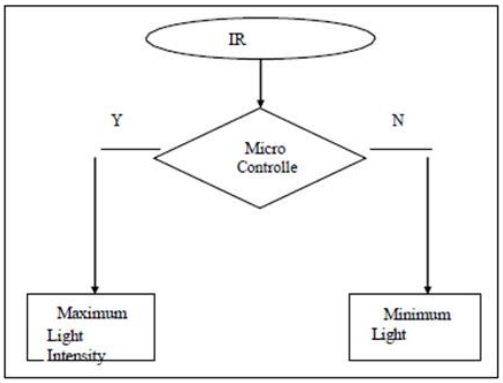

Fig. 1. Flow chart for detection of Vehicle

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 se t on side of the street and photodiodes are set on the opposite side of the street, straightforwardly confronting IR diodes.

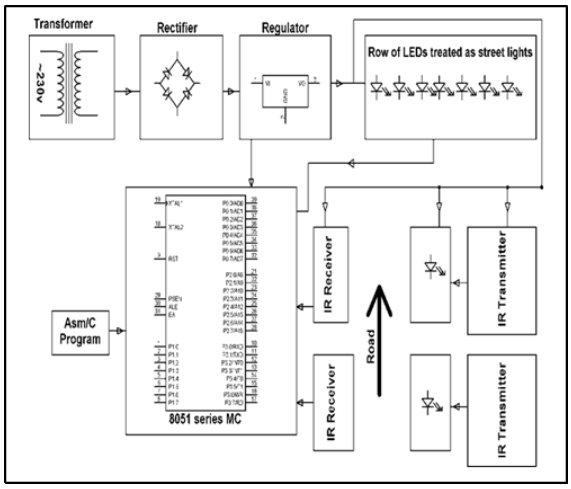

Fig. 2.
Proposed Block Diagram for automatic light controller.

In this proposed block diagram consisting of the IR sensors which is used for interruption detection and send logic signal to microcontroller for the gl owing of the LEDs ahead of the vehicle as shown in Fig. 2.

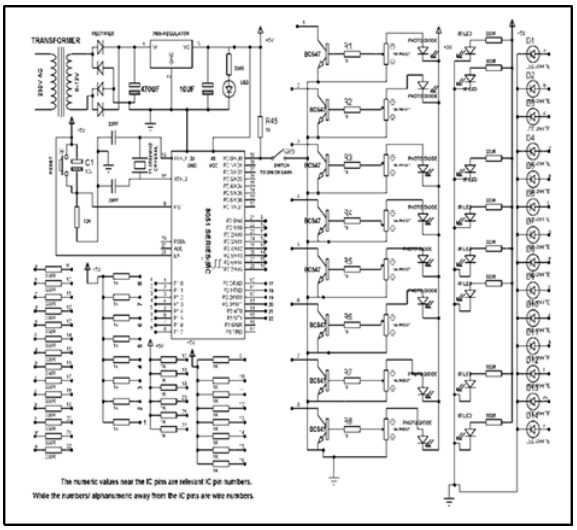

Fig. 3. Circuit Diagram with necessary hardware.

Consider the situation when there is no vehicle o n the highway. For this situation, the infrared radiation produced from the infrared diode straight incident on the photo sensor, which is placed facing towards IR sensor. This makes photo sensor to conduct and current flows through it. The current goes through the photodiode and experiences the variable resistor to the base-emitter region of the transistor. From the circuit diagram shows the emitter is connected to ground. The collector of the transistor is associated with the in put port (port 1), which goes to ground i.e., rational ZERO. Th erefore, when the vehicles are absent, at that point a sensor output to the microcontroller port 1 is ZERO.

The Fig. 3 shows the arrangement of hardware model, in which consists of PIC micro-controller in series with voltage regulator and transformer at input end. Towards the output, consists of LED lights and IR sensors, the similar arrangement as shown in Fig. 5.

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 th en 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 an d the two pins of port 2 and port 3 go HIGH. This procedure g oes 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

The hardware have been implemented and the model performance were checked for two modes of operation as shown below and the arrangements of IR sensors and Lighting devices as shown in Fig. 4 and Fig. 5.

1. Transition of street lamps from dark to bright state for less density areas

2. Transition of street lamps from dull to bright state for more density areas

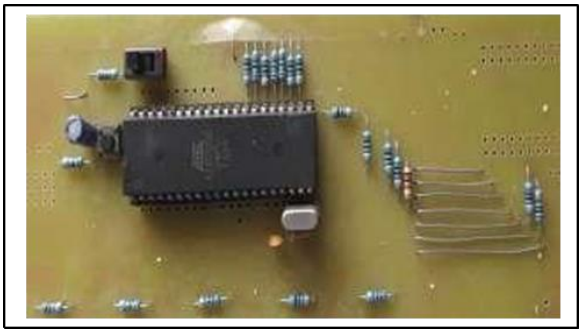

Fig. 4. The mode of switch and reset button with microcontroller setup.

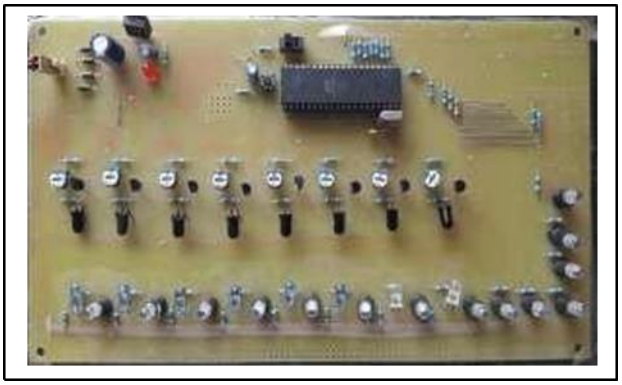

Fig. 5. Street lamp arrangement with IR sensors

1. Mode 1:

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 as shown in Fig. 6.

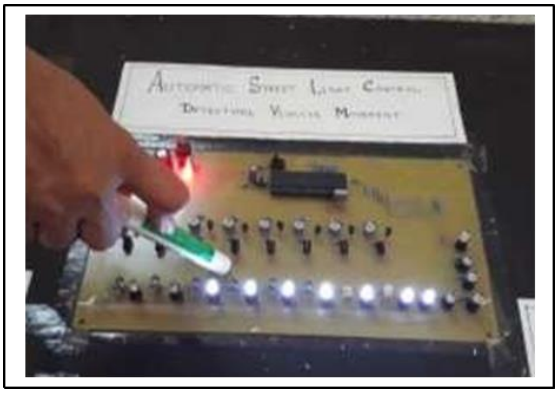

Fig. 6. Setup. Mode 1 operation

2. Mode 2: In this mode, when there are no vehicles, the street lights will be in very low brightness. Once the vehicle is detected, the block of street lights in front of the vehicle lights up. The mode 2 operation shows the LEDs are glowing at 10% intensity when no vehicle. The moment at any vehicle comes in between the sensors then the light will increase to 100% intensity ahead of the vehicle and the trailing lights will revert back to 10% intensity (First five LEDs)as shown in Fig. 7.

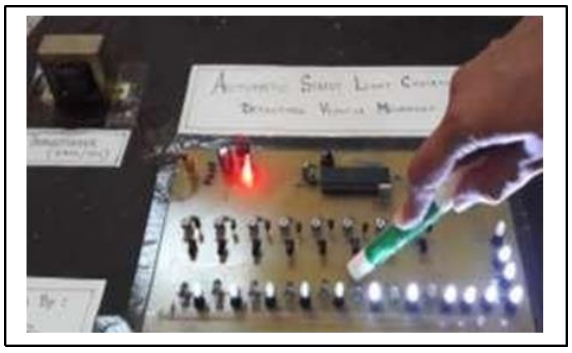

Fig 7. Setup. Mode 2 operation

VI. CONCLUSION

The implemented model is a less cost, pragmatic, eco friendly 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 street light ing, 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.

REFERENCES

[1] Payal Rodi, Leena Chandrakar, Saylee Ginde Sivanantham S and Sivasankaran K, "*Energy Conservation using Automatic Lighting System using FPGA*", International Confernece on Green Engineering and Technologies, 2015.

[2] Deepak Kumar Rath," *Arduino Based: Smart Light Control System*", International Journal of Engineering Research and General Science Volume 4, March-April, 2016.

[3] Gouthami. C, Santosh. C, A. Pavan Kumar, Karthik. A, and Ramya.K.R, "*Design and Implementation of Automatic Street Light Control System using Light Dependent Resistor*", International Journal of Engineering Trends and Technology (IJETT) – Volume 35 Number 10 - May2016.

[4] Ahmed ShariqueAnees, Anupriya, Ayushy Chowdhary,Shalini Dubey and Shweta Verma, "*Solar Powered Led Streetlight With Automatic Intensity Control*", International journal of innovative research in electrical, electronics, instrumentation and control engineering, Vol. 3, June 2015.

[5] Prof. K.Y.Rajput, Gargeyee Khatav, Monica Pujari and Priyanka Yadav, "*Intelligent Street Lighting System Using Gsm*", International Journal of Engineering Science Invention, March, 2013.

[6] S. Suganya, R. Sinduja, T. Sowmiya and S. Senthilkumar, "*Street light glow on detecting vehicle movement using sensor,* International journal for advance research in Engineering and technnhnology,2014. hnology, 2014.

[7] Sanal Malhotra1 and Shiv Taneja, "*Automatic Brightness Control Using LDR Sensors*", Advanced Research in Electrical and Electronic Engineering, 2014.

[8] Ch Kavitha, Swathi, Satyaprakash and Vinitha, "*Solar Powered LED Street Lighting with Auto Intensity Control*", International Journal of Scientific & Engineering Research, July, 2016.

[9] Parkash, Prabu V and Dandu Rajendra, "*Internet of Things Based Intelligent Street Lighting System for Smart City*", International Journal of Innovative Research in Science Engineering and Technology, May, 2016.

[10] Yu-Sheng Yang et al," An Implementation of High Efficient Smart Street Light Management System for Smart City", IEEE Access, Vol.8, Feb 2020, doi: 10.1109/ACCESS.2020.2975708.

[11] Yusaku Fujii et al," Smart Street light system with energy saving function based on the sensor network", Conference: Proceedings of the fourth international conference on Future energy systems, DOI/: 10.1145/2487166.2487202, Jan 2013.

[12] Sarr, Y.; Gueye, B.; Sarr, C. Performance Analysis of a Smart Street Lighting application using LoRaWan. In Proceedings of the 2019 International Conference on Advanced Communication Technologies and Networking (CommNet), Rabat, Morocco, 12–14 April 2019.

[13] Hannan, S.; Humayun Kabir, M.; Uddin, M.J. A Case Study on a Proposed Adaptive and Energy Efficient Street Lighting System for Chittagong City. In Proceedings of the 1st International Conference on Advances in Science, Engineering and Robotics Technology 2019 (ICASERT 2019), Dhaka, Bangladesh, 3–5 May 2019.

[14] Barve, V. Smart Lighting for Smart Cities. In Proceedings of the 2017 IEEE Region 10

Symposium (TENSYMP), Cochin, India, 14–16 July 2017.

[15] Cheng, C.A.; Chang, C.H.; Ching, T.Y.; Yang, F.L. Design and implementation of a Single-Stage Driverfor supplying an LED Street-lighting Module with Power Factor Corrections. IEEE Trans. Power Electron. 2015, 30, 956–966