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IoT based Street Light Auto Intensity Control and Fault Detection

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Abstract—**When it comes to metropolitan cities the night also plays an important role and the consumption of power the street lights is of 8-10% of the total consumption. The operating of this streetlight plays an important role, manual operation is one the most common operation used. In our proposed system we introduced automatic street lightening based on the intensity of sunlight.In addition to solar panels, we also used piezoelectric sensors for the generation of electricity. The piezoelectric sensors convert the pressure produced by the movement of the presence on the road into electrical energy. In this way, power can be consumed and safety measures can be taken in road ways. In addition to that we introduced the fault detection.**

Keywords—IOT, Smart Street light, Fault Detection, Wi-Fi Module, Arduino Uno

I. INTRODUCTION

In past days, we have been using the street lights. Those street lights need man power and they have to operate manually from time to time. As if the operating person was late for duty, then the lights will glow continuously up to morning, this leads to the wastage of electricity[1]. In past days, if there is any fault in the street lights, it will be known only if and only if when the technician checks it manually. If incase of any delay in the process of technical check, it may lead to accidents.so, in order to overcome this problem, an iot based street light system has been introduced.

In present days, we are using iot based system. The operation of this iot system is based on timers. [2-5]These timers are Designed to ON and OFF at particular timings (e.g., 10pm-6am). But there are some limitations with this system when there are variations in between the sunrise and sunset (seasonal and climatical changes). Hence, a new IOT based system has to be introduced.

In our proposed system, we have used LDR sensor to detect the presence of sunlight. [6-10]By this, we can overcome the above discussed problems. In this system, we have also used IR sensor. Whenever there is a movement of vehicle/pedestrian, then the system is in active mode i.e, it glows brightly; else it is in dim position. If there is any failure in the street light, the circuit makes use of the Wi-Fi module. [11-20]WIFI module sends the particular street light information to the control room. This will be very easier to spot the fault light and can resolve this issue at earliest.

In winter and rainy season, there is no chance for adequate sunlight for charging the solar panels. So, we are alternatively using the piezo electric sensors and rotating speed breakers to generate the electricity.

II. OBJECTIVE

The main objective of this project is to save the electricity. Now a days, there are many issues regarding the electricity in rural areas. Since the power consumption is high in metropolitan cities and industries, there is no efficient electricity to provide in the rural areas. At present, electricity is generating by using the water. Since there is no sufficient amount of water, we are unable to meet the electricity needs of all the people. We have an enormous amount of water in oceans, but this salt water is unfit for generation of the electricity. So, we are opting for non-renewable sources like solar energy and also from hardware sources like piezoelectric sensors and rotating speed breakers. By doing these, we can provide electricity to the rural areas too, since we are generating electricity from non-renewable sources. By the idea of our project, we can also save the power consumption. So that we can make our country a developed country by providing electricity to each and every region.

The main objectives of this project are:

- To avoid unnecessary Waste of light.
- Provide efficient, automatic, and smart lighting system.
- Totally based on Renewable energy sources.
- Longer life expectancy.
- Energy Saving.

Problem statement

Statement 1: Street lights are ON even when there is enough light in the surrounding environment

Statement 2: Street lights are ON in the absence of any vehicles or pedestrians.

Statement 3: There is NO light failure detection

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III. METHODOLOGY OF IOT BASED STREET LIGHT AUTO INTENSITY CONTROL

Four main parts has been discussed under this topic. They are:

- Design architecture
- Hardware specifications
- Software development
- IOT based control

A. *Design Architecture:*

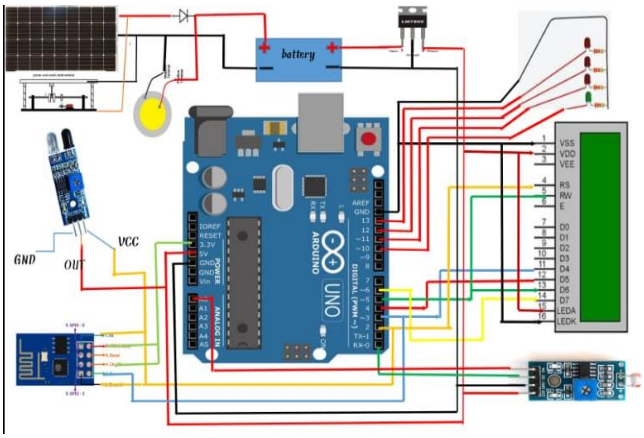

Figure 1: Hard ware model connections

B. *Hardware specifications:*

The components used in designing solar based streetlight with auto intensity control and fault detection are listed below:

S.No	Components	Specifications
1	Solar panel	10Watt, 12Volts
2	Light dependent resistor sensor	100Ω in sunlight, 10MΩ in absolute darkness
3	Infrared sensor	up to 20CM
4	Arduino Uno	ATmega328P
5	Wi-Fi module	ESP8266
6	Light emitting diode	0.2V
7	Piezo electric sensors	Up to 13V
8	Lcd display	2×16 line display
9	Battery	12V
10	Bypass Diode	--
11	Rotating speed breaker	Up to 5V

C. *Software development:*

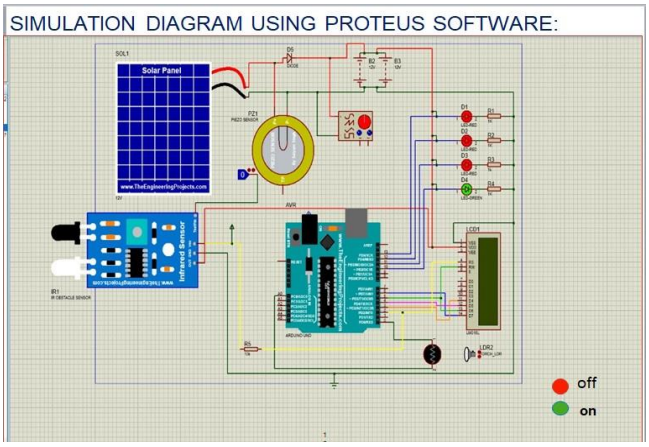

Figure 2: simulation diagram using proteus software

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension (.ino). The editor has features for cutting/pasting and for searching/replacing text.

The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information.

The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

D. *IOT based control:*

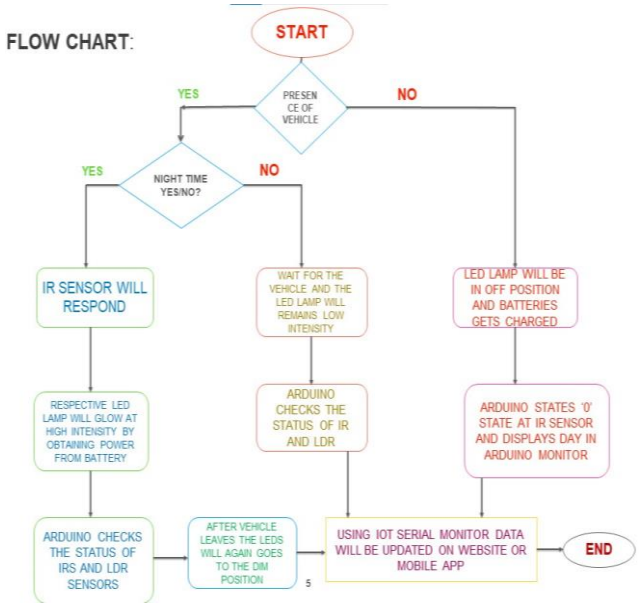

Figure 3: flow chart of iot based street light

Fig 3 shows, if there is presence of the vehicle/ pedestrian in the night time, then the IR sensor will be activated and the respective led lamp will glow with high intensity by obtaining the power from the battery and it also checks the status of the IR and LDR sensors. After the vehicle/pedestrian left the street light, the LEDs again goes to the dim state. This scenario does not happen in day time, because our main idea of the proposed system is for night time, in order to reduce power consumption.

Here we are dimming of the lights to increase the lifetime of the LEDs.If the lights are continuously on and off, then there will be an effect towards the life time of the LEDs. Led use less power when compared to other lights. So, we are using LED lights to reduce the power consumption.

IV. WORKING OF PROPOSED SYSTEM

During day time. Solar panels use sunlight as a source of energy to generate direct current electricity and before storing it in a battery we have to convert the generated DC signal to

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AC. The sensors such as LDR and IR are connected to Arduino Uno.

LDR sensor is used to detect the light source. If the surrounding environment is dark then. LDR resistance is very large. When it is under bright light. its resistance is low. A circuit that makes use of this change in resistance at different light conditions is able to switch the lights on and off automatically during night and day time respectively.

Whenever a vehicle /pedestrian/animal movement takes place on the road then the IR sensor detects that movement which in turn results, increase in intensity of street light. If there is no vehicle movement then the intensity of light decreases automatically. The street lights will be turned off automatically when there is a sunlight.

If there is a failure in street lights then by using Wi-Fi module a message will be sent to control room regarding the failure, which helps in fast replacement of defected street Lights, which in turn reduces accidents. We are also using piezoelectric sensors and rotating speed breaker to generate electricity. • When there are turning/ blind spot IR sensors detect the movement and indicates the signal (red light) to the opposite vehicle

V. RESULT

At the day time, the light will be in off position. When the sunlight is decreasing the level of intensity of light increases, whenever there is a moment of vehicle/pedestrian in the range of 15-20mts the IR sensor detects the moment of vehicle/pedestrian and the light will become bright. Before that the light will be in dim position. Whenever there is a light failure the LDR sensor will detect it and the message will be sent to the control room through WI-FI module.

Hence an enormous amount of energy can be saved by using renewable resources controlling the intensity of LED's without effecting the lifetime of LED's. and by Remote monitoring helps in detecting the failure of light which reduces the manpower. Furthermore, the solar based streetlight system provides better illumination, optimum usage of electricity with reducing operational and maintenance cost after installation compared to sodium lamps.

By implementing this project in real time. we can save a lot of energy which will be useful for future generation. We are also using input sources as piezoelectric sensors and rotating speed breakers.

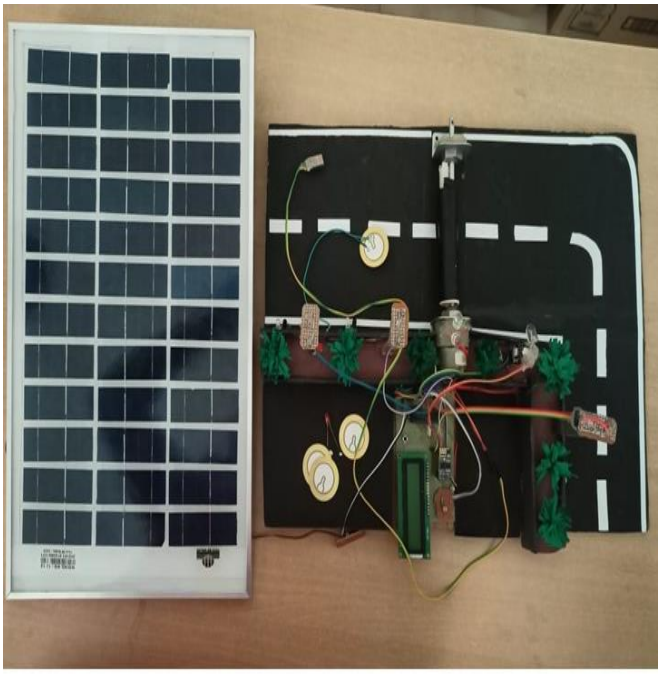

Figure 4: prototype of hardware connections

A. HARDWARE RESULT ANALYSIS IN DIFFERENT CONDITIONS

Signal Lights / VEHICLE AT SENSORS	G1	G2	R1	R2
VEHICLE AT IR1	GREEN	GREEN	GREEN	GREEN
VEHICLE AT IR2	GREEN	GREEN	RED	RED
VEHICLE AT IR3	RED	RED	GREEN	GREEN

Table 1: tabular form for hardware result analysis in different conditions

By looking into the above table 1 we can analyze the signal light conditions when the vehicle approaches different sensors. When the vehicle is at IR1 the G1, G2, R1, R2 glows with green light. When the vehicle is at IR2 the G1, G2 glows with green light and the R1, R2 will glow with red light giving the signal to the opposite vehicles. When the vehicle is at IR3 the G1, G2 will glow with red light and R1, R2 glows with green light. Here the green light indicates there is no vehicle in the opposite and the red light indicates there is a vehicle in the opposite direction and you have to slowdown.

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LEDS / VEHICLE ARRAIVAL	LED 1	LED 2	LED 3	LED 4
VEHICLE AT IR1	ON	OFF	ON	OFF
VEHICLE AT IR2	OFF	ON	ON	OFF
VEHICLE AT IR3	OFF	OFF	ON	ON

Table 2: tabular form shows the behavior of LEDs

From the above table 2, we can come to know that the LEDs will be in totally OFF position in the day time. When the intensity of natural light decreases the LEDs will be in Dim position when the vehicle approaches the respective IR sensor the LED connected to the IR sensor will glow brightly and after the vehicle leaves the LEDs will go back to dim position. When the vehicle is at IR1 the LED1, LED3 will be in ON position and LED2, LED4 will be in OFF position. When the vehicle is at IR2 the LED2, LED3 will be in ON position remaining will be in OFF position. Similarly, when the vehicle is at IR3 the LED3, LED4 will be in ON position. At the speed breaker the LED3 will be in ON position continuously till morning.

B. MOBILE APPLICATION RESULTS USING THINGSVIEW APPLICATION

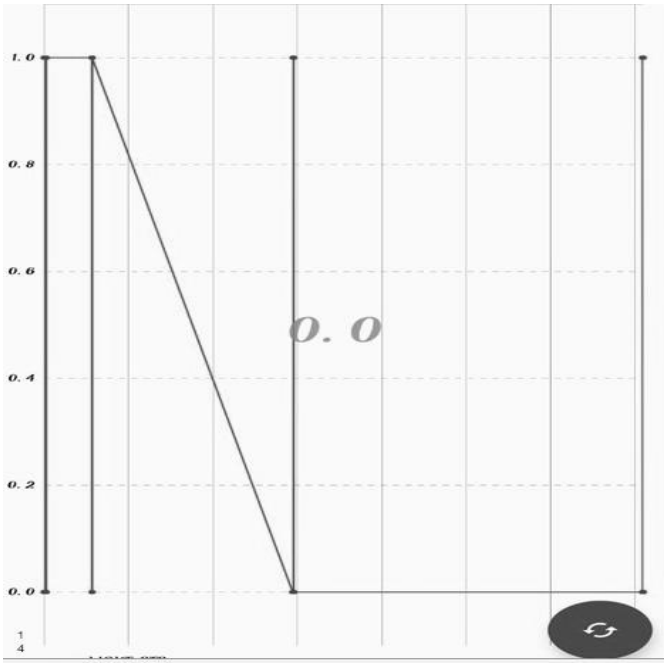

Figure 5: mobile application view UNDER FAULT condition

Figure 5 shows whenever there is a fault in street light the Wi-Fi module send message to the mobile app. If there is a fault in light it will show 0.0 in graph or else it will show 1.0 which indicates NO fault

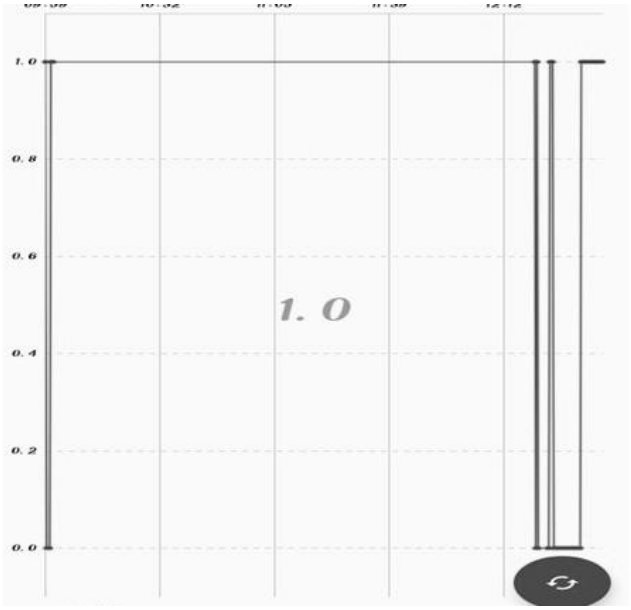

Figure 6: mobile application view when there is NO fault

Figure 6 shows whenever there is a fault in street light the Wi-Fi module send message to the mobile app. If there is a fault in light it will show 0.0 in graph or else it will show 1.0 which indicates NO fault

VI. CONCLUSION AND FUTURE SCOPE

Hence, an enormous amount of solar energy is utilised to generate electricity in our project. We can save this energy to our future generations. We can use the energy generated by the piezo electric sensors and rotating speed breakers to domestic purposes. Remote monitoring helps to find the defected street light and it helps to reduce the manpower. By using the dimming effect, we can save power when compared with the previous system, if we are able to implement our project in real-time, we can save a lot of energy and can also generate a huge amount of electricity from various techniques.

By using this smart project, we can also detect the speed of the vehicles and by image processing, we can also recognise the number plates of the vehicle. In addition to these, Li-Fi technology can be implemented to this project. By using Li-Fi technology, two-way communication between the vehicles can be achieved. In this two-way communication, the information will be sent to the other vehicles through the headlights of the vehicle. If there are any obstacles happened in the road, then this information will be communicated to the vehicles through the street lights to the headlights of the vehicles and this information can be displayed in lcd screen or through voice message

REFERENCES

[1] M. A. D. Costa, G. H. Costa, A. S. dos Santos, L. Schuh, and J. R. Pinheiro, “A high efficiency autonomous street lighting system based on solar energy and LEDs,” in Proc. Power Electron. Conf., Brazil, Oct. 1, 2009, pp. 265–273.

[2] Po-Yen. Chen, Yi-Hua. Liu, Y.-T. Yau, and H.-C. Lee, “Development of an energy efficient street light driving system,” in Proc. IEEE Int. Conf. Sustain. Energy Technol., Nov. 24–27, 2008, pp. 761–764.

[3] Hengyu Wu, Minli Tang, Guo Huang, ”Design of Multi-functional Street Light Control System Based on AT89S52 Single-chip

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 11 Issue 05, May-2022

Microcomputer." in 2010 2nd International Conference on Industrial Mechatronics and Automation, pp. 134-137.International Journal of Pure and Applied Mathematics Special Issue

[4] Reinhard Mullner and Andreas Riener, "An energy efficient pedestrian aware Smart Street Lighting system," in International Journal of Pervasive Computing and Communications Vol. 7 No. 2, 2011 pp. 147-161.

[5] Li Lian and Li Li, "Wireless Dimming System for LED Street Lamp Based on ZigBee and GPRS", in 2012 3rd International Conference on System Science, Engineering Design and Manufacturing Informatization, pp. 100-102.

[6] Fabio Leccese, " Remote-Control System of High Efficiency and Intelligent Street Lighting Using a ZigBee Network of Devices and Sensors in IEEE TRANSACTIONS ON POWER DELIVERY, VOL. 28, NO. 1, JANUARY 2013, pp. 21-28.

[7] W. Yue, S. Changhong, Z. Xianghong, and Y. Wei, "Design of ne intelligent street light control system,"in Proc. 8th IEEE Int. Conf. Control Autom., Jun. 9–11, 2010, pp. 1423–1427 [6]. C.Bhuvaneshwari, R.Rajeswari, C.Kalaiarasan, Analysis of Solar energy based street light with auto tracking system, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol 2, Issue 7, July 2013

[8] "Intelligent Street Lighting System Using Gsm" International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734,

[9] Long. X: Lino, R: Zhou, J. "Development of street lighting system-based novel high-brightness LED modules." Optoelectronics, IET, vol.3, no.1, pp.40-46, February 2009 doi: 10.1049/topt: 20070076

[10] Xingming Long: Jing Zhou, "An intelligent driver for Light Emitting Diode Street Lighting." Automation Congress, 2008. WAC 2008. World, vol., no., pp. 1-5, Sept. 28 2008-Oct. 2 2008

[11] Po-Yen Chen; Yi-Hua La Yeu-Torng Yau; Hung Chun Lee.. "Development of an energy efficient street light driving system." Sustainable Energy Technologies, 2008. ICSET 2008. IEEE International Conference on vol., no., pp.761-764, 24-27 Nov. 2008 doi:10.1109/ICSET 2008 4747108

[12] http://www.arduino.org/products/boards/arduino-uno

[13] https://www.elprocus.com/solar-powered-led-street-light control-circuit

[14] Rohaida Husin; Syed Abdul Mutalib Al Junid; Zulkifli Abd Majid, "Automatic Street Lighting System for Energy Efficiency based on Cost Microcontroller", DOI 10.5013/USSST.a.13

[15] Alzubaidi, S.: Scari, P.K. "Study on energy efficient street lighting system design," Power Engineering and Optimization Conference (PEDCO) Melaka, Malaysia, 2012 leve International, vol., no., pp.291,295, 6-7 June 2012, doi: 10.1109/PEOCO.2012.62308

[16] Ansis Avotins, Peteris Apse-Apsitis, Maris Kunickis, Leonids Ribickis, "Towards smart street LED lighting systems and preliminary energy saving results", Power and Electrical Engineering of Riga Technical University (RTUCON) 2014 55th International Scientific Conference on, pp. 130-135, 2014.

[17] Abhishek Murthy, Dong Han, Dan Jiang, Talmai Oliveira, "Lighting-Enabled Smart City Applications and Ecosystems based on the loT", Internet of Things (WF-loT) 2015 IEEE 2nd World Forum on, pp. 757-763, 2015

[18]Zeeshan Kaleem, Tae Min Yoon, Chankil Lee, "Energy Efficient Outdoor Light Monitoring and Control Architecture Using Embedded System". Embedded Systems Lotters IEEE, w up 15-21, 2016, ISSN 1943-0663

[19]Abelmoughni Toubal, Billel Bengherbia, Mohamed Ouldenuri Mohamed Maazouz, "Energy effici street lighting control system using wireless sensor networks", Modelling Identification and Control (ICMIC) 2016 8th International Conference on, pp. 919-924, 2016

[20] Bruno A., Di Franco F., Rascona G. 2012. Smart street lighting. EE Times http://www.eetimes.com/design/smart energydesign/ 4375167/Smart-street-lighting