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PYRO AND PV ENERGY STORAGE WITH DC LIGHTING CONTROL BY USING LIGHT INTENSITY

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ABSTRACT

The system uses a TRIAC based light intensity control circuit. The TRIAC controls the voltage applied to the circuit which is proportional to the light intensity. The light intensity is controlled based on the traffic measured by sensors and the system is automatically switched on/off based on the sunrise/sunset information available from reliable internet sources. The power electronics circuit combined with Internet of Things (IoT) devices and software creates a fully autonomous system which reduces unnecessary power consumption in street lights. The system can be monitored and overridden (during emergencies) with the help of a simple Graphical User Interface (GUI.)

Intensity control takes place by the use of power electronics device TRIAC. It is a controlled bidirectional switching device which conducts when a gate pulse is given to the TRIAC. Node MCU also acts as the gate driver circuit and produces the necessary trigger pulses. An OPTO coupler IC is used to isolate the control circuit from the power circuit. The gate pulses are produced with an interval of 10ms as per the zero crossing technique i.e. the instant at which the voltage crosses zero is taken and after the desired delay from the zero crossing point, the gate is triggered. The next triggering instance will be the next zero crossing plus the delay. In this way, an effective gate driver circuit is obtained. Zero crossing detection becomes necessary as it indicates whenever a sine wave signal is going to change direction and voltage being a sinusoidal signal; it plays a major role in implementing the gate driver circuit with ease.

Keyword: GUI, TRIAC, IR, LED

1. INTRODUCTION

The system can be monitored and overridden (during emergencies) with the help of a simple Graphical User Interface (GUI.) Lighting systems are one of the most common electrical systems and are essential to not only the development but also the sustainability of the processes in residential, industrial,

institutional and commercial sectors. The modern interconnected world is built on the backbone of a few fundamental systems including lighting which keeps it running round the clock.

These systems increasingly consume gigantic quantities of power and always operate at a 100% capacity. This leads to unnecessarily increased operational costs and an indirect effect on the environment since most of the power produced still depends on fossil fuels. Thus, the lighting systems are highly inefficient and an unviable financial investment. Manual control of the capacity is cumbersome as the demand may fluctuate and follow trends that may not be easy to identify and utilize manually. Analyzing the problems with current systems provides a direction for the kind of solutions required to improve the efficiency and return on investment of these systems. Current systems do not cater to the dynamic requirement of power. This can be fulfilled with the help of a control circuit working in conjunction with the power system. The lack of a feedback loop for improvement and better utilization of the system is also missing in current systems. IOT devices and systems can be utilized to improve this area. Historical performance of a system is extremely important in the future planning of and up gradation of the system.

The simulations and analysis are done using P Sim. A hardware model has also been created and tested. The intensity of light can be controlled by varying the voltage applied to the lights. It has been noted that a TRIAC which is a bidirectional triode thruster, with appropriate electronic control circuitry can vary the intensity based on the requirements. It stays in conduction mode once a triggering pulse is applied to the gate and the mode of operation can be changed with another pulse. TRIAC can control current switching on both halves of an alternating waveform which allows much better power utilization.

The intensity is varied according to the hourly traffic near the light monitored using an ultrasonic or other motion detection sensors. The sensors are controlled using an Arduino microcontroller which sends the data to the Node MCU module. The recorded data is sent to by the Node MCU to a local server or it can also be stored on a cloud service. The recorded data is analyzed to extract periodic trends which are used to set the intensity. Sunrise/sunset data is taken from weather websites to automatically turn on/off the system. A master switch for manual control is also provided in the GUI.

2. RELATED WORK

[1] “Arduino Based Auto Street Light Intensity Controller” There is a time slot allotted during which the intensity of the system keeps reducing and turns the lights OFF at morning. The time slot starts when it is specified. Reduction of intensity starts gradually at midnight when it is not much dark and there is not much traffic and is switched OFF at 6 in the morning. Some use IR (Infrared Ray) sensors to detect vehicles. Existing systems do overcome the drawbacks of HID based systems, but do not save enough energy as they are time based also in seasons like monsoon the environment remains dark compared to regular days. Winters bring the fog and if the lights are dim it could result into a great accident or disaster. Therefore still some improvements in systems like these are needed. Time slot based systems consider the time slot as an advantage, but it actually is a drawback as it could not work in all conditions. it needs to be customized if it is to be implemented in foreign countries due to time differences. Also, if any, hardware failure or error occurs, it could be expensive to solve it. Thus, another system is needed which overcomes these drawbacks.

[2] “Design of Modern Solar Street Light Intensity Controller: An Energy Saving Approach” Energy is the primary and most universal measure of all kinds of work by human being and nature.

Energy is a crucial commodity in the process of economic, social and industrial development. As conventional energy sources are depleting day by day, utilization of alternative energy source is the only solution. The increased power demand, depleting fossil fuel resources and growing environmental pollution have led the world to think seriously for other alternative source of energy and save this energy as much as possible. In this paper we design an automatic dark detector and auto intensity control of street light and it will take energy from the sun as well as from local grid.

Photo diodes (PD) are used at one side of the road. One switching transistor (ST) is meant for each PD. Each reversed biased PD is connection to the base of the ST. one infra-red (IR) diodes faces each PD on the other side of the road. When used no vehicle obstruction is there, the IR ray falls on the PD forcing the ST that conducts form controller to emitter like a switch. One variable resistor is used to control adequate base current of ST, as parameters of each conducting PD may be different from each other, while IR rays fall upon. The conducting ST develops a logic zero state at it's collector that feeds one of the microcontroller pins that acts as an input. Eight such inputs are made by above arrangement.

[3] "Design and Control of Street Light Intensity for Fog and Rain" This paper presents smart LED street light system which controls intensity of light during rain and fog. The system works first on colour sensor and then LASER beam light is used to detect the fog,according to that the intensity of LED light has been varied.If the beam of LASER light received by the color sensor is very less then brightness of LED will be increased and when there is no fog or rain the intensity of light will remain low. This system is achieved by using ARDUINO, LED lights and LED dimming control PWM circuit. The power consumption by using LED and intensity variation graph of street light has been shown through MATLAB. By using PWM circuit, current and voltages values are presented. The mechanism of circuit depends on pulse width modulation and analog to digital convertor features of microcontroller.

3. CONVENTIONAL METHOD

IOT (internet of things) has become one of the most powerful tools for collecting and utilizing data. An autonomous and highly efficient lighting system can be created by combining the power of iot with power electronics and traffic sensors. Simple circuit using ac supply, TRIAC, pulse width modulation (PWM) wave generator for triggering TRIAC, resistor (representing street lamp) etc. Was implemented and analyzed for different values of firing angles. At different values of firing angle corresponding RMS values of output voltage were noted. These firing angles are used for the controlling the intensity.

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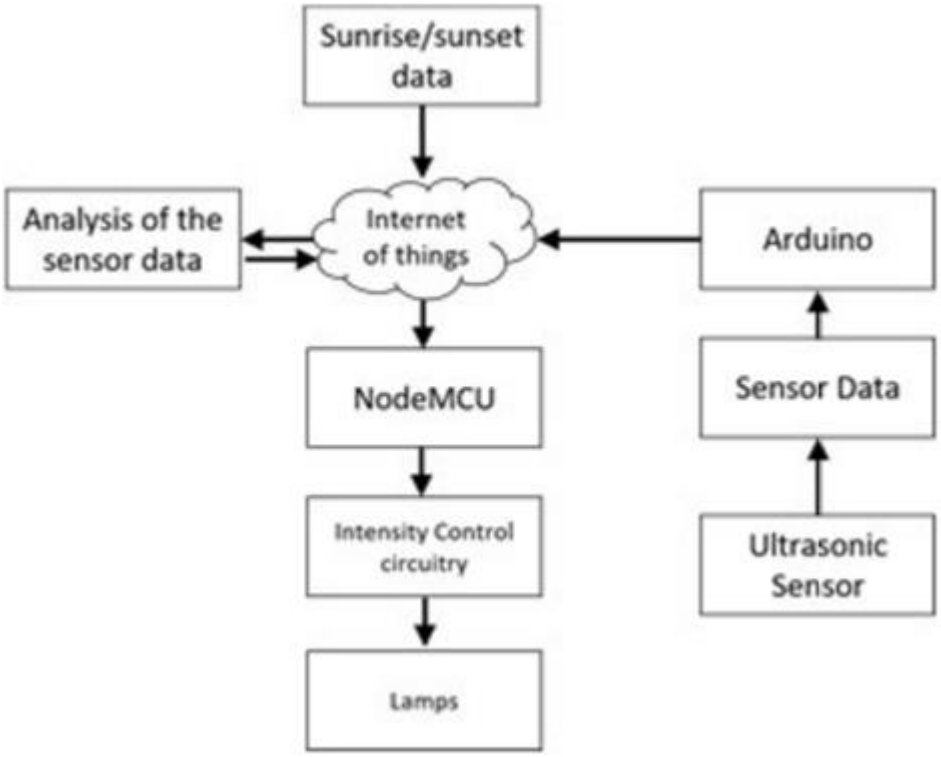

Fig 1.1 Existing Block Diagram

4. PROPOSED SYSTEM

This system has automatic street light intensity control based on the vehicular movement and switching ON and OFF of street lights depending on the light ambiance. This will help in reducing the power consumption during hours of meager road usage. The street light module is installed consequently for every certain distance. Street lighting provides a safe night time environment for all road users including pedestrians. Research indicates that night-time vehicular accidents are significantly reduced by the provision of street lighting. It also helps to reduce the fear of crime, and encourages social inclusion by providing an environment in which people feel they can walk in hours of darkness. Providing street lighting is one of the most important and expensive responsibilities of a city.

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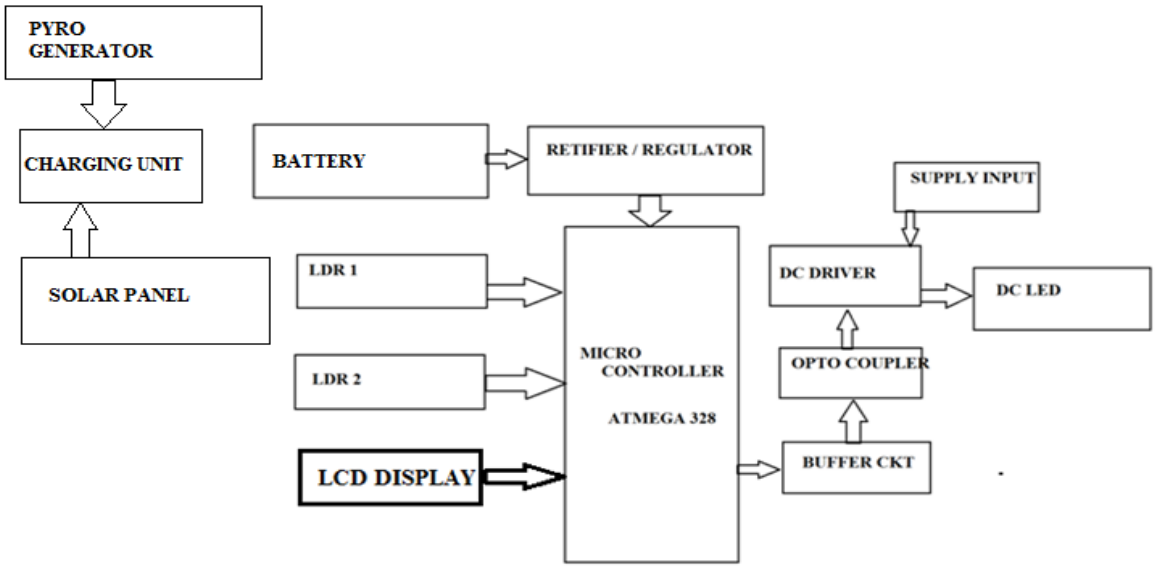

Fig 1.2 Proposed Block Diagram

5. SIMULATION RESULT

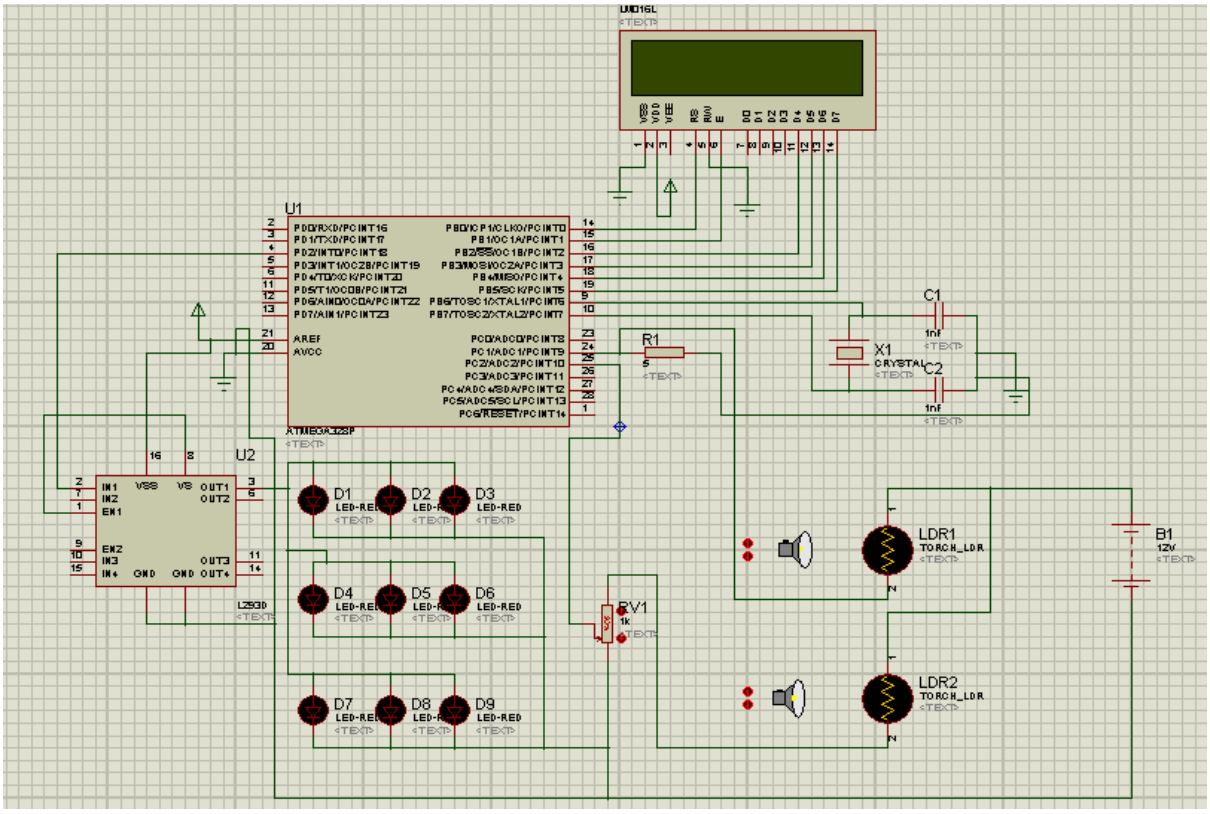

Fig 1.3 Simulation Result

6. CONCLUSION

This paper is aimed at designing and implementation of an automatic system where in the street lights that are not required through the night can be dimmed. Additionally, the ambiance of light is checked and lights are turned ON when it is dark and turned OFF during the day. Our government is striving hard to provide electricity to customers. Thus this paper once implemented on a large scale can bring in significant reductions in the power consumption caused by street lights. This initiative will help the government to save this energy and meet the domestic and industrial needs. Alcohol-impaired driving remains a serious national problem that tragically affects many victims annually. The proportion of crashes that are alcohol-related is still a point of consideration. This paper also aims at detecting consumption of alcohol by the driver and if it exceeds certain level it impairs the driver from entering into the vehicle.

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