

ZIGBEE WIRELESS COMMUNICATION FOR MONITORING RENEWABLE STREET LIGHT SYSTEM

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Abstract - *The advancement of technology brings advantages to human race to certain extent. Unfortunately, some of the technological inventions not only brings advantages, but also disadvantages. One of the disadvantages is the pollution of environment. Therefore, to prevent the pollution from getting worse, environmental-friendly aspect is suggested to be included in new inventions now-a-days .The proposed system consists of microcontroller, rechargeable battery, solar panel, light sensor, working sensor, ZIGBEE. The light sensor which is placed at the top of street light system detects the day or night. For every couple of street lights LDRs are placed to detect the vehicle light, whenever a vehicle arrives at the street light the corresponding lights will be ON. The working sensor used to check the light condition. A ZIGBEE is placed to check the each and every status of light from monitoring section.*

Key Words: ZIGBEE,LDR,LED,Microcontroller,light sensors,solar panel

1.INTRODUCTION

The world is increasing experiencing a great need of additional energy resources so as to reduce dependency on conventional sources. Renewable energy became an essential source for many applications in the last four decades. The existing electric grids are not capable of supplying the electric need. Thus the Solar Battery Charging[5] and Load Protection is a new project that has emerged to the rural India as well as in urban areas to change the scenario.

The project is designed to detect vehicle movement on highways/rural areas to switch ON only a block of street lights[4] ahead of it and to switch OFF the trailing lights to save energy. During night all the lights on the highway/rural areas remain ON for the vehicles, but lots of energy is wasted when there is no vehicle movement. This proposed system

provides a solution for energy saving. This is achieved by sensing an approaching vehicle and then switches ON a block of street lights ahead of the vehicle. As the vehicle passes by, the trailing lights switch OFF automatically. Thus, we save a lot of energy. So when there are no vehicles on the highway, then all the lights remain OFF. High Intensity Discharge Lamp (HID) presently used for urban street light are based on principle of gas discharge, thus the intensity is not controllable by any voltage reduction. White Light Emitting Diode (LED) based lamps are soon replacing the HID lamps in street light. Sensors[2] used on either side of the road senses vehicle movement and sends logic commands to microcontroller to switch ON/OFF the LEDs. Thus this way of dynamically ON/OFF helps in saving a lot of energy.

2.HARDWARE DISCRIPTION

2.1 Solar panels

Converting solar energy into electrical energy by PV installations is the most recognized way to use solar energy. Fig 1 shows the functioning of photovoltaic cells.Since solar photovoltaic cells are semiconductor devices, they have a lot in common with processing and production techniques of other semiconductor devices such as computers and memory chips. As it is well known, the requirements for purity and quality control of semiconductor devices are quite large. With today's production, which reached a large scale, the whole industry production of solar cells has been developed and, due to low production cost, it is mostly located in the Far East.

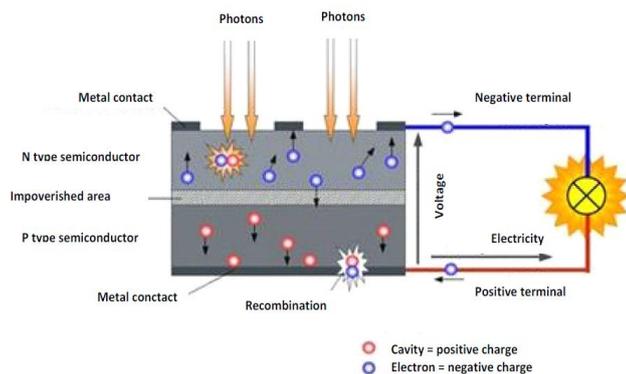


Fig- 1: Functioning Of Photovoltaic cells

2.2 Power Supply

The input to the circuit is applied from the regulated power supply. The input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. Fig 3 shows the regulated power supply to rectifier. The output obtained from the rectifier is a pulsating dc voltage. So in order to get a pure dc voltage, the output voltage from the rectifier is fed to a filter to remove any arc components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

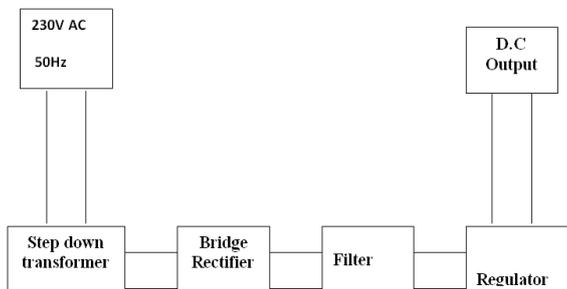


Fig-2: Regulated Power supply

2.3 Streetlight Designing

The idea of designing a new system for the streetlight that do not consume huge amount of electricity and illuminate large areas with the highest intensity of light is concerning each engineer working in this field. Providing street lighting is one of the most important and expensive responsibilities of a city. Lighting can account for 10–38% of the total energy bill in typical cities worldwide.

Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Fig 4 shows the block diagram for solar LED for street lighting. Inefficient lighting wastes significant financial

resources every year, and poor lighting creates unsafe conditions. Energy efficient technologies and design mechanism can reduce cost of the street lighting drastically. Manual control is prone to errors and leads to energy wastages and manually dimming during mid-night is impracticable. Also, dynamically tracking the light level is manually impracticable. The current trend is the introduction of automation and remote management solutions to control street lighting.

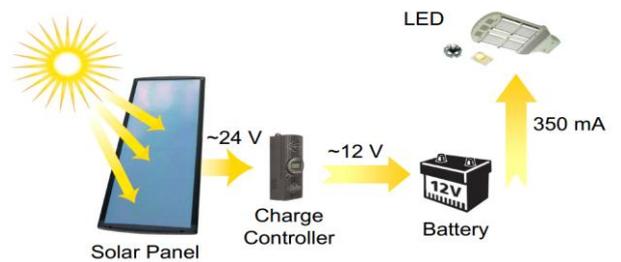


Fig-3: Block Diagram for Solar LED for Street Lighting

2.4 Transformer

Usually, DC voltages are required to operate various electronic equipment and these voltages are 5V, 9V or 12V. But these voltages cannot be obtained directly. Thus the ac input available at the mains supply i.e., 230V is to be brought down to the required voltage level. This is done by a transformer. Thus, a step down transformer is employed to decrease the voltage to a required level. So, here we are using a transformer of rating (12-0-12) V, 750mA.

2.5 Rectifier

A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification. Physically, rectifiers take a number of forms, including vacuum tube diodes, mercury-arc valves, copper and selenium oxide rectifiers, semiconductor diodes, silicon-controlled rectifiers and other silicon-based semiconductor switches. Historically, even synchronous electromechanical switches and motors have been used. Early radio receivers, called crystal radios, used a "cat's whisker" of fine wire pressing on a crystal of galena (lead sulfide) to serve as a point-contact rectifier or "crystal detector".

2.6 Sensor

To detect the movement in the street, the IR sensors have been used in this project, where emitter and receiver are in

one unit. Light from the emitter strikes the target and the reflected light is diffused from the surface at all angles. If the receiver receives enough reflected light the output will switch states. When no light is reflected back to the receiver the output returns to its original state. In diffuse scanning the emitter is placed perpendicular to the target. The receiver will be at some angle in order to receive some of the scattered (diffuse) reflection.

2.7 Microcontroller

Microprocessors and microcontrollers are widely used in embedded systems products. Microcontroller is a programmable device. A microcontroller has a CPU in addition to a fixed amount of RAM, ROM, I/O ports and a timer embedded[3] all on a single chip. The fixed amount of on-chip ROM, RAM and number of I/O ports in microcontrollers makes them ideal for many applications in which cost and space are critical. The Intel 8051 is Harvard architecture, single chip microcontroller (μC) which was developed by Intel in 1980 for use in embedded systems. It was popular in the 1980s and early 1990s, but today it has largely been superseded by a vast range of enhanced devices with 8052-compatible processor cores that are manufactured by more than 20 independent manufacturers including Atmel, Infineon Technologies and Maxim Integrated Products.

3. BLOCK DIAGRAM OF POWER SUPPLY FROM GRID TO THE STREET LIGHTING.

Fig:4 shows the block diagram representation of connection of power supply from grid to the street lighting. In this connection, the 230V ac supply is stepped down to our desired voltage level (i.e., 12V) with the help of a step down transformer. And now, this 12V ac supply is converted into 12V dc supply with the help of a modern rectifier. This 12V dc supply is passed through a modern rectifier to become pulsating dc supply. And this 12V dc supply is further allowed through capacitors/filters to become ripple free and pure dc supply. Here, the 12V dc supply is regulated to our desired level i.e., 5V dc with the help of a voltage regulator 7805. This 5V dc is supplied to the LEDs which are available for street lighting and also for the microcontroller 8051 and the IC555 timer.

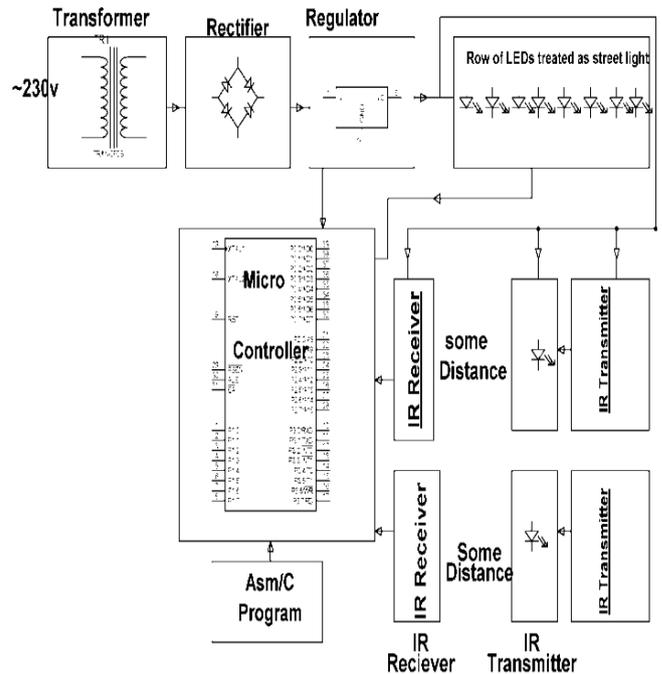


Fig-4: Block diagram

4.ZIGBEE



Fig-5:zigbee module

Zigbee is a low power spin off of WiFi. It is a specification for small, low power radios based on IEEE 802.15.4 – 2003 Wireless Personal Area Networks standard. Fig .1 shows zigbee module. The specification was accepted and ratified by the Zigbee alliance in December 2004.. Many years ago, when Bluetooth technology was introduced, it was thought that Bluetooth would make Wi-Fi redundant. But the two coexist quite well today, so do many other Wireless standards like Wireless HART and ISA100.11a. Then why would we need another WPAN standard like Zigbee? The answer is, the application focus of Zigbee Alliance - low cost and low power for energy efficient and cost effective intelligent devices. Moreover, Zigbee and Bluetooth have different application focus. Despite of all their similarities,

desired rating devices and components should be implemented practically. So, finally from the results observed in the prototype we can clearly say that a large amount of power can be saved by the use of automatic ON/OFF mechanism of street lighting in addition to renewable source of energy i.e., solar energy. Highly efficient solutions like MPPT are needed to maximize the efficiency from solar panels. Expectations are increasing for solar-powered LED lighting to become the environmentally friendly outdoor solution for the 21st century.

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