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Arduino Based Solar Street Lightning

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Abstract: ***It is about automation of street lighting systems and efficient application of street lights by using arduino. Nowadays energy crisis is taking place in India which is an important crisis. Energy loss takes place due to street lights which consume enormous electric energy. In the present study, smart street lighting systems are developed to ensure efficient street lighting and reduce consumption of electric energy. When no movement is detected using infrared sensors auto intensity light control helps in dimming the street lights. Design of such systems which have efficient applications do not only achieve energy saving but also extends the service life of street lighting equipment. How energy savings in public systems can be saved with different viewpoints are discussed here.***

Keywords: arduino, led, solar, street lighting.

I. INTRODUCTION

Conservation of our energy or sources is very essential as mostly we depend on energy sources like coal and natural gas that can't be replaced. In today's Era we all are well acquainted with our nation's energy scenario. We are well aware of fact that not only available power is less than wasted on large scale. The wastage is in form of unnecessary usage of lighting, low power factor and similar other factors. As we know major source of energy to produce electricity is hydroelectricity energy i.e. energy is generated using water force which is converted into potential energy which ultimately leads to increase the cost required to produce energy, instead if we use solar energy it would be cost efficient . So it is necessary for efficient and renewable energy system that has greater advantages. Most of time we see street lights are ON even after sunrise thus by having an smart system which turns ON and OFF street lights of given time or when ambient light falls below a specific intensity. In our project we are using motion sensors i.e. IR sensors which detect the motion of the object passing through it, using this motion of object LED's are turned ON using Arduino. Solar energy is the main renewable source utilized from biomass and solar collectors to provide ventilation specifically driven by solar power. To achieve the various concepts have been considered in order to optimize zero carbon emissions with regard to fossils fuel, over the life of a commercial sized building.

II. REVIEW OF RELATED LITERATURE

Street lights in the beginning were manually controlled; latter they were controlled via time control and optical control man-ner. These methods are very costly and noted for difficulty in monitoring. They involve high power consumption. The universal observation is that about 20% power consumption occurs through street lighting system due to their designs as per old standards which do not incorporate the latest technology features. There are three possible solutions for the problems mentioned above. First possibility is use of Renewable energy source in the place of the conventional source. The second is utilization of the latest possible LED technology which offers many bene-fits like, environment friendliness, energy efficiency and about a 50% saving in power consumption. The third is the Remote-Control system

III. PROCESS DESCRIPTION

In this project, basically solar panels are used to charge batteries by converting sunlight into electric energy, reflecting below block diagram Ato control charging. This project works on principle of solar cell. This project is designed for LED based street lights with scheduled ON time control by an Arduino board using solar power from solar cells and rechargeable battery.

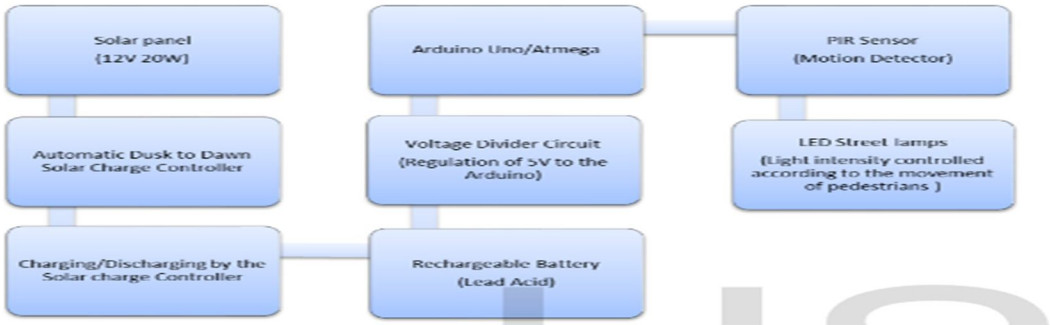


Fig:1 Block Diagram

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A. Solar Panel

Solar panel is one of the most important parts of solar street lights, as solar panel will convert solar energy into electricity. There are 2 types of solar panel: monocrystalline and poly-crystalline. Conversion rate of monocrystalline solar panel is much higher than polycrystalline.

Types of Lamps	Luminious Efficiency	Lamp Life (in hour)
High Pressure Sodium	50-150	1500-2400
Fluorescent	100-120	15000-20000
LED	70-160	4000-9000

Table 1: Life span of different lamps

1) Equation For Efficiency Of Solar Panel

For e.g.: Suppose 250W panel ,1675mm long and 1001mm wide, efficiency is calculated using below equations
Its surface area is calculated as:
Surface area=l*b
=1675mm*1001mm
=1.675sq.m
At STC watts per meter sq. (w/sq.m)=1000w/sq.m
Efficiency=245/(1.675*1000)=0.1462
%Efficiency=0.1462*100
=14.62%

B. Arduino ATmega2560

The Arduino Mega is a microcontroller board based on theATmega1280. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4UARTs (hardware serial ports), a 16MHzcrystaloscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the micro-controller; simply connect it to a computerwith a USB cable or power it with a adapter.

C. PIR Sensor

An IR sensor is an infrared electronic device that emits in or-der to sense some aspects of the surroundings. PIR sensors are commonly called simply "PIR", or sometimes "PID", for "passive infrared detector". The term *passive* refers to the fact that PIR devices do not radiate energy for detection purposes. They work entirely by detecting infrared radiation (radiant heat) emitted by or reflected from objects. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor. A PIR sensor can also be called as a motion sensor.

D. Lighting Fixtures

LED is usually used as lighting source of modern solar street light, as the LED will provide much higher Lumens with lower energy consumption. From Table.1 the energy consumption of LED fixture is at least 50% lower than HPS fixture which is widely used as lighting source in Traditional street lights. LED's lack of warm up time also allows for use of motion detectors for additional efficiency gains.

E. Rechargeable Battery

Referring Fig.1, Battery will store the electricity from solar panel during the day and provide energy to the fixture during night. The life cycle of the battery is very important to the life-time of the light and night. The life cycle of the battery is very important to the life-time of the light and the capacity of the battery will affect the backup days of the lights. There are usually 2 types of batter-ies: Gel Cell Deep Cycle Battery and Lead Acid Battery and many more. There are some guidance which must be followed for lighting streets. Guidance for lighting of public streets, roads, and highways is provided in the Indian Standard (BIS, 1981). Since these guide-lines are not enforced by any regulatory authority, it is common for municipalities to be unaware of the standards, and many fail to comply.

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IV. MERITS AND DEMERITS

A. Merits

1) Solar street light is independent of grid as a result of this operating cost is much low.
2) Maintenance cost is much low compared to conventional street light.
3) Intensity of LED can be controlled effectively without changes in its light color which is not possible in case of HPS.
4) Risk of accidents is very low.
5) Environmental friendly, no harmful emissions.
6) Longer life compared to conventional street lights.
7) Power consumption is lower.
8) Solar street lights are independent of the utility grid, hence operation cost are minimized.
9) Since external wires are eliminated, risk of accidents is low
10) Non-polluting source of electricity.

B. Demerits

1) Initial investment is very high.
2) Rechargeable batteries have to be replaced from time to time
3) Non-availability of sunlight during rainy and winter seasons is a problem.
4) Dust accumulation on the surface of panel creates a problem.

V. CONCLUSION

The paper describes an automatic solar panel based LED street lighting system; it integrates latest technology such as LED technology and Renewable Energy Source in order to reduce power consumption, cost and manual controlling method. 20-25% of power consumption and maintenance cost is reduced through this prototype. This street lighting system is appropriate for rural and urban areas. The designed system is flexible, extendable and fully adjustable to us.

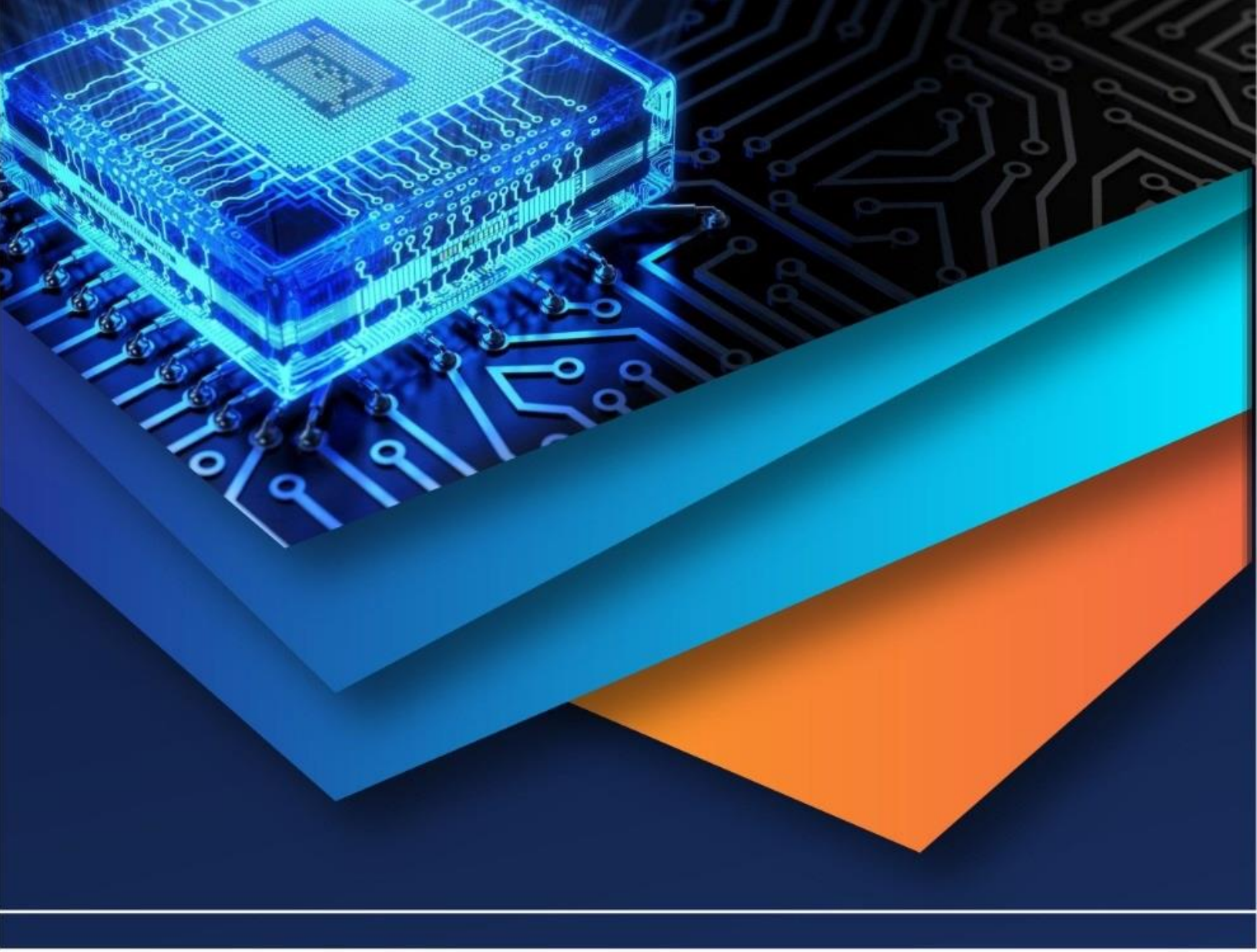
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