IMPLEMENTATION OF LOW COST AUTOMATIC SOLAR STREET LIGHT CONTROL USING LDR

KEYWORDS Graphical User Interface (GUI), Light Depending Resistor (LDR), Light Emitting Diode (LED).

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ABSTRACT Now-a-days, it became essential for people who are working in nights and returning back to homes at late nights; crime rate is also increased during night times. This can be best overcome by implementing proper solar based lighting system on Streets. We will get more power consumption, saving money through solar panel. Also saving our precious time and should decrease the huge human power from the LDR, IR Sensors. The Street lights are controlled through a specially designed Graphical User Interface (GUI) in the PC. In this paper a new method is suggested so as to maximize the efficiency of the street lighting system and to conserve the energy using the LED lights sensors. Here automation of street lights is done by LDR sensor. Intensity of led street lights can be controlled by IR sensor and pulse width modulation.

I.INTRODUCTION

It is very common to see solar PV based street lights. People became aware about the importance of moving from conventional resources based energy production to renewable energy based power production. We all know that fossil fuel resources are going to fed us for only 50-60 years from now. So it is high time for us to shift to renewable energy based power production and usage as it is the only alternative available. It is sure that we can't live in a society without power. So we need to maximize the usage of renewable energy in order to preserve conventional resources.

Normal solar PV based street lighting system lacks automation. The problem is that power is getting wasted during daytime. In this paper a new technique is suggested to automate the entire system. Here when there is no necessity of light the system will go into a power down mode and the lamps won't glow. Sensors sense the intensity of light and presence sensor is used to detect the presence of humans or cars and then it gets turned on automatically.

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.

LDR, which varies according to the amount of light falling on its surface, this gives an inductions for whether it is a day-night time, which can be controlled by Ic555.

In this paper, using the LDR we can operate the lights, i.e. when the light is available then it will be in the OFF state and when it is dark the light will be in ON state, it means LDR is inversely proportional to light. When the light falls on the LDR it sends the commands to the Timer IC that it should be in the OFF state then it switch OFF the light.

The practicality of doing so will be examined, as well as the benefits and drawbacks. In addition, the use of solar energy is currently applied will be noted. Due to the nature of solar energy, two components are required to have a function as solar energy generator. These two components are acollector and a storage unit. The collector simply collects the radiation that falls on it and converts a fraction of it to other forms of energy (either electricity and heat or heat alone). The storage unit is required because of the non-constant nature of solar energy; at certain times only a very small amount of radiation will be received. At night or during heavy cloud cover, for example, the amount of energy produced by the collector will be quite small.

In this paper, the Automatic Solar street light control are designed in very low cost and simple circuits, which are designed by LDR. The rest of this paper is organized as follows. A brief overview of proposed system of Automatic Solar street light control is presented in Section II. In Section III, the proposed Delay Line Controller is designed. Section IV gives the details of the simulation results and its performances. Section V gives the conclusion of this work.

II. PROPOSED SYSTEM OF AUTOMATIC SOLAR STREET LIGHT CONTROL

LDR is a light dependent resistor which is having very high resistance. Whose resistance decreases when light impinges on it. This kind of sensor is commonly used in light sensor circuits in open areas, to control street lamps. This LDR mainly used to differentiate day and night light.

This proposed system may be criticized as being expensive however we must consider its advantages slightly higher prices

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of the lampposts are compensated by lack of costly wiring and the availability of power network and considerably lower prices of maintenance (due to central management and reliability of LEDs).Energy savings are of utmost importance today.

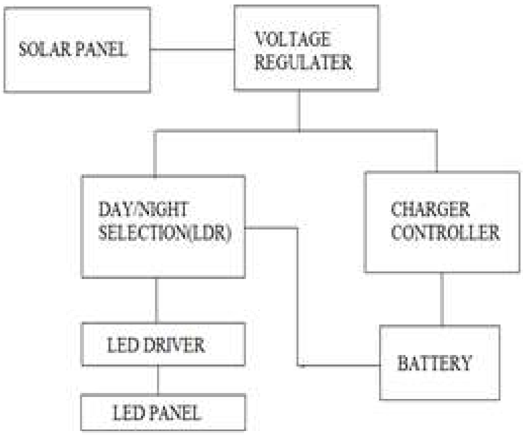

Figure:1 Block Diagram of Proposed system

The goal is, therefore, the reduction of operating prices of street lighting with the creation of a system characterized by straightforward installation and low power consumption, powered by a renewable supply of energy through solar panels with no harmful atmosphere emissions and minimizing light pollution.

Making a short comparison with the normal street lighting systems: Supposing that one lamp is switched on for 4,000 hours per year. One streetlight has a median consumption of 200 W yearly. With the system presented in this paper, every lamp uses about 20-25 W (95% of energy consumed by the LEDs). Based on the field tests another possibility of energy savings becomes evident.

Classical system consumes energy independently if it is needed or not. It is active for about 10 hours daily and the total number of working hours is about 300 per month, versus 87-108 hours proposed system, savings of about 66% to 71% are expected. The savings may be improved by using more efficient LEDs, since the consumed energy almost entirely depends on LEDs consumption.

III. DESCRIPTION AUTOMATIC OF SOLAR STREET LIGHT CONTROL

Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. A photovoltaic (in short PV) module is a packaged, connected assembly of typically 6×10 solar cells. Solar Photovoltaic panels constitute the solar array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions, and typically ranges from 100 to 365 watts. The efficiency of a module determines the area of a module given the same rated output – an 8% efficient 230 watt module will have twice the area of a 16% efficient 230 watt module. There are a few solar panels available that are exceeding 19% efficiency.

Solar modules use light energy (photons) from the sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells based on cadmium telluride or silicon. The structural (load carrying) member of a module can either be the top layer or the back layer. Cells must also be protected from mechanical damage and moisture. Most solar modules are rigid, but semi-flexible ones are available, based on thin-film cells. These early solar modules were first used in space in 1958.

Electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired current capability. The conducting wires that take the current off the modules may contain silver, copper or other non-magnetic conductive [transition metals]. The cells must be connected electrically to one another and to the rest of the system. Externally, popular terrestrial usage photovoltaic modules use MC3 (older) or MC4 connectors to facilitate easy weatherproof connections to the rest of the system.

Bypass diodes may be incorporated or used externally, in case of partial module shading, to maximize the output of module sections still illuminated.

Some recent solar module designs include concentrators in which light is focused by lenses or mirrors onto an array of smaller cells. This enables the use of cells with a high cost per unit area (such as gallium arsenide) in a cost-effective way.

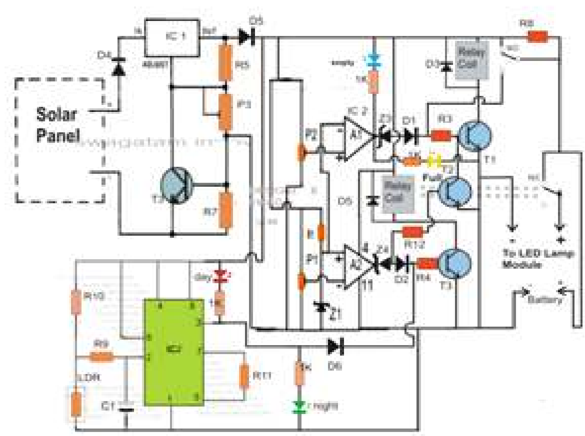

Figure:2 Circuit of automatic of solar street light control

A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes a panel or an array of solar modules, a solar inverter, and sometimes a battery and/or solar tracker and interconnection wiring. The price of solar power, together with batteries for storage, has continued to fall so that in many countries it is cheaper than ordinary fossil fuel electricity from the grid (there is "grid parity").

3.1 VOLTAGE REGULATOR (LM338):

LM338 are adjustable 3-terminal positive voltage regulators capable of supplying in excess of 5 A over a 1.2 V to 32 V output range. They are exceptionally easy to use and require only 2 resistors to set the output voltage.

3.2AUTOMATIC VOLTAGE REGULATOR (AVR):

To control the output of generators (as seen in ships and power stations, or on oil rigs, greenhouses and emergency power systems) automatic voltage regulators are used. This is an active system. While the basic principle is the same, the system itself is more complex. An automatic voltage regulator (or AVR for short) consists of several components such as diodes, capacitors, resistors and potentiometers or even microcontrollers, all placed on a circuit board. This is then mounted near the generator and connected with several wires to measure and adjust the generator.

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3.3 OPERATIONAL AMPLIFIER (LM324):
The LM324 is Single Supply Quad Operational Amplifiers. The LM324 series are low−cost, quad operational amplifiers with true differential inputs. They have several distinct advantages over standard operational amplifier types in single supply applications. The quad amplifier can operate at supply voltages as low as 3.0 V or as high as 32 V with quiescent currents about one−fifth of those associated with the MC1741 (on a per amplifier basis). The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing components in many applications. The output voltage range also includes the negative power supply voltage.

3.4 TIMER IC (IC555):
The LM555 is a highly stable device for generating accurate time delays or oscillation. Additional terminals are provided for triggering or resetting if desired. In the time delay mode of operation, the time is precisely controlled by one external resistor and capacitor.

3.5 LIGHT EMITTING DIODE (LED):
Light-emitting diodes (LEDs) are promising lighting sources for general lighting applications with the promise of being more than ten times as efficient as incandescent lighting. Such characteristic combined with their long operating life and reliability has made them becoming a potential choice for next generation of lighting systems including automotive, emergency, backlight, indoor, and outdoor. To ensure proper operation and to control the light intensity, LEDs need an efficient driver, normally implemented by power electronics-based conversion stages, to match the LED characteristics with the AC grid voltage and to generate a controllable, high quality light.

3.6 LIGHT DEPENDING RESISTOR (LDR):
The theoretical concept of the light sensor lies behind, which is used in this circuit as a darkness detector. The LDR is a resistor as shown in Fig. 2, and its resistance varies according to the amount of light falling on its surface. When the LDR detect light its resistance will get decreased, thus if it detects darkness its resistance will increase.

3.7 HEAT SINK:
A heat sink (also commonly spelled heatsink) is a passive heat exchanger that transfers the heat generated by an electronic or a mechanical device into a coolant fluid in motion. Then-transferred heat leaves the device with the fluid in motion, therefore allowing the regulation of the device temperature at physically feasible levels. In computers, heat sinks are used to cool central processing units or graphics processors. Heat sinks are used with high-power semiconductor devices such as power transistors and optoelectronics such as lasers and light emitting diodes (LEDs), where the heat dissipation ability of the basic device is insufficient to moderate its temperature.

IV. SIMULATION RESULT AND PERFORMANCE COMPARISON
In this simulation result, the output of Voltage Regulator Maximum voltage is 14.3 volts, current limited to 4.4 Amps.

The Cut OFF of Battery Full is 13.98 volts (set by P2) and the Cut OFF of Low Battery is 11.04 volts (set by P1).When the Battery Reached 13.98 Volts, The Charging section is Disconnect and the Battery Reached 11.98 Volts, The Charging section is Connect.

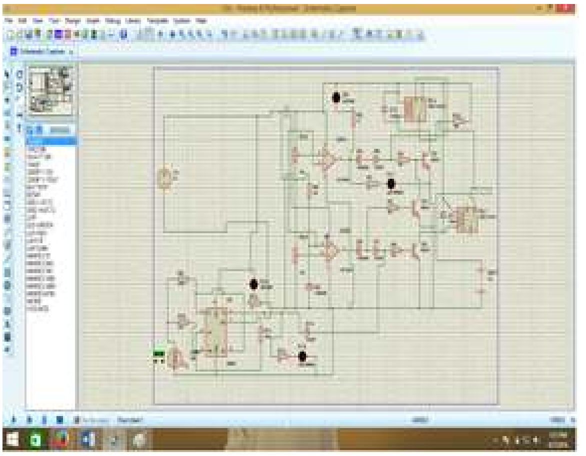

Figure:3 Day/ Night And Charger Controller Section in Proteus

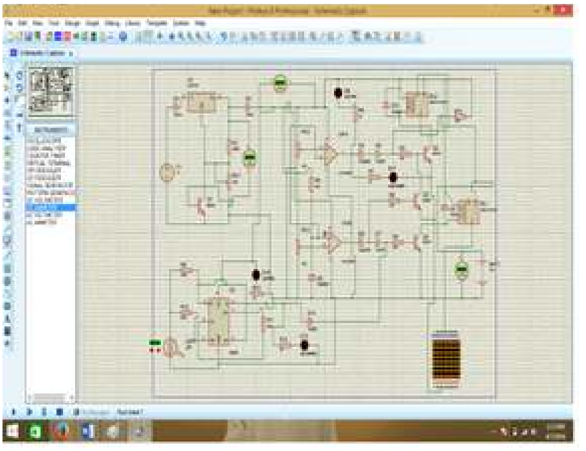

Figure:4 Schematic Result of Automatic Day/Night Switching with LDR Sensor in Proteus

Automatic Day/Night Switching with LDR Sensor (set by selecting R10 appropriately).LDR reached 2k ohm resistance. Day section will be activated.LDR reached 410k ohm resistance. Night section will be activated.

TABLE:I COMPARISON OF SOLAR LED STREET LIGHT PERFORMANCE Sl.No

Sl.No	Description	Tamilnadu GOVT (Microcontroller based)	Private company (LDR Based)	Proposed work (LDR Based)
1	Power consumption	High(400w)	Medium (100w)	Low (40w)
2	Battery and circuit size	large	small	Very small
3	Working time	12hrs (constant)	LDR based	LDR based
4	Cost	high	High	Low
5	Maintenance	less	Less	Less
6	Rework & Repair	complicated	Easy	Very easy
7	Charging power & voltage level	High (80w, 24volt)	Low (60w, 20volt)	Low (40w, 16volt)

8	Implementation	complex	Easy	Easy (very simple circuit mechanism)
9	Charging time	8hrs	6hrs	6hrs
10	Lumens	1800	2000	2000

The Comparison of Solar LED street light performance as explained in Table I.This paper result is compared with Tamilnadu Government and Private Company. The Overall Estimation level of Solar LED street light as compared in Table.II.

TABLE:II COMPARISON OF SOLAR LED STREET LIGHT OVER ALL ESTIMATE LEVEL

Sl.No	Description	Tamilnadu GOVT (Microcontroller based)	Private Company (LDR Based)	Proposed work (LDR Based)
1	Solar Module	4500 (80W)	3800 (60W)	3145 (40W)
2	Lead Acid Battery	3500 (40AH)	2500 (30AH)	1800 (26AH)
3	Solar Charge controller 12 volts / 6 Amp	800	500	300
4	Date/ night section	1000	600	100
5	Aluminum Die cast LED	800	800	350
6	Edison Make LED of 1 watt	700	800	250
7	LED Driver	500	500	50
8	Wires	50	50	50
9	GI pole of 17 feet with fitting for	2000	1800	1300
10	Battery Box	600	500	250
11	Concrete foundation	1500	1300	700
12	Labour	1500	1000	800
TOTAL	17450/-Rs	13550/- Rs	9250/- Rs	

V. CONCLUSION

As Government of India is concentrating on solar domain as an alternative energy resource, we developed a low cost and high efficient automatic solar street light and implemented successfully. In future we are aiming on high end solar devices for all kind of budgets. In account of this , we are planning to extend this project to the next level by developing various solar devices at low costs. This concept clearly tackles the two problems that world is facing today, saving of energy and also disposal of incandescent lamps, very efficiently. Initial cost and maintenance can be the draw backs of this project. With the advances in technology and good resource planning, the cost of the project can be cut down and also with the use of good equipment, the maintenance can also be reduced by periodical checking. The LEDs have long life, emit cool light, donor have any toxic material and can be used for fast switching. For these reasons our project presents far more advantages which can over shadow the present limitations. Keeping in view the long term benefits and the initial cost would never be a problem as the investment return time is very less. This paper has scope in various other applications like for providing lighting in industries, campuses and parking slots of huge shopping malls. This can also be used for surveillance in corporate campuses and industries.

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