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All in One Solar Street Light

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Abstract - *All In One Solar street light is a compact integrating Solar panels, LED light,Battery,RTC, Arduino, Gas sensor and a PIR motion sensor. Due to its compact size, this light can be easily mounted on pole top by anyone. Light is operated on automatically with using RTC.The light has automatic dusk to dawn operation and needs negligible maintenance once installed. The All in One Solar Street light uses high quality material and is designed for Indian environments. They also provide external Theft Protection for solar kit and indication are provided by Buzzer.*

***KEY WORDS*: Solar Panel, Battery, ATMega328, TC,PIR Sensor, pollution Sensor, Theft Protection.**

1.INTRODUCTION

All In One Solar street light is a compact integrating Solar panels, LED light, Rechargeable Battery, RTC, Arduino, Gas sensor and a PIR motion sensor. All In One Solar street light uses a PIR motion sensor to adjust the LED light brightness intelligently. On detecting any movement in 12m radius around the light, the LED glows at full brightness. If no movement is detected for more than 1 minute, the brightness is reduced to one-third. This intelligent brightness control coupled with maintenance free Rechargeable battery technology provides longer backup time and better battery life. Due to its compact size, this light can be easily mounted on pole top by anyone. The light has automatic dusk to dawn operation and needs negligible maintenance once installed. The All in One Solar Street light uses high quality material and is designed for Indian environments. It even gives indication to the user that the Solar panel is alert form theft.

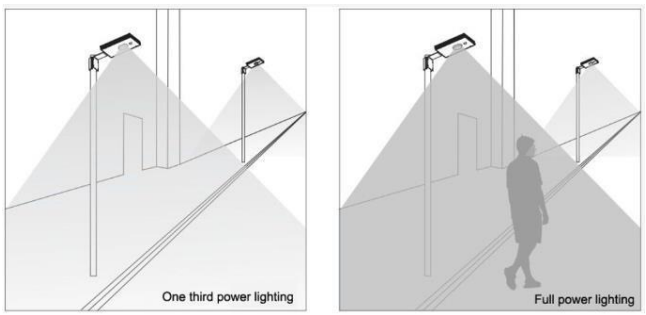


Fig-1. System Configuration of solar street light

2.SYSTEM DESIGN

Solar panel are charge the battery within time and battery is overcharge then relay circuit to cut off the supply.

Using RTC light is ON at night time,in midnight light operated using motion sensor. Also using pollution sensor to indicate pollution on environment and emergency signal. They are provide external Theft protection.

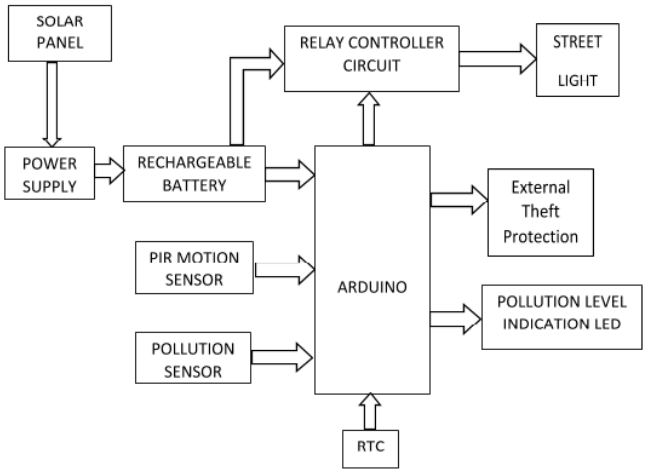


Fig-2: Block Diagram of All in One Solar Street Light

3. COMPONENTS OF THE SYSTEM

3.1 Solar Panel

A solar panel is a collection of solar cells. The solar panel converts the solar energy into electrical energy. Output of the solar panel is its power which is measured in terms of Watts or Kilowatts. Solar power uses multiple reflectors to collect more sun's thermal energy. Thermal energy collected through the day to perform different operations. Performance of the solar panel depends on a number of factors like climate, conditions of the sky, orientation of the panel, intensity and duration of sunlight and its wiring connections.

In solar street lights, the solar panel is one of the most important parts, and it is also known as solar photovoltaic cell. These cells are of two types: poly crystalline and mono crystalline. Compare to the polycrystalline, monocrystalline conversion rate is higher. solar panels use light energy from the sun used to convert solar energy into electricity, which can be used to run many applications.

Electrical connections are made in series to accomplish an output voltage and to provide a current facility connections are made in parallel. The majority of modules use silicon or wafer based crystalline silicon but most of these solar panels are inflexible.

Fig -3.1:Solar panel

3.2 Rechargeable Battery

Rechargeable battery is a type of electrical battery or accumulator and its electro mechanical reactions are reversible so it is called as secondary cell. Usually, there are two types of batteries: lead acid battery and gel cell deep cycle battery.

In solar LED street lights, a battery is used to store electricity from the solar panel during the day time to provide energy in the night time. The capacity and lifetime of the battery is very important as they affect the backup power days of the lights.

Fig -3.2:Rechargeable Battery

3.3 ATMega328p

The ATmega328P provides the following features: 32Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 1k Bytes EEPROM, 2K bytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, Real Time Counter (RTC), three flexible Timer/Counters with compare modes and PWM, 1 serial programmable USARTs , 1 byte-oriented 2-wire Serial Interface (I2C), a 6- channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages) , a programmable Watchdog Timer with internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption. In Extended Standby mode, both the main oscillator and the asynchronous timer continue to run.

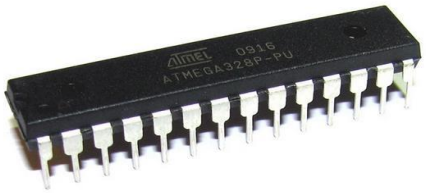


Fig -3.3:ATMega328p

3.4 Motion Sensor

The PIR motion sensor is ideal to detect movement. PIR stand for “Passive Infrared”. Basically, the PIR motion sensor measures infrared light from objects in its field of view. So, it can detect motion based on changes in infrared light in the environment. It is ideal to detect if a human has moved in or out of the sensor range.

Fig -3.4:Motion Sensor

The sensor in the figure above has two built-in potentiometers to adjust the delay time (the potentiometer at the left) and the sensitivity (the potentiometer at the right).

3.5 RTC

This tiny RTC module is based on the clock chip DS1307 which supports the I2C protocol. It uses a Lithium cell battery (CR1225). The clock/calendar provides seconds, minutes, hours, day, date,month, and year information. The end of the month date is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with AM/PM indicator. All

Fig -3.5:RTC

3.6 Pollution Sensor

Air Pollution Sensor are devices that detect and monitor the presence of air pollution in the surrounding area. They can be used for both indoor and outdoor environments. These sensors can be built at home, or bought from certain manufactures. Although there are various types of air pollution sensors, and some are specialized in certain aspects, the majority focuses on five components: ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrous oxide. The sensors were very expensive in the past, but with technological advancements these sensors are becoming more affordable and more widespread throughout the population. These sensors can help serve many purposes and help bring attention to environmental issues beyond the scope of the human eye.

Fig -3.6:Pollution Sensor

4. System Working

4.1 RTC configuration

A real-time clock (RTC) is a computer clock , that keeps track of the current time. Although the term often refers to the devices in personal computers, servers and embedded systems, RTCs are present in almost any electronic device which needs to keep accurate time.

In over project we require time for ON the street light lamp in normal mode operation (6:00pm to 10:00pm) and after this we switch the PIR motion sensor detection motion in that area an ON/OFF lamp up to (11:00pm to 5:00am). And after 5.00am hole system is fully OFF.It is continuous process to every day.

4.2 PIR Motion Sensor operate LED Array

All in One Solar street light uses a PIR motion sensor to adjust the LED light brightness intelligently. On detecting any movement in 12m radius around the light, the LED glows at full brightness. If no movement is detected for more than 1 minute, the brightness is reduced to one-third. This intelligent brightness control coupled with maintenance free Rechargeable battery technology provides longer backup time and better battery life.

4.3 pollution Sensor Work on System

MQ2 Gas sensor is a semiconductor sensor it is use for detects the combustible gas and smoke also. It has high sensitivity for LPG, Propane, also be used to methane and combustible gas detection. The voltage of gas sensor output change by the smoke level / gas level that present in atmosphere. This sensor output voltage is proportional to the concentration of smoke or gas.

The relationship between the gas sensor and voltage is as follow:-

- If the gas level is increase then the output voltages also be increase
- If the gas level is decrease according to the atmosphere then the output voltages also be decrease.

Working in project:-

Gas sensor read the output voltage and

- If it is air quality is less than 74% then the Red led is high (ON).
- If air quality is air quality is greater than the 85% then Green led is high (ON).
- Else the Yellow led is high (ON).

When air quality is less than 74% then buzzer is ON.

4.4Theft Protection

The theft protection is provided to protection of hole system safety. They can provide buzzer for alert message. In ATMega328p IC theft protection pin 18 and GND are connected.

5. Result

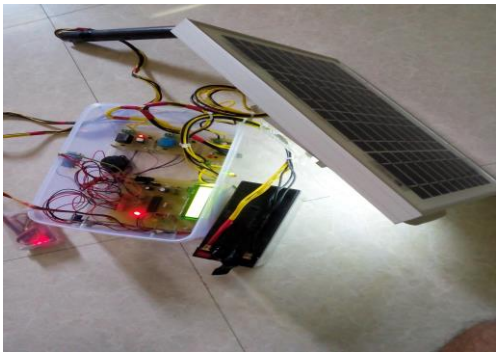
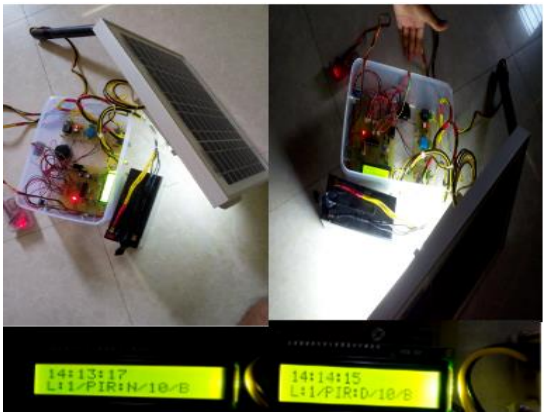


Fig -5.1:Front view of final project

All in one solar street light are ON at 6PM. It is dealy process are operated by RTC. After 11pm minimum traffic is in road then light is operated by PIR motion sensor. When someone are entering on that area then light having full intensity, And no one are in that place then 30% intensity of that light. Air sensor are used to sensed the environmental air qualities with using different colours of LED's indicated by air quality levels. This project also proved the theft protection.

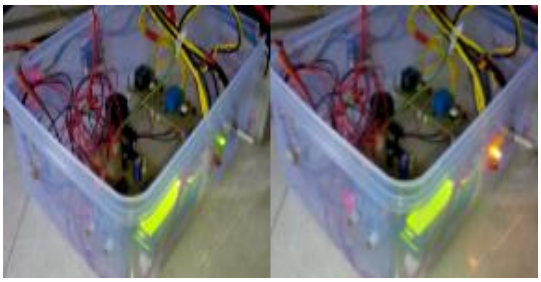


PIR are NOT detected. PIR are detected.

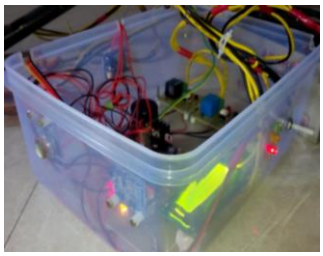
Fig -5.2: Motion Detection

Seal OK Alert Theft

Fig -5.3:Theft Protection



Normal air quality. Medium air quality.



High pollution level

Fig -5.4:Air quality Levels

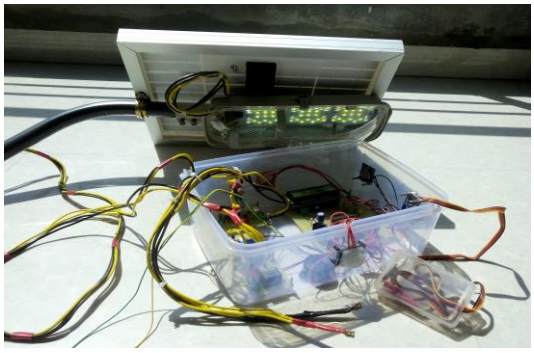


Fig -5.5: Real Time Working

3. CONCLUSIONS

The project entitled "All in One Solar Street Light" mainly gives an idea in saving power consumption by various devices in any field. Since it can switch automatically in reference to real time it doesn't waste power. Usually most of the street lights run on the power generated by several power plants using lots of resources. This project is designed in order to use the natural power generated from solar rays. Also, it consumes very less power and works for a long time.

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