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INTRODUCTION TO INNOVATIVE PROJECTS (PHY1999)

FINAL PROJECT REPORT

TITLE: *AUTO INTENSITY CONTROL OF STREET LIGHTS*

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REPORT ON AUTO INTENSITY CONTROL OF STREET LIGHTS

INTRODUCTION :

The 21st century is striving hard to save electrical energy. Street lights are essential, but expensive, therefore there is need to optimize the system in a way that it is affordable and efficiently conserves energy. Manually controlling the street lights is a time taking and tedious process. Working in such manner could sometimes result in large disasters and destructions. The main problem that manual controls on the street lights face is that there would be a lot time taking during evening times when they are to be switched ON and a significant waste of energy is done at morning at all could not be turned OFF together at once. Another way in which the wastage is done is that at midnights lights glow at full intensity although there is not much traffic. Therefore, there is a need to come up with a system which overcomes the problems of existing systems. A system which reduces manual control and would efficiently save energy. This could be done by using low power, robust and efficient components.

Generally, streetlights on roads and highways are designed with high intensity lamps that consumes more energy and also cannot be changed as per the requirement. Thus, the proposed system overcomes these problems by using LEDs instead of HID lamps in the street light systems. So the light intensity can be changed and controlled according to the needs.

The main concept of this project is to reduce consumption of energy by using LEDs as the Street Lights. The street light intensity increases during the evening time and gradually reduces in late nights and continues again in the morning 6am. Thus a LDR sensor can be used to detect the ambient lighting conditions and reduce or increase the intensity of the street lights.

WHY DO WE NEED TO USE LEDs :

The light intensity cannot be controlled accurately according to the requirement. This problem can be overcome by an alternative method of lighting system by using LEDs. This project proves the usage of the LEDs as the light source and its adjustable intensity control, according to the obligation. Also, the lifetime of the lights used in this system is more and consumes less power as compared to the HID lamps. Thus the light intensity is controlled during the non-peak hours, which is not possible in HID lamps.

WHY THIS PROJECT IS UNIQUE?

Lets answer this question by going through the data analysis of the power consumption by country street lighting systems.

Reportedly India has 35 million street lights which generate a total demand of 3,400 MW. With LED, this can be brought down to 1,400 MW, saving 9000 million kWh of electricity annually, worth over $850 million(60,50,72,50,000.00 Indian Rupees as per the international monetary exchange rates on 11 Feb, 6:10 pm UTC) in the process. To put this into

perspective, the electricity deficit in India during 2014-15 was 38,138 million kWh and 7,006 MW which could be resolved by implementing this project.

This money is saved just by implementing LED lights in place of the conventional mercury bulbs, thus by installing the auto light intensity module along with the LED lights and with the conventional lights ,a cheap temporary solution can be made to save energy until the LED lighting system installation picks-up pace.

EXISTING SYSTEMS :

The existing systems consist of manual controls which need constant monitoring and maintenance. Considering the wastage of energy due to manual control many systems have been introduced. These systems are designed in such a manner that they could reduce their intensity and save as much energy as possible. Systems like these use LEDs (Light Emitting Diode) instead of HID (High Intensity Discharge) lamps due to dimming feature. 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. As mentioned above it created problems during seasonal changes, 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.

Scenario During Day Under Full Brightness :

At day time due to full environmental brightness, no LEDs are ON and the value of LDR remains almost constant. The intensity varies as time changes. Time and Intensity under full brightness at day could be seen.

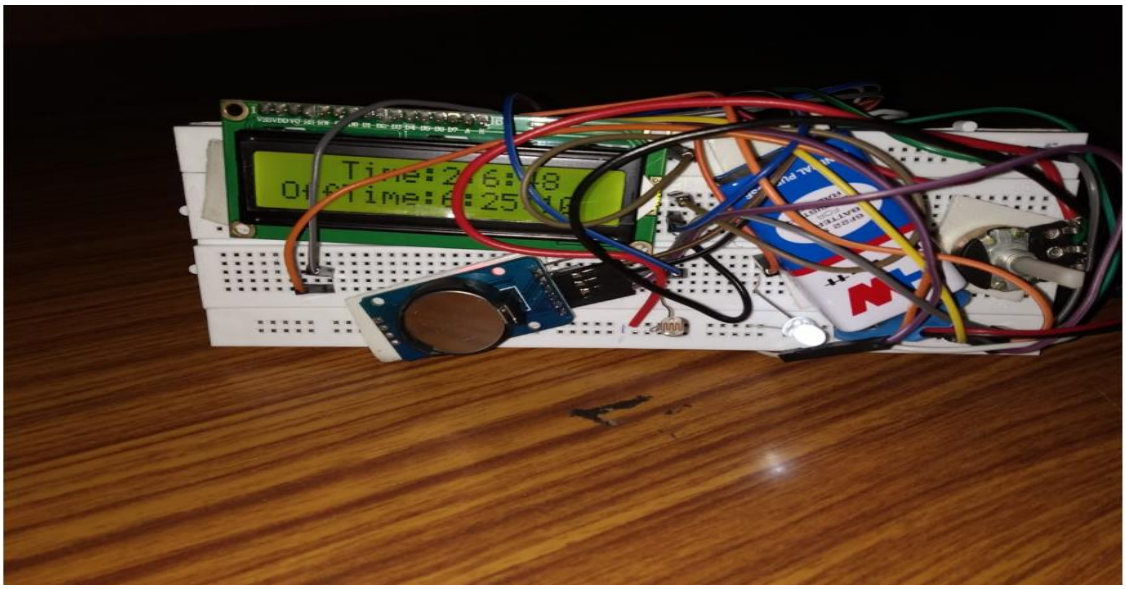
Scenario during Night under Full Darkness :

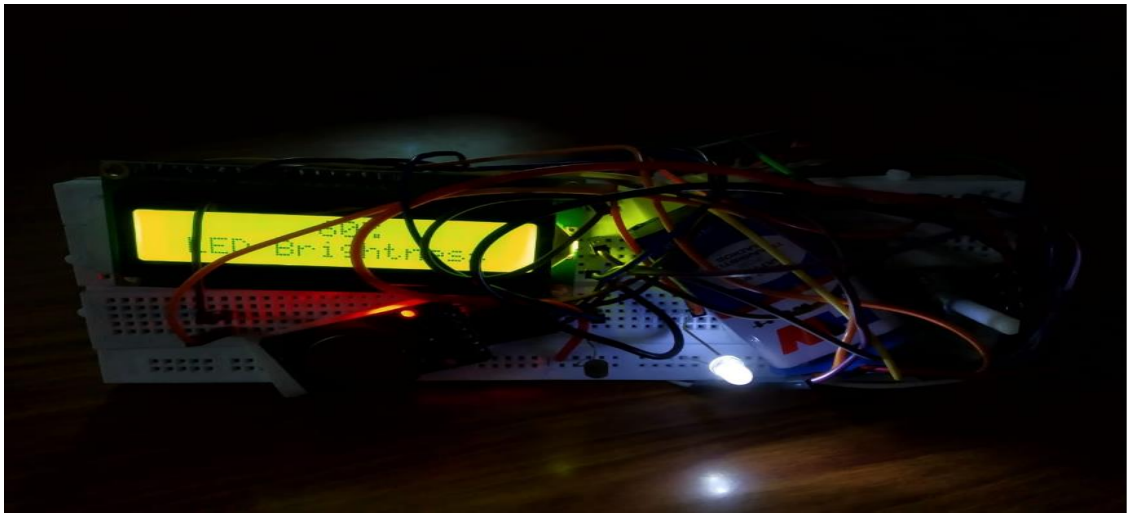
At night due to zero environmental brightness, all LEDs are ON at their full intensity and the value of LDR here too remains almost constant as the LDR would not sense any light all night.

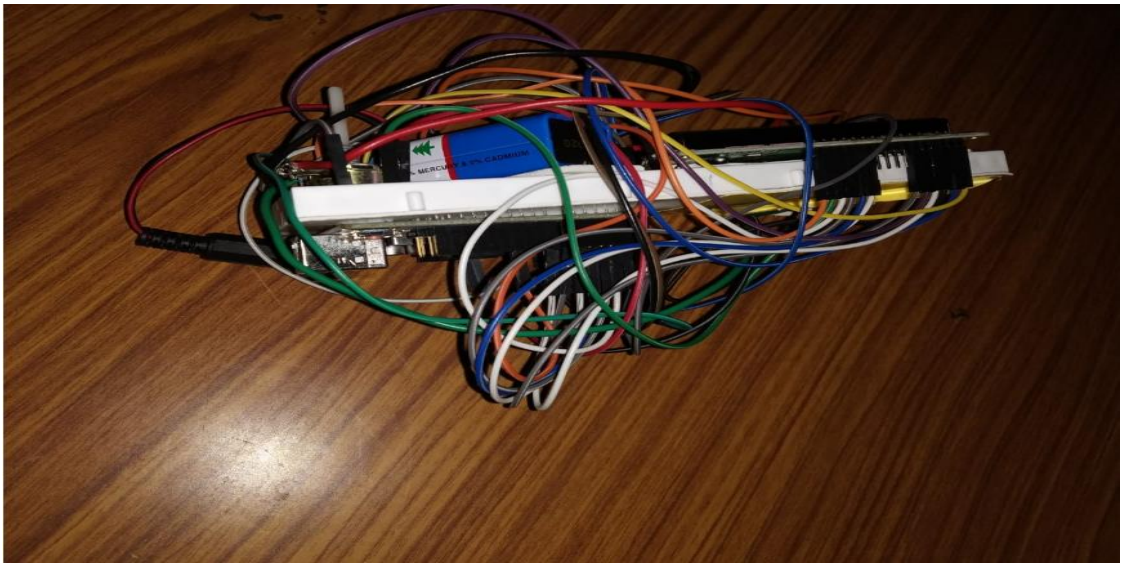
CONCLUSION :

The solution to energy conservation is to eliminate time slot and introduce a system that could sense brightness environment and act accordingly so that seasonal change would not affect the intensity of street lights. Also, LEDs

should replace HID lamps due to their dimming feature, another reason are that they are more reliable.







COMPONENTS USED IN THE PROJECT

1. Breadboard: It is used to make all the connections and provides a base for all the components to be fixed upon.

2. LED (light emitting diode): It is a device having two terminals one positive and other negative. It is a white coloured light which changes its intensity as commanded by the program of the Arduino.

3. Arduino Uno: It is the major component used. Its stores the source code according to which all the components act.

4. LCD DISPLAY: It is used to display the brightness of the light in percentage and whether the light is running in RTC mode or LDR mode.

5. Light dependent Resistor: Light dependent resistor is a device which is able to increase or decrease its resistance according to the light of the environment. In this model when light in the surrounding is high then the resistance increases which results in decrease in the intensity of the light and when the light in the surrounding is low then the resistance also decreases which leads to more intensity of light.

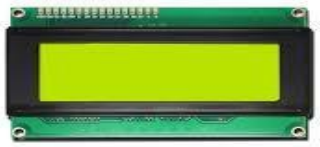
6.DS3231 RTC Module: It is used to track the current time and date. In this model it is used to switch on and switch off the light automatically on the time entered in the source code when operating in the RTC mode.

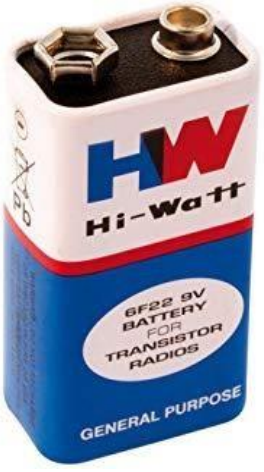
7. Power Source: In this model we are using a 9V battery which is connected to the Arduino Uno using a banana port**.**

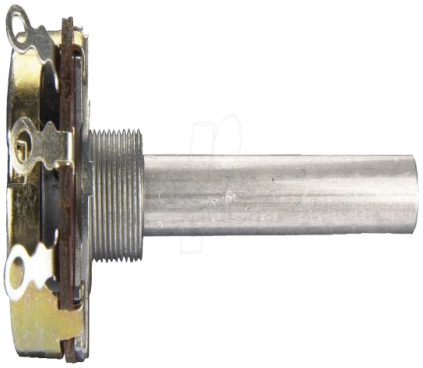
8. 10 Kilo Ohm resistor: This 10 Kilo ohm resistor is connected in parallel to the LDR because LDR is a sensitive element and it cannot bear a high current through it.

9. 10 Kilo ohm potentiometer: In this model it is used to adjust the brightness of the display.



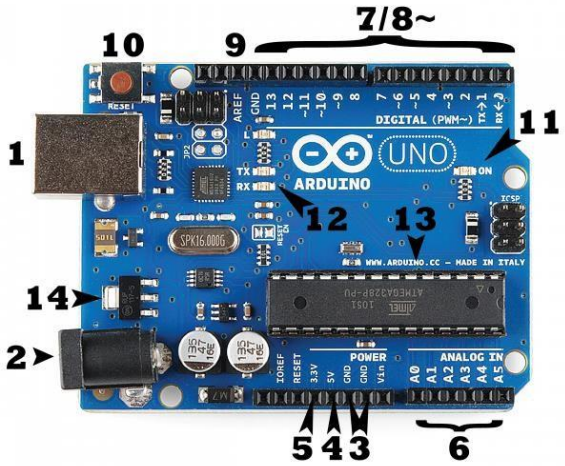


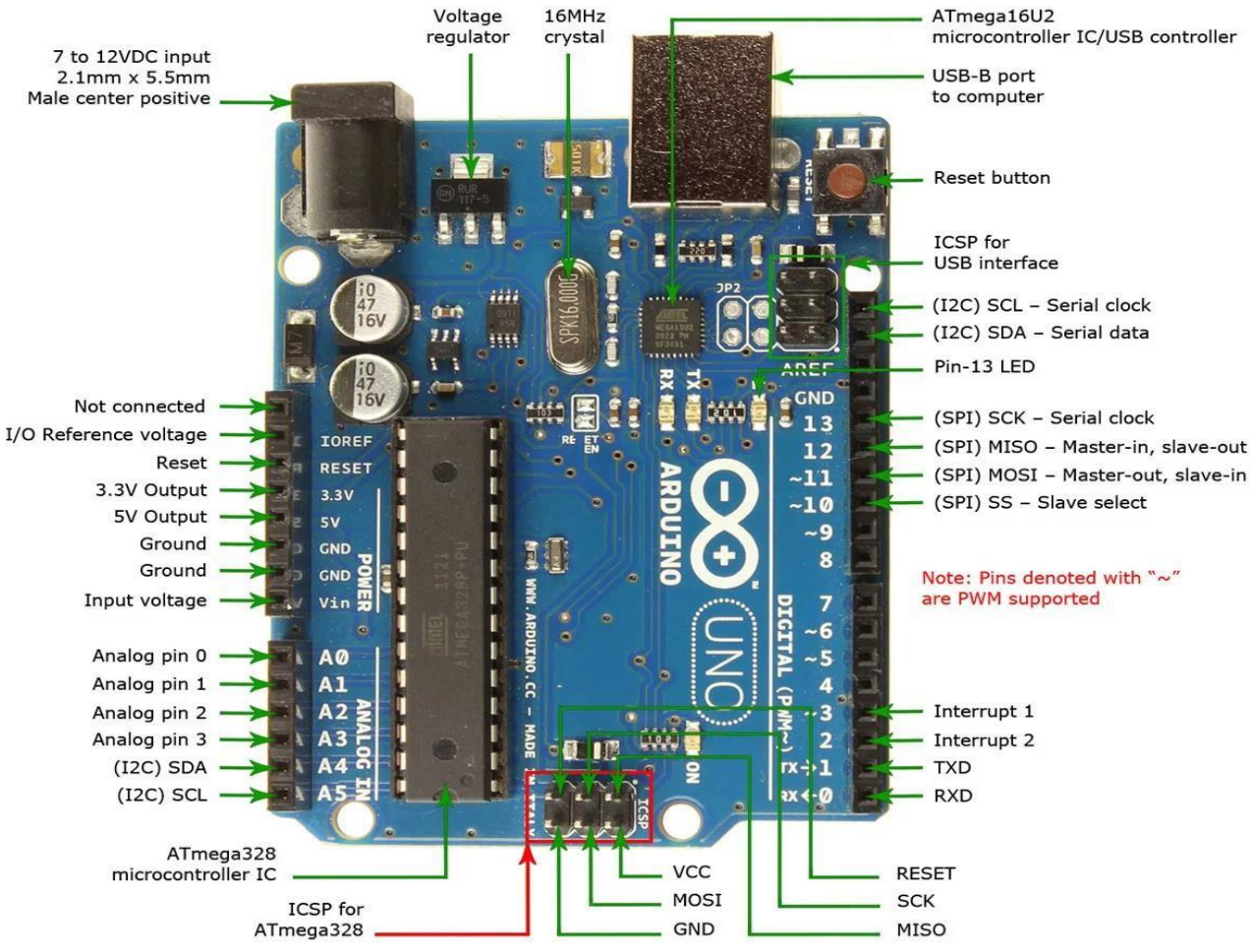



10. Power (USB/Barrel Jack): Every Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall power supply that is terminated in a barrel jack. In the picture above the USB connection is labelled (1) and the barrel jack is labelled (2). The USB connection is also how you will load code onto your Arduino boards.

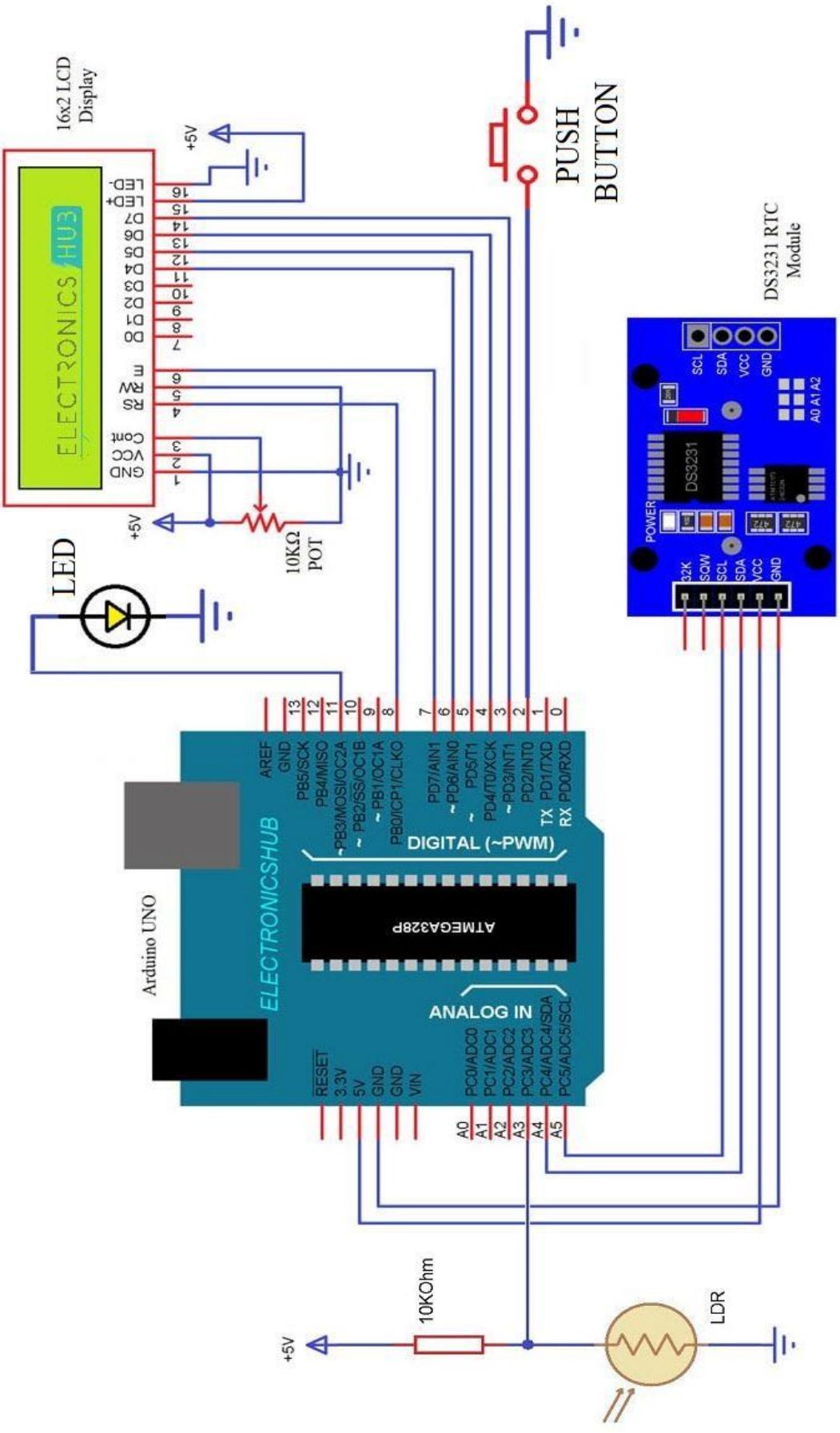
A power supply greater than 20 Volts is not used as it will overpower (and thereby destroy) the Arduino. The recommended voltage for most Arduino models is between 6 and 12 Volts.



ARDUINO BOARD: DIFFERENT CONNECTIONS AND LAYOUT



PROJECT CIRCUIT DIAGRAM



The project can be implemented in the following manners:

1. Street Lights:
The most basic use of this system is in street light as a lot of power and energy is wasted in our country due to glowing of streetlights at times unnecessary. If our system is implemented this would reduce the wastage of energy by a huge margin.

2. Public transport Internal lighting system:
As we might have observed while using public transport that the lights inside the transport like metro is glowing with high intensity even though so much intensity is not needed at that time and hence leads to power and energy wastage. It's often noticed as the manual turning on and off of the transport lights mostly leads to the lights being used for a longer period of time than required hence causes energy wastage. This idea can help in that matter.

3. Solar Powered LED Street Lighting with Auto Intensity Control:
It is a cost effective, practical, eco-friendly and the safest way to save energy. It clearly tackles the two problems that world is facing today, saving of energy and also disposal of incandescent lamps, very efficiently. According to statistical data we can save more that 40 % of electrical energy that is now consumed by the highways. 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 with the use of good equipment the maintenance can also be reduced. On combing solar

powered LED with our project, we would effectively be using our very own energy and using it smartly.

International and National level playgrounds

As we might have notice while watching a cricket match in cricket or so that whenever the time is around 6-6.30. All the lights are turned on in the cricket ground which is sometimes a huge wastage of energy and sometimes a discomfort for the players as there is a lot of unwanted light. According to me the concept can be implemented here to save energy. If the light is implemented the transition will be a lot easier for player and audience.