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6 Pin IC Controlled Ultra Capacitor based Smart Street Light

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***Abstract*:- In my previous paper [1] I concluded that UltraCapacitor can be used as a source of street light and by using a 6 Pin IC we can control and turn the normal street light into Smart Street Light. In order to make the smart street light we have to minimize the human involvement. We can do that by using a Motion Sensor and Lux sensor. These sensors have their own purpose and it turns normal street light into Smart Street Light. These sensors can be controlled by a 6 pin IC. Street lights are the most ignored and under rated appliance. No one notices its presence until its absent. Smart Street Light can play a big role in the projected smart cities as it will operate automatically and no human involvement is required. UltraCapacitor will replace the battery and hence the human involvement will not be needed at all hence these street light with proper arrangement can be installed anywhere in the country without thinking much about the terrain. The smart street light will get its power from solar panel. We only need to ensure the uninterrupted solar rays falling on the solar panel.**
There are certain things that we need to take care of and that will be discussed in this paper.

Index Terms— Renewable Energy, Smart street light, UltraCapacitor, Lux Sensor, Motion Sensor

I. INTRODUCTION

In this paper I will show how we can actually work with UltraCapacitors in order to make a feasible setup. Implementing new technologies has always been challenging. This gives us an opportunity, as an engineer we can use our technical skills and learning to build something new which can be used to benefit the society
UltraCapacitor is the new technological marvel which is used to store Electrical Energy. As we all know that the electrical energy can only be stored in form of DC and UltraCapacitor enables us to store large amount of charge in small space however the power to weight ratio [2] of UltraCapacitor is less than that of battery hence it can be used in the places where there is no issue related to space.

The below shown image is taken from a locality where it can be seen that the street lights are not working. The picture would have been different if all the street lights were working.

Image: - Current Situation

we have developed a Battery Less Independent Smart Street Lighting System (BAISL) for anywhere use. To achieve this goal, a single control unit in form of a 6-pin IC is needed for each lamp. In this way the system can independently control the street light depending on the brightness of the environment by means of Lux sensors and a smart control system. Experimental results are provided to show the effectiveness of the solution.

In this setup I have used LED. With the accessibility of adaptable lighting innovation like light emitting diode (LED) lights and all over accessible remote web association, quick responding, dependable working, and power moderating street lighting frameworks get to be reality. The Smart Street Light Setup focuses on the saving of power; to construct a vitally energy efficient smart lighting framework with integrated sensors and controllers; to outline a smart lighting framework with particular methodology plan.

BAISL can be deployed anywhere in any kind of terrain without second thoughts. These street lights can be installed even to the remotest area of our country or anywhere in the world without even thinking about the maintenance cost or process. All it need is the direct sunlight for sufficient amount of time.

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II. PROBLEM OF CURRENT INDEPENDENT SETUP

In current Independent setup[6][12] of solar light is that it is not smart and it uses battery that stores the electrical energy in form of chemical energy and when the output is needed then it converts that chemical energy into electrical energy.

Batteries will store the electricity generated by the solar panel during the day and provide energy to the fixture during the night. This energy conversion degrades the battery quality with time and a point in time comes where it cannot be used. The life of battery depends on the charge cycles [6][12]. Also batteries are heavy hence it requires special setup to store battery and also to keep it from theft [6][12].

Drawbacks of battery are many that are electrical in nature.

1. Battery life
2. Numbers of charge cycle
3. Efficiency
4. Time to charge

I have mentioned in the earlier paper that why I am using UltraCapacitors[6] in place of batteries

As there is no energy conversion taking place hence the efficiency also goes up to 99% [15] and the charging time of capacitors is shorter. Now the UltraCapacitors works on 2.7Volts-3.2 Volts this means in case of cloudy days as well the capacitor will charge to its full capacity by using the correct solar panel.

As mentioned earlier it is a simple setup but making it work is a real challenge as the discharge of a capacitor is exponential and the voltage we are dealing here with makes it really complicated as the operating window is very narrow because as the voltage reaches below 2.75 volts[15] (approx.) the intensity of SMD LED falls. To overcome this problem we need to use a controller. Here I am using a 6 pin IC aka voltage controller.

A controller[3],[6] is a major component as it does not only controls the discharge of UltraCapacitors but also controls the UltraCapacitors from over charging and Over voltage protection.[8]

III. CALCULATIONS

1. Cost of Battery Based street light setup:- [6]

Particular	Description
Solar Light	24 Watt
Solar Panel	100 Watt
Solar Battery	75Ah
GI pole	5 meters
Charge Controller	Inbuilt
Price	Rs. 21000

The operating cost of both setup is nil however the initial cost and maintenance cost cannot be neglected. Initial cost of UltraCapacitor based setup is more because this is a new Technology but the maintenance cost of UltraCapacitor based setup is zero. It is literally fit and forget type of setup. On the other hand the maintenance cost of Battery based setup is high as life cycle of battery is very less as compared.

IV. ACTUAL PROJECT

In the previous paper I displayed the working without the controller. Controller[4] is a 6 pin IC with its supporting components[9]. 6 pin IC is also known as voltage regulator as it gives constant output voltage.

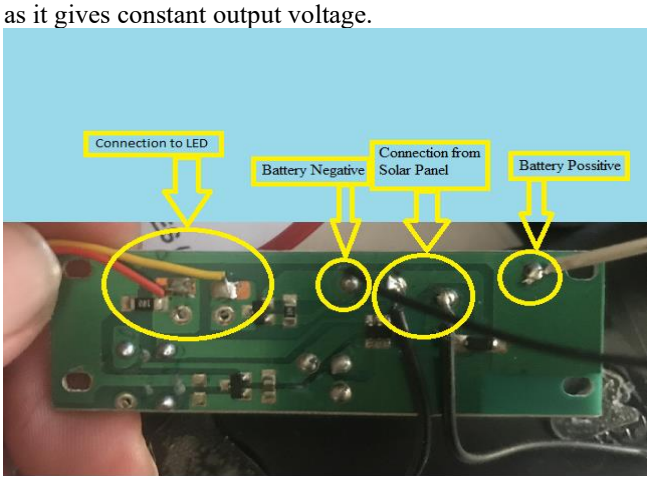

Figure: - 6-Pin Controller

In the picture above all the major connections are named. The Battery positive and Battery negative is just for indicating purpose and in current setup it is replaced by UltraCapacitor. Usage of UltraCapacitor is this easy. It just have to be placed in place of batteries although correct number of UltraCapacitors have to be determined.

Any battery or UltraCapacitor [11] based device is feasible only if the rate of charging is higher than rate of discharging. And in current situation as the power demand is extremely high, people want things to charge asap. UltraCapacitor as it is electrical component it can be charged extremely fast.[13]

The charging time of UltraCapacitor of 100Farad that I have used in this setup charges in an approx. 30 minutes. We have to be extremely care full with the input voltage to the UltraCapacitor as a bit of high voltage than the rated voltage may result in breakdown of dielectric and permanently damaging the UltraCapacitor.

V. CONCLUSION

Using the 6-Pin IC we can easily control the charging and discharging of UltraCapacitor and at the same time we can get a constant voltage output. Because the discharge of UltraCapacitor is exponential, by using this voltage controller and we can achieve the required goal.

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