

## **Photovoltaic powered led outdoor lighting system with battery storage**

**R.D.D.P.S. Amarasingha, K.M.L.U. Jayasinghe, D.R. Senanayake\*,  
and P.J. Binduhewa**

*dilan.senanayake@aiesec.net*

Outdoor lighting is an essential item in the present lifestyle. Outdoor lighting is required during night time and it mainly depends on the utility supply. Lighting powered by a local power source reduces the burden on the utility network. Photovoltaic, coupled with battery storage is a possible solution. As Sri Lanka experiences a reasonable amount of solar power during daytime, this is an attractive solution and this has not been exploited well. This paper presents a photovoltaic powered LED lamp with battery storage.

The proposed system consists of a photovoltaic panel for power generation, battery storage for storing generated power from the photovoltaic panel and LED lamp to convert the electrical energy into light. The battery charges during daytime when sunlight is available through a buck converter. The controller of the buck converter consists of two loops: (a) inner loop, to control the input voltage and (b) outer loop, which is the maximum power point (MPP) tracker. The inner voltage controller is based on a PI controller. Fraction of open circuit voltage method is selected as the MPP tracker as its implementation is simple and follows the MPP with time. This controller ensures that the photovoltaic panel is operating at MPP.

The power rating of the LED lamp is 5 W. A 3.7 V lithium ion battery is selected for this application. Efficiency around 88% can be achieved when driving the LED lamp. A 5W photovoltaic panel is selected to charge the battery. On a good sunny day, it is possible to generate 11 Wh. Therefore, the capacity of the battery is 3000mAh at 3.7 V. The LED lamp is implemented and it provides the expected results considering the light intensity levels. The buck converter is designed and implemented. The open loop operation of the converter is verified. The inner current loop of the converter is designed. The maximum power pointer tracker is to be implemented. In conclusion, the proposed LED lamp powered by battery and photovoltaic panel is a relatively simple and environmental friendly solution for lighting applications such as corridors and small pathways.