Solar **Garden Lamp**

D. MOHAN KUMAR

Described here is an easy-to-make solar night light that can be fixed in the lawn. It automatically turns on in the evening and turns off in the morning.

The rechargeable battery in the unit charges during day time using power from the solar panel. A 0.5W white LED in the circuit gives sufficient light to walk in the lawn's pathway.

Author's prototype is shown in Fig. 1.

Fig. 1: Author's prototype

Circuit and working

Circuit diagram of the solar garden lamp is shown in Fig. 2. It is built around 6V, 350mA solar panel connected across connector CON1, pnp transistor SK100 (T1), a 0.5W white light LED (LED1), 4V, 1Ah rechargeable battery (BATT.1) and a few other components.

The 6V solar panel provides the charging current to the battery during day time and also acts as a light sensor to switch on/off the white LED via transistor T1. During day time, the solar panel generates around 350mA current for charging the battery through forward-biased diode D1. At the same time, base of T1 is held high by the current through resistor R1. Since T1 is a pnp transistor, it remains off during day time due to positive bias from the solar panel. This keeps LED1 turned off.

When sunlight reduces in the evening, current from the solar panel ceases and diode D1 reverse biases. At the same time, T1 becomes forward-biased since its base goes low. This turns on LED1. This condition remains the same till morning when the day light falling on the solar panel reverses the condition. LED1 turns off and the battery starts charging again.

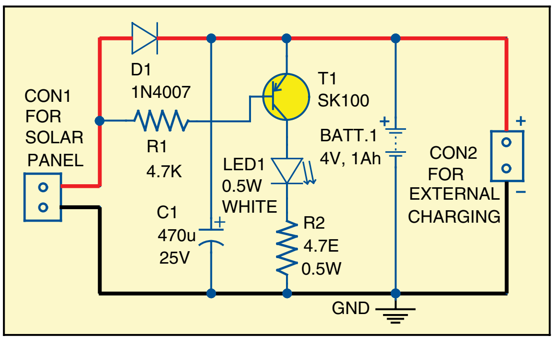

Fig. 2: Circuit diagram of the garden lamp

Capacitor C1 is a buffer for the stable charging process. SK100 (or CK100) is a general-purpose medium-power pnp transistor that provides sufficient voltage and current at its collector for the full brightness of LED1. It can handle a maximum of 800mW power.

PARTS LIST	
Semiconductors:	
T1	- SK100 pnp transistor
D1	- 1N4007 rectifier diode
LED1	- 0.5-watt white LED
Resistors (all 1/4-watt, ±5% carbon, unless stated otherwise):	
R1	- 4.7-kilo-ohm
R2	- 4.7-ohm, 0.5-watt
Capacitor:	
C1	- 470F, 25V electrolytic
Miscellaneous:	
CON1	- 2-pin connector terminal
CON2, CON3	- 2-pin connector
BATT.1	- 4V, 1Ah chargeable battery
	- 6V, 350mA solar panel (SP)

Since LED1, which may be connected across connector CON3, requires more than 50mA current for maximum brightness, the current limiting resistor (R2) for it should be between 1-ohm and 10-ohm. In the circuit, a 4.7-ohm, 0.5W resistor is used as R2.

Connector CON2 is connected across the battery for charging it from an external charger on cloudy and rainy days. You can use a mobile charger with a suitable socket for the same.

Construction and testing

An actual-size, single-side PCB for the solar garden lamp is shown in Fig. 3 and its component layout in Fig. 4.

Assemble the circuit on the PCB shown in Fig. 4 and enclose it, along with LED1 and battery, in a rain-proof transparent case as shown in the prototype in Fig. 1.

Fix the solar panel on top of it to get direct sunlight. Keep the unit in a place where direct sunlight is available. Use a 4V, 1Ah mini lead-acid battery. ●

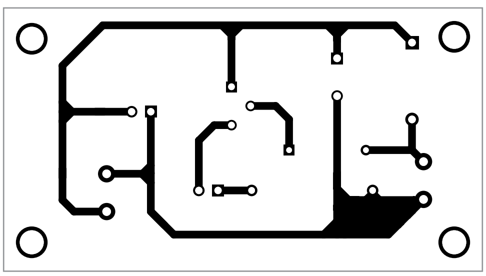

Fig. 3: Actual-size PCB pattern of the solar garden lamp

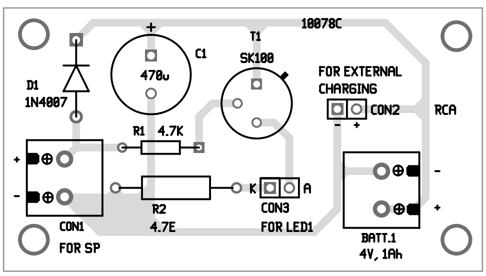

Fig. 4: Component layout of the PCB

D. Mohan Kumar was associate professor at Government College for Women, Thiruvananthapuram, Kerala