

Integrated Solar Path Light

Sponsored by: Elite Lighting Designs

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Abstract

Most solar powered path lights sold in bulk have an average life expectancy of 6 months. This coupled with the overall quality of the solar path light provides an opportunity for improvements. By using modern solar panel technology ELSE has designed a more efficient and higher quality path light.

Need for Product

Current solar powered path lights sold in bulk, last for 6 months on average and are made with materials which are fragile. These path lights are also susceptible to being exposed to the elements, causing the internal electrical components to degrade quickly over time. For example, the adhesive used in most bulk path lights are of poor quality. For consumers, this can be costly over time as this creates more E-waste and can prove to be a deterrent when purchasing bulk solar powered path lights. This is why team ELSE has worked to design a more efficient and higher quality solar powered path light. Figure 1 shows how the adhesive has already failed over time from repeated exposure to the elements.



Figure 1

Design Concept

Our Integrated solar path light uses a different approach, rather than using a typical photoresistor, we used a solar panel and a MOSFET to control the light. Our fixture design was created using Tinkercad as seen in figure 2, this allowed us to design a 3D model, which we used to 3D print our design. Figure 3 shows our current circuit design.

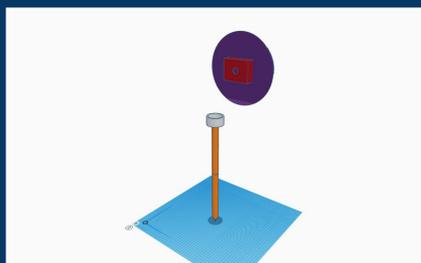
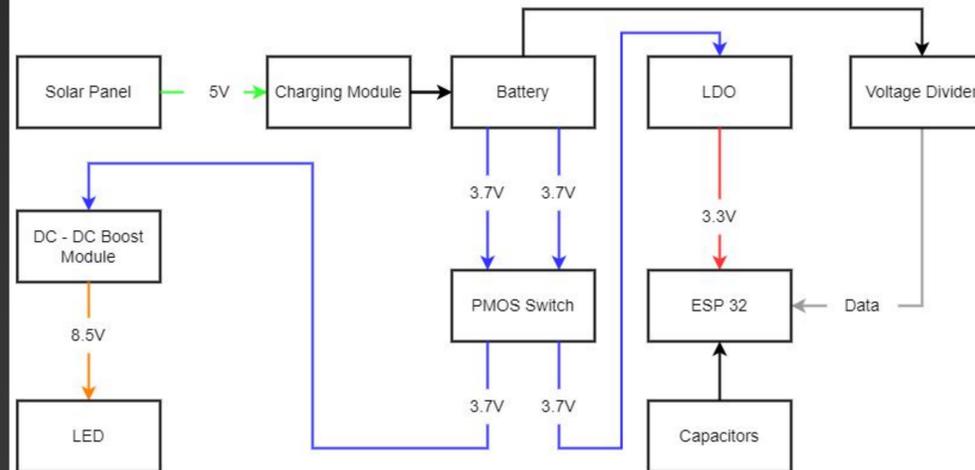


Figure 2

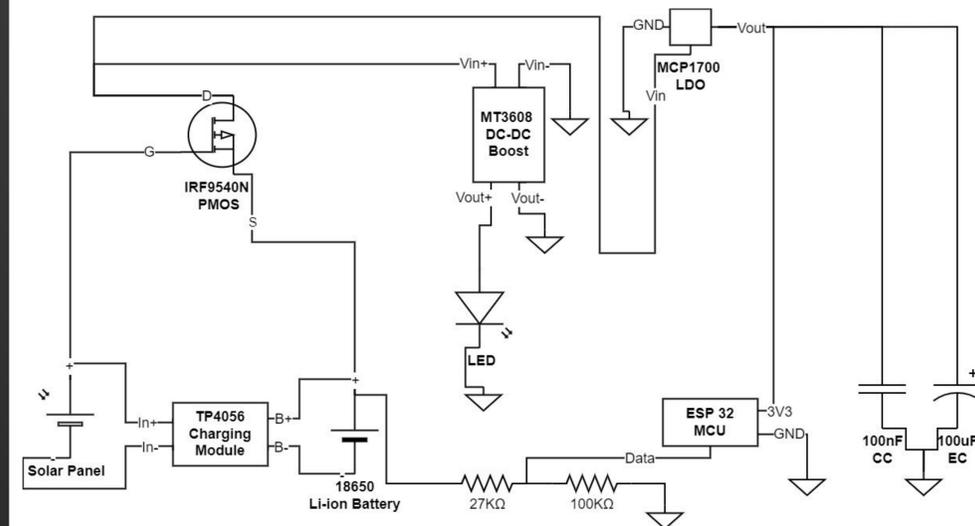


Figure 3

Hardware Function Diagram



Project Schematic



Components

- 3 Watt LED
- Solar Panel
- ESP 32 Microcontroller
- DC-DC Boost Converter
- Rechargeable Li-ion Battery
- Charging Module
- P-Channel MOSFET
- Low Dropout Voltage Regulator

Future Considerations

ELSE was successfully able to design and implement a working integrated solar path light that is more battery life efficient and is of better quality regarding the electrical components. Throughout the process we identified a few future aspects that could be implemented.

- Better materials for the fixture like aircraft grade aluminium.
- PCB design for the circuit to be more compact.
- Code for more smart capabilities.
- Longer trials where the fixture is exposed to the elements.

Glossary

- **Integrated:** To be unified in a single system.
- **Path light:** A type of lighting fixture that illuminates walkways to a guided path.
- **Microcontroller:** A small computer that acts as a controller for products.
- **Boost Module:** A module used to boost voltages in a circuit.
- **Li-ion Battery:** A type of battery in which lithium ions move around to allow for rechargeability.
- **Charging Module:** A module used in circuits to ensure safe charging, giving overcharge protection.
- **Photoresistor:** A device made of photoconductive cells that will lower in resistance when receiving light.
- **MOSFET:** Acts as an electrically controlled switch.
- **PMOS:** An electrical switch that turns on when power is low.
- **Tinkercad:** A free web based 3D modeling software.
- **E-waste:** Electronics being discarded after reaching the end of its usefulness.
- **Regulator:** A device that automatically maintains values for machines.

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ELSE (Elite Lighting Student Engineers)

Who ELSE is better for clean energy!