# 光能非接觸式無線充電系統

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# **Abstract & Motivation**

This project report primarily explores the feasibility of wireless non-contact charging systems by photo-energy analyzes various factors that affect charging efficiency. These factors include the light source, temperature, maximum power point tracking.

Inspired by the U.S. Defense Advanced Research Projects Agency's (DARPA) airborne relay systems, we recognized their potential for development in special scenarios, such as space, caves, and other areas difficult for humans to access, and conducted small-scale testing.

#### Hardware Architecture



# **Experimental Results**

• Types of Light Sources

We use different light sources to illustrate the impact of uniformity on charging efficiency.

LED 10cm (Lux)			
27297	35410	28816	
33939	47533	33240	
26213	32895	27907	

Halogen Lamp 40cm (Lux)

25388	25204	24028
26634	26764	26103
29022	28987	28244

### **Factors Affecting Efficiency**

• Illuminance

$$\phi = \frac{R_{\rm source} A_{\rm source} \eta_{\rm trans}}{L^2}$$

- Φ : Radiant Flux
  Rsource : Radiant Intensity
  Asource : area of light source
- ηtrans : Transmission Efficiency
  L : length for light to solar panel

$$E = \frac{\Phi}{A}$$
 (lux)

• Types of Light Sources



- Halogen Lamp : high luminance, high uniformity
- LED : low thermal output , energy-efficient
- Maximum power point





• Due to poor uniformity, the charging efficiency of the LED is extremely low.

#### • Different Illuminance of Halogen Lamp

20cm charging(Illuminance : >=54612 lux) current : 0.38A~0.23A

#### 20cm charging curve



40cm charging(Illuminance : 25583.13 lux) current : 0.15A~0.13A



• Temperature



30cm charging(Illuminance : 39285.46 lux) current : 0.24A~0.21A





- It shows that the closer the distance, the higher the illuminance, the higher the charging efficiency, and the shorter the required charging time.
- The average charging current at 20 cm is 2.18 times that of the average charging current at 40 cm.



- To optimize the efficiency, P must be maintained at the maximum power point.
- Temperature





• As the temperature increases, the conversion efficiency of the solar panel decreases.

#### • Maximum power point



# **Future Development**

This system can charge equipment in locations where cable installation is obstructed, such as monitoring devices installed in caves. Personnel can be dispatched periodically to perform non-contact charging using a light source.