

OptimSolar

Optimizing Solar Systems Using Solar Tracking and Cooling

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Introduction

Motivation for OptimSolar:

- Encourage more customers into the solar market
- Increasing performance and ease the installation process of existing solar panels

OptimSolar can be described as a universally compatible solar energy optimization unit. It has the potential to increase the efficiency of solar panels by up to 65% using solar tracking and surface cooling.

Methods

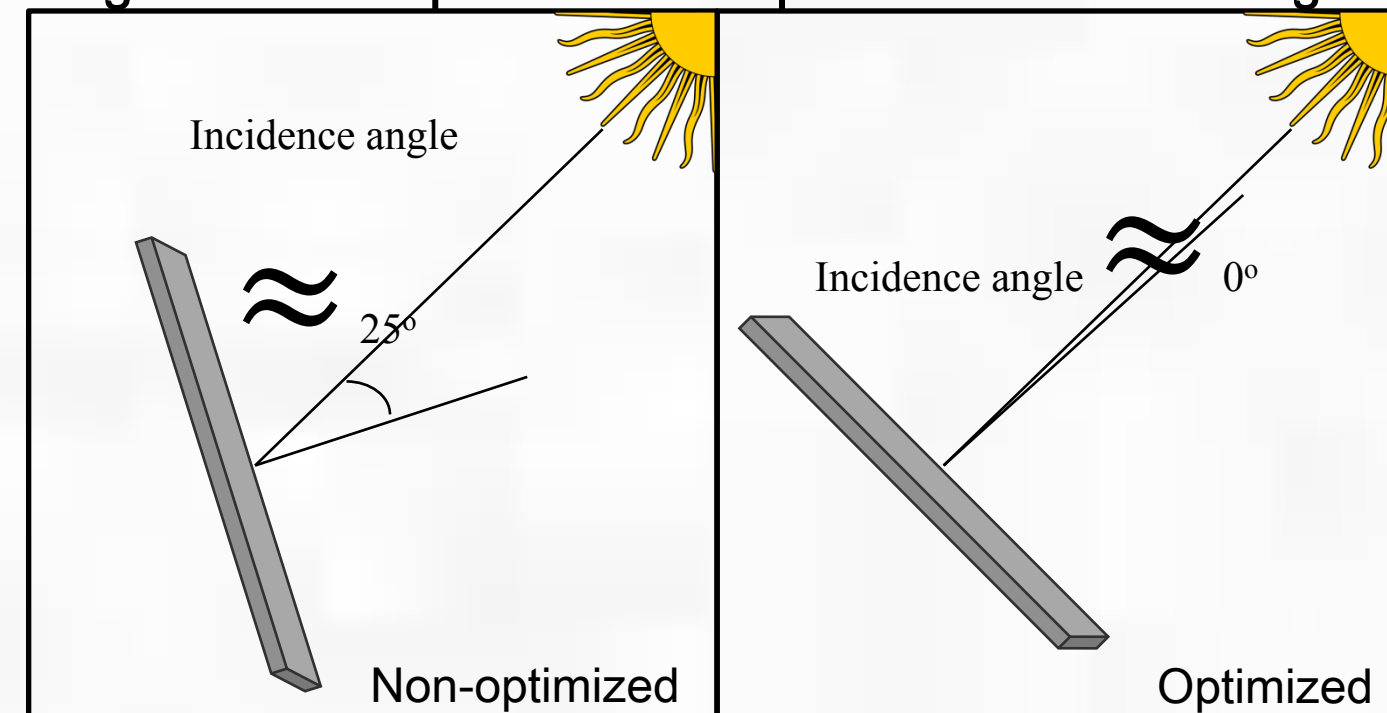
1. Solar Tracking

- Throughout each day, the sun traverses the sky. As the Earth rotates around the sun, beams of solar radiation strike the solar panel at different angles
- As the incidence angle of the beams grow larger, less radiation is absorbed
- OptimSolar attempts to maintain a solar incidence angle of 0° by using four corner sensor modules (photoresistors) and two axes of rotation
- An incidence angle of 0° will provide up to a 45% increase in efficiency [1]

2. Temperature Regulation

- Solar panels have optimum operating temperatures between 15°C and 35°C
- Sprinkler system attempts to maintain a solar panel surface temperature of 25°C
- This can provide up to a 25% increase in efficiency [2]

Figure 1: Non-optimized Vs. Optimized Incidence angle



Market

- OptimSolar is a companion product
- Designed for homeowners, DIYers, solar panel enthusiasts, and solar panel installers
- Easy to use, 'plug-and-play' system that can be used to mount a wide range of solar panel sizes
- OptimSolar has a performance monitoring system and an active LCD display to give immediate feedback of the increased efficiency
- Designed to compete with standard stationary mounts (costing upwards of \$500 and requiring labor intensive mounting)
- OptimSolar aims to shock the market with a \$400 price tag

Power Calculations

To maximize the power increase the OptimSolar unit must run off as little power as possible

- OptimSolar must consume less than 5% of the daily power improvement of the system
- Real time embedded computing systems emphasize reliability and low power consumption

The computing system is responsible for:

- Enabling and optimizing tracking and cooling functionalities
- Supporting real time user interfacing
- Minimizing power consumption by controlling duty cycling and sleep/wake interrupts

The mechanical system must work harmoniously with the computing system:

- There are three mechanical components: two stepper motors and a water pump

Table 1 shows the results of the expected power usage calculations. Based on these values, OptimSolar only consumes 1.1% of total daily power production of an average solar panel.

Table 1: OptimSolar Power Consumption

Unit	Power Consumption (kWh/day)
Computing System	0.005542
Mechanical System	0.026600
Total	0.032120

Prototype

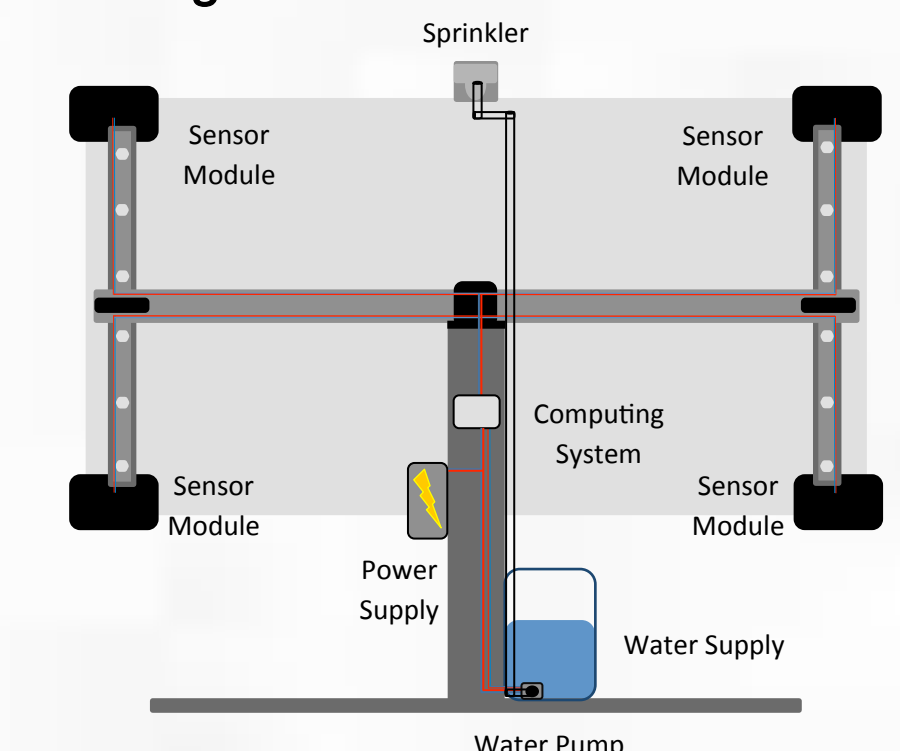
Presented is the proof of concept for OptimSolar. This is a small scale model showing tracking capabilities. The following months will be set to develop a full scale prototype.

- Figure 2 shows a 3D render of OptimSolar
- Figure 3 is a detailed layout of the different modules, wiring, and shape of OptimSolar
- The prototype will be completed within the next 5 months
- Excessive testing will be performed to prove the performance enhancement

Figure 2: 3D Render



Figure 3: Module Locations



Conclusion

PNW Energy is committed to designing a universally compatible solar panel mount, capable of providing dramatic performance improvements. OptimSolar recovers efficiency losses due to stationary panel mounting and panel overheating.

References

- [1] "Are Solar Panel Tracking Systems Really Necessary?", Energy Informative, 2013. [Online]. Available: <http://energyinformative.org/solar-panel-tracking-systems>. [Accessed: 19- Feb- 2018].
- [2] "How Does Heat Affect Solar Panel Efficiencies?", Civic Solar, n.d. [Online]. Available: <https://www.civicsolar.com/support/installer/articles/how-does-heat-affect-solar-panel-efficiencies>. [Accessed: 19- Feb- 2018].