# Dual-axis Solar Panel Tracker

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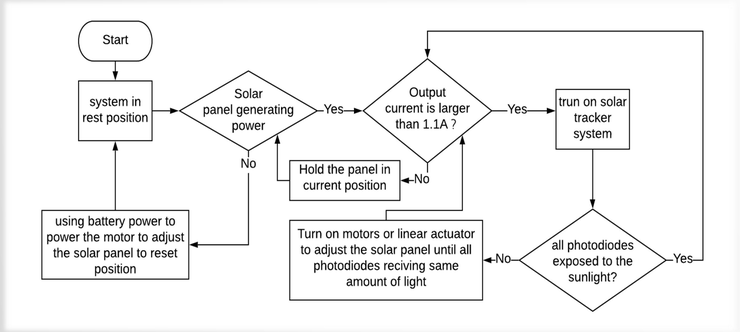
## INTRODUCTION

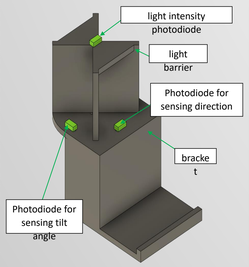
The device's application can effectively ensure that the solar panel can face the sun and that the power generation efficiency will be optimal. This project expects to generate more power in a day when the panel cannot face directly to the sun. This project focuses on maximize the power output by minimizing unnecessary power consumption. The goal of this project uses less than 1% of the energy that the solar panel generates in a day.

## CASE STUDY

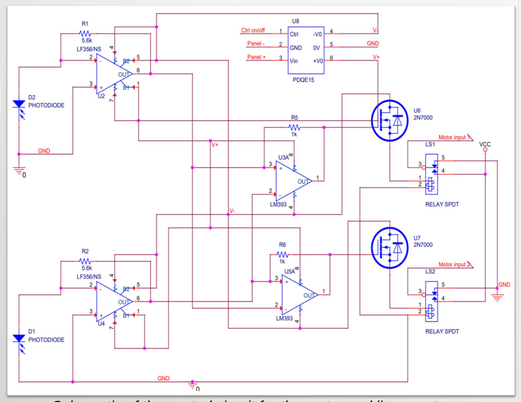
The design is to use the photodiode to find the direction with the highest light intensity, then adjust the facing direction and tilt angle of the panel. To start the tracker, the panel needs to detect whether the light intensity is strong enough to power up the system. If the light intensity is weak, such as cloudy days, the tracker will not turn on.




## DESIGN OF TRACKER




*Bracket of photodiode and placement of each photodiode*




*Schematic of the control circuit for the motor and linear actuator*

## MODEL

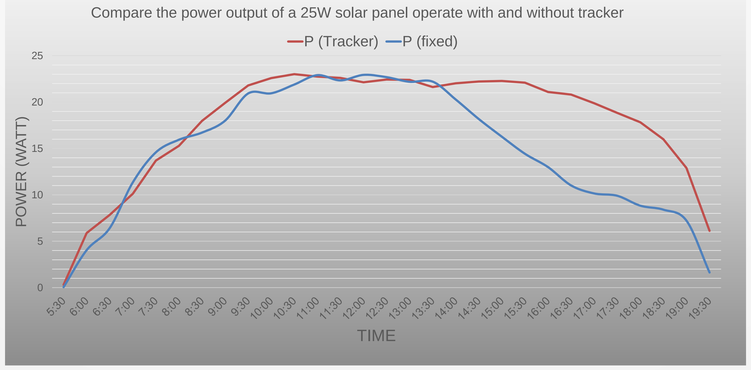
*Left: Finished model of Dual-axis Solar Panel Tracker  Right: Close look of mechanic unit of the model*

The model is powered by a battery, which is connected to the solar panel charge controller. The tracker is powered by the solar panel, so the tracker will not waste energy when the panel does not have any power output. If the solar panel does not generate any power, the charge controller will switch to load mode, which will power up the rest circuit.

The title angle adjusts by a linear actuator, it can tilt from 15° to 75° . The facing direction adjusts by a motor, the panel can face any direction. We optimize the tracker by the following method:

- The tracker will only work at peak sun hour.
- Reduce the frequency of adjusting the linear actuator.
- The rest system will turn off after resetting the direction.

## RESULTS AND DISCUSSION




To find the total energy generated by the panel in a day, the panel was being placed under the sun on a sunny day. The experiment was performed on two consecutive days to minimize the difference in the daytime. By measuring the total energy output of solar panel fixed with 37° title facing southeast and with the tracker. The panel generated 213Wh energy when the panel was fixed and 257Wh energy when the tracker is on. The power output increases by 20.6%. The power consumption of the tracker is 2.5Wh/day on sunny days, and the rest module will consume 0.2Wh after sunset. The total power generated is around 250Wh/day, so the fraction of the power consumption is 1.1%, which is very close to 1% as expected.

## CONCLUSION

The solar tracker is not ideal for a residential solar module for the following reasons. First, the power consumption of the tracker is too high for using it on a small size module. Second, the tracking system needs maintenance after a period of usage, such as lubrication and replacing electronic parts. Third, the cost of a residential solar panel is decreasing significantly in recent years. So, improve efficiency with more panels is more budget-friendly.

Solar panel tracker is more ideal for use in the solar farm for the following reasons. First, solar farm usually does not have any extra space for more panels. Second, solar farm always has technician on-site, so maintaining the tracker will not be a problem.

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