

Solar Powered Desk Fan

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Type: Design problem
Student time: Two weeks
Location: Laboratory and take home

Summary

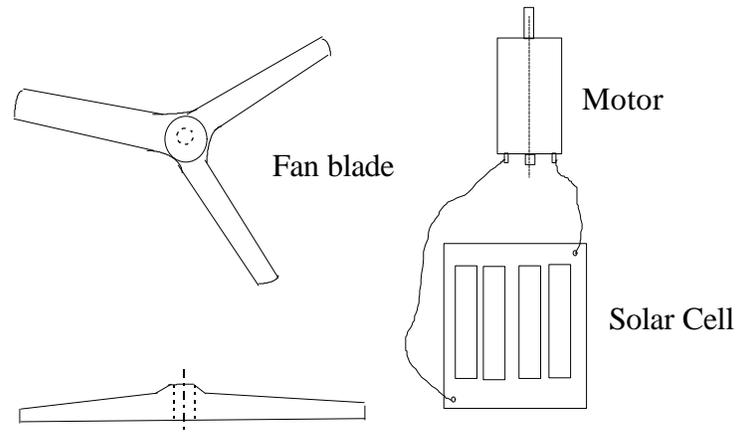
This project is intended to be used with first year engineering students in the first week or two of classes as an introduction to engineering design and cooperative learning. Students will work in a group of two to design and construct an enclosure for a solar fan using a sheet of cardboard. Aesthetics and the strength of the enclosure may be considered as evaluation criteria.

The primary purpose of this project is to enable the students to understand spatial disposition of objects and a means to devise an enclosure to support them. The project will also demonstrate the concepts of object representation techniques with orthographic and isometric projections.

ABET Descriptors

Engr Sci Content: First Year Engineering
Type: Component and system
Elements: Analysis, construction, testing and evaluation
Features: Design methodology, creativity, open-ended, communication
Constraints: Limited materials, time, strength and aesthetics
Effort: Team

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Problem Statement:

An electrical engineer developed a solar powered desktop fan having components as shown in the above figure.

- I. Study various components of the solar powered fan. Write a paragraph explaining the function of each component.
- II. Design an enclosure for the fan out of a sheet of cardboard so that it can be mounted on an outdoor study desk. Ensure that the enclosure will not sag more than 1/4" when a book weighing 1 lb. is placed on top.

You may check out the solar fan for a period of one hour from the laboratory instructor.

Resources:

A solar cell, a fan blade, a variable speed motor, one 8-1/2"x11" cardboard sheet and glue.

Evaluation Criteria:

Design procedure
Pictorial representation
Project Report
Style
Use of correct English
Deflection of the fan when loaded
Aesthetics.

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Engineering notes:

The primary objective of this project is to familiarize the students with the importance of spatial disposition of 3-D objects. It will also help in understanding the transformation of 3-D representation to 2-D. Students will get hands-on training on measurements and dimensioning.

Expected outcome:

The professor should observe the solution procedure followed by the students. The students can be asked how any limitations in their designs can be avoided.

Discussion/follow-on activities:

Study the air pollution problem in a nearby city and explain how solar energy may avoid further pollution. (Evaluation in English and Engineering courses).

Study the relationship between the intensity of the sun and the voltage developed by the solar cell.

Study the variation in insolation (the intensity of the sun from sunrise to sunset) in your location. Examine its effect on ambient temperature.

Study the effect of the intensity of the sun on the rpm of the motor and the air speed.

Study the impact of ambient temperature on energy consumption in households. You may contact junior and senior level students working for the nearest Energy and Diagnostics Center (EADC) for detailed information. Represent the data pictorially so that the city residents will be able to appreciate your research.

Compare the initial and operating cost of the solar powered fan versus a fan driven by electricity. What should the life of the solar fan be so that its cost will be equal to the energy savings?

Comment on the limitations of the solar fan. How can one overcome these limitations?

Design a balanced, optimal electrical storage for the solar fan.