

The Solar Car Model

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Type: Design Problem
Student time: 3 to 4 weeks
Location: In class, the last week session will finish with a race on a flat concrete surface.

Summary

This project is intended for first year students during their second semester. The job is suitable for work in teams of 3 persons. The objective is to come up with a conceptual design of a solar car and build a working prototype. Students are given 4 solar cells (2" x 1") and encouraged to use recyclable materials. The overall cost of the vehicle should not exceed \$15.00, including the solar cells. Students will have to submit receipts. This project provides an opportunity to be creative, draw sketches, construct and test.

The project requires that students write a two-page report about the characteristics of the car and its cost (materials only).

In the third week, all groups will make an oral presentation about their car. A race on a 30 foot straight line path over a flat concrete surface will follow afterwards.

ABET Descriptors

Engr. Sci. Content: First Year Engineering
Type: Components and system
Elements: Design, construction, testing, evaluation
Features: Creativity, design methodology, open-ended design, communication
Constraints: Recyclable materials, limited solar cells, economic factors,
aesthetics
Effort: Team

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The class will be divided into groups of three students.

You are asked to design and construct a working model for a solar car. Once the car is constructed, there will be a race among the different groups in the class. The only source of energy to move the car will come from the sun through the 4 solar cells supplied. Use of batteries or other storage technique is not allowed. Steering system is optional.

In addition you have the following constraints:

- The cost of the car (materials only) is limited to \$15.00, including the solar cells. Submit receipts.
- You are free to choose the other components or materials. Using recyclable material is encouraged.
- Minimize the weight.
- The design and construction of your vehicle should be kept as simple as possible.
- Limit the construction of parts to the tools and machines available in the College or Department machine shop. In case of manufacturing parts, these will have to be made by members of the team.
- The length is from 9 to 12 inches. The other dimensions should be proportional.
- Use of remote control guiding and steering devices are not allowed
- Should be able to race on a flat concrete surface.
- The car should look good (aesthetics).

Working Schedule:

By the end of the first week the group will meet with the instructor in his office to discuss their progress (oral progress report).

Submit with your car in three weeks: Sketches of your car and not more than a 2 page summary about the characteristics of your car (electrical circuits, manufacturing details, difficulties encountered, etc.). Also include recommendations on how you would have made your car if you were to start again. Indicate how many hours you spent in the project and how you utilized your time (planning, drawing, discussing, etc.).

Prior to the race, groups will make a 10 minute presentation about their car. This will be 20% of the grade. The other grading parameters will be weight (8%), dimensions (8%), durability (4%), aesthetics (12%), ease of construction (8%), propulsion system (8%), originality (8%) and speed (28%).

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Road test of your vehicle:

Vehicle road test will be on a flat concrete surface for speed and direction. The evaluation will consider the above specifications. The speed criterion will be based on the time to reach a 30 ft distance without deviating more than one foot to any side of a straight course. All the cars will race after the presentations.

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Engineering Notes:

This is an exercise for creativity and hands-on experience on building simple things while having fun. More than one person will be needed to grade these projects. It is advisable to form an evaluation team in which other faculty and graduate students may participate.

In addition to testing speed on 30 feet, it could be done at 10 and 20 feet. Also a ramp of moderate slope may be included.

Students may want to use wheels from old toys. Some of them may come up with the idea of using a capacitor, initially charged by solar energy, to provide a fast start to the car. However, this is not allowed at this level of students because it will make a considerable difference at the start. After the race the instructor may want to meet with the group and discuss all the outcomes from the different designs.

The project requires a short lecture about solar cells and energy conversion.

The project statement does not mention the use of a dc motor. Students will have to find this out and make a selection.

Designs from several parts of this car may be developed later in Machine Design, Design of Energy Systems or Energy Conversion courses.

A capstone design course in which a full sized car is designed and built may be considered. This could include students from different majors (Mechanical, Electrical, ...)