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Battery-Powered Device to Run One Person Vehicle

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Type:	Design Problem/Design Project
Student Time:	Six Weeks
Location:	Take home

Summary

This project deals with the design of a device that uses two ordinary D size cells to move a one person vehicle through 300 feet on a leveled concrete side walk. The students are given ten (10) minutes to convert the battery power in to a more useful form by designing a device. The race begins right after the 10 minutes time but, both the battery and the device itself will be disconnected from the one person vehicle. In other words, the energized device and the D size cells can not be carried along with the vehicle. Also, the device must not contain any prior internal or external supply of energy in any form. Nuclear or any explosive devices may not be used to propel the vehicle. This project is intended for the first year students to do conceptual designs, or this project may be assigned to senior students as a Capstone Design Project that includes more thorough and detailed design. Since team work is important to cover the several aspects of this project, this work may be done in a group of 3 or 4 students.

The students must address issues such as safety of the device, cost, material, manufacturing, and other pertinent issues. Any available computer software may be used and the different design alternatives analyzed to determine the optimum design. This information can be used in the understanding of the design of human powered or other similar vehicle designs. At the end of the project, the student will hand in project need, specifications, alternative solutions, the final concept, and a diagram or sketch of the device. A prototype of the device may be made and tested. They may also want to include an oral presentation of the results at the end of the project.

ABET Descriptors

Engr Sci Content:	First Year Engineering
Type:	Systems Design
Elements:	Establish objectives, synthesis, conceptual design, testing, evaluation
Features:	Design methodology, creativity, design alternatives, open-ended, feasibility
Constraints:	Performance, cost, time, optimum design, weight, safety, stability, aesthetics (Must appeal to users and by-standees)
Effort:	Team

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You are to design a device that uses two ordinary D size cell batteries to launch a one person vehicle through 300 feet on a leveled concrete floor. You are given ten (10) minutes to use (convert) the battery power to energize the device that launches the one person vehicle. Both the energized device and the D size cell batteries will not be a part of the racing one-person vehicle. You are to accurately define the scope of the project, need and design specifications to the best of your ability. You may use any available software in assisting you to study the different other similar devices, to analyze the different designs that use various materials, and the type of joints used, etc. The information developed from the analysis of the design may be used to understand the design process and the manufacture of battery powered and similar other devices.

You will also have to consider other factors such as safety, human factors, aesthetics of the product, its cost, weight, ease of use, etc. You should describe how the unit may be tested if built.

You will hand in a report outlining your activities and results. It must include a complete design definition and specification as well as a drawing with enough detail showing your product solution.

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Engineering Notes:

Objectives/Comments: A comprehensive analytical model may be developed, or any available computer package used for studying the different design alternatives of the device that moves the human and the vehicle through 300 feet on a leveled concrete floor. Based on some simple engineering calculations, and using the physical laws, the racing time may be predicted before the racing starts. Some hand calculations may be performed to check your design. If possible, a prototype of the model may be built and tested to see if the device moves the one person vehicle through the distance in the anticipated time.

Students may want to visit a web site on internet, or go to a library to obtain more information on similar devices.

Certain other constraints are added to the project. For example, no other previously stored external or internal energy in any form may be supplied to the device or to the vehicle. This includes, for example, using the energy from a previously wound spring, etc.

Outcome: The student is expected to visualize the situation and come up with a conceptual design of the proposed device that launches a one person vehicle. In this exercise, the electrical details of the battery, the mechanical/electrical design of the energy storage device, and the design of the vehicle are to be studied in detail. This is to be followed by estimating the racing time based on physical laws. The various assumptions made in the analysis are to be clearly outlined during the design process. Individual failure criteria needs to be established while designing the members and the other components associated with the joints. As discussed in the class, the students are expected to define the scope of the project, the objectives, design specifications, idea generation and selection, and final implementation. The report should document each activity, including a sketch of the product in sufficient detail showing the dimensions and to show how it is designed.

It is expected that students will be exposed to the design process before undertaking this project. As a result, they should be able to determine the design steps from the given information and form the process accordingly.

Discussion/Follow-up: The project may be continued in future classes like, Static force analysis, detailed stress analysis using finite element method, materials selection, fatigue, machine component design, senior capstone design, economics, manufacturing issues, human factors , etc. Liability and safety issues may also be discussed in the other design courses.