Mini Mars Rover

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Introduction

• The Palouse Discovery Science Center would like a rover that is, at least partly, powered by solar energy and able to stay cool in warm conditions. This would greatly decrease maintenance and would enhance the reality and aesthetics of the Mini Mars Rover exhibit.

About The Rover

• Enclosed oval-shaped track.
• Remote control.
• Camera - interfaced to a monitor on the outside of the exhibit.
• Enclosed track (safety).
• Lights inside the enclosure.
• Enough terrain to create a realistic Mars effect.

The Problems

• Battery Use – Camera, Rover Board.
• Temperature – confined enclosure.
• Aesthetics – Must look like the Mars Rover.
Solution

- Solar Motors
  - less power required
- Camera
  - alternate source
  - longer runtime
- Rover Board
  - Boost Convert from Solar - brainstorming
- Cooling System.
  - PC fan.

The Design

- Motors
  - Two Solar motors ~(0.5v, 122mA)
- Gears
  - To provide torque
- Power
  - Batteries 7 AA NiMh 2000mAh for the camera.
    - Recharge camera at night via plug-in.
  - Solar cells for the motors.
  - Boost Converter from the Solar Cells to power Rover Board.

Photovoltaic Theory

- Each photon will free exactly one electron.
- Absorb 15 percent or less.
**Solar Motors**

- Currently Rover used two 3v batteries
  - Approx. $14.00/pair, 100 mAh

- Will run off of less power
  - Approx. 0.5v, 122mA, 62.5mW
  - Solar energy will run the rover all day.
  - No batteries to replace with the motors.

**Camera Source**

- Currently
  - lasts one hour on one 9v.
  - Approx. 9.13V, 83.2mA.
  - More heat in the enclosure draws more current.

- Proposed
  - Seven 1.2V AA NiMH rechargeable batteries.
  - In series ~ 8.4V, 2000mAh
  - Recharge at night by plug-in (docking).

**Rover Board**

- Currently
  - Runs off the two 3v batteries
  - Expensive, and replacements are necessary about every two weeks.

- Proposed
  - Boost Converter from the Solar Cells to power Rover Board.
  - Requires high volts, low current.
  - Keep current frequency (26.997mHz)

**Boost Converter**

- Input is small voltage.
- Output is higher voltage.
- Current stays the same.
Cooling the System

- Currently
  - None
    - vents in the enclosure.

- Proposed
  - PC fan
    - Low voltage, low current
  - Heat-sink
  - More ventilation in enclosure

Summary

- The Palouse Discovery Science Center has a Mars Rover exhibit that needs improvement. They need a better way to power the rover unit, with low maintenance and higher levels of safety. Our task is to fulfill this need and design a more aesthetically pleasing replica of the actual Mars Rover.

Project Expenditures

| Table 1: Funding that we need to accomplish our first task (working model of the Mini Mars Rover by the end of April) |
|-------------------------------|----------------|-----------------|
| Item                         | Quantity | Price/Unit | Total Price |
| camera                       | 1        | $28.00      | $28.00       |
| fan (Radio Shack)            | 1        | $20.00      | $20.00       |
| sample rover (for parts)     | 1        | $49.99      | $49.99       |
| photovoltaic cells (Radio Shack) | 20  | $4.99       | $99.80       |
| rechargeable NiMH batteries (Radio Shack) | 20  | $5.00       | $100.00      |
| copper foil tape #7588T8316 (Techni-Tool) | 1        | $29.95      | $29.95       |
| dc-dc boost converter #295-228-1-1-ND (DigKey) | 3        | $5.00       | $15.00       |
| Misc. (wire for connections, fiber glass board, epoxy, solder, etc.) |  |  | $50.00 |
| **Grand Total**              |  |  | **$393.00** |

Part Information

- The sample rover is needed because it contains the motors and the circuit board with the receiver on it.
- The fan is needed to keep the unit cooler than the current model.
- We are going to construct two packs of batteries for this rover (one pack for back-up use) and use the rest for testing.
- Boost converters are needed to step up our DC voltage from the photovoltaic cells.
- Copper foil tape is needed for making traces on our photovoltaic cell panel.
- The price in the miscellaneous category listed in Table 1 was calculated to ensure that we have enough funding to buy wire, sheets fiber glass for making circuit boards, solder, conductive epoxy, etc.
Schedule and Milestones

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- Solar Motor Gearing
- Camera Cooling
- Powering Board – Boost from solar panel
- Aesthetics