Solar Project (Experimental Design)

Richard Centore, David Sagan, Usman Rehman, Noah Peretzman

Activity Report

1 Question

The objective of this project is to build a system that can take solar energy and deliver that energy to a motor in order to power a 1/10 scale solar car. The primary question that needs answering is ”how can me make the system more efficient?” Efficiency between power production and power consumption will be of utmost importance as we will be able to go further and faster with the same solar panel if the system itself is more efficient. With efficiency in mind, we must test the length of time and the conditions that the car can run in under load. This power consumption can be monitored via the on-board micro controller. Efficiency of the overall system can be measured in run-time for the car.

2 Hypothesis

Based on the physical design for our RC car, we should be able to develop a system that will allow an RC car at 1/10 scale to move utilizing solar energy and a PV(photo-voltaic) panel of roughly 22” by 26”. This car will be able to operate continuously during good weather conditions, i.e. high light level, low wind conditions. Under less than perfect weather conditions, as the efficiency of our system grows throughout the year; the car will still be able to operate continuously. Finally once the conditions of the weather are too poor to support the power needs of the car a battery charged with excess power from the PV panels will turn on, thus increasing total run-time.

3 Metrics

- Voltage: Average Voltage produced by the solar panel.
- Current: Average current produced by the solar panel.
- Power Production: Using the measured voltage and current we will calculate the average power produced by the solar panel.
- Travel Time: How long that solar car is able to move with the power provided by the solar panel.
- Time of Day and Year: We will note down the time of day and year to measure how daylight and weather impact the performance of our solar car.

4 Data Collection

The solar car data collection will start with getting the solar panels to produce power from photons emitted by visible light. In the first phase the solar panels will produce power and drive a motor load to power and turn the wheels in place and in a line. The motors will be initially tested with an external power supply to test the in rush current, the instantaneous high input current drawn by a power supply at turn-on, and optimal efficiency rpm. In the second phase the car will be tested on two different tracks one will be rectangular and the other will be a figure eight. Data parameters to be collected are going to be the amps and voltage between the panel and load. Parameters that will be logged are going to be the time of day/year, latitude and weather conditions.

Finally we will include the test road conditions, smooth and rough surfaces.

5 Control

The bias in our project is the variable energy provided by the sun via the solar panel. The difference in the energy produced can be due to many reasons such as: a rainy or cloudy day can lead to a lower energy production due to less photons, different time in the day or the year can also lead to a decrease in power production. We can control this bias by using a battery that would store some amount of energy during peak hours so that we can supply some stored energy when the solar panel is not able to provide sufficient power to run the motors.

We can also use an artificial light source like the Halogen Stand Work Light available to us from last semester to get some data generated indoors or during night time.

6 Data Analysis

The data collected will have two phases. In the first phase, power will be collected from the panel and will be connected to the load for simplicity. Also, the panel will be mounted flat to the the car. In the second phase we will use two different tracks and measure the average power for some amount of time. The time runs will be the dependent factor that allow for consistent test conditions. Each test session we will log the date, location, weather, and surface conditions. The main test location will be Albany, NY, at latitude: 42.6 degrees, and the weather conditions will state how much cloud cover is overhead during the test. Each session will be timed and the average voltage and current measurement will be logged from the run. Real time voltage and current measurements will be used for battery charge state once battery will be implemented. In the second phase the panels will have some tilt toward the sun for more direct light absorption. This phase has more systems that are associated with the panel tilt so initial testing will start with a more simplified version. The data collected will be analyzed to find the most efficient conditions for power production.

7 Conclusion

Assuming our experiment validates the hypothesis that we formulated earlier, we should be able to develop a fully solar powered 1/10 scale car using the the designed system from our physical design document. This solar car should be able to operate indefinitely under its own power from the sun at optimal to less than optimal absorption, and will be able to store excess power for usage at times when the absorption from the sun is too low. Assuming we are successful, this project would go to help proving that solar power is a sustainable way to power transportation in the future.