CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Travis S. Adams

Project Number
J0801

Project Title
Maximizing the Power Output of a Crystalline Silicon Photovoltaic Module through the Use of Solar Concentrators

Abstract

Objectives/Goals
Can you enhance the performance of solar cells by utilizing mirrors as a way of collecting or directing more light energy (photons) upon the surface of the solar cell? When the sun is blocked by clouds, the power output of the photovoltaic cells drop dramatically. My objective was to increase the power output of the solar cell on a cloudy day, with solar concentrators, so it is equal to the power output produced on a sunny day, without the solar concentrators.

Methods/Materials
1.The solar concentrators or mirrors were set up on the stands at the correct angles under the lights. 2. The circuit was set. 3. The mirrors were covered and then the lux was measured with the light meter. 4. Then the Light Meter was taken off and the voltage and amps were recorded. 5. This was done ten times with the covers and without the covers at the different lux readings. These lux readings were varied through the use of a dimmer. 6. Lastly, the volts and milliamp readings were recorded and then multiplied together to get watts. 7. This whole process was repeated outdoors in cloudy and sunny conditions. Materials: 1. Solar Cell, 2. Solar Concentrators, 3. Light Meter, 4. Five High Powered Lights, 5. Multimeters.

Results
Through my experimenting, I found that at a very low level of lux, 5,290, the mirrors enhanced the power output of the solar cell by 65%. But, when the lux was very high, 118,000, the mirrors only raised the power output of cell by about 23%. So, on a typical cloudy day, the solar cell, with the enhanced performance of the solar concentrators, will produce about 45% more energy than without the solar concentrators. The closer the cell was to producing its maximum power on a sunny day, the mirrors, or solar concentrators became less and less effective. However I did prove my hypothesis correct, for on a typical cloudy day, I produced, with solar concentrators, the same amount of power as on a sunny day without the solar concentrators.

Conclusions/Discussion
Yes, I can enhance the performance of solar cells by utilizing mirrors as a way of collecting or directing more light energy (photons) on the surface of the solar cells. By increasing the area of the solar cell, more photons or light energy is collected and directed onto the surface of the photovoltaic cell. This is a very economic way to increase the power output of the cell.

Summary Statement
My project is about maximizing the power output of a silicon photovoltaic cell using solar concentrators (mirrors).

Help Received
My mother partly helped assemble the board, my father helped with the buliding of the concentrator

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Sera H. Aguirre

Project Number
J0802

Project Title
Is the Voltage Created by Lemon Batteries Usable Energy?

Abstract

Objectives/Goals
Make a lemon operate a LED, a watch, and a small light bulb.

Methods/Materials
4 galvanized nails
4 small copper wires about 2 inches
4 lemons
8 alligator clips
a multimeter
a watch
a small light bulb
a LED

Results
The lemons were able to operate the LED and watch, but not the small light bulb.

Conclusions/Discussion
The lemon was able to operate the LED and the watch because they had little resistance and required very little voltage. The light bulb didn't operate because it had too much resistance and too little current.

Summary Statement
Making a lemon operate small electronics.

Help Received
My dad helped me get the materials such as the copper wires, alligator clips, and the galvanized nails. My mom helped me get the lemons. My dad also helped me put the galvanized nails and copper wires into the lemons.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Gregory C. Arena

Project Number
J0803

Project Title
Shocking! The Effect of the Shape of an Electrostatic Comb on the Charge Production of a Van de Graaff Generator

Abstract

Objectives/Goals
The purpose of my project was to determine if the comb shape will affect the electrostatic charge production of a Van de Graaff Generator.

Methods/Materials
The Van de Graaff generator produces static electricity through friction, in this case a rubber belt driven by two different roller materials as far apart on the triboelectric series (a scale ranking materials from releasing to attracting electrons) as possible. As the belt rubs against the rollers, it strips electrons that are gathered by an electrostatic comb and the charge is distributed to the terminal (two rim less stainless steel bowls). The charge concentrates until the electrons discharge forming a spark between the terminal and a smaller grounded sphere.
To determine which comb performs best I measured the spark length, as one inch of spark is the equivalent to 25,000 volts. This is determined by the equation E = 0.5 CV^2. Four electrostatic combs were constructed: a thin strand copper wire, a copper screen, an aluminium serrated edge and an aluminium straight edge. Uniform in size, they were tested three times each.

Results
The copper wire comb (the sharpest) performed best, with a mode spark of 1 3/4 inches. The second comb, the aluminum serrated edge, was 1 3/8 inches. The third comb was the copper screen at 1 1/8 inches. The forth comb (the least sharp) was the aluminium straight edge with a mode spark of 3/4 inch.

Conclusions/Discussion
This demonstrated that a sharp comb is more efficient in charge production.
A more efficient Van de Graaff generator can produce more static electricity which is useful in the modern world to sterilize surgical equipment, in the treatment of superficial cancerous growths, in the study of X-rays, and investigation into the possibilities of accelerated plant growth without the need of fertilizers, green houses or hybridization.

Summary Statement
This project was to determine whether the shape of the electrostatic comb would affect the charge production of a Van de Graaff generator; it was shown that the sharper the comb the greater the production of electrostatic electricity.

Help Received
My father helped with the construction of the generator, and comprehension of principles and formula.
My mother helped with dictating copy while I typed, and cutting photographs used on display board.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Ian J. Bennett

Project Number
J0804

Project Title
Generating Electricity from Wastewater Using a Microbial Fuel Cell

Abstract

Objectives/Goals
My project is to determine which wastewater sample creates the most millivolts using a microbial fuel cell (MFC). I believe that the simulated ground food wastewater sample will produce the most millivolts using an MFC.

Methods/Materials
Three microbial fuel cells with identical cathode and anode chambers, electrodes, and salt bridges were built. The secondary (biological) treatment sample was collected from the wastewater plant, and the ground food household wastewater sample was mixed. The wastewater samples and control were poured into individual anode bottles, and sealed airtight. Each cathode bottle was filled with a saltwater conductive solution. The external circuit was connected to the resistor (multi-meter) and the millivolt readings were recorded twice daily, for seven days.

Results
The secondary (biological) treatment wastewater sample from the Sunnyvale, CA Water Pollution Control Plant produced the highest reading, 152.45 millivolts. Simulated ground food wastewater sample generated a 78.75 millivolt reading.

Conclusions/Discussion
My conclusion does not support my hypothesis that the simulated ground food wastewater sample will produce the most millivolts using an MFC. Microorganisms added to the secondary (biological) treatment wastewater at the treatment plant, generated the highest reading of 152.45 millivolts. This is only 10.16 percent of a 1.5 volt AA battery output. Ground food naturally produced nearly half the secondary treatment millivolt level. The data demonstrates that a microbial fuel cell can be used to harvest electricity from ground food and secondary (biological) treatment wastewater.

Summary Statement
The purpose of my project is to present experimental data comparing the amount of electricity, measured in millivolts, generated from wastewater samples using a microbial fuel cell.

Help Received
My parents drove me to purchase supplies, collect wastewater plant samples, and borrow the multi-meter. My parents paid for all materials and lent me tools. My parents answered questions about grammar and word choice, took pictures, and made sure I thought safety first.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Brynn Bradley; Zoe LaPorte

Project Number
J0805

Project Title
Hamsters Gone Green

Abstract

Objectives/Goals
If the weight of a hamster is proportional to the amount of energy it can produce then we should be able to create a linear equation to use weight to predict the amount of energy each hamster can produce. We can then use the equation to determine how large a hamster or how many hamsters will be needed to power common household electrical items.

Methods/Materials
We connected a DC motor to a hamster wheel, which acts as a generator when the wheel is rotated. Using a resistor and computer readable voltmeter, we recorded the voltages that hamsters of different weights produced during twelve-hour trials. We converted the voltages into electrical power (P=V2/R) for each trial. We graphed power vs. hamster weight to determine if there is a linear relationship.

Results
After testing hamsters of different weights and measuring power output and total energy output with four different dependent variables, we found that only one of the dependent variables (average power output when hamster was running) showed a good fit with a linear equation. The other three dependent variables (Peak power output, total energy output, and average power over twelve-hours) showed a poor fit with a linear equation. We expected all of our dependent variables to fit well with a linear equation, so we were surprised to only find one that did.

The best fit line we found was for average power when running vs. weight:

y=10.341x+20.205 (y is in microwatts, x is in ounces)

Conclusions/Discussion
Using our linear equation, we determined we would need 1,160,429 five-ounce hamsters to power a 60-watt light bulb. Therefore we found that using hamsters to generate electricity was not even close to being practical with our method. We think it is possible that there is a better way to turn the energy from the rotating exercise wheel into electricity, for example by using a different kind of generator, or by finding a way to spin the generator faster using different gears.

Summary Statement
The purpose of our project is to determine if hamsters can generate a useful amount of electrical energy and to try to find a linear equation relating energy produced vs. hamster weight.

Help Received
We had too much data to open in excel so my father helped us create a pearl script to analyze the data. He also helped us with the power tools needed to attach the DC motor to the exercise wheel and mount it in the hamster cage.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Shyamal Buch

Project Number
J0806

Project Title
Live Green or Dye Hard: Analysis of Nanocrystal Dye-sensitized Solar Cells using New Low-Cost Robotic D-SCOPE

Abstract

Objectives/Goals
This project is about solar cells built using nanocrystals sensitized to visible light by plant-extract dyes. The objectives are: (1)To find which dye results in the best power output and fill factor, and (2)To design a new electronic tool to automate measurements of these solar cells. It is hypothesized that Raspberry and Blackberry dyes would provide the best results.

Methods/Materials
24 Dye-sensitized Solar Cells (DSCs) are constructed using 10 different plant-extract dyes, nanocrystals of Titanium Dioxide (TiO2), electrolyte, graphite, and conductive glass slides. The dyes used are: Blueberry, Blackberry, Raspberry, Cranberry, Pomegranate, Cherry, Frozen Blackberry, Beetroot, Red Cabbage, and Spinach. A Control cell is built with no dye.
A new robotic tool ("D-SCOPE") is designed to test these Dye-sensitized Solar Cells. A daylight lamp illuminates the solar cells within a light chamber. Programs are written to automate the process of obtaining characteristic curves of the solar cells. From these curves, the maximum power output and fill factor are derived.

Results
The 3 cells with the highest power output were Raspberry, Blackberry, and Pomegranate DSCs. They also had the best fill factor (46.03%, 43.23%, and 40.67%, respectively). D-SCOPE measurements met the targets for speed, accuracy and repeatability.

Conclusions/Discussion
My hypothesis was partially correct, since Raspberry and Blackberry dyes provided the best and third best power output, respectively. Dye-sensitized Solar Cells can convert abundant solar energy into electrical energy. Compared to silicon solar cells, DSCs cost less, are easier to make, and "green" (better for the environment). The new D-SCOPE tool which I designed enables automated measurements at much lower cost than lab equipment, and can fit student budgets.

Summary Statement
24 Dye-sensitized Solar Cells are built using 10 plant dyes, and their characteristic curves are obtained using a new robotic tool (D-SCOPE) which I designed.

Help Received
My teacher, Ms. Mohler, gave encouragement; Mr. Reinking introduced me to robotics & programming; Mr. Reidy of Hartford Glass provided conductive glass, TiO2 and electrolyte; Dad helped with soldering, sintering, & guidance; Mom & Sister helped with extracting dyes, taking pictures, & board layout.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Caroline Chan; Sierra Tobin

Project Number
J0807

Project Title
Radio Hide and Seek: The Effect of Obstacles on Radio Waves

Abstract

Objectives/Goals
The objective is to make an electronic pet finder that would be small enough to hang on a pet collar. Our project will test the effectiveness of the pet finder by measuring the effect of obstacles on radio waves.

Methods/Materials
We built an FM Radio Transmitter from a kit (Ramsey Electronics Model Kit FM10C FM Radio Transmitter), and transmitted a signal to a radio receiver with and without obstacles (sponge pad, nylon screen, poster board, and particleboard) obstructing the transmitting antenna. We measured the distance at which the radio receiver lost the signal, which played a distinct audio tone, with the help of an indicator light. In addition to testing different obstacles, we tested different frequencies (87.50 MHz, 94.30 MHz, 98.40, and 108.00 MHz) to verify the Friis Transmission Equation.

Results
Our results showed that the 108.00 MHz waves traveled the farthest, followed by 94.30 MHz, 98.40 MHz, and 87.50 MHz. We also found that at most frequencies the screen was the most obstructive and the foam poster board was the least obstructive.

Conclusions/Discussion
Our hypothesis was partially correct; the distances traveled by the higher frequencies were farther than the distances traveled by lower frequencies for the most part. We were wrong about how obstructive the obstacles were; we predicted that screen would be the least obstructive, but it was the most. The overall order of obstruction is the nylon screen, the sponge pad, the particleboard, the foam poster board, and the unobstructed test. For the tests at 98.40 MHz, we believe there was interference from an outside broadcast, so that test may be invalid. Our conclusion is that our pet finder will work best at the highest frequency, but that its effectiveness will vary depending on the type of obstructions.

Summary Statement
We transmitted radio waves of different frequencies to a radio receiver through different obstacles to test how well an electronic pet finder would work.

Help Received
Pak Chan helped hold the soldering iron when soldering the Printed-circuit board and explained some scientific concepts.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Taylor S. Davis

Project Number
J0808

Project Title
Amplifying Effects of Reflective Materials on Photovoltaic Cells

Abstract

Objectives/Goals
My objective was to determine which reflective materials are the most effective in amplifying the energy output of a photovoltaic cell.

Methods/Materials
Eleven different reflective materials were tested by positioning them to reflect direct sunlight onto a solar cell. The solar cell was connected to a digital voltmeter. Direct sunlight on the solar cell was used as the experimental control. Each material was tested at the same time of the day, twelve inches away from the solar cell and at the same angle to keep the results uniform. The voltage for each material was recorded in volts. All of the materials were tested three times a day on three different days. The results were all averaged.

Results
Out of the 11 materials I used, the Mylar and the mirror consistently tested higher than the other materials and each increased the average energy output by 2.56%. All of the metallic materials performed with a significantly higher reading than the nonmetallic materials. The glass tile had no effect.

Conclusions/Discussion
I conclude that the best materials to use for increasing the energy output of a photovoltaic cell are mirrors and Mylar. I can also conclude that metals are good reflectors and could also be used to increase solar energy.

Summary Statement
My project is to determine which reflective materials will be the most effective in increasing the energy output of a solar cell.

Help Received
Mother helped me collect materials and put together my presentation board. My advisor/teacher explained the experimental process.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Joseph D.A. De Los Santos

Project Number
J0809

Project Title
Wi-Fi: How Do Different Antennas Affect the Performance of Signals?

Abstract

Objectives/Goals
The objective is to determine which Wi-Fi antennas perform the best when examining distance, speed, and packet dropping.

Methods/Materials
The antennas tested are the Omni-Directional and the Directional Panel. I used a 2.4 MicroTik radio and a laptop with an integrated wireless card. I set up the node with one of the antennas(test variable), and I used the laptop command prompt to ping it 100 times with one Kilobyte of data at each distance. The distances were 0-5 feet, 100 feet, 200 feet, 275 feet, 350 feet, 500 feet, 575 feet, 650 feet. I found the packet dropping, the range, and the time it took for the signal to be sent and received for each of the test variables at each distance.

Results
Overall the Omni-Directional was the worst performer. At home, a rural setting with no interference, the Omni Directional antenna had the least quality performance and the most packet dropping. In the alley, the signal bounced off of the surroundings and affected the signals. The Directional Panel had two polarities, vertical and horizontal. At home, I found the horizontal polarity had equal packet loss at 650 feet as the vertical polarity and was slightly slower. It also had sort of, a"donut" effect, where there was a poor quality signal right in front of the node. The performance increased until about 200 feet, then the signal started to degrade. In the alley, the horizontal polarity did not perform as well as Vertical Polarity but still performed better than the Omni-Directional antenna.

Conclusions/Discussion
Overall all antennas had a sort of "Donut" effect, where there was a poor signal right in front of the node. The Directional panel outperformed the Omni-Directional antenna. For speed and packet dropping the fastest was the Directional Panel on vertical polarity. On range, the Directional Panel vertical polarity was the best performer, but vertical polarity was mainly useful for point-to-point across nodes, as it covers a smaller focus. The Omni-Directional covers 360 degrees but has the least performance as well as some spots with degraded signals. In conclusion, I would use Omni-Directional for cost efficiency, four Directional panels at horizontal polarity for speed broadcasting in an area very heavily populated with clients, and I would use the Directional panel antenna vertical polarity for point to point to other nodes.

Summary Statement
My project is about determining the affects of different antennas on the performance of Wi-Fi signals.

Help Received
Grandfather provided materials for the project

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Kyle S. Estabrooks

Project Number
J0810

Project Title
Supercharged

Abstract

Objectives/Goals
The purpose of this project is to see if there is some way of increasing the amount of power you can get out of a solar cell without having to make some complicated changes to the silicon in the cell. The objective was to concentrate a beam of light on a photovoltaic cell using a concentrator and measure the energy out of the cell to see if it will be maximized when the concentrator is at its focal point relative to the surface of the cell.

Methods/Materials
100w light bulb, lamp, concentrator(magnifying glass), tape, tape measure, solar cell, multi-meter, and hight varying clamp. The basic method is to set the lamp with the 100w bulb at a fixed hight and focus its light using the concentrator onto the cell. Change the focus of the light while measuring the output energy of the cell.

Results
The results show an increase in output voltage that appears to be somewhat independent of the focus of the light. I believe that this had to do with the surface area of the concentrator being almost twice as large as that of the cell.

Conclusions/Discussion
Focusing the beam of light on one spot on the cell does increase the amount of energy by a small amount but a significant increase will come if you use a concentrator with a larger surface area than that of the cell.

Summary Statement
I focused light on a photovoltaic cell to see if it would increase the energy output over that of the cell on its own.

Help Received
Dad assisted me as I conduct experiments.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Nathan E. Galicia

Project Number

J0811

Project Title

Determining the Effectiveness of Series vs. Parallel Augmented Design on Rail Gun Performance

Abstract

Objectives/Goals

The purpose of my project was to compare two types of rail gun designs, series augmented and parallel augmented, and determine which was best at increasing the speed of a projectile. My hypothesis stated that a series-augmented rail system would be more effective than parallel rail system, because the increased electromagnetic field would be directed between the rails and toward the projectile, instead of just around the rails.

Methods/Materials

A railgun is basically made up of four (4) separate systems--an air injector, a power supply, a capacitor bank, and the rails. The bench power supply I am using can provide 18VAC and up to 400VDC. The capacitor bank is charged up using the DC; each of the four capacitors that I hooked up in parallel are each rated for 3900Aµf and 400V. First, for each test run I loaded the injector with 35 PSI of air from a rechargeable air pump. Second, after setting the bench power supply to DC mode, I charged up the capacitor bank, which takes several seconds. After positioning the projectile, and once the capacitor bank was fully charged, I switched the power supply to AC mode. Pressing the launch button, the valve (which runs on AC) on the injector opened and released the compressed air. The projectile is then pushed by the air down the track where it makes contact with the rails and is then accelerated as a result of the Lorentz forces produced by the metallic projectile completing the electric circuit. The above steps were repeated for no augmentation (my control), for parallel- and for series-augmentation. I calculated the â#ospeedâ## of the projectile for each test using the formula, speed = d * SQRT(g / 2h), where d is horizontal distance traveled by the projectile, g is a constant for gravity (32 ft/sec2), and h is height of the projectile above the floor.

Conclusions/Discussion

The results of my testing showed that the series augmented rail system was able to accelerate the projectile more efficiently than the parallel augmented rail system, and my hypothesis was proven to be correct. If I were to make modifications to my project, so that the parallel-augmented rails had a greater effect on performance, I would probably move the augmenting rails closer to the main rails and/or increase the voltage of the augmenting rail power source.

Summary Statement

My project determines whether parallel- or series-augmented rail design is most effective at improving the performance of a rail gun.

Help Received

My father helped me purchase some of the components that had to be mail-ordered and also checked all of my electrical connections before I started each test run. My uncle taught me how to use his router to cut my acrylic plastic pieces.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
David P. Hamilton

Project Number
J0812

Project Title
Wave Blockers

Abstract

Objectives/Goals
I wanted to find out what materials block radio waves more than others. I believed that material covering an antenna would affect the transmission of radio waves and block the transmission.

Methods/Materials
Test the distance a 49MHz remote controlled car will travel on a flat surface three times with no covering on its antenna. Next cover the antenna with aluminum foil, wax paper, plastic wrap, paper, cotton cast padding, and nylon synthetic wrap, and test the distance the car will travel. Repeat each test three times. Recharge the battery for fifteen minutes prior to each new test material.

Results
The control car went 39.60 meters. Aluminum foil did not seem to affect the transmission of the radio waves, at 39.80 meters. Wax paper seemed to help the radio waves travel farther. It traveled 47.26 meters. Several materials seemed to block some, but not all, of the radio waves. Synthetic wrap blocked the most radio waves. The car only traveled 19.31 meters while the transmitter was wrapped in the synthetic wrap.

Conclusions/Discussion
It turns out that my hypothesis was almost completely incorrect. I originally thought that the plastic wrap and the wax paper would block the radio waves. It turns out the wax paper went farther than any other test condition. I thought that the unwrapped antenna would go the farthest. The wax paper and the aluminum foil went further than my control group. Apparently one of my variables was not controlled as well as I thought. It is certain that none of the materials that I used was thicker than the radio wave transmitted from my controller, since the radio waves were not blocked.

Summary Statement
Using a remote controlled car, I tested to see how far the car could travel with different materials blocking the antenna's radio waves.

Help Received
Parents helped measure; Dad provided some materials and helped design my tests; County mentor helped edit my project abstract.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Sean W. Handley

Project Number
J0813

Project Title
Surf Power

Abstract

Objectives/Goals
Purpose: To prove that when looking at the power available in a wave, the height of the wave has a greater contribution than the period of the wave.

Methods/Materials
MATERIALS: Plexiglass wave tank + Specialized wave power generator.
MEASUREMENTS: Using a voltmeter, led light, and oscilloscope.
PROCEDURE/METHOD: A wave generator produces electricity from the up and down motion of a wave. My experiment uses a pair of gear reduction motors, mounted inside a waterproof cylinder, that are attached to a floating "U" device, which causes the shaft of the motors to turn with wave action. A bridge rectifier is used to convert the positive and negative voltages produced (AC) into positive only voltages (DC), and a capacitor is used to even out the voltage drop that occurs when the shaft slows down to reverse directions. By varying the load resistance of the measuring device, the current and voltage can be measured to calculate the generated power.

Results
TESTING RESULTS: From the results of my dry runs, the small waves are approximately 1.5 inches from crest to trough, and 10 inches apart, and the large waves are approximately 3 inches from crest to trough, and 20 inches apart. The larger waves produced 4.5 times more power than the small waves.

Conclusions/Discussion
My hypothesis of larger amplitude waves generating more electricity than lower amplitude waves that appear more frequently is supported by the results of my testing. The larger waves produced four times more energy than the smaller waves, even though they were only two times larger in height. This also supports the power wave density formula that the power of the wave is proportional to the square of the height (i.e., P in kW/m^2 = 1.2h^2/T).

Summary Statement
Capturing power from waves to demonstrate that larger amplitude waves generate more electricity than lower amplitude waves that appear more frequently.

Help Received
My father helped me select the motors used in my floating device to capture energy, he generated waves during testing while I took measurements, and he helped find a mathematical formula that can calculate potential energy from waves. My mother reviewed my draft report.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Dana T. Hartman

Project Number
J0814

Project Title
Generating Electricity through Wave Motion

Abstract

Objectives/Goals
In this experiment, I was trying to design and build a working generator that would use wave motion to generate electricity.

Methods/Materials
To build my generator I had to wrap two spools of magnet wire into their own little coils around a small tube and then placed some neodymium magnets inside and blocked off both ends with PVC end caps. I then built a waterproof housing using a plastic tube and PVC end caps that still allowed me to remove the generator at any time. Along with this, I built an anchoring system that used a small weight and a foam noodle to kept my generator from floating off.

Results
My results are inconclusive because of the lack of strong winds on the San Francisco Bay and my inability to create large enough waves.

Conclusions/Discussion
Because my results for this project are inconclusive, I cannot draw an accurate conclusion at this time.

Because the idea of using wave motion to generate electricity is still fairly novel, not all the possibilities have yet been exploited. However, from other data collected so far, it seems like an efficient way to create electricity. From what I was able to gather from my project I agree. However, I cannot be completely sure because I was unable to complete my project.

Some of the errors in this project were that there were not strong enough winds in the bay to create the necessary wave size, I was unable to synthesize large enough waves on my own, there was a very slight leakage in my waterproof housing system, and the generator would not always point directly into the oncoming wave.

If I was to expand on this project, I would make sure to test my design during the summer, when the winds on the San Francisco Bay are strongest. I would make the fin on my waterproof housing longer so the setup wouldn#t move around as much and I would also try and use more sealant to make sure my housing stayed completely watertight.

Summary Statement
This project explored the idea of building a machine that could be used to harness and convert wave motion into electricity and if this could be used as a renewable resource.

Help Received
My father supervised me while I used dangerous tools such as drills and saws.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Aidan F. Healy

Project Number
J0815

Project Title
Capturing Solar Energy

Abstract

Objectives/Goals
The purpose of my project is to determine which type of reflector will make a photovoltaic solar cell gain the most solar energy. My hypothesis is: If light rays are directed from a magnifying glass, mirrors, or a parabolic reflector, the solar energy absorbed by a photovoltaic solar cell would then increase.

Methods/Materials
The experiment was performed at the same time, in the same place, on five separate days. A magnifying glass, one mirror, then two mirrors, and a parabolic reflector were reflected onto a photovoltaic solar cell to determine which reflector would cause the greatest gain on a DCAmp 200mA voltage meter.

Results
The parabolic reflector generated the greatest energy gain in the photovoltaic solar cell because it was very reflective. The two mirrors generated the second highest energy gain. The one mirror showed the third highest gain. The magnifying glass showed the lowest energy gain. The magnifying glass showed less energy gain than the control because the shadow of the magnifying glass itself, blocked the sun's rays.

Conclusions/Discussion
My conclusion is that parabolic reflectors should be used whenever possible when solar cell panels are being installed. Parabolic reflectors increase the amount of energy the solar cells absorb.

Summary Statement
My project tests different reflectors to see which one will cause the greatest energy gain in a solar cell.

Help Received
My mother helped type and format my report. My dad helped me connect the solar cell to the voltage meter.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Jack D.S. Ireland

Project Number
J0816

Project Title
Poop to Power: Microbial Fuel Cell Uses Chemistry and Microbiology to Ease Environmental Problem and Create Electricity

Abstract

Objectives/Goals
Cleaning our country's (and others') waste water (poop) requires significant electricity which creates more pollution, chemicals and water in other places of society. Furthermore poorer countries often have bad sewage disposal or none at all which can make people sick. My goal is to see if building a giant Microbial Fuel Cell (MFC) would be a rational way of generating electricity, and cleaning water on a higher level. If I can succeed, it could help poorer countries bring more electricity to society, clean their water more efficiently and kill two birds with one stone.

Methods/Materials
I built two Microbial Fuel Cells (one small one and one three times larger) using two chambers (anode/cathode) and identical materials. I used carbon fiber brushes as electrodes and sewage fortified with E. Coli in the sealed anode chamber. I also dissolved L-Cysteine in the sewage solution to remove dissolved oxygen, hopefully forcing the E. Coli to break down the poop anaerobically, which releases more electrons. In the cathode chamber I used carbon fiber-platinum catalyst as electrodes and phosphate buffered saline as the conductive solution. I bubbled air through this solution constantly to maintain a high level of oxygen so their would be plenty of cations. I separated the anode and cathode chambers with a membrane that allows cations to pass through, but not electrons, forcing electrons to travel up the electrode's wire and generate electricity. I used two digital multimeters connected to a computer to log the voltage and amperage every minute for a few days for each MFC.

Results
The voltage output of the MFCs jumped around during the first twelve hours, but then both MFCs leveled off (except when it dropped during the cold early morning hours) around 200 millivolts. The larger MFC put out much more than three times the amperage of the smaller MFC.

Conclusions/Discussion
I couldn't get enough volts or amps to run my iPod. Even though an MFC using millions of gallons of sewage every day could generate significant power, it still is not enough to run the plant or cover the cost of building and running the giant MFC. My conclusion is that using an MFC to treat waste water for a whole city is an irrational idea until further scientific breakthroughs.

Summary Statement
I wanted to build a microbial fuel cell using poop that would run my iPod and see if a large MFC at a water treatment plant would generate (not consume) significant electricity while breaking down wastewater contaminants at the same time.

Help Received
Dr. Nielson: anode brushes; Dr. Grot (Ion Power): proton exchange membranes; Mr. Morse (E-tek): platinum-carbon catalyst; Mr. Voller (Ajinomoto): L-Cysteine; Mr. Donati: sewage sample; Mrs. Vodraska: lab materials, 2 rubber stoppers and 30 grams of potassium chloride. My parents paid for stuff.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Alexandra R. Jernigan

Project Number
J0817

Project Title
The Power of the "Magic Rock"

Abstract

Objectives/Goals
The objective of my project was to find the exact ratio of a one gram magnet to the mass of various metal rods in increasing increments. By testing the magnet to my smallest rod, I tested each time if the magnet attracted it or not,until I found my average ratio. By finding the ratio, I could use it to predict whether or not a magnet would attract the metal. My goal for the future is to make my results more accurate and prove my ratio to be true with different types of magnets.

Methods/Materials
a centimeter ruler
* magnets with masses starting with about 1g up to 120g.
* metal rods (cut) starting at 7/10cm to 10cm going up in increments of 7/10 cm.
* Extra Metal Rods; about 4 feet altogether
* flat surface that is not metal (plastic or wood is preferred)
* mass scale

Results
All in all, after testing for the ratio of mass of magnet to the mass of the metal rod; it turned out that a magnet can pull, on average, 8.70 times its own mass.

Conclusions/Discussion
In conclusion, I thought that it would take more magnetic mass than mass of the metal in order to attract it. It turned out that I under estimated the power of the "Magic Rock", it could actually pull, on average, 8.70 times its own mass.

Summary Statement
My project is about trying to find the attraction ratio of a magnet to a metal rod; using this ratio I could predict whether or not a magnet will attract the rod.

Help Received
My science teacher lent me the mass scale

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Elliott L. Kingston

Project Number
J0818

Project Title
Recording on a Wire

Abstract

Objectives/Goals
The objective of this project was to determine the optimum conditions for the recording and play back of information when a magnetic wire was run passed a transducer. The optimum transducer (ferrite bead) would create the largest amount of voltage during playback, creating the highest quality recording. It was hypothesized that the greater the resistance of the transducer the greater the voltage generated. The hypothesis was incorrect. The optimum resistance for the transducer was 28 ohms in this project. A transducer with more or less resistance generated a smaller amount of voltage, therefore creating a lower quality recording.

Methods/Materials
Materials

Digital Multimeter
Transducer
Wire turning appartus

Procedure

Create an appartus which enables one to spin magnetic wire past a transducer
Vary the resistance of the transducer
Record which transducer is the most effictive
Record Results

Results
A 3/4 inch ferrite bead with a coil of 28 ohms resistance was most effective in creating the optimum recording and playback conditions

Conclusions/Discussion
The results of my experiment proved my hypothesis to be incorrect. It was hypothesised that as the resistance of the treansducer increased the quality of the recording would also increase. After conducting the experiment the data protrays that there was an optimum resistance for the transducer, 28 ohms. If the transducer had more of less resistance the quality of the recording decreased.

Summary Statement
The purpose of my experiment was to determine the optimum conditions for storing and retrieving magnetic data stored on a steel wire,

Help Received
My father assisted me in constructing an appratus in which I was able to conduct my experiment under controlled conditions.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Joel L. Kosmatka

Project Number
J0819

Project Title
A Self-Propelled Magnetic Levitation System for Launching Airplanes

Abstract

Objectives/Goals
The purpose of this project was to build a magnetically propelled levitating car and to get it going fast enough to launch a small hobby airplane. I am interested in magnetic levitation and magnetic propulsion and have done science fair experiments relating to these subjects for the past two years. I wanted to see if I could design an electromagnetic device to launch an airplane. This could save energy. I had read an article that said that scientists would like to build something like this for the future.

Methods/Materials
The track I built has lengthwise parallel permanent magnetic strips and a center row of alternating permanent magnets. I designed and built a maglev car that has permanent magnets on the four corners for levitation, and controllable switching electromagnets along the centerline for propulsion. I built a car circuit board that has a bipolar Hall-effect sensor to determine the track magnet polarity. My car circuit board then uses an H-bridge circuit to switch the car's electromagnet polarity to push off the rearward track magnets and pull towards the forward track magnets. I measured the time it took the maglev car to accelerate down the track and then calculated the ending speed. I tested six different settings for the Hall-effect sensor for a total of more than fifty tests.

Results
In my results I found that I only needed a 9-volt battery to power the car instead of the 30 volt DC train transformer I had planned to use. The maglev car went down the track fastest with four small electromagnets instead of two. Changing the position of the Hall-effect sensor changed the ratio of magnetic attraction and repulsion forces and affected the maglev car's speed. The alternating electromagnetic forces caused the car to bounce at start-up, but I found ways to eliminate the bounce. On my short 0.41-meter long maglev track, the maglev car quickly accelerated to 2.52 kilometers per hour.

Conclusions/Discussion
To launch a hobby RC airplane I would need a much longer track with more powerful magnets in order to propel the car and airplane to 9-16 kilometers per hour. I see the potential of maglev propulsion to launch airplanes at airports in the future.

Summary Statement
I designed and built a maglev car and track to launch airplanes; the car has a bipolar Hall-effect sensor to determine magnetic polarities and uses an H-bridge circuit to switch the on-board electromagnetic polarity.

Help Received
My science teacher assisted me in researching my topic; my dad helped locate needed parts; Steve Roberts helped with the design idea for the bipolar Hall-effect switch; my mom helped edit my report.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Wesley Larsen; Aren Lorenson

Project Number

J0820

Project Title

Constructing an Inductrack Maglev

Abstract

Objectives/Goals

In our project Constructing an Inductrack MAGLEV, our engineering goal was to construct a magnetically levitated train complete with a propulsion track.
The design criteria:
Chassis must be light as possible, must achieve levitation of at least 2 millimeters, transition speed must be lower than 10 m/sec, and must be durable.

Methods/Materials

The main components of the MAGLEV are inductor arrays, a fiberboard chassis, a propulsion circuit, and magnet arrays. The inductors were created by winding 18 AWG magnet wire around a 3x2 inch plastic brace 86 times. The chassis was made with fiberboard cut to 3x2 inches. Halbach arrays are a sequence of magnets created by orientating 5 neodymium magnets so that they are more powerful. This creates a strong field. The propulsion circuit uses an electrically charged coil to create an electromagnetic field that propels the chassis. Using a PVC gutter 8 feet long, we used a bungee cord to launch the chassis with the attached magnet arrays over the inductors. This was used to test our chassis for levitation. The electronic propulsion was tested separately from the levitation.

Results

From our results, we determined that levitation was not achieved.
Propulsion was achieved. The chassis was as light as possible (415g), with almost all of the mass belonging to the magnets. The chassis was durable. We could not achieve levitation because our chassis speed could not meet the transition speed. More issues were that there was a braking force on the chassis as it passed the coils, and also because there was too much coil resistance.

Conclusions/Discussion

Some reasons why our project did not work is because there was a braking force on the chassis and inductors were not the same size, so some inductors did not act on the chassis equally. In the future we would wind Litz-wire coils to increase coil efficiency and would find a method to measure the current in the inductors. We would obtain software modeling that determines the design to use based on the numerous variables such as wire size, number of winds, and coil dimensions, etc. We would also add a more stable track to test higher chassis speeds, add electronic parts that can sustain higher amps, have our coils professionally wound and purchase higher quality magnets.

Summary Statement

The purpose of the project was to design and construct a magnetically levitated train with electronic propulsion circuitry.

Help Received

Wesley's father supervised our construction of the Halbach arrays and the electronic propulsion circuit.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Timothy R. Le

Project Number
J0821

Project Title
What Is the Voltage and Efficiency of Solar Panels at Different Angles Facing the Sun?

Abstract

Objectives/Goals
I wanted to have my project related to the current event of global warming and the high price of gasoline. I hoped to learn the efficiency of solar panels at different angles facing the sun.

Methods/Materials
Four solar panels were mounted into an adjustable frame. They were connected to a computer interface to record the voltage produced at different angles facing the sun. The efficiencies were then calculated for the different angles and the efficiency was set at 100% at 90^o to the sun.

Results
The average voltages and efficiencies for my experiment are listed below:
At 0^o, the voltage was 1.61 V; at 30^o, the voltage was 2.39V; at 60^o, the voltage was 2.19V; at 90^o, the voltage was 2.56V; at 120^o, the voltage was 2.14V; at 150^o, the voltage was 2.01V; and at 180^o, the voltage was 1.36V. At 0^o, the efficiency was 67.20%; at 30^o, the efficiency was 96.25%; at 60^o, the efficiency was 92.45%; at 90^o, the efficiency was 100%; at 120^o, the efficiency was 89.15%; at 150^o, the efficiency was 80.19%; and at 180^o, the efficiency was 67.71%. We did not measure the voltage and efficiency of the solar panels at 181^o to 359^o (facing away from the sun) because it would be impractical to mount solar panels at those angles on a roof.
* Percent efficiency was calculated with 90^o being 100%.

Conclusions/Discussion
The voltages produced by the solar panels would vary according to the movement of the sun and the maximum efficiency would be when the solar panel faces the sun at right angle. The solar panels should not produce any current at 180^o and 0^o to the sun. My independent variables were the angles of the solar panels. My dependent variables were the voltages produced and the efficiency(%). My results supported my hypothesis because at 90^o angle, the highest volatage and efficiency was produced. My results all came over 50% efficient, even at 0^o and 180^o.
My experiment relates to real life because the efficiency of the angles of the solar panels are important for people who want to make a lot of electricity thus reducing the use of environmentally damaging ways of producing electricity. This would reduce harm to the planet. I also came up with an idea to make solar panel arrays mounted on mini-blinds that always face the sun at 90 degrees to the sun for maximum efficiency. This way the solar panels do not have to be mounted on the roof and then can be accessed easily for repair.

Summary Statement
The purpose of this experiment was to find out the voltage and efficiency of solar panels at different angles to the sun.

Help Received
Dad helped in changing of the angles of the solar panels.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Steven T. Lin

Project Number
J0822

Project Title
Exploring Photovoltaic Solar Cell Efficiency with Different Wavelengths of Light

Abstract

Objectives/Goals
My project explored the relationship between different wavelengths of light and the output of solar panels. This is beneficial to society because it may provide an alternate way to produce more electricity for the growing world population. This project was designed to see if different wavelengths of light actually stimulated the solar cell to produce more energy.

Methods/Materials
This experiment was done by shining different wavelengths of light on solar panels and measuring their output by charging a battery and measuring its voltage. I made a graph to show the trend the data took and which one was better during the period of time I did my experiment.

Results
During my project I found that the first minute decided the three trends. When I finished performing my experiment, I found that the simulated visible light, the incandescent bulb, preformed the best and that ultraviolet preformed the worst. The infrared light generated a medium amount of energy.

Conclusions/Discussion
From my project I concluded that there is no apparent relationship between wavelength of light and the amount of charge generated by the solar panel. This could have happened because the generic solar panel is tuned to accept light from the sun, which is similar to incandescent light. This shows that if we used ultraviolet or infrared light to power solar panels, it would not be as effective as normal light.

Summary Statement
My project explored the relationship between different wavelengths of light and the output of solar panels

Help Received
Mother, Brother, and Father all provided guidence; Robert Boucher helped with the plugs and whattmeter

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Uzair N. Mohammad

Project Number
J0823

Project Title
Generation Nation: Generating Electricity with Everyday Motion

Abstract

Objectives/Goals
The general objective for this experiment is to utilize everyday motion of the human body to generate electricity using methods which can convert kinetic energy into electrical energy.

Methods/Materials
In its current stages, my project consists of these materials:
#Small electric motor
#4 gears (3 which are approx. 2 cm diameter, one 1 cm diameter)
#Electrolytic Capacitor (1 microfarad)
#Voltmeter
#4 Diodes
#Solder
#Connector Blocks
#Large Velcro Strap
#Elastic Band
#Some Tape and Wire Tie
#Some medium wire for interconnections
#Stiff wire for swing arm to attach weight
(Made from an old coat hanger)
#Small weight
(Used old battery)

Results
After my data was collected, I had sufficient knowledge to answer my question effectively. My natural motion was converted into electricity at about a rate of 40 millivolts for 1 calorie, this was achieved by utilizing a pendulum, attached to my leg, moving an electric motor. Now my generator is functioning, I now must try for new variations of more efficient systems and methods.

Conclusions/Discussion
The ever-moving human body has much more potential than the transportation of ourselves, but that of energy creation. This technology could be used in many different fields and situations, everything from LED enhanced clothing to a soldier's back-up walkie talkie generator. I hope that, eventually, everybody will have their own personal generator which suits their needs, whatever they may be.

Summary Statement
This project attempts to generate electricity using my natural body motion.

Help Received
My father and brother helped me use the soldering iron.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Nikhil P. Narang

Project Number
J0824

Project Title
Solar Cell Efficiency

Abstract

Objectives/Goals
The objective of this experiment is to increase the efficiency of a solar cell. To conduct this experiment, I carried out a series of three experiments. The focus of the first experiment was to find how UV rays affect the amount of energy a solar cell can produce. The second was to determine the best source of artificial light when using a solar cell indoors. The last experiment tested what type of encapsulation is best for a solar cell.

Methods/Materials
Experiment 1: Glass
Experiment 2: UV Bulb, Soft White Bulb, Plant Light, Clamp Light, Box
Experiment 3: Acrylic Plastic, Polycarbonate Plastic, Glass
2 Solar cells and a multimeter are used in every experiment.

Experiment 1
Place the glass in front of the solar cell and measure the volts produced with the multimeter. Remove the glass and record the voltage.
Experiment 2
Measure the voltage with the UV bulb in clamp light. Do the same with the other two bulbs.
Experiment 3
Place the Acrylic plastic over the solar cell and measure the voltage on the multimeter. Do the same with Polycarbonate plastic, glass, and then measure the voltage without any covering.

Repeat the experiments more than once using both solar cells.

Results
Experiment 1:The average energy for a solar cell with UV rays was 1.952 volts and the average without UV rays was 1.924 volts.
Experiment 2:The average energy produced with a white bulb was 1.548 volts, the average with a plant light was 1.55, and the average with a UV bulb was 1.26.
Experiment 3:Using a glass encapsulation resulted in a voltage of 1.844, an acrylic plastic encapsulation resulted in a voltage of 1.858, a polycarbonate plastic encapsulation resulted in a voltage of 1.847, and normal sunlight resulted in a voltage of 1.88.

Conclusions/Discussion

Summary Statement
This project is a study of how to increase the efficiency of a solar cell.

Help Received
Father helped me choose and buy materials

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Jeremy D. Ray

Project Number
J0825

Project Title
Do You Want to Go for a Spin?

Abstract

Objectives/Goals
This experiment investigated how a simple electric motor's size affects speed. The hypothesis stated that a bigger coil will run slower because it has farther to turn.

Methods/Materials
An electric motor was built using the instructions at www.sciencebuddies.com. The rotational speed was measured ten times for each coil size by winding a thread on one arm of the spinning copper coil and measuring the average string winding coil diameter. Rotational speed was calculated by converting the string winding diameter to circumference and dividing it into the known string length(200 cm) to find the number of windings in a measured length of time. this yeilds revolutions per second.

Results
Coil 1 (1.2 cm diameter) ran the fastest at 15.2 revolutions per second(rps). Coil 2(1.5 cm)ran the slowest at 9.6 rps. Coils 3 (2.8 cm) and 4 (2.0 cm)were close together at 12.9 rps and 13.8 rps, fairly close to Coil 1.

Conclusions/Discussion
The data didn't show any clear relation between coil diameter and speed although the smallest coil ran the fastest. Interaction between the electromagnetic field created by current flowing through the coil and the magnet's magnetic field causes the coil to spin. If the strength of the electromagnetic field is not dependent on coil diameter, then there would be no relation between data sets could have been caused by a minor variations in the motor construction and testing procedures.

Summary Statement
Four coils of different diameters were tested to determine if the size of the coil affected the revolutions of the coil.

Help Received
Father helped in building the motor construction, father helped with setup of board and supervised use of knife and wire cutting

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Matthew Roknich

Project Number
J0826

Project Title
It's a Bird, It's a Plane, It's Gone! How Geometric Shapes Affect Electromagnetic Reflections (Radar)

Abstract

Objectives/Goals
The purpose of my experiment is to measure the radar reflections of two airplanes with very different geometry in order to prove that avoiding some shapes and using others contribute to an airplane's stealthiness. I predict that the F-117 will prove to be stealthier than a typical fighter, such as the F-14, because, according to my research, the flat plane facets of the F-117 will deflect radar while the many other shapes of the F-14 will reflect radar back to its source.

Methods/Materials
I'm only a 7th grade student, and I'm not a pilot, so I did not have a full-size airplane, and did not have access to a real radar. So I created my own formula to predict radar cross section (RCS), and used 1:48 scale models with battery-powered red lasers for alignment and measurements. I created my own units, which I called R.I.C.E., and used Maxwell's equations from my research and a spreadsheet to compute the final RCS. In order to measure the RCS of each aircraft, I did three trials on each and calculated averages. Each trial included 13 different angles of aircraft pitch, and 13 different angles of aircraft roll, with each aircraft mounted to a tripod that had angle measurements (a telescope tripod). I used a reflective tape and metallized paint to reflect the laser in the same way that the aircraft reflects radar.

Results
As I predicted, the F-117 had a smaller radar cross section than the F-14. Using my special measurement system and units, the F-117 had a final score of 41 RICE points, and the F-14 score was 150 points, which is almost four times more visible to radar than the F-117.

Conclusions/Discussion
The shape of the F-117 definitely reduces its radar signature. I found that for the F-117 to be stealthy, it relies on its faceted shape, its hidden inlets, and its internal stores to prevent radar waves from reflecting back to the radar source. The many complicated shapes of the F-14, including corner reflectors, cylinders, and vertical tails, all contributed to its high RCS. Using my formula, I could analyze other vehicles, like boats, cars, and other types of aircraft, even satellites, or the Space Shuttle. With this formula, and the way it calculates how different shapes return radar reflections, my project would be used to help design these other types of vehicles to be stealthy to radar.

Summary Statement
Using what I learned in my research about electromagnetic reflections from simple shapes like planes, corners & cylinders, I measured the radar cross section of two different airplanes to prove that shape affects their visibility to radar.

Help Received
My dad bought supplies at Home Depot and online. He showed me how to solder and use a saw to build my display. He explained some of the radar terms and concepts, and taught me how to create a polar graph in Excel.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Tessa L. Shifflett

Project Number
J0827

Project Title
The Shock of Your Life!

Abstract

Objectives/Goals
The goal of my project was to find out what gauge wire will have the least amount of power dropped at any length wire. This goal was important to me because it will really help out on the ROV team i am on.

Methods/Materials
My method was: measure the wires, cut the wire at the right lengths, make the light fixture, connect every thing together and get all my data. The materials i used were: a screw driver, a wire cutter, a tape measure, volt/amp meter, 200 ft. of 14 gauge wire, 200 ft. of 18 gauge wire, 200 ft. of 20 gauge wire, 200 ft. of 22 gauge wire, a 12 volt ROV battery, 60 watt light bulb, a light socket and a wood board.

Results
My resauts showed that the thicker the wire the less power is dropped.

Summary Statement
My project was to find out what gauge wire has the least amount of power dropped at any length wire.

Help Received
Mr. Mellenger helped with the background and was my mentor, Dad helped with the testing, Mom helped me fill out the applications.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Vincent M. Spadone

Project Number
J0828

Project Title
Wave Power

Abstract

Objectives/Goals
My objective was to make a floating device similar to a buoy that would generate electricity using the constant motion of the ocean.

Methods/Materials
Based on the Faraday shaking flashlight concept, a small floating device was created to generate energy using the motion of the ocean. Using a 2-liter soda bottle cut in half, a plastic tube, copper coil, magnets, Styrofoam, silicone, metal rod, a light emitting diode (LED), and rubber bands, a small floating model was made. The bottle was cut in half and fitted around a piece of Styrofoam. Copper wire was wrapped around a hollow plastic tube and attached to an LED light. The plastic tube was placed through the center of the Styrofoam and the bottle placed overtop and sealed with silicone. A strong magnet was placed on top of a metal rod and attached to a base for weight. Large rubber bands were attached to the bottle and base to keep the rod and floating device together. The floating device was placed in water to test.

Results
The final project design was able to light the LED when bounced up and down. In a controlled test, the buoy was moved manually to simulate the ocean. As the top part moved, the rubber bands kept the rod attached to the float causing the magnet to move up and down through the copper coil. As magnet passed through the plastic tube and copper coil, the LED flashed. More testing was done at the marina. When the water was calm, the rod did not move. When boats passed by, the wakes caused the surface water to move which moved the magnet through the coil to power the light.

Conclusions/Discussion
The movement of the ocean can be used to generate electricity. The efficiency of this prototype can be improved. For example, the rod is starting to rust and the rubber bands and weight need to be adjusted to match the force of the wave motion. More testing needs to be done in the open ocean. A more advanced design could actually store energy in a battery and quantitative tests could be run to see how much voltage is being made. The application of this concept is unlimited for future renewable energy resources.

Summary Statement
I created a floating device with magnets and copper coil that can generate electricity using the surface motion of the ocean.

Help Received
My mother helped proofread my report, drive me to stores and test sites, and assist with silicone glue

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Casey H. Stolberg

Project Number
J0829

Project Title
Robofisher

Abstract

Objectives/Goals
My objective for this project was to build a remote controlled fishing boat, with a remote controlled reel, and catch fish with it.

Methods/Materials
Fabricate Boat Hull
1. Cut and bond foam sections into the shape of a hull using an exacto knife and Super 77 Multipurpose spray on adhesive.
2. Cut out pockets to accommodate the Reel Assembly Electronics and components and the Zig Zag Racer (remote controlled boat used for propulsion and steering)
3. Cut a slight slope into the back approx. 4cm in, install line guides in rear sides
4. Sand, shape smooth, and fill in any imperfections or gaps with wood putty, Epoxy and Paint as desired
Procedure for reel:
1. Remove reel handle, and machine a threaded hole into the center of the reel jam-nut that matches the output shaft of the reel motor
2. Assemble drive motor to reel for clockwise rotation, drill mounting holes in bracket and mount reel assembly
3. Assemble and solder wires all wires in the reel assembly and Remote control relay per manufacturer instructions
4. Test remote control to verify operation

Results
Well, a bigger boat needs a bigger rudder to be able to turn tight circles. More power is better than speed when reeling in a fish. Don#t drop electric motors into ponds. And finally, you can build a remote control boat that catches fish.

Conclusions/Discussion
My hypothesis was correct; you can remotely catch a fish. First you must construct a boat that has a hull like a real boat, so that it can sail through the water easily. Also, a large boat needs to have a large rudder or it can not turn as easily as it should. You need to construct a motor that can turn the reel fast enough to reel in the fish. The closer your remote is to your receiver, the faster the signal gets to it. As seen in my observations, using bait and a bobber was the best method to catching a fish. Lastly, water-logged electric motors do not perform well, actually, they don#t perform at all.

Summary Statement
Building a remote controlled fishing boat with a remote controlled reel that can catch fish

Help Received
Dad had reel specially drilled to fit motor; Familly friend soldered wires; Mom and Dad helped with display board

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Gagandeep S. Thandi

Project Number
J0830

Project Title
Solar Shock

Abstract

Objectives/Goals
Goal-create a solar-related energy sorce which can power any type of electronic using no advanced eqipment

Methods/Materials
-A sheet of Copper Flashing. -Alligator Clip Leads. -A sensitive micro-ammeter that can read currents between 10 and 50 microamperes. -An electric stove. -A large clear spring water bottle. -A couple teaspoons of table salt. -Sand paper. -Tap water. -Sheet metal shears for cutting the copper sheet.
METHOD:-
- I cut a piece of copper sheeting about the size of stove
- I washed my hands so they don't have any grease on them and than i wash the copper sheet with soap to get rid of oil or grease off of it.
-I use the sandpaper to clean the copper sheeting so any sulphide or light corrosion is removed.
-I cooked the 1 copper sheet on gas stove for half an hour till i got the blackcoating of cupric oxide.
- I noticed as the copper cools, it shrinks. The black cupric oxide also shrink @ diffrent rates which make black cupric oxide flake off.
-I took a spring water bottle in that i put 2 pieces of copper sheets with the help of alligator clips, 1 was heated and other was not.
- I attached the other corners of the alligator clips into the ampmeter.
- I pour the saltwater into the bottle and I was very careful so that the water won't touch the alligator clip.
- I took my project to sun than i turned the ampmeter ON to the RX10 and i noticed the needle jumped go to 50 amp.
- I tried the same procedure in cool and dark place needle jumped but it was just on 20 amp.

Results
Yes it worked.Why?
Cuprous oxide is a type of material called a semiconductor.Its in between a conductor, where electricity can flow freely.In a semiconductor, there is a gap, called a bandgap between the electrons that are bound tightly to the atom, and the electrons that are farther from the atom, which can move freely and conduct electricity.Electrons cannot stay inside the bandgap.An electron must gain enough energy to move farther away from the nucleus, outside of the bandgap.When sunlight hits the electrons in the cuprous oxide, some of the electrons gain enough energy from the sunlight to jump past the bandgap and become free to conduct electricity.The free electrons move into the saltwater, then into the clean copper plate, into the

Summary Statement
Solar Energy

Help Received
Books, library, Mom

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Blake B. Tickell

Project Number
J0831

Project Title
Rodent Recharge

Abstract

Objectives/Goals
My objective was to get my hamster to generate electricity using his exercise wheel and to store that electricity in a rechargeable battery.

Methods/Materials
4 nail generators were made by wrapping each nail with enamel coated wire and spinning a magnet in front of them. The size of the wire, nail, and the strength of the magnet were varied, but they did not work. Then several box generators were made. Each was made with cardboard, a nail, wire, and 4 strong magnets inside. This lit the light bulb brightly. The box generators were then tested by hooking them up directly to a small wheel that spun the magnets when driven by the hamster wheel.

Results
My hamster was easily able to light the bulb as he ran and to store electricity in a battery. As a result, my hamster was able to generate 1.6 volts of electricity. He was also able to store 51 seconds of electricity for every 5 minutes of constant running.

Conclusions/Discussion
My hypothesis was correct because I was able to generate electricity with my hamster. I feel that if we look for alternative ways of using electromagnets and electronics, we can save a great deal of energy and help the global environment.

Summary Statement
In my project I tried to save energy by getting my hamster to generate electricity using his hamster wheel.

Help Received
Mom helped by finding supplies and helping me to drill holes in the base so the wheel could be attached.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Omar R. Valladares, III

Project Number
J0832

Project Title
Bright Idea

Abstract

Objectives/Goals
I will attempt to show a 6-volt battery can light up 3 miniature 6-volt light bulbs.

Methods/Materials
Methods
1. With hookup wire connect three miniature lamp sockets.
2. Glue or tape flat sticks together to form a #T#.
3. Using houses made from wood use them to make a small town.
4. Watch as your houses illuminate

Materials
1. Miniature 6- volt hobby lamps
2. Lamp sockets
3. Hookup wire
4. 6-volt lantern battery
5. 6-volt lantern battery with spring-top connectors
6. Strong straws
7. Wood building

Results
My final results where that all my houses illuminated, the house that was most illuminated was the house that had the light on top.

Conclusions/Discussion
If I were to do a project on electricity again, I would probably build a few more houses and would build bigger houses to simulate a City Town.

Summary Statement
How electricity travels through a continuos circuit into three houses.

Help Received
father helped with soldering wires and mother helped with board.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Brian J. Vallelunga

Project Number
J0833

Project Title
Levitation

Abstract

Objectives/Goals
The objective of this experiment is to produce a flying machine capable of sustained flight without wings or a visible propulsion system. The lifter will levitate using only the Biefeld-Brown effect.

Methods/Materials
The methods used in this scientific investigation are experimental and theoretical calculation of lift generated as given my the Evgenij Barsoukov equations. These equations can be found in the Lifter Theory article by said author.

The materials used in this scientific project can be organized into three categories:
Project Apparatus: - Plywood board; - GRA10 Anti-Gravity Driver; - PS8C 13.8 VDC Power Supply; - Emitter and Collector PVC Tower Assembly; - Black Spray Paint; - Plexiglass sheet; - Various hardware components.
Lifter: - Balsa Wood (2mn by 6mn); - Super glue; - Aluminum Foil; - Stainless steel wire (0.0028"); - 30-Guage enameled copper magnet wire; - Sewing thread; - Scotch tape; - Washers; - Hobby knife; - Scissors.
Test Equipment: - Fluke 80K-40 high voltage probe; - Fluke 8021B digital multimeter; - Ohaus triple beam balance; - Various cables.

Results
The results of the test data collected compared very favorably too 2x the predicted values given by the Evgenij Barsoukov equations. The lifter was able to maintain sustained flight using only the Biefeld-Brown effect.

Conclusions/Discussion
This scientific exploration conclusively proves that lift can be achieved using only the Biefeld-Brown effect. The lifter levitates because the emitter wire creates a positively charged ion cloud that is accelerated towards the negatively charged collector creating a net vertical force. Simultaneously, the negatively charged collector is attracted the positively charged ionic cloud adding to the net vertical thrust generated by the lifter.

In conclusion, the lifter can generate sufficient thrust to over come its own weight and levitate solely by the Biefeld-Brown effect.

Summary Statement
This project explores a lifting body without wings or a visible source of propulsion using the only the Biefeld-Brown effect.

Help Received
Dr. Wunder gave me encouragement, mother helped me with the board, father help me understand the science and build the apparatus, Mr. Varda provided the triple beam balance and Mr. Foster also a source of encouragement.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Ethan A. Van Steenburgh

Project Number
J0834

Project Title
Magnetic Propulsion

Abstract

Objectives/Goals
This study aimed to determine which ferromagnetic material makes the best electromagnetic projectile for use in magnetic propulsion systems.

Methods/Materials
Three common magnetic materials Iron, Cobalt, and Nickel were chosen for this study. An experimental apparatus was constructed of plastic tubing through which the magnetic projectiles are accelerated. To generate a strong magnetic field, magnet wire was wound in a coil around the tube. A large voltage stored in a capacitor was discharged rapidly into the coil providing sufficiently high currents resulting in a large magnetic field along the axis of the tube. Differences in the magnetic capabilities of each material can then be determined by measuring the speeds of the different magnetic projectiles. Projectile speeds are determined by measuring the time it takes the projectiles to cover a fixed distance inside the tube. Great care was taken to cancel out unwanted variation caused by the experimental setup including sidewall collision, air friction, and weight differences between elements. Each projectile was weighed to be approximately the same weight to cancel out the effect of gravity. Conducting multiple trials cancels out the random effects of sidewall collision and air friction.

Results
Iron was 6% faster than Cobalt and nearly double the speed of Nickel.

Conclusions/Discussion
Based on literature research, Iron has the highest coercive magnetic force and so Iron should be the best magnetic projectile. However, the results in this experiment are inconclusive because sample weight differences between Cobalt and Iron turned out to be about the same as the speed differences measured. The reason Iron did not go significantly faster than Cobalt is still unclear. Literature research shows that Iron could be saturating at the high flux densities experienced in the coil so this may explain the anomaly. Future experiments could include more elements like Niobium (NB) or Samarium-Cobalt (alloy) and also investigating a detachable mechanism that ejects the payload as it passes thru the coil thereby eliminating magnetic drag caused by reversing magnetic polarity as the projectile traverses the length of the coil. With these techniques, Magnetic propulsion may enable more efficient delivery of payloads into space using magnets instead of fossil fuels.

Summary Statement
This project attempts to determine which ferromagnetic material is best for magnetic propulsion systems.

Help Received
My dad helped me to wire the timer circuit board.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Nishitha Viswanathan

Project Number
J0835

Project Title
The Fuss over Fuel Cells

Abstract

Objectives/Goals

Hydrogen fuel cells are electrochemical energy conversion devices. This means that they convert chemical energy into electrical energy. This process is able to occur only when the two fuel sources, hydrogen and oxygen, are continuously supplied. One of the factors which determines the hydrogen and oxygen production includes the type of electrolyte used. The focus of this experiment is conceptually demonstrate the hydrogen fuel cell due to the fact that hydrogen is highly flammable and difficult to obtain.

Hypothesis: If you use an electrolyte with a low conductivity value, then the conversion efficiency (electrical power) of the fuel cell will decrease.

Methods/Materials

Electrodes-platinum coated nickel wires (30 cm),cup,digital multimeter,circuit board,toggle switch,4 electrolytes: tap water,coke,lemon juice,white vinegar,and a 9 Volt battery

In my experiment, I connected a circuit board and a single pole, double throw (SPDT) toggle switch. To this device, I also connected 2 insulated, copper wires and a 9 V battery. The cup is used to hold the various electrolytes and dipped in the electrolyte, are the electrodes which have been coiled and connected to the circuit board and multimeter. I used the process of electrolysis (passing an electric current through an electrolyte) to generate the fuel sources of hydrogen and oxygen. I then flipped the toggle switch to recombine these two fuel sources to produce electricity. I repeated this procedure for each electrolyte.

Results

Out of the 4 electrolytes, vinegar and lemon juice produced more fuel sources, therefore more electricity. The coke started out by producing a tremendous amount of hydrogen and oxygen although the decline was incredibly quick. This could have been because of the continuous ionization in the phosphoric acid. In the case of the tap water, the depletion of the hydrogen and oxygen were quite similar. This disproved my theory because I believed that the high citric acid content in the lemon juice would cause it to produce more of the fuel sources/electricity. Although, it is a possibility that a residue of tap water got mixed in with the lemon juice due to the fact I used the lemon juice corresponding to the tap water.

Conclusions/Discussion

The power generated by the fuel cell does not correlate to the conductivity of the electrolyte. This necessitates further experimentation and development to figure out the reasons behind this conclusion.

Summary Statement

My project depicts how the differences in various electrolytes can affect the energy outcomes produced by a hydrogen fuel cell.

Help Received

My dad soldered the wires onto the circuit board and the electrical connectors onto the wood. In addition, he drilled 2 holes into the wooden block and helped me with my board and and interpreting my data. He also supervised me and reinforced what I learned.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Gareth C. Wang

Project Number
J0836

Project Title
Building and Testing a Solar Powered Car So That It Is Able to Run at Night

Abstract

Objectives/Goals
The goal of this project was to build and modify a solar powered car so that it is capable of running at night.

Methods/Materials
I designed and built a basic solar car and made modifications to it and tested it. To see if I could make it run at night, I tested five versions of the car, each with different numbers and types of rechargeable batteries and different numbers of solar panels. In my test, we measured out a twenty foot long track and timed how long it took each version. I did this several times with a stopwatch.

Results
Results indicate that the fastest car for the 20-foot dash was Tai Yang 4 with two or seven rechargeable batteries. Their average time was 20 feet in 6.7 seconds. With no batteries and just solar panels, the car went 20 feet in an average time of 20 seconds. With one rechargeable battery, it went 20 feet in an average time of 14.7 seconds. With four batteries, the car went 20 feet in an average time of 7 seconds. We also tried a combination of seven rechargeable batteries and four solar panels. The car with that combination went 20 feet in 10.5 seconds.

Conclusions/Discussion
I concluded that the biggest improvement we made in our project was putting on the rechargeable batteries because this helps the car run at night and move faster than with just solar panels. The second biggest improvement we made was to use NiMH batteries instead of NiCad because we could actually make the car move. The third biggest improvement we made was to add the electric circuit engine that allows the solar panels to charge the batteries, and add a light, which also helps the car run at night.

Summary Statement
Building and testing a solar powered car so that it can run at night.

Help Received
Father helped explain basic electronic principles. Father helped get parts to build car. Father launched car during testing runs while I timed car.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Christopher J. Weis

Project Number
J0837

Project Title
Electric Motors Are Everywhere!

Abstract

Objectives/Goals

The purpose of this project was to learn about electric motors and variations of electric motors. I wanted to learn about the parts inside of an electric motor and what makes it turn. Electric motors are found in things as big as cars and as tiny as watches. They are very important in contemporary life.

My hypothesis was that round coils with multiple magnets would require less current and produce more hertz than the rectangle coils. Additionally, I expected that the more windings on the coil would produce more electricity for the magnet to pull.

Methods/Materials

My procedure began with making a fixture to hold the coil windings so I could measure the speed (hertz) and electricity (amps) generated. I used a Volt Meter to obtain my measurements and connected it differently to measure hertz and amps. Volt Meters are connected in parallel to the circuit.

Results

The 50 wrap coil, 15 gauge wire and one magnet was energy efficient; however, the fastest coil was the 35 windings, 15 gauge wire, and 1 large and 1 small magnet. The worst in these categories were the 20 and 22 gauge coils because they did not run. Round coils and more wraps worked best.

Conclusions/Discussion

I was surprised that the more magnets I used, decreased the speed and flow of electricity. The most efficient motor uses less current and produces more speed.

My results showed that the most energy efficient coil was the one with 50 wraps of coil, 15 gauge wire and 1 large magnet because it used the least current. The worst performers were the 20 and 22 gauge coils because they did not run.

The fastest coil was the 35 windings, 15 gauge wire, and 1 large and 1 small magnet. The slowest coils were the 20 and 22 gauge. In conclusion, round coils and more wraps worked best.

Summary Statement

In conclusion, electricmotors can be designed better by changing some important parts.

Help Received

Mom helped me type report; Dad helped me make model and test it

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Nehemiah Yap

Project Number
J0838

Project Title
Solar Revolution: The Conversion of Sunlight into Electricity

Abstract

Objectives/Goals
The objective is to determine if the angle of the sun affects the speed of the solar car. I believe that the higher the angle of the sun is, the faster the speed of the solar car will be.

Methods/Materials
The angles of the sun were measured and recorded every hour from 8 a.m. to 12 p.m. Then a solar car was tested and recorded six times every hour from 8 a.m. to 12 p.m. under different angles of the sun at the same start and finish line with a certain distance of twenty feet between.

Results
The angles of the sun were 25, 35, 45, 55, and 65 degrees at 8 a.m., 9 a.m., 10 a.m., 11 a.m., and 12 p.m. The solar car did not moved at 25 degrees, and the average speeds of it were 11.6 seconds at 35 degrees, 9.6 seconds at 45 degrees, 9.1 seconds at 55 degrees, and 8.7 seconds at 65 degrees. The results showed that the speed of the solar car ran faster when the angle of the sun was higher.

Conclusions/Discussion
My conclusion is that the angle of the sun has an important role in the speed of the solar car: the higher the angle of the sun is, the faster the speed of the solar car will be.

Summary Statement
The higher the angle of the sun is, the faster the speed of the solar car will be.

Help Received
Mother corrected the structure of my writing, held the yard stick when I measured the angles of the sun, released the solar car when I started the stopwatch, held one end of the measuring tape while I measured a distance of 20 feet. Supervised the work of my board.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Ryan G. Yoo

Project Number
J0839

Project Title
Can Water Power the World?

Abstract

Objectives/Goals
To create a power source using just a liquid and metal cans

Methods/Materials
On a table, place a plastic container upside down
Place a reservoir on the top of the container
Make plastic tubing where water flows through two cans and lands into two cans at the bottom
Let water flow and see what happens between the nails

Results
This method is quite impractical for purposes in a private home, given that it takes about 24 million liters to make a single kilowatt-hour. However, some waterfalls in the world flow at about 12 million liters per second, this would mean that each kWh would be produced every 1.8MW. This translates to about 16GWh of energy each year.

Conclusions/Discussion
Each person uses only 10 MWh each. Therefore, this could produce electricity to about 1600 people. This could easily power two small towns! For example in Idaho, here is a town named Swan Valley. It's population is 210 and is near a waterfall. This fall, even if it has only 1/8th the waterflow, could still power the whole town.

Summary Statement
Making renewable energy from water

Help Received
My mom bought the materials

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Aleem Zaki

Project Number
J0840

Project Title
Dependability of Solar-Powered Cars

Abstract

Objectives/Goals
I am concerned about harmful effects of global warming due to our use of gas-powered cars. I conducted this experiment because I was curious to find which hour of the day a solar-powered car would work best. I studied the relationship between the Sun's angle and the car's speed. This information would be important in the development and use of solar-powered cars.

Methods/Materials
Procedures
1. Place solar-powered car on a wide, flat surface (without incline) at 9 am.
2. Record how long it takes to reach 9.5 feet (which corresponded with a concrete slab of my sidewalk.)
3. Repeat this every hour, on the hour, until 3 pm. Get 5 timings for each trial.
4. Find the mean (after eliminating the high and low outliers) for the time it took to reach 9.5 feet for each hour. Compare averages for each hour.
5. Note the lowest average which will show which hour the car worked best .

Materials: Klutz The Solar Car Book. Car dimensions=9" L x 4.5" W x 1.5" H; Casio digital stopwatch; Durtex 12 feet 0.5 inch-wide measuring tape; Notebook; Pencil; Calculator.

Results
The data shows that 12 pm timings were the fastest. This was followed by the 11 am, 1 pm, 9 am, 3 pm, and 2 pm timings, respectively. Wind and temperature did not affect the car's performance while cloud-cover did. On cloudy days we couldn't collect data because the car slowed down significantly or even failed to work. We were careful to avoid casting our shadow on the car's path. Direct sunlight was the most important factor, even on a cold day.

Conclusions/Discussion
The data showed that the solar-powered car worked best at 12:00 pm. These results are consistent with my hypothesis. This is probably due to the fact that the Sun's light rays were perpendicular to the solar panel allowing it to operate optimally. The Sun's light is solar radiation. In a solar-powered car, this light energy is converted into potential energy in the solar panel. Kinetic energy is demonstrated when the car moves. The panel is made of photo-voltaic cells which is a battery that makes electricity from light. When sunlight strikes the cell, electrons get displaced. It's the movement of the electrons in the same direction that creates an electric current that does the work. It would be more convenient to let the solar panels charge during optimal hours and then store the energy in a battery. This way we can drive when

Summary Statement
Find what times during the day solar-powered cars work best

Help Received
Father helped write readings. Mother helped glue board

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
David A. Zarrin

Project Number
J0841

Project Title
Designing a Laser Communication Device

Abstract

Objectives/Goals
Laser communication has many advantages over wired devices. Lasers can carry messages near the speed of light with little interference whereas electrical signals travel at 60%-90% of speed of light. The goal of my project was to build a low cost device to transmit my voice a long distance in open air using lasers and learn as much as I can about the related technologies.

Methods/Materials
I researched, brainstormed, and conducted a series of experiments in 2007 through Feb'08 to understand the concepts and built devices for sending my voice in open air using lasers.I video taped diaphragms of speakers playing sounds, examining the motion frame-by-frame, and learned the basics of speakers, sound, waves, frequency, microphones, lasers, solar cells, Doppler effect, simple circuits, and analysis /computer tools.
In my first series of experiments, I connected small mirrors to speakers and eventually headphones. I shone laser beams onto mirrors while playing music. I pointed the reflected beams into solar cells connected to MIC input of a laptop and used Adobe SoundBooth to capture and analyze the received signals.
In my second set of experiments, I used carbon-dust microphone to modulate my voice onto laser beams. I built my own carbon-dust microphone from pencil led (which I learned from a Nova science program on telephones). I connected the carbon microphone in series with the laser pointer batteries. I shone the beam onto a solar cell 200 feet away connected to the MIC input of a laptop, and captured /amplified the AC signal generated by variations in laser photon intensity.
In my final set of experiments, I attached a mirror to the bottom of coffee cans and shone lasers onto the mirror while talking into coffee cans. I pointed the reflected beams onto a solar cell connected to MIC input of a laptop.

Results
I achieved my goals of building a device capable of transmitting my voice with great clarity for $32 and learn many new concepts in the process. The carbon MIC had medium sound quality and cost $24. The coffee can designs cost $21 with 30% of transmitted words recognizable.

Conclusions/Discussion
Audio signals can be transmitted long distances using the techniques in my experiment. I also discovered other practical uses of my experiments including recreation of audio signals using lasers reflected off of vibrating windows acting as diaphragms far away, detecting earthquakes, and ground movements.

Summary Statement
Building a low cost device to transmit audio a long distance in open air over a laser beam.

Help Received
I received help on handling power tools and the laser device from my advisor.