CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Austin Adee; Alex Thomas

Project Number

S0801

Project Title

Rotoverter

Abstract

Objectives/Goals

The objective of our project is to see if electricity can be generated more efficiently than conventional methods. We hypothesize that using two three-phase motors, in a setup a "Rotoverter" electric energy can be generated more efficiently than conventional methods.

Methods/Materials

Materials: A steel U beams, copper wire, capacitors, switches, power meters, two AC three phase squirrel cage motors, Plexiglas, transformers, full wave bridge rectifiers, an inverter, and epoxy are used in our experiment.

Methods: To build our setup; weld the steel U beam in a rectangular configuration; open the electric motors, and clean the bearings of grease; reverse the casing of one of the two electric motors, and assemble them back together; wire the motors so that one is an alternator and the other a motor; wire the switches in series to the capacitors, which are parallel to each other; and wire the capacitor banks to motor and alternator.

Results

We successfully found an alternative way to generate electric energy more efficiently than conventional means. In the process of doing this, we generated more reactive power than is consumed. Reactive power can be described as energy that does net value of no work. Achieving a greater amount of reactive power than true power is not a new concept and is accomplished very easily. What's different about the Rotoverter is that we can extract some of this power which is considered imposable by definition. We are not sure how the Rotoverter works, but only that it does produce large amounts of reactive energy that can be extracted on a small scale. There are two probable solutions around this; either get a resistive load to match our resonating output, which in our case would be a 4.5kw light bulb; or get an inductive load such as a transformer, that does not break the resonance of the alternator.

Conclusions/Discussion

As of this moment, we have only produced reactive power, but at a much greater amount than real power consumed. We have not yet experimented with the two possible solutions mentioned before because of the lack of materials. Further experimentation may reveal that the reactive power can be extracted.

Summary Statement

An alternative means to generate electric energy.

Help Received

Advice from Hector Torres

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Adam L. Berman

Project Number
S0802

Project Title
Water Works: The Effect of the Density of Water on the Wattage Output of an Hydroelectric Generator

Abstract

Objectives/Goals
I was trying to find out if a higher density liquid would create a higher electrical output when passed through an hydroelectric generator at the same rate of flow as a lower density liquid.

Methods/Materials
I concocted three solutions - water, water with 1/2 the maximum soluble amount of sugar, and water with the maximum soluble amount of sugar - and ran them through a homemade hydroelectric generator.

Results
The results show that the highest density liquid created considerably more electricity than the medium density liquid or the lower density liquid.

Conclusions/Discussion
There are no major outliers in the data, and the results support my hypothesis.

Summary Statement
I built a hydroelectric generator and tested it's electrical output based upon the density of the liquids that I ran through it.

Help Received
Borrowed Equipment from Tam High Science Department; Sister (Freshman at Harvey Mudd) helped with technical details; Cousin (Phd from Cornell) helped with density related problems.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Aubryn R. Butterfield

Project Number
S0803

Project Title
Wind Farming the Fertile Pavement of the San Joaquin Valley: Stage 3

Abstract

Objectives/Goals
I observe that I need to eliminate or reduce the cut in wind speed requirement of my Savonius wind turbine. I plan to create a hybrid unit by utilizing solar power, and to re-design my wind turbine for increased efficiency.

Methods/Materials
I improved the design of my wind turbine by decreasing the blade depth and reducing the wobble of the dowel. Next, I affixed a small solar powered 3 volt motor to the dowel. I took numerous readings along the freeway fence line and at a designated control, which was 12 meter away from the test site. The readings consisted of windspeed and volts obtained when the solar powered motor was turned on as well as when it was turned off. Additionally, I took readings when the motor was completely removed from the dowel.

Results
All the reading at the freeway fence line: with solar, without solar, and without the motor attached all produced more voltage than thier associated control readings.

Conclusions/Discussion
I conclude that the addition of a solar powered motor and the improved design did eliminate the cut in wind speed requirements of my wind turbine.

Summary Statement
Capturing wind generated by freeway traffic through a hybrid solar and wind powered Savonius turbine.

Help Received
Parents providid financial resources, transportation, an extra pair of hands and questioned my process.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Nitin K. Egbert

Project Number
S0804

Project Title
MindMouse: A Mind-Computer Interface without Pattern Recognition Based on Biofeedback Training

Abstract

Objectives/Goals
The phrase "mind-computer interface" conjures up images of the movie "The Matrix". There have been some different attempts at building commercially viable mind-computer interfaces, and they all took the path of the matrix: the computer actually tries to read your thoughts. This involves complicated pattern-matching techniques that require a lot of processing power. This project explores the feasibility and practicality of non invasive mind-computer interfaces in which the computer does not attempt to figure out one's thoughts.

Methods/Materials
I built an EEG that acquires two signals, one from either side of the forehead, and then translates these signals into mouse movement using a very simple algorithm that does not involve pattern matching. The device can move the cursor on a computer screen in all directions. I wanted to see if it would be easy enough for people to learn how to use. I then wrote Java based software for the device. I was able to attain a fair amount of control over the cursor after spending about an hour with the device. However, it is hard to make people sit down for an hour to help with a scientific study. So I programmed in a set of training modes that first teaches one how to move the mouse in one direction at a time. It timed each attempt to move the cursor across the screen, enabling me to measure the subject's progress. This made the device easier to learn, and now most attain fairly precise control within 40 minutes.

Results
People show excellent learning curves when training with the device. The first time most people try to move the cursor in one direction; it takes about 40 seconds to move it across the screen. After practicing, it only takes about 2 seconds to move it across the screen. The best learners could select 3 objects about the size of a desktop icon in one minute. This shows incredible promise.

Conclusions/Discussion
It is fairly clear that anyone could learn how to use this. The practical applications of this device are enormous. Quadriplegics could use the device to perform tasks that they can't do otherwise. It could also be used to control vehicles. Similar devices would also be useful to people who control complex machinery, allowing them control over their work that they could otherwise only have with more than four limbs.

Summary Statement
I created a device that allows one to control a computer with one's mind, without the computer actually figuring out what one is thinking.

Help Received
Parents helped brainstorm and buy parts for device

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Matthew C. Godkin

Project Number
S0805

Project Title
The Piezoelectric Floor: Electrical Energy When We Walk

Abstract

Objectives/Goals
I tried to create a floor that harnessed the mechanical energy released when we walk. I thought that I could do this by putting piezoelectric elements in the floor that would be compressed and create electricity when the floor was stepped on.

Methods/Materials
I tested several different designs by applying about 29 newtons of force, the same as one of my steps. I tried to make my own piezoelectric Rochelle salt crystals by growing them. I also used piezo disks and used them to make a small floor sample. I then tested using several different pads to test on these piezo disks to maximize power output.

Results
The Rochelle salt crystal peak was 27 microwatts. The piezo disks created more than that. The best design, which had cork pads underneath the piezo disks and rubber eraser on top, generated 70 microwatts.

Conclusions/Discussion
If I were to implement this design on a larger scale, it would never pay for itself in power generated. However, I have shown that it can be done, and that with a better design it could be made to work.

Summary Statement
I tried to design a floor that would generate electrical energy when walked on, using piezoelectric elements.

Help Received
Father helped theorize about idea; Uncle taught me how to solder and helped with part of the design. Math teacher helped me with statistical analysis.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Chandan G. Lodha

Project Number
S0806

Project Title
Solar Thermal Energy: A Novel Approach Using Non-Imaging Optics with the Seebeck Effect

Abstract

Objectives/Goals
The goal of this project is to determine whether electrical energy can be generated at a reasonable efficiency by combining non-imaging optics with the Seebeck effect, to directly transform the sun's radiant heat into electricity.

Methods/Materials
Peltier (3x3 cm Bismuth Telluride), Fresnel Lens (11x11 in), Homemade Lego Mindstorms Solar Tracker (With motor and counter-weights), Small Solar Panel (2x4 in), Thermocouple, Multimeter, Aluminum Foil (2x6 in), 2 Alligator Clips, Electrical Tape, Clock

The first step is to build a solar tracker with Lego Mindstorms, to support and rotate the Fresnel lens. The small photovoltaic cell is mounted on the tracker and connected to the motor using alligator clips. Then, the non-imaging Fresnel lens concentrates sunlight onto one side of a peltier device, which causes a temperature difference to be established across the two sides of the peltier and induces an electrical voltage by the Seebeck effect. The peltier device generates electricity all day long because the sun tracker is powered by the photovoltaic cell and hourly data is recorded (temperature on both sides of the peltier, voltage and current).

Results
The solar tracker was successfully able to rotate the Fresnel lens throughout the day and concentrate sunlight onto the peltier device. The maximum temperature difference reached across the two sides of the peltier device was almost 900 degrees Celsius. The maximum induced voltage of the prototype solar concentrator was 0.62 Volts and the maximum current was 44.2 mA.

Conclusions/Discussion
My prototype solar collector was successful at converting the sun's heat energy directly into electrical energy at a reasonable efficiency. This process of collecting electrical energy via solar thermal non-imaging optics is 100 percent renewable, pollution free and has a promising future in renewable energy systems.

Summary Statement
This project utilizes a non-imaging Fresnel lens on a home-made solar tracker, to concentrate sunlight onto a peltier device, which uses the Seebeck effect to convert the sun's radiant heat into DC electricity.

Help Received
Professor Ali Shakouri discussed a number of related solar thermal ideas and helped to choose a specific project. He also provided a digital thermocouple and peltier device. Father helped buy supplies, edit abstract and provide general guidance. A neighbor lent me two alligator clips.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Jodi T. Loo

Project Number
S0807

Project Title
Reducing The Photovoltaic Cost by Using Multijunction Concentrator Solar Cells

Abstract

Objectives/Goals
My goal is to reduce the photovoltaic cost by using the multijunction (MJ) concentrator cell as a viable energy source.

Methods/Materials
I first performed an analysis using the Excel program to determine the effect of the leakage current and the series resistance on a concentrator solar cell. The leakage current was computed using the ideal diffusion model at two sets of doping concentrations, (P=5x10^17, N=5x10^16) cm-3 , and (P=5x10^18 , N=5x10^17) cm-3 in Si. The results are compared to the junction generation-recombination current using an electron-hole lifetime of 1 nanosecond. The series resistance effect was studied at 1, 10 and 100 suns. I then performed outdoor measurements on a InGaP/GaAs/Ge multijunction cell on loan to me from the Boeing/Spectrolab using a home-built concentrator system that I designed. I measured the photo I-V at 1, 14 and 34 suns. The data are then correlated and explained by the modeling results.

Results
The measurements show that at low currents (1 sun) the MJ cell was shunted because of higher junction leakage predicted by the modeling. However, at high currents (> 100 suns) the cell performance is degraded by the series resistance (>0.1 ohm). During the experiment, I also demonstrated that this concentrator system needs a solar tracking device because it only works in the direct sun light. Furthermore, we must maintain the cell at room temperature especially at high suns. Lastly, I estimated my 2007 calendar year household electricity to be 0.15 cents/KWh. This cost is then compared to the solar electricity cost that I obtained from the Sharp Electronics website, 0.5 cents/KWh. Thus, we must reduce the solar electricity cost by a factor of three in order to be competitive with the fossil fuels.

Conclusions/Discussion
The Boeing MJ concentrator cell is $12/cell and yields 20 W at 500 suns. I would need 10 MJ concentrator modules to make a 200 W panel comparable to a conventional single junction panel ($1000/panel). Consequently, my hypothesis would be correct if I could make a concentrator module plus the MJ cell reliably by incorporating the tracking and cooling devices to be at around $30 each.

Summary Statement
I learned and demonstrated how a cost effective photovoltaic concentrator system using multijunciton cells could help increasing the efficiency of solar cell yet make solar energy more cost competitive with the fossil fuels.

Help Received
Thanks to: my parents for supporting me; Dr. Oscar Stafsudd at UCLA for the optical lens; Mr. Sam Ontiviros for materials supply; Dr. Authi Narayanan at Boeing/Spectrolab for loaning me a multijunction cel;

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Mitchell T. Maas

Project Number
S0808

Project Title
Electromagnetic Propulsion: Phase II

Abstract

Objectives/Goals
Does changing the permanent magnetic field affect the launch height of the rocket more than changing the strength of the electromagnetic field?

Methods/Materials
Methods: Create an electromagnetic launcher to fire a rocket at a 45 degree angle to see whether permanent magnets or electromagnets launch the rocket farther.

Test method: Test the difference between the electromagnetic field utilizing 1, 2, 3 and 4 parallel wired capacitor configurations vs varying the permanent magnetic field by testing 3, 6, 9, and 12 magnet configurations.

Materials: Magnet wire (29 ga.) to build coil, four 4400 uf capacitors, limiting resistor, 110 volt DC bridge, electrical wire (18 ga.), 1/8 in wood dowel x 6 in long, 1 in diameter cardboard tube, balsa wood, foam, glue, 12 1/4 in rare-earth permanent magnets, 2 electrical switches, and 110v AC power connector, box to hold electronics, and a contactor.

Results
I experimented using a different number of capacitors and magnets to see which one would launch the rocket farther on a 45 degree angle. There were 17 total tests completed. I was able to observe that adding more capacitors did not help the distance the rocket traveled. In fact, when I tested for three and four parallel charged capacitors, I observed that the distance the rocket flew was the same. I compared and graphed the results by calculating the percentage difference between the electromagnet configurations and the permanent magnet configurations. This postively showed that the permanent magnets have more affect on the launch distance of the rocket in my test model, than increasing the electromagnetic field.

Conclusions/Discussion
My hypothesis was incorrect. I had predicted that the energy stored in the additional capacitors would make the electromagnetic field stronger than the permanent magnetic field, therefore causing the rocket to go farther, but I was wrong. I can conclude this because of the fact that when I analyzed all the test data, the electomagnetic field outperformed the permanent magnetic field by over 3X. I concluded that there were no performance benefits after the fourth capacitor was added. I feel that the additional capacitance was not being utilized in my test model. I believe that if two parallel coils were used, the additional capacitance could have resulted in a higher electromagnetic launch.

Summary Statement
A study to find the effect of changing the electromagnet field vs a fixed permanent magnetic field.

Help Received
Mr. James Edman reviewed my schematic diagram. My father helped assemble the box and measure the rocket launch distance. My mother also verified the rocket launch distance.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Sol C. Moon

Project Number
S0809

Project Title
Superconductor Pendulum: An Energy Paradox

Abstract

Objectives/Goals
Since the Law of Conservation of Energy should hold, if the superconductor- pendulum (made of Yttrium, Barium, and Copper Oxides) is below the critical temperature of 92K, in a frictionless environment, then it should remain swinging forever, generating persistent current without limit, unlike regular conductors inhibited by eddy current governed by Lenz's Law.

Methods/Materials
The 3 pendulums were swung through a magnetic field and I recorded the time they took to stop. They were also measured without the magnetic field's presence. The superconductor was measured at room temperature and at liquid nitrogen temperature. I used a copper plate, aluminum plate, 1-2-3 Yttrium, Barium and Copper Oxide SC, fishing wire, a Newton's Cradle, 6 neodymium magnets, electromagnet, and stopwatch.

Results
The average time it took for the Aluminum pendulum to stop without the magnetic field was 26 seconds, and with the magnetic field was 12 seconds. Similar results were seen in copper; 40 seconds to 26 seconds. The superconductor swung for 80 seconds at room temperature. When cooled with LN(2), the mode of time was less than one second. The average time was offset by a number of data points taken as the superconductor warmed past its critical temperature of 92K.

Conclusions/Discussion
The results that I gathered were actually far from what I had expected. Instead of becoming a fluid, almost frictionless pendulum, the superconductor-pendulum in the magnetic field exhibited extreme damping - superdamping. It appears that all mechanical energy in the pendulum's motion was lost; this was quite different from the other two conductors. Eddy current induced damping is too weak to explain the superdamping. The superconductor became repulsive to magnetism and veered away, which induced superdamping. Since the superconductor is now diamagnetic, the superconductor has now broken the energy conservation law.In conclusion, this effect, called the Meissner effect creates the superdamping of the SC pendulum and makes my hypothesis incorrect as based on eddy current resistance in the other two conductors. The superconductor retains its zero-resistance in the magnetic field, but it changes its magnetic properties to diamagnetic, and rearranges the magnetic field around it. This is what I did not expect at all, but in the end, explains the results of the motion of the SC pendulum within the magnetic field.

Summary Statement
The Law of Conservation of Energy seems to broken in the superconductor-pendulum when it is swung through a magnetic field.

Help Received
My dad and younger brother helped me build the setup and collect data.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Rowan C.A. O'Neal

Project Number
S0810

Project Title
Hexepod Robotics

Abstract

Objectives/Goals
To build a six legged walking robot which can avoid obstacles.

Methods/Materials
Methods: to extensive to include within the character requirement
Materials: to extensive to include within the character requirement

Results
It walks and doesn't bump into things if it should have been able to see them and it was not confused by infrared interference.

Conclusions/Discussion
n/a

Summary Statement
This proect nvolved learning the skills required to buld a fully finctional autonomous robot.

Help Received
Michael Loik, Professor-UCSC: helped compile parts list; Jim Powel, firmware engineer-Plantronics: taught soldering; Steven Lynch, family friend: taught tool use, lent drill press

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
William R. Oakley

Project Number
S0811

Project Title
Railgunz 4 Dummiez

Abstract

Objectives/Goals
The objective of this project was to give people a firsthand look at railgun physics and to test the possibility of a small-scale railgun for mundane uses, Ex. Construction.

Methods/Materials
The railgun and its charging circuit was constructed from some scrap metal and a few disposable cameras. It's effectiveness was measured by allowing the capacitor bank to achieve different charge degrees and measuring the distance traveled by the armature.

Results
Overall the project was a success as it provided a clear demonstration and explanation of railgun physics, however the railgun i created, while it did work, failed to accelerate the armature past the end of the rails.

Conclusions/Discussion
My research suggests that railguns could only be feasible on a small scale if a small, high voltage capacitor bank could be assembled for its use. Given the materials i have access to it's impossible to create an efficient railgun.

Summary Statement
This project is a physical model of railguns and the physics that drive them.

Help Received
Father helped me drill rails and taught me to solder electrical components.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Nitya Rajeshuni

Project Number
S0812

Project Title
The Effects of Extreme Conditions on Primary and Secondary Cells

Abstract

Objectives/Goals
I studied the capacity of a dry cell battery to survive at extreme temperatures, in particular, that of Mars, -120 degrees Celsius, the North Pole, -60 C, the Mojave Desert, 50 C. Although extreme conditions exist in many areas, institutions such as NASA create rovers capable of surviving such conditions. Hence, I hypothesized that batteries function better at room temperature than at extreme temperatures. In the first additional set, I tested AA dry cells, focusing on nuances and discrepancies, such as varying voltages between individual batteries and exposure to the full temperature range of a day on Mars. In the second additional set, I tested the capacity of secondary cells with a similar strategy, instead focusing on electrochemical properties.

Methods/Materials
Through a thermal chamber, four sets of D cells, one for each temperature, were exposed to their respective temperatures and were then placed inside the flashlights, which were then left to discharge. I then measured the time each flashlight took to discharge. Another four sets of batteries were placed in the flashlights, which were operated at respective temperatures. I then measured the discharge times. The AA set followed similar procedures. In the study on rechargeable cells, I used a thermal chamber and with a multimeter, measured the voltage across the circuit while the batteries were operating.

Results
All the D cells discharged faster at lower temperatures. Flashlights tested within the thermal chambers stopped earlier than flashlights tested outside the chamber, although the cells had not discharged. The tests ran on the AA cells displayed no significant effects. Rechargeable cells exhibited the same effects of extreme temperatures.

Conclusions/Discussion
After observing the set of batteries operated at extreme conditions within the thermal chamber, I concluded that the time a battery takes to discharge is not unanimous with the time a flashlight takes to stop emitting light, for after the flashlights stopped emitting light at -120 C, they began to again emit light as the chamber approached 25 C, signaling that they had not completely discharged. Thus, the flashlights did not turn off because the batteries had run out of chemicals to create energy, but because they could not supply enough energy to satisfy the demand of the flashlights. Similarly, for the rechargeable cells, the voltage fluctuated in a similar pattern.

Summary Statement
When operated at extreme temperatures, primary and secondary cells fail to function as efficiently as at room temperature due to a failure to output enough energy to satisfy the demand of the appliance not due to complete discharge.

Help Received
used lab equipment at JPL under the supervision of Dr. Ramesham Rajeshuni

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Michael C. Ray

Project Number
S0813

Project Title
The Weight to Energy Efficiency of a Hydrogen Peroxide Powered Tesla Turbine

Abstract

Objectives/Goals
This project is the result of the search for a cleaner alternative energy source. Because hydrogen peroxide produces only water and oxygen as a byproduct of its breakdown, it is one of the cleanest fuels in the world. This project is a test of whether a hydrogen peroxide powered Tesla turbine has more energy than a battery of the same weight.

Methods/Materials
This project uses 30% by weight hydrogen peroxide in a conventional Tesla turbine. Catalyzing the hydrogen peroxide and running it through the turbine, then measuring the electrical output obtains the energy content. By dividing the energy content by the weight, the weight to energy efficiency of the apparatus is obtained.

Results
In order to achieve a higher weight to energy efficiency than a NiMH battery, the turbine must achieve about 50% efficiency in converting the energy efficiency of the hydrogen peroxide into electrical energy. Currently Tesla turbines can achieve efficiencies of 80 to 95%.

Conclusions/Discussion
This project proves hydrogen peroxide as a viable alternative to batteries and other portable energy sources. The benefits of this project are that it also details a system for the application of hydrogen peroxide as a fuel source.

Summary Statement
This project is an attempt to provide a cleaner alternative energy source that would replace batteries as a mobile energy source.

Help Received
Mother helped check grammar in report; Dad checked experiment for safety and correctness; Chemical reaction information discussed with uncle (Tom Sliga) as well as Dr. Joel Burley of Saint Mary's College.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Azwad A. Sabik

Project Number
S0814

Project Title
Fascinating Fields of Flux

Abstract

Objectives/Goals
The objective of my project was to determine which of the following variables most greatly affected the strength of an electromagnet: the number of coils, the voltage of the power source, the diameter of the core, and the gauge of the wire. I hypothesized that the number of coils wrapped around the core of an electromagnet would most greatly affect its strength.

Methods/Materials
The materials I used in my experiment were: different gauges of insulated copper wire, batteries of various voltages, steel bolts with different diameters, an index card, a few alligator clips, and staples. I made an electromagnet by wrapping the copper wire around a bolt and connecting the wire to one or more batteries with alligator clips. This produced a magnetic field around the bolt and wire. I measured the strength of the magnetic field by measuring the distance at which the bolt could pull a staple across the flat surface of an index card to one of its ends. I did four sets of experiments. During each set, I changed only one of the variables and kept the others constant throughout the experiments. This allowed for observation of only the effect of changing that specific variable.

Results
I observed that increasing the number of coils, the voltage of power source, the diameter of the core, and the thickness of the wire (the higher the gauge, the lower the thickness), all resulted in an increase of the magnetic fields strength. When comparing ratios between the changes in the results of each test and the changes in the factors for those same tests, I observed that increasing the number of coils of wire around the core increased the strength more than the other variables did.

Conclusions/Discussion
Therefore, I concluded that within the scope of my testing environment and procedure, the number of coils surrounding an electromagnet most greatly affected its strength. This validated my hypothesis.

Summary Statement
The purpose of my project was to determine which of a set of factors most greatly affected strength of an electromagnet.

Help Received
Science teacher helped with research; father helped conduct experiment.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Surya Sivaram

Project Number
S0815

Project Title
Extending the Range of UAVs through the Use of Proton Exchange Membrane Fuel Cells and Other Renewable Energy Sources

Abstract

Objectives/Goals
The goal of this project was to extend the range and flight duration of UAVs through the use of Proton Exchange Membrane (PEM) fuel cells and other renewable energy sources. An additional goal was to attempt to harvest a percentage of the fuel from the environment.

Methods/Materials
In order to test the practicality and efficiency of harvesting fuel from the environment, different water collection devices were tested first to see if and how much water could be collected from the surrounding atmosphere. Another part of the project involved testing model helicopter motors using a Lithium Polymer battery and recording the running times. The same test was repeated using a PEM fuel cell to power the helicopter motor. The reversible PEM fuel cell was powered by the hydrogen that the electrolyzer produced. The data from these tests were recorded and later analyzed.

Results
A fuel cell used in conjunction with a battery increases the total running time to 149% of the time with just the Li-Poly battery. A maximum of 2.5 mL of water was harvested using the most efficient rainwater collection method

Conclusions/Discussion
The use of PEM fuel cells to power UAVs is very promising. The project successfully demonstrated that PEM fuel cells, when used to augment traditional power sources, achieved the goal of increasing the range and flight duration of UAVs. The success of the UAV in harvesting its own fuel entirely from the environment is plausible but not very efficient. Since the efficiencies of future PEM fuel cells are expected to be above 75%, using PEM fuel cells to increase the flight duration of UAVs is a viable and efficient option.

Summary Statement
The design and construction of an alternate and renewable power source for UAVs which extends their range and flight duration.

Help Received
Moral support from parents. Advice from Mr. Kawanami.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Jeff M. Sotelo

Project Number
S0816

Project Title
Can a Pacemaker Get Recharged to Reduce Pacemaking's Invasiveness?

Abstract

Objectives/Goals
-Plan out an efficient system that can charge scaled up version of a pacemaker.
-Design a pair of electrodes that can transmit electricity through an electrically resisting tissue substitute. Then attach to charging system.
-Test the system's efficiency at charging a battery through a simulated tissue medium and then power the pacemaker with it.
-Test the safety of the prototype by testing how much ambient electricity is surrounding the medium by measuring voltages of the contiguous gelatin.

Methods/Materials
MATERIALS:
Experimental Supplies: Pacemaker parts (refer to the log book#s total list of the parts); -Power Supply (9V); Rechargeable 9 volt battery; Hookup wire.
Soldering supplies: Desoldering Braid (to make leads out of and desolder mistakes); Soldering iron; Solder.
Testing Supplies: Multimeter (to measure various electrical units during the experiment); Gelatin (human tissue substitute); Mold or Tupperware Case (to place gelatin in); Thermometer.

METHODS: Solder pacemaker components onto a circuit board (mine was supplied by pacemaker project). Then attach a rechargeable battery to the test pacemaker. Design and test various electrode prototypes to charge pacemaker with. Test the systems efficacy by charging the system through the gelatin and running it. Collect data from the charging and discharging cycles by using the multimeter. Test the prototype's safety by testing how much excess voltage is being passed.

Results
The results were that there was a linear voltage/distance relationship for the first trial (trend=-0.8v/14cm). There was also a predictable relationship of resistance for every centimeter of thickness and distance from electrodes. Thirdly the efficacy of the charging process proved to be very confusing because of a trend that revealed that efficiency decreased as the gelatin's thickness was decreased.

Conclusions/Discussion
First of all, charging anywhere between 0.2-0.5 cm is completely feasible if the charging current is 9 volts or below, and that the surface area of the electrodes needs to be greater than 2 square inches total (mk II

Summary Statement
The project is aimed at finding a suitable power charging system that can eliminate the need to surgically replace a pacemaker.

Help Received
Edna Sotelo (mom) drove around and bought parts; Pacemaker Project supplied the original blank circuit board; Mrs De La Cruz supplied the room to conduct experiments at.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
James D. Warner

Project Number
S0817

Project Title
Makeshift Maglev

Abstract

Objectives/Goals
To find the best angle for a series of electromagnets need to be placed to provide the best propulsion for a magnetically propelled car with permanent ceramic magnets attached to it.

Methods/Materials
Build a track using a 1X4 and 3/4 in. bean poles. Assemble the magnet circuit, set magnets to varying angles (for the different tests) hook it all up to a 12volt battery and put the car on the track. Observe what happens to the car.

Results
My particular design failed to propel the car more than an inch due to multiple flaws including magnet strength, car design and power issues. The design was flawed but helped to figure out ways to fix the design in order to hopefully make it work.

Conclusions/Discussion
In the end, my design failed, but the experiment provided e with valuable information that can be used to build fully functional small scale MAGLEV.

Summary Statement
The goal was to find the amgle at which the magnets propelling a MAGLEV train would be the most efficient.

Help Received
Friend helped wrap magnets

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Olivia P. Zolfaghari

Project Number
S0818

Project Title
Robotic Technology in a Hospital Environment

Abstract

Objectives/Goals
Question: Can robots be applied in the medical field so that they can deliver blood bags from laboratories to nursing stations within the hospital?
Hypothesis: If the current methods used in today's hospitals do not sufficiently perform the transportation of blood from laboratories to nursing stations, then robots will properly deliver the blood in an easier and safer manner.

Methods/Materials
Bill of Materials:
7 chassis rails, 2 chassis bumpers, 4 motors, 4 2.75# tires, 2 60-tooth gears,2 12 tooth gears, 2 84 tooth gears, 2 square bars, 4 36 tooth gears, 1 receiver antenna sleeve holder, 1 RF receiver module, 1 micro controller module, 2 long bars, 1 short bar, 4 square bars 3#, 4 long angle bars, 3 square bars, 12#, 5 gussets, 2 ½# fully threaded beams, 2 2# partially threaded beams, 3 3# partially threaded beams, 1 limit switch, 3 zip tie, 2 pivots, 1 battery holder, 1 extension league, 3 line follower, 1 mounting bar, sufficient screws, nuts, collars, bearing flats, and spacers.

Results
Programed three digital pixel sensors on my robot to follow the given path. Robot can grab a blood bag and place it in an insulator, to deliver from laboratories to nursing stations.

Conclusions/Discussion
Supports my hypothesis and question. Robot can properly function by dispending blood bags and following a given path from laboratories to nursing stations within hospital environment as a means of transportation.

Summary Statement
Creation of robotic technology programmed to perform tasks within the hospital environment, primarily using the line tracking system.

Help Received
Mark Barglowski, the Lab Director at Los Robles Hospital, for preparing a blood bag with which my robot could demonstrate. In addition, Mrs. Usher, science teacher and director of the Robotics Club for staying after school supervising me while I was constructing in her room. Also, Mr. Usher, lab

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Anna K. Simpson

Project Number
S0899

Project Title
Chemical Sensing with Porous Silicon on an Autonomous Robot

Abstract

Objectives/Goals
The challenge of this project was to create an autonomous robotic system that could sense chemical vapor. Using porous silicon, which changes color when chemical enters the pores, I hypothesized that I could create a highly sensitive vision sensor to interface with a LEGO RCX microcomputer using standard electrical parts. The microcomputer could then be programmed to respond autonomously to the chemical vapor.

Methods/Materials
A porous silicon optical interference filter was attached to a photodiode, and then combined with an LED that matched the spectrum of the silicon to make a chemical sensor. The system was put into a black box to eliminate the effects of ambient lighting. Characteristics of the signal, such as noise, were measured, and I did repeated tests using a syringe and various concentrations of ethanol to determine the size of the signal change. I taught myself the programming language LabVIEW to create the necessary programs for data collection and robot response to chemical.

Results
Isolating the LED, porous silicon, and photodiode inside the box kept the noise and drift of the sensor readings very small. The change caused by the chemical was far greater than this noise, generally 8-10 units greater. The robot was able to quickly detect and sound an alarm when chemical was present, even when it was just over a container of chemical with a syringe to draw the outside air in.

Conclusions/Discussion
I created, wrote control programs for, and tested a chemical sensor on an autonomous robot and demonstrated that it could sense chemical vapor with sufficient accuracy to sound an alarm. My success in developing and testing the sensor system also suggests possible future expansions to the project, such as making this autonomous robotic chemical detector mobile.

Summary Statement
In this project, I created, wrote control programs for, and tested a chemical sensor on an autonomous robot and demonstrated that it could sense chemical vapor with sufficient accuracy to sound an alarm.

Help Received
Used lab equipment under the supervision of and recieved porous silicon samples from the lab of Professor Michael Sailor at UCSD