CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Ayoub A. Abdi

Project Number
J0901

Project Title
Got Connection

Abstract

Objectives/Goals
The purpose of this project is to test which material will block a satellite signal the strongest. Also, to see if a material can increase the signal#s reception. This project could also be useful in giving information on how to make satellites water proof and stronger during snow or hail storms. This will benefit later generations by increasing satellite technology.

Methods/Materials
Material
1. Direct TV satellite dish.
2. Dish Network satellite dish.
3. FTA satellite dish.
4. Super Buddy satellite signal grader
5. Brick

Procedure
1. Assemble satellite
2. Fix Dish Network satellite to a firm foundation
3. Attach LNB cable to the satellite dish
4. Connect super buddy signal grader to the satellite
5. Aim satellite at downlink
6. Place satellite in front of building at a distance of 5 feet

Results
The findings for this project were, that at 7 feet the tree was the most effective and lower the signal strength to the lowest. This proved my hypothesis wrong because I predicted that the building was going to be the best signal blocker.

Conclusions/Discussion
The findings from the experiment went with my hypothesis. The data that was collected proved that the building is the best building blocker. The three satellites gave signals of -45.8,-45.7,-29.2 for Dish, Direct TV, and FTA respectively. My thoughts on the out come were that the results were quite believable. The reason for my belief is because the building is a large obstruction.

Summary Statement
This project was conducted to see what obstructer affects the satellite signal the most.

Help Received
Mr. Mahmoud help i lending me tools; brother Ahmed help organizing my project; Mrs. Najwan for supporting me through the whole process

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Ever R. Avary

Project Number
J0902

Project Title
Maglev Madness

Abstract

Objectives/Goals
The author wanted to find how much load a magnet can hold and where in the magnetic field it is the most powerful. The author hypothesized that the magnets will drop at a steady rate along with the weight of rice being added, and eventually cap off at around 30mm because of the controlled and steady power of the magnetic field and the magnetic field#s tendency to become more powerful at the core of the magnet.

Methods/Materials
The rig was designed by slicing and slitting pieces of foam core to allow a magnetic platform to float midair. The author then added weights of rice to the magnetic platform and measured the height of the platform in proportion to the weights of rice.

Organization of this experiment was a primary goal:

*Constant: The constant in this experiment was the height of magnetic platform with no weight.
*Controlled Variable: The controlled variable was the use of rice as a weight.
*Manipulated Variable: The manipulated variable was the weight applied to magnet platform.
*Responding Variable: The responding variable was the height of the magnetic platform.
*Trials: There were 11 weights of rice that I tested twice for a total of 22 trials.

Results
Results showed that as the amount of rice added to the platform was increased, the height of the magnetic platform dropped. At the platform#s resting rate, it was at 47mm, and dropped to around 28mm. This experiment is still in progress.

Conclusions/Discussion
The author concluded that the height of the magnetic platform decreased at a steady rate. For every tablespoon of rice that was added, the height of the platform decreased one millimeter. This experiment showed that as you get closer to the core of the magnet, the gauss levels becomes more concentrated.

Summary Statement
This project tested how much a magnetic platform can carry and where it has the most concentrated gauss.

Help Received
Parents helped purchase supplies and supervised use of Exacto knives.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Haripriya N. Bellam

Project Number
J0903

Project Title
The Crystal Radio

Abstract

Objectives/Goals
The objective of this science fair project is to build a simple crystal radio from scratch. Then experiment to see if it works without external power. If it does work, to then experiment how the radio#s antenna length will affect its voltage, clarity and the number of stations it will play.

Methods/Materials
Materials:
Cylindrical Kraft Tube, 4-in. diameter; Masking tape; Mounting board, wood, about 6 in. # 9 in.; Wire, solid, plastic insulated, 22 gauge, 100 ft.; Steel wire, galvanized, 20 gauge, 100 ft.; 2 PVC pipe couplings, 1## x ##; Germanium diode; 47-komh resistor; Wood screw, small; Alligator Clip, 2#, non-insulated; Ceramic earphone, high- impedance; Wire strippers; Philips head screwdriver; 4 fanestock clips; Glasses, Safety, ANSI Certified; Lab Notebook

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Method:
First assemble the radio with the reference to the model of a crystal radio diagram. Then connect the antenna and the ground connections and experiment using various antenna lengths. Record the micro amps, clarity and the number of stations being played.

Results
In the end, my hypothesis proved to be correct and the radio worked without electricity. When the experiment was conducted, once again my hypothesis was correct and the was proven that the longer the antenna length, the better clarity, more number of stations.

Conclusions/Discussion
My conclusion turned out that my hypothesis was correct! The surprising thing was that the radio actually worked without electricity and that we could actually listen to many stations!

Summary Statement
The crystal Radio is an unique device that uses no electricity and is dependent on the antenna length.

Help Received
My dad helped me with experimenting and building difficult parts of the apparatus.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Dylan L. Beyermann

Project Number
J0904

Project Title
Battery Performance at Different Temperatures

Abstract

Objectives/Goals
The objective was to measure how well alkaline batteries perform at different temperatures. Batteries produce electrical energy using a chemical reaction. Since chemical reactions are slower at lower temperatures, a battery should not last as long when it is colder.

Methods/Materials
A resistor was connected to the battery to act as a load. The voltage across the load and the temperature were measured every 2 minutes and stored in a Data Logger. After the battery discharged, the data were downloaded to a netbook for analysis. From the time dependence of the voltage, the battery's lifetime was determined. The experiment was repeated twice at room temperature, in a refrigerator and in a freezer.

Results
At room temperature, the battery lasted 8.79 hours. The battery's lifetime decreased to 6.77 hours at 1.4 °C, and it only lasted 1.95 hours at -15 °C. This demonstrated that the battery's performance decreased with decreasing temperature.

Conclusions/Discussion
The experiment supported the hypothesis that alkaline batteries do not last as long when used at lower temperatures. Since the storage of energy is essential in our technological world, knowing how batteries perform in different environments is important.

Summary Statement
This experiment is about how an alkaline battery's performance is affected by temperature while being used.

Help Received
Father helped me build the circuit and mount the experiment on the display board. Mother helped me prepare the display board. Parents purchased some materials.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Ayriel L. Bransford-Fonseca

Project Number
J0905

Project Title
Power Is Money: Investigating the Cost to Run Extra Electrical Devices in the House

Abstract

Objectives/Goals
Because I was getting in trouble for leaving my lights on, I wanted to find the cost of different electrical devices in a normal household. I wanted to find out who in my family wastes the most money using extra electrical devices; my mother, my father, or me. Because my dad watches TV all of the time, my hypothesis was that he wastes a lot more money on electricity than my mother and me.

Methods/Materials
I used two EnPower power usage meters to test a lamp, portable DVD player, a laptop, 2 televisions, 2 humidifiers, a toaster, hand-tool battery chargers, a hair dryer, hair curlers, and a Keurig coffee maker. I used the monthly Edison bill to find our average cost per kilowatt hour. I put the cost per kilowatt hour into the power usage meter. I used the average of the highest two tiers on my electric bill because that's how much we would save if we didn't use the extra devices. I tested each device twice for one hour using two different meters.

Results
I found the cost for each electrical device per year, day, and hour. I adjusted the cost using fractions based on the time we actually use the devices. I used the average of both tests to find the calculated cost of extra electricity per day for my father, my mother, and me.

Conclusions/Discussion
My father wastes more money than my mother or me combined. My hypothesis was correct. I learned many things from this project. One of the things I learned was the real price of using electricity. Realizing all of this makes me wonder how much money a family can save if they don't use the extra electrical devices. Now when I turn on an electrical device, I think of having to put money in the device like a vending machine. All electrical devices have a cost, some more than others. If we didn't use the devices tested, we would save over $100 a month. I wonder if people would use less electricity if they could see the cost as they use the electrical devices. I'd like to do research on that in the future. I also want to research if electric cars really save money since you have to charge them.

Summary Statement
I tested the cost of many extra electrical devices used in a common household and found who in my family wastes the most energy and money.

Help Received
My mother helped me gather all of the materials, learn definitions, and helped edit my display.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Jessica Bristol; Mallavi Sinha

Project Number
J0906

Project Title
Burning Green Laser

Abstract

Objectives/Goals
The goal is to prove that metal will be able to withstand the most amount of heat from a burning laser because the metal is a stronger material as compared to wood, plastic, cloth, or paper.

Methods/Materials
The materials utilized are: 1 green laser, jeweler's screwdriver, bonding glue, soldering iron, 3 sheets of newspaper, 3 pieces of redwood, 3 pieces of cloth, 3 plastic pieces, 3 sheets of metal. The experimental design are as follows: 1) Place newspaper on a flat surface; 2) separate the two halves of the green laser pointer by unsealing the glue; 3) remove the battery cap from the laser pointer; 4) Remove the batteries from the battery cap and place both parts on the newspaper; 5) Use the jeweler's screwdriver to adjust the exposed screw and place the parts on the newspaper; 6) Heat up the soldering iron and touch the tip to the circuit board that is right above the screw that was previously adjusted; 7) Remove the tip of the soldering iron after 5 seconds & reassemble the laser pointer; 8) Test the laser on the materials and time how long each one takes to burn; 9) Record all results in seconds.

Results
The metal was able to withstand the longest duration of heat from the burning laser. The average time for each material is as follows: Metal - 341 seconds; Plastic - 150 seconds; Wood - 72 seconds; Newspaper - 12 seconds. Therefore, we were able to quantify the length of time it took to burn the different test materials.

Conclusions/Discussion
The results show that the objective of the experiment was attained since the metal did withstand the longest duration of heat. This project expands our knowledge about electronics since we were able to convert a laser beam pointer from a visual pointing object to a far more powerful instrument. The concentration of the beam through minor mechanical manipulation shows that a simple instrument can be altered to an instrument that can be used in multiple ways.

Summary Statement
A green laser pointer can be converted into a laser beam and the burning thresholds of different materials can be measured.

Help Received
Parents, team mate, and teachers helped in the research and purchasing for the project.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Dominic H. Catanzaro

Project Number
J0907

Project Title
Soaring Solenoids

Abstract

Objectives/Goals
It is common knowledge that an electro-magnet attracts ferromagnetic metals and can attract or repel a permanent magnet. How do you get a magnetic coil to levitate over metal? A coil supplied with alternating electric current can induce a magnetic field in a nearby conductor that repels the coil. My project shows how this can be used to levitate a coil and how the thickness and resistivity of nearby sheet of metal affects how high the coil levitates.
My hypothesis is that two factors play a strong role in the force that repels a coil from a nearby sheet of metal. The lower the electrical resistance of the metal sheet, the higher the coil will levitate. The thicker the metal sheet, the higher the coil will levitate.

Methods/Materials
To test my hypothesis, I built a coil powered by alternating current and measured the height it levitated over a sheet of metal. The coil was 250 mm in diameter and 200 windings of copper wire. The alternating current was supplied by a wall outlet (110 VAC, 12 Amps). I measured the height the coil for three different metals at four different metal thicknesses.

Conclusions/Discussion
The data agreed with my hypothesis. The higher the resistance, the lower the coil floated when the metal thickness was 3 mm. When the thickness of the metal increased, the height of the coil increased. However, after a certain thickness the coil did not levitate any higher.

Summary Statement
The effect of electrical conductivity and thickness of a metal plate on the magnetic repulsion force created by an alternating magnetic field.

Help Received
Rick Lee of General Atomics provided materials for a coil; Industrial Metal Supply loaned sheet metal for measurement.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Alexander del Palacio

Project Number

J0908

Project Title

Zap: Making a Van de Graaff Generator and Testing Two Different Triboelectric Material Combinations

Abstract

Objectives/Goals

To test and see which of two triboelectric material roller combinations in a Van de Graaff Generator(VDG) that I built generates a larger static field around the sphere of VDG. The two roller combinations used were Aluminum and Silicon for the first set and Aluminum and Poly Vinyl Chloride (PVC) for the second. To test the distance of the field of static electricity around the sphere of the VDG, I used a simple instrument that I built called an Electroscope which reacts to static charges. My hypothesis, based on the triboelectric series chart, is that the combination of silicon rubber and Aluminum, being farther apart from each other on the chart than the combination of Aluminum and PVC, would generate a larger static electric field around the VDG.

Methods/Materials

Methods:A VDG is constructed from 2 steel bowls joined together and attached to a standard 1.5" ABS pipe. Inside the tube 1 aluminum roller and 1 PVC or silicone rubber roller are connected by a rubber belt and driven by a Dremel motor.At the base and at the top 2 copper wire brushes and one ground wire to transfer the electrons to the sphere. A second apparatus consists of a 12 oz glass jar with 2 aluminum foil vanes suspended inside the jar by a paper clip wire which extend outside the jar.

Materials:2 steel bowls(1 with hole at bottom), 1 rubber belt,1Aluminum roller,1 Silicone rubber roller,1 PVC roller,copper wire,ABS Pipe 3.81 cm diameter x 33 cm long, 7mm X 58mm bolt and nut,3.81 cm x 7.6 cm ABS hub,1 Threaded ABS connector and nut,1 2.5 mm x 5.0 cm drill rod,1 glass jar,1paper clip,1 3"x5"cardboard,stranded copper wire,1 Dremel 4000 power tool.

Results

After testing both combinations of rollers a total of 10 times each the result was that the combination of the silicon rubber and aluminum rollers generated a larger static field, ranging between 27.5 to 29 centimeters, while the PVC and Aluminum roller combo field range was 22.86 to 23.62 centimeters.

Conclusions/Discussion

At the end of my tests, the data I collected supported my hypothesis that the combination of the silicon rubber roller and the Aluminum roller would generate a larger static field than would the PVC roller and Aluminum roller set.This result is consistent with the ranking of the materials on the triboelectric series chart, whereby silicone rubber is farther away from the aluminum roller than is PVC.

Summary Statement

I comapred the static fields generated by 2 different triboelectric material combinations in a Van de Graaff.

Help Received

I recieved help from my father for the use of powertools. I also recieved help from my teacher Ms. Buck with editing.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Paul A. Dennig, Jr.

Project Number

J0909

Project Title

Fusing a ZigBee Wireless Network with Sonar and Infrared Sensors in an Indoor Navigation System for Alzheimer's Patients

Abstract

Objectives/Goals

My objective is to identify the best way to build an indoor navigation system that can help Alzheimer's patients find their locations at home and receive cues for accomplishing daily activities. My research question was whether ZigBee (XBee) radios by themselves would be sufficient in measuring distances indoors or whether they would perform better when combined with Sonar and Infrared (IR) sensors. I predicted that the fusion method would be more accurate since the received radio signal strength (RSS) decays as log (1/r^2) and can be affected by environmental factors.

Methods/Materials

First, I studied the advantages and limitations of XBees, Sonar, and IR by testing them against six drawback factors, each with two or more levels. I hung a barrier corresponding to a drawback factor on a 5 ft by 5 ft plastic frame. Then, I tested each sensor over 6.5 meters in 0.5m increments, recording 30 measurements for each distance, then repeating the whole process for each barrier. I also did a control run with no barriers. I then compared my data to measurements based on mathematical formulae. Second, I took the best combination of sensors for each environment and implemented it in a 2-D prototype.

Results

Without barriers, RSS decayed from -30 dBm at 0.5 m to about -50 dBm at 6.5 meters, as predicted by my formula, and the accuracy was high at 95%. When metallic barriers were used, the accuracy dropped to 37% at 0.5 m. Reflective surfaces affected IR significantly and porous materials confused Sonar. The main problems for Sonar were from outliers in the data, which were caused by Sonar's wide beam catching side walls in the testing area.

Conclusions/Discussion

I correctly predicted the XBee control data based on my equations; however, I didn't expect XBees to be this robust in the absence of drawback factors. My hypothesis about the fusion method as being more effective is accurate. Each tool has its strengths that can be utilized in different areas of a building. Radios are best for long non-line-of-sight paths while Sonar is best for shorter, open, direct distances and is not affected by metal. IR is good for .5 m to 1.5 m but needs to be positioned away from shiny objects. In my prototype, I shifted my reliance from Sonar to XBee measurements between 2 m and 5 m. In the future, I will expand this system to 3-D and test it with Alzheimer's patients.

Summary Statement

My project examines the best way to fuse ZigBee radios with sonar and infrared sensors to build a navigation system for Alzheimer's patients.

Help Received

Dad introduced me to XBees and helped me with programming and math new to me, Mom edited my writing, and my science teacher, Mr. Hu, provided support and critical input.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Azad Doulat

Project Number
J0910

Project Title
The Effects of Voltage on the Efficiency of a Hydrogen Cell

Abstract

Objectives/Goals
The objective is to determine if altering the input voltage to a standard electrolyzing fuel cell alters the efficiency of that cell.

Methods/Materials
The cell was hooked up to a power supply, and the input voltage and amperage was carefully monitored by multimeters, until enough units of hydrogen had been produced. The same measurements were taken with a wattmeter with regards to output voltage and amperage, and the data was calculated to find energy, power, and efficiency.

Results
Increasing the input voltage increased the overall efficiency of the hydrogen cell/electrolyzer, with the increase lessening slowly as the input voltage approached maximum, eventually causing the efficiency to dramatically decrease when voltage reached 95% of the maximum possible input for the cell.

Conclusions/Discussion
Manipulating the voltage in a hydrogen fuel cell can allow for far more efficient hydrogen and energy production, but increasing input voltage too much can damage the cell's efficiency, resulting in a drop in energy output. As such, careful management of voltage can make an already clean fuel far more energy efficient, as long as it is managed carefully.

Summary Statement
Can hydrogen fuel cells be made more efficient by manipulating input voltage and amperage?

Help Received
Parents helped format display; Resources from school laboratory; Theoretical and tutoring help from J. Shirajian and J. Nuttall

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Jarred Druzynski

Project Number
J0911

Project Title
Steeling the Show

Abstract

Objectives/Goals
In my project, I wanted to know if the core used in a solenoid will affect the strength of the magnetic field.

Methods/Materials
A solenoid was constructed, allowing different cores of identical size to be inserted. The solenoid was connected to a power source, switched on and the strength of the magnetic field measured by 2 methods: how many paper clips each core/solenoid picked up, and a gauss reading using a homemade gauss meter. For each core, 5-10 readings were taken at 3v, 6v, 12v, and at both polarities.

Results
The steel core was the strongest. The next strongest cores were air, zinc, and water. Copper and brass were the weakest overall.

Conclusions/Discussion
Conductivity of the core in a solenoid has little to no effect on the strength of the magnetic field, only how ferromagnetic the material is.

Summary Statement
I tried to determine if different cores used in a solenoid would affect the magnetic field strength.

Help Received
Father helped wind coil; My teacher helped get project organized

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Alexander C. Engel

Project Number
J0912

Project Title
Hydroelectric Generators: Oscillating Water Column vs. Tapered Water Channel

Abstract

Objectives/Goals
The objective was to determine which hydroelectric generator produces the highest electrical output, the Oscillating Water Column or the Tapered Water Channel. My hypothesis was that the Oscillating Water Column generator would produce a higher electrical output than the Tapered Water Channel.

Methods/Materials
Models of the Oscillating Water Column and Tapered Water Channel generators were constructed out of household and easily obtainable materials. Both generators were fitted with the same size turbines and generators. The generators were tested in five trials each, simulating ocean wave action with the same amount of wave volume and frequency.

Results
The peak electrical output of the Oscillating Water Column generator was higher than the Tapered Water Channel generator in all five trials.

Conclusions/Discussion
My conclusion is that the Oscillating Water Column generator consistently produces a higher electrical output than the Tapered Water Channel generator in ocean wave conditions of the same volume and frequency.

Summary Statement
My project compares the electrical outputs of Oscillating Water Column and Tapered Water Channel hydroelectric generators.

Help Received
My mother helped get the correct materials and read the electrical outputs while I simulated the wave motion for each generator. Parents and teachers proofread my report.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Andrew A. Fineman

Project Number
J0913

Project Title
Does an Electrolyzer and Fuel Cell, in Circuit, Provide More Energy Than One Reversible Cell over Time?

Abstract

Objectives/Goals
The experiment purpose was to find out if a Reversible Fuel Cell provided more power than a Fuel Cell over time. It was hypothesized that the RFC and FC would produce about the same amount of power because the hydrogen cell was the same.

Methods/Materials
14 trials were conducted on each cell with the control being the Electrolyzer and Fuel Cell. Power output was measured in voltage and amperage. Remaining hydrogen was measured in cubic centimeters.

Results
The RFC resulted with the greatest power output over the Fuel Cell. The averages were (RFC/FC): 0.4837/0.2124 volts; and 0.4661/0.1502 amps. There was a 228 percent voltage difference, and a 310 percent amperage difference between the RFC and the FC.

Conclusions/Discussion
Of the hydrogen applications tested, the Reversible Fuel Cell provided more power over a period of time than the Fuel Cell. A fuel cell and an electrolyzer cell are the exact same thing; the only difference is the cells application. Electricity and water are run through an electrolyzer cell in which the hydrogen and oxygen in the water are separated. Hydrogen and oxygen are then run through the fuel cell and produce electricity, water, and a small amount of heat. A fuel cell can run forever if an unlimited supply of hydrogen were available, however, moisture build up in the cell stops the process. That is probably why the RFC worked better, because it could rid of all the moisture inside itself when run as an electrolyzer.

Summary Statement
My project was to measure wether or not an Electrolyzer and fuel cell was more efficient than one reversible cell.

Help Received
Grandfather bought supplies.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Justin S.T. Fitzmaurice

Project Number
J0914

Project Title
Electromagnetic Propulsion Systems: Railguns

Abstract

Objectives/Goals
The objective of this experiment is to determine which of three rail compositions (copper, brass, or aluminum) would fire a projectile from a rail gun the furthest distance. A rail gun uses an electrical current to accelerate a projectile along a pair of metal rails.

Methods/Materials
Five prototype rail guns were constructed using a range of power sources and rail configurations, all resulting in a lot of sparking but no movement of a projectile. The sixth configuration produced movement, at which point three rail guns were built for this experiment. Each gun used a different rail material: copper, brass, and aluminum. The guns were each fired ten times, and the distances that the projectile travelled were measured and recorded.

Results
The rail gun that utilized copper rails consistently fired further than the gun that employed brass rails. The gun with aluminum rails fired the shortest distance.

Conclusions/Discussion
The test results indicate that rail guns using copper rails fire a projectile further than guns that use brass or aluminum rails, presumably because copper is the best conductor of electricity of the three metals.

Summary Statement
The objective of this experiment is to determine which of three rail compositions (copper, brass, or aluminum) would fire a projectile from a rail gun the furthest distance.

Help Received
Dad helped with the long process of trial and error with the many iterations of rail guns construction.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Julie A. Fukunaga

Project Number
J0915

Project Title
Weedfinder: An Eco-Friendly Herbicide Sprayer, Year 2

Abstract

Objectives/Goals
Herbicide is wasted every year by farmers who spend 8 billion dollars to control weeds. Farmers lose money and harm the environment when using the full spray method in which everything is sprayed, including bare soil. To address this problem, I designed and built a device using electronic components and computer programming to detect and spray weeds selectively in vineyards. This eco-friendly system will lower farmers operating costs and reduce the volume of herbicide and water used.
The engineering goals are to increase the efficiency of the device by 50% compared to last year#s prototype while maintaining a low cost of production for widespread use.

Methods/Materials
I built a circuit and programmed a microcontroller to turn on a solenoid valve to spray herbicides whenever the sensors detect a plant#s light reflectance (chlorophyll reflects infrared light). After testing several prototypes (year 2), I found out that frequency modulation helped detect weeds more efficiently. I also added a User Interface (UI) with a menu system and display to make testing easier, redesigned the lights and sensors for better brightness and alignment, and mounted the Weedfinder device on an ATV instead of using a handheld device.

Results
Trials in several vineyards showed that the average volume of herbicide and water saved was 67% compared to 38% in year 1.

Conclusions/Discussion
The design criteria and engineering goals are met in this project. The average volume of herbicide and water saved was 67% when using the Weedfinder. The new additions and changes in the device made it more efficient, and solved the problem of ambient light affecting the device#s light source (year 1). Because of the use of pulse-width modulation, the sunlight no longer overpowers the infrared lights, making it difficult to detect the weeds# reflectance. The Weedfinder can benefit farmers and the environment by lowering the amount of chemicals and water used by 67%. A future application will be to test the device with a propane weed flame burner.

Summary Statement
My project is about building an eco-friendly device that identifies and sprays weeds selectively to help farmers save on the herbicide, gas, and water they use.

Help Received
My father helped with soldering, spraying chemicals, and explaining C language; my mother helped with the board layout. I would like to thank Mrs. Anderson, Mrs. Burrell and Dr. Oliver for their support.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
John M. Grosen

Project Number
J0916

Project Title
The Effect of Changing Frequency on CPU Energy Usage

Abstract

Objectives/Goals
The purpose of this experiment was to find whether it is more energy efficient to run a CPU at a high frequency (running a task quickly, then having the CPU sleep for the remainder of a set period of time) or at a low frequency (running the task more slowly, then having the CPU sleep for a shorter amount of time or not sleep at all).

Methods/Materials
A program was written for the DSP (digital signal processor) CPU of the OMAPL138 system-on-a-chip to characterize its power usage while busy (actively computing); it was run, and a multimeter was used to measure power draw for four different frequencies: 100 MHz, 200 MHz, 300 MHz, and 456 MHz, and the results were recorded. A similar program was used to measure its power usage while sleeping. Next, the number of cycles needed to go to sleep and the number of cycles needed to wake up were measured. Then the total actual energy used was measured. Finally, an equation was written to model the energy usage, and the theoretical values were compared to the measured quantities to verify the validity of the equation.

Results
When testing for a period of 50 ms, the highest frequency, 456 MHz, used the least energy whenever the number of cycles was above 1,300,000. Below 1,300,000 cycles, 100 MHz used the least energy. When computing 5,000,000 cycles, 456 MHz used the least energy as long as the amount of time was below 190 ms; above this, 100 MHz used the least.

Conclusions/Discussion
In order to maximize energy efficiency, a dynamic clock rate is necessary. The highest frequency yields the lowest energy usage when the ratio of the period to the number of cycles is reasonably small. If the period is long and the task is short, the lowest frequency is best.

Summary Statement
The purpose of this experiment was to find whether it is more energy efficient to run a CPU at a high frequency or at a low frequency, assuming the CPU is able to sleep.

Help Received
Father provided equipment and documentation; mother helped with construction of board

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Andrew D. Gudmundsen

Project Number
J0917

Project Title
The Draw of Electromagnets

Abstract

Objectives/Goals
My objective was to determine how the length of wire or coils affect how much weight an electromagnet can lift. I believe that if I change the amount of wire wrapped around an iron core, then the electromagnet that will pick up the most paper clips will be the one with the most wire wrappings.

Methods/Materials
First I built a box using wood, staples, paint, and screws to house the electromagnets. Then I used 6 inch long bolts, solid strand wire, wire cutters, solder and soldering iron to connect the wire to the bolt and finally electrical tape to make the electromagnets. A doorbell button was installed to access the battery power. A rotary switch was installed to select one of the electromagnets. Finally, the electromagnets were then hung with ropes and pulleys.

Results
The data collected from the trials showed that the electromagnet with the most coils of wire did indeed pick up the most paper clips.

Conclusions/Discussion
Through my experiment I learned that my hypothesis was correct. The more wire that is wrapped around the iron core increased the strength of the electromagnet. This is because as more coils are added to the electromagnet a stronger and stronger magnetic field is created. If I were to add to my project, I would add an extra battery to study the change that electrical current has on the power of electromagnets as well. I would like to study more about electromagnets and their everyday use!

Summary Statement
My project is about how the strength of electromagnets is affected by the amount of wire wrapped around a core.

Help Received
My dad supervised me when I used the power tools and also to help install the power button and switch. My mom helped me organize the data for my display board.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Lauren E. Henske

Project Number
J0918

Project Title
It's Raining Electricity: Generating Electricity from Water Using Kelvin Electrostatic Generator Principles

Abstract

Objectives/Goals
The purpose of my "IT'S RAINING ELECTRICITY" project was to observe how water flow rate effects the generation of static charge in a Kelvin electrostatic generator. I predicted that as you speed up the water flow rate, the intervals between sparks produced by the generator would decrease because the copper coils would gather ions from the water at a faster rate. The experimental variable was the water drip rate. My goal was to make it work and learn more about static charge generation.

Methods/Materials
To test this, it took three different design attempts before I could run trials that would reliably generate a spark, effectively monitor the drip rate as a variable, and accurately measure the time interval between sparks. My final (successful) apparatus used two petcocks, which restricted water flow and enabled accurate measurement of milliliters per minute, as well as a unique spark fixture that created "lightening." It also relied on water free-falling into a double helix of copper coils that descended into weighted metal canisters resting on insulated foam, with electrodes connected to the spark fixture. To run a trial, I poured water into the top, varied the drip rate, let the water move through the static charge collectors (coils, canisters, electrodes and spark fixture), and timed the interval between sparks.

Results
My results indicated that when you increase the water drip rate in a Kelvin electrostatic generator, the interval of time between sparks decreases. I also learned that humidity is an important variable to control, and that there is an "art" to the science of building a reliable Kelvin electrostatic generator.

Conclusions/Discussion
While this may seem like a very simple relationship, these results validated my hypothesis and were satisfying beyond words because at times, I was uncertain I could consistently generate a static charge and run trials. Replicating my design exactly and controlling for humidity may help future science students understand Sir Kelvin's discovery and generate their own reliable data. While it may be wishful thinking, perhaps future researchers will turn Sir Kelvin's 145-year-old discovery into a usable form of alternative power someday too.

Summary Statement
My project proved that flowing water can successfully generate static electricity and that the drip rate speed directly effects the rate of static charge transmission, with a faster drip rate resulting in a faster spark rate.

Help Received
My father helped me use power tools to build the apparatus; the three designs were based on my research and ideas. My dad also helped attach the title to my poster board.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Jesus F. Hourmand

Project Number
J0919

Project Title
Teleoperated Anthropomorphic Hand

Abstract

Objectives/Goals
The project involved creating a teleoperational robotic hand using servos. The hand includes a Microcontroller board that sends digital signals to the motors and is linked to a user-operational glove. The glove, when manipulated by a user, changes the position of the digits and wrist of the robotic hand. The hypothesis of this project, was to determine whether teleoperation could work through a user and the servo controller, and if the servos that drive the hand would have an increase in response time or delay when supplied voltage decreases and ambient temperature increases.

Methods/Materials
The hand was first built and all hardware, software, and printed circuit board were designed. The glove which included flex sensors, was built and connected to the hardware. A cardboard box with an attached blow dryer was used as an environmental chamber. The robot's arm that contained the servo motors, was placed in the box. The temperature was monitored using a meter with a thermocouple temperature sensor. Servos were tested over two temperatures: 20C and 60C. A power supply generated 12 voltages in the range 7.25V to 4.50V to simulate battery drainage. For each voltage, there were 5 trials to test the hand's response time. The response time was measured by the delay between the glove's input and robot's movement. There was a total of 120 trials.

Results
Response time increases as battery voltage drops and when temperature is significantly above room temperature. The response time increased 30% to 40% as temperature increased from 20C to 60C, and when the supply voltage was below 6V.

Conclusions/Discussion
As servos are used extensively with large loads or they are run in hot ambient temperatures, they heat up and response time increases significantly. This is due to mechanical time constant. Cooling the servos using forced air flow or by using heat sinks would help reduce response time.

Summary Statement
A robotic hand that is remotely controlled by a glove, was built and tested for it's response time to user's hand movements, at two different temperatures and various battery voltages to demonstrate servo motors' performance issues.

Help Received
Father helped clarify some electrical questions.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Megan N. Kawakami

Project Number
J0920

Project Title
Is There More Resistance on a Magnetic Levitation Train or a Train on Wheels?

Abstract

Objectives/Goals
My project was to determine whether a magnetic levitation train has more or less resistance that a train on wheels. I believe that magnetic levitation train has less resistance.

Methods/Materials
I constructed a model train with magnets on one side and wheels on the other side attempting to keep the train symmetrical. I placed magnets on a circular plate creating a track for my train. I aligned a plastic sheet supported by golf tees to form a guardrail that the train could be guided with. I constructed a lever arm to push on the train using a roller skate bearing for rotation. I attached a scale to the lever arm to measure the amount of force needed to push the train.
I made a cardboard surface to cover magnets that would be used to compare the train on wheels.
I placed the magnetic train on the track and used the lever arm to push train around track at a constant speed. I recorded the scale readings at various locations along the track.
For the wheeled experiment, I placed the cardboard on top of the magnets. I placed the wheeled train on the track and used the lever arm to push train around track at a constant speed. I recorded the scale readings at various locations along the track.

Results
The maglev train had consistently lower scale readings than the wheeled train. This demonstrated a lower resistance requirement to push the train.

Conclusions/Discussion
My conclusion is that the maglev train had less resistance, proving my hypothesis.

Summary Statement
My project measured the resistive differences between a train utilizing magnetic levitation versus rolling wheels.

Help Received
Father helped to cut wood, pay for supplies, helped to record scale readings.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Ryan D. Kmet

Project Number
J0921

Project Title
Railgun: Turning Current Resources into Tomorrow's Shocking Solutions

Abstract

Objectives/Goals
The purpose of this experiment was to determine, of copper, aluminum, brass, and molybdenum sheet, which material would allow the best conductivity and lowest level of degradation when used with a limited power source as rails in a railgun. The hypothesis was that, given its electrical conductivity rating and degradation point, copper would achieve the most effective results.

Methods/Materials
Sets of four miniature railguns were constructed using wood blocks and cut sheets of copper, aluminum, brass, and molybdenum, a 6-volt battery pack, and a projectile made of a 1.5-inch steel nail and two 3/8-inch cylindrical magnets with the poles opposing. The rails were charged, the projectile was released ten times on each set of rails, and the results were recorded.

Results
The conclusion partially supported the hypothesis in that the copper sheet was an effective conductive material for the railgun rails. However, the aluminum, brass, and molybdenum were successful, as well, though to lesser degrees. Additionally, there was an undesirable arcing seen with the propulsion of the projectile along all the rails, which is demonstrative of one of the biggest issues of the railguns in use today.

Conclusions/Discussion
The limited power source in this experiment failed to adequately stress the materials used for the rails, so an absolute conclusion on the optimal material is not possible without further research. Though the copper rails were slightly more conductive, considerations for the optimal material also need to include cost and degradation. A highly conductive but costly material with a low degradation point will not be any more optimal than a less conductive and less expensive material with a higher degradation point. Further research could include alloy metals and protective coatings applied to them for the rails, as well as a larger power supply and possibly a capacitor bank to store this power in order to more effectively charge the rails and adequately stress them to better determine degradation.

Summary Statement
The purpose of this experiment was to determine, of copper, aluminum, brass, and molybdenum sheet, which material would allow the best conductivity and lowest level of degradation when used with a limited power source as rails in a railgun.

Help Received
Mother and stepfather purchased the materials and supervised the experiment, and Cal City Ace Hardware generously assisted in cutting the metals and wood blocks to size.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Micah A. Knox

Project Number
J0922

Project Title
Gauss Magnetic Linear Accelerator

Abstract

Objectives/Goals
My project is to determine if the amount of neodymium magnets and the amount of chrome ball bearings affect the speed at which the last ball bearing is going.

Methods/Materials
four different arrangements of the 16lbs. pull force neodymium magnets. Also four arrangements of the 41lbs. pull force neodymium magnets. The arrangements will consist of one neodymium magnet (16lbs) and two ball bearings, two neodymium magnets (16lbs) with two ball bearings each, three neodymium magnets (16lbs) with two ball bearings each and four neodymium magnets (16lbs) with 2 ball bearings each. I will be measuring the speed by using the formula V=S/T or velocity = speed/time.

Results
in my project I tested if the amount of neodymium magnets in a gauss linear accelerator affected the final speed. I tested with nine different sets each with one more set than the last. My slowest set was set #1 at a speed of 1.08 mph. my fastest set was set #9 at a speed of 4.oo mph. each set was relatively close to the one before and after it. my closet two sets were set #7 and set #8. Set #7 was at 3.27 mph and set #8 was at 3.30 mph. my farthest two sets were set #8 and set #9. Set #8 was at 3.30 mph and set #9 was at 4.00 mph.

Conclusions/Discussion
My hypothesis was correct. The amount of sets of neodymium magnets and chrome ball bearings does affect the speed of the last chrome ball bearing. The first set was undeniably the slowest out of all the sets. Set 9 was the fastest of all the sets. If I were to make a gun that uses the gauss linear accelerator I would use a design that closely resembles set 9 and not set 1. Although if I want a gun that was very small and compact I would probably use a design that closely resembles group 1,2 or 3 but instead of using 16 lbs. pull force I would use 41 lbs one.

Summary Statement
My project is about how the amout of neodymium magnets and metal ball bearing affect the speed of my ball bearing track speeds.

Help Received
mother helped me set up my board.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Anirudh Makineni; Nishanth Salinamakki

Project Number
J0923

Project Title
Calling = Electric Power

Abstract

Objectives/Goals
The purpose is to capture radiating energy, convert it into electricity, store the energy, and be used to light up a LED without using any external power source.

Methods/Materials
1. Germanium diode; 2. LED ; 3. Copper Wire; 4. Platform; 6. Ruler; 7. GSM phone.

1. Construct the circuit that will capture the mobile phone waves sent from it. 2. The circuit is made out of copper wire to capture energy: a germanium diode to make sure the current goes in one direction, and an LED to show the energy. 3. Stretch the copper wire on a flat surface into a square loop of 7.5 x 7.5 cm and build the circuit with copper wire, diode, and LED. 4. Run the application or any other variable planned to be used and wait. 5. See how long the LED lights up if it lights up at all. 6. Then record results, time, and observations down of the LED glowing. 7. Repeat step 7 for other phone activities that needs network link. 8. Compare results and from data to see when LED glowed the longest.

Results
This table shows which cellphone activities light up the LED or not.

Short Text Long Text Maps Videos on YouTube Browsing the app market Calling Sending e-mails
Yes Yes Yes* Yes Yes No Yes*
Yes Yes No Yes Yes No No
No Yes Yes Yes No No No
No Yes Yes No Yes No No
Yes Yes No Yes Yes No Yes
Yes No Yes No No No Yes
Yes Yes Yes Yes Yes Yes No

Conclusions/Discussion
After much time researching, experimenting, and trials, the LED finally glowed without using any external source but the radio waves emitting from the cellphone. Eventually the experiment was successful, but could not measure the voltage during the cell phone activity, though the LED was glowing.
The original idea was to measure the electricity, but this could not be done due to lack of time and resources.

Summary Statement
The project is about glowing a LED without any external electric power source.

Help Received
Dad helped in soldering circuit and getting the necessary components for the experiment.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Emily R. Manabe

Project Number
J0924

Project Title
Best Battery Temperature for Maximum Performance

Abstract

Objectives/Goals
The purpose of my experiment was to determine how temperature will affect the power output of batteries.

Methods/Materials
Pairs of AA batteries were brought to different temperatures ranging from 0 F to 170 F and were then attached to a circuit that used a calorimeter to heat water. The calorimeter was made by putting ten 10 Ohm resisters together, five on each side. The resistors were connected in a parallel circuit. The power of batteries were determined by measuring the change in temperature of the water that was heated by the resisters in the calorimeter. The water temperature from the calorimeter was measured after the batteries discharged for 10 minutes. This was repeated four more times, for a total of five water temperature readings for each battery temperature.

Results
The first set of data included seven battery temperatures that ranged from 0 F to 170 F and the second set of data included five battery temperatures that ranged from 0 F to 170 F. Batteries at higher temperatures consistently heated the calorimeter water to higher temperatures than the batteries at lower temperatures.

Conclusions/Discussion
The power output of batteries increased as the battery temperature increased.
This is an important environmental factor for battery performance.

Summary Statement
How temperature affects the power output of batteries.

Help Received
Father helped design project and mother helped write report.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Fletcher T. Matthews

Project Number
J0925

Project Title
Spin Right 'Round with Electric Motors

Abstract

Objectives/Goals
The amount of energy that industrial nations are using continues to increase. Making electric motors more efficient would help reduce the use of energy and help the environment. My objective was to investigate different wire diameters in the coil of the electromagnet in an electric motor to determine if a larger diameter wire will produce a stronger electromagnet. This should result in a faster more efficient electric motor. Based on Ohm's law, I hypothesize that the larger diameter wire will have less resistance and will produce a faster electric motor than a smaller diameter wire.

Methods/Materials
I first built a simple electric motor. I then built three different wire coils for the electromagnet using 25, 27 and 29 gauge copper wire but kept the length of the wire the same for the coils. I then tested the electric motor with each different electromagnet and measured the rotations per minute of the armature. I repeated the test 10 times for each different electromagnet.

Results
The electromagnet with the largest diameter wire (25 gauge) consistently spun the electric motor the fastest over the smaller diameter wire.

Conclusions/Discussion
My conclusion is that the larger diameter wire used in the electromagnet coil produces a stronger electromagnet and a more efficient electric motor than the smaller diameter wire. The wire gauge used in the electromagnet coil is an important factor in electric motors. This experiment supports Ohm's law that a larger diameter wire has less resistance and results in a faster spinning electric motor. For stationary motors such as washing machines and air conditioners, using the larger diameter wire should produce a more efficient electric motor. However, for electric motors used in moving vehicles where weight is important, the extra weight with a larger diameter wire for the coil may not prove beneficial.

Summary Statement
Does using a larger diameter wire in the coils for an electromagnet produce a stronger electromagnet which results in a more efficient electric motor than smaller diameter wire in the coils.

Help Received
My mom helped record the data and helped me type my report. My dad helped me build the electric motor. Finally my mom and dad helped me understand the concept of electromagnetism.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Erik Z.S. Meike

Project Number
J0926

Project Title
A Robot for Photo-Documenting Parks

Abstract

Objectives/Goals
The purpose of my project was to create a robot that will autonomously map trails in parks while recording its position and take 360º immersive photos of hiking trails for virtual hikes, disabled access, and preserving scenery for future generations. In order to develop the technologies required for this complex project, I created small scale versions of all the major components. There were 3 projects:
1. A stabilized base for mounting a 360º camera
2. A maneuverable robotic base
3. Vision and pathfinding systems

Methods/Materials
1: Using my hardware and software experience, I designed and built an IMU (inertial measurement unit) to sense orientation and used a servo-controlled pan and tilt bracket for keeping the camera level and properly oriented.
2: I constructed an Arduino-based circuit and wrote code to interface to the sensors and motors for the robotic base. I built three different frames before settling on the one using Lego-based motors and frame.
3: I am taking classes to learn state of the art techniques for vision and path finding systems: A* algorithm, structure from motion, particle filters, Kalman filters, Open CV.

Results
1: The camera platform performs well. I do not have access to a 360º servo or 360º camera, so the current platform can rotate 180º and has a stereo camera for proof of concept. I am confident that adapting to the final version will be straightforward.
2: The robot is able to stand, however, more work needs to be done to enhance stability and add navigation.
3: Although, I have not yet built a prototype system, I have done the background research and have a good understanding of the main components involved. I am now preparing to move to the experimental phase.

Conclusions/Discussion
I built a camera platform that reliably faces in whatever direction I want it to, and adaptively keeps the camera level. In the process of designing this, I discovered a technique to simplify the process of creating an interconnected lattice of 360º photos into a navigable scene by always pointing the camera north. Also, after testing several algorithms for the robot base, I found that the PID algorithm balances the robot the best. I have made substantial progress in designing and building two out of three of the major components of this complex system.

Summary Statement
A robot for autonomously mapping and photographing trails in parks with 360º images for virtual hikes, disabled access, and preserving scenery for future generations.

Help Received
My dad helped me with some software issues. My family helped me glue up my poster.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Ahmed A. Mohamed

Project Number
J0927

Project Title
Hydroelectric Generator

Abstract

Objectives/Goals
My objective is to build a hydro electric generator and test it to find out the relationship between the heights of the water and the amount of electricity generated.

Methods/Materials
A tower test ring with adjustable shelves was constructed to simulate the different water level before and after a dam. The rig is equipped with a water tank setting on the highest shelf, used turbine wheel from a turbocharger, a hose with ball valve connecting the water tank to the turbine, and water collecting tank under the wheel. The electric generator was constructed by forming four 200 rounds of copper coils, that were attached to a CD mounted on the rig, few millimeters above the coil a second CD with 4 strong magnets glued to it, and attached to the wheel shaft. To study the relation between the water height and the electricity generated the top shelf were adjusted to be to different heights above the turbine wheel ranging from 1 ft to 4 foot, in each case the water was allowed to flow down and the produced voltage and the number of LEDs lit were recorded.

Results
With 4ft of water 3LEDs were lit and around 8.7 Voltage was produced while with 2ft of water only 1LED was lit and 2.4 voltages were emitted.
I found that more electric power is generated if higher water level is being used.

Conclusions/Discussion
The greatest amounts of electricity were generated from the highest water level tested. The relations of water height to the measured voltage were almost linear. Which means more water the more electricity is generated.

Summary Statement
To a hydro electric generator and to test what height will pro duce the greatest amount of electricity.

Help Received
my mom helped me spin the coils will my dad cut the wood.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Carson A. Pope

Project Number

J0928

Project Title

Voltage Revival: Recharging 1.5 Volt AA Alkaline (Non-Rechargeable) Batteries

Abstract

Objectives/Goals

was to determine if it was possible to recharge 1.5V AA pile alkaline (non-rechargeable) batteries using a cordless drill as a generator.

Methods/Materials

I recharged 18 batteries using a cordless drill as a generator, by turning a metal hand crank (attached to the drill) 50 times. First I tested the voltage of used batteries using a volt meter, and divided them into 4 categories depending on their voltage. The categories were 1v* or under, 1v-1.240v, 1.240v-1.35v, and 1.35v-1.5v. Then I tested 3 batteries from each category, and recorded the voltage before, directly after, and 2 minutes after recharging. A set of 6 batteries (3 batteries from category 1 and 3 batteries from category 3) went into a 1.2volt incandescent light bulb circuit to determine how long the batteries would continue to light the incandescent bulb. Another group of 6 batteries (3 from category 1 and 3 from category 3) went into a LED bulb lighting circuit to determine if the batteries would light the bulb before and after recharging.*v=volts

Results

The batteries in all categories recharged to near full or over capacity and dropped in voltage after 2 minutes, but were still significantly higher than the starting voltage. The average total voltage increase for category 1 was 0.32v, category 2 was 0.092v, category 3 was 0.126v, and category 4 was 0.069v. Batteries from category 3 that were not completely drained before recharging lasted a lot longer in the 1.2v lighting circuit than batteries from category 1 that were dead before recharging. For the LED test, batteries from category 1 didn't light the bulb before being recharged, but did light the bulb after being recharged. For the batteries from category 3 they lit the LED bulb both before and after recharging.

Conclusions/Discussion

It is possible to increase the voltage of 1.5volt batteries using the cordless drill recharging unit. Even though AA alkaline batteries don't retain a complete charge, it is still worth recharging them if you use a power efficient bulb like a LED. By being able to recharge (non-rechargeable) AA pile alkaline batteries, you can get the maximum use out of them before sending them to the landfill.

Summary Statement

My project is to determine if it is possible to recharge 1.5V AA pile alkaline (non-rechargeable) batteries using a cordless drill as a generator, and testing the recharged batteries in an incandescent and LED light bulb circuit.

Help Received

My father helped with the assembly of the drill recharging unit (using power tools), light bulb testing circuits (soldering wires), and paper cutting for the display board.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Martin A. Quiroga

Project Number
J0929

Project Title
Measuring the Strength of Electromagnets

Abstract

Objectives/Goals
My objective is to determine how the strength of an electromagnet changes by changing the number of loops in an electromagnet

Methods/Materials
The method used was to set up a stand (wood) with a carriage (wood) to hold the electromagnet (3 1/2 inch iron nail with copper wire) and change the carriage distance to the measuring device (a magnetic compass) while using a low voltage power source (4-AA batteries) connected to the electromagnet

Results
The strength of each electromagnet increased with an increase in the number of coils. This was observed when the magnetic compass needle deviated at greater distances as the electromagnets loops increased. Also the rate of change of neddle deflection angle was greater for each centimeter the lectromagnets with more loos were moved closer to the compass.

Conclusions/Discussion
My hypothesis was correct: the strength of electromagnets change with a change in the number of loops. The results were graphed showing the changes. However, a relation of the lines to the distance could not be developed in time. Further analysis and testing is required for that after making a few improvements to make the results more consistent, such as using a more reliable power source,or adapting an electric circuit that could keep the batteries from draining too fast. It was fun to create an experiment that actually worked.

Summary Statement
My project is about measuring the strength of electromagnets by changing the number of loops

Help Received
Father and Mother helped with the design and construction of the stand and testing equipment. Father helped with the testing and graphs. Mother helped witht the report and display of this experiment. All efforts were done at home

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Alex C. Radovan

Project Number
J0930

Project Title
Can You Hear Me Now?

Abstract

Objectives/Goals
The objective of my experiment was to see how different materials affected Bluetooth transmission distances. I think the reduction in transmission distance will be proportional to the specific density of the material.

Methods/Materials
MATERIALS:Sheetrock,Sheet Steel and Sheet Aluminum,Plywood,Cloth,Carpet,String,Bluetooth Headset,Bluetooth capable phone,Rokenbok connectors,Tape Measure 100',Hot Glue Gun and glue,Tape.
PROCEDURE:
1.Build Each Box. 2.Glue materials to the outside of the boxes. 3.Place phone inside box. 4.Put lid on box. 5.Lay Tape Measure Out. 6.Call the phone. 7.Start to walk away from the phone with Bluetooth headset. 8.Record distance when the person on the other side of the phones voice becomes static. 9.Record distance when you can#t understand the person on the other side of the phone. 10.Record distance when the headset disconnects

Results
RESULTS: My results were very interesting and were not exactly what I expected. The sheet aluminum constantly had the worst average performance. It made the voice static at 18 ft.(AVG), inaudible at 35 ft.(AVG), and made the headset disconnect at 66 ft.(AVG). The 2-Ply sheetrock had the best average performance even better than the control. The 2-Ply sheetrock made the voice static at 52 ft.(AVG), inaudible at 102 ft.(AVG), and made the headset disconnect at 100+ ft. every time. A lot of the tests made the headset disconnect at 100+ ft.

Conclusions/Discussion
CONCLUSION: My hypothesis was partially correct. The denser materials did affect the transmission distances more than the less dense materials. However on average the densest material effected the transmission distances less than the second densest. The 2-Ply sheetrock affects the transmission distances less than the single layer of sheetrock. I am not sure why this happened. I thought it was because the amount of interference around us might have changed. In order to rule this out I tested the sheet steel once immediately after I got the strange results with the 2-Ply sheetrock. I got the same results that I had gotten earlier with the sheet steel so I knew that my data was accurate. The order of effect that materials had on the headset is not the same order of the Specific Density of the materials. Specific Density is the density of a material times the thickness of the material.

Summary Statement
I tested how various materials affected the distances at which a Bluetooth headset disconnected, as well as the distances at which a call became static and inaudible.

Help Received
Dad helped build boxes and talked on the phone for my tests; Mom helped gather the materials needed for my experiment.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
V.V. Sandy Ryan

Project Number
J0931

Project Title
Shaking Up Some Energy: Electromagnetic Induction

Abstract

Objectives/Goals
While investigating how a crank flashlight gets energy to power a bulb without batteries, I learned about electromagnetic induction. Based on this idea a simple flashlight can be made from magnets, conducting wire and a low voltage bulb. My project was to determine if using these materials, enough electricity could be produced to light a bulb and to determine factors that affect the voltage created.

Methods/Materials
The flashlight was created by wrapping 30 gauge magnet wire around a short length of PVC pipe. Varying numbers of Neodymium magnets were placed inside the pipe and sealed with caps. The wire ends were attached to the LED light and the flashlight was shaken to observe the LED brightness. The wire ends were then attached to a multimeter and the flashlight was shaken over a 60 second period to determine average voltage output.

Results
Even with the lowest amount of coil turns (500) and magnets (1) enough electricity was produced to light the LED bulb. This combination produced the lowest voltage and the brightness of the bulb was dim. The most voltage and brightest lighting of the bulb was produced with 2000 coil turns and 4 magnets.

Conclusions/Discussion
It is possible to create a simple flashlight from magnets, conducting wire and a low voltage bulb. Higher magnetic field strength and number of coil turns does increase voltage produced. Data shows that the increase is not consistent. Based on this information, the distance between the wire and the magnetic field also affects voltage production.

Summary Statement
My project was to determine if enough voltage could be produced with magnets and copper wire to light up a low-voltage LED bulb and determine factors that affect the voltage produced.

Help Received
Aunt helped obtain materials, appratus set-up, record data, type report and assemble display.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Anish Seshadri

Project Number

J0932

Project Title

Automated, Wireless Monitoring and Control System (AWMCS) for Greenhouse Management

Abstract

Objectives/Goals

The problem that is addressed in this project is that currently operation of greenhouses involves wastage of water and electricity as well as high labor costs for maintenance. The purpose of this project is to build an automated, wireless monitoring and control system (AWMCS) for greenhouse management and maintenance to reduce system, labor and installation costs, water usage, and electricity consumption.

Methods/Materials

The key evaluation criteria included automation, design of a mobile sender unit using a robot and system operation using wireless communication. The AWMCS is completely automated and wireless. No human involvement is needed for monitoring the greenhouse and for turning on/off heating, lighting and watering systems. This cuts down on labor cost and helps establish scalable greenhouses for agriculture.

The AWMCS has two building blocks: the Mobile Sensor Unit and the receiver unit. The Mobile Sensor Unit is made up of sensor circuits for collecting plant soil moisture, surrounding temperature and light data. An NXT robot carries the sensor circuitry and ensures that all points of the greenhouse are maintained within acceptable levels of light, temperature and soil moisture. This data is then transmitted wirelessly to the receiver XBee and Arduino. The software runs on the Arduinos and enables the AWMCS to operate devices like water pump, heater or light bulb using relays.

The prototype AWMCS is tested at many levels. Moisture, temperature and light sensor and receiver circuits are tested independently as sub-systems. Then the integrated AWMCS is tested in a greenhouse environment.

Results

I collected moisture, light and temperature data for a total of 19 hours over 2 days using the Mobile Sensor Unit and my greenhouse was operated successfully by the AWMCS as designed. Based on actual data, it is estimated that the total daily cost of maintaining a 60 sq. ft. greenhouse with 8 6-inch planters in San Jose using the AWMCS in winter is $1.66, which translates to a monthly cost of approximately $49.80.

Conclusions/Discussion

It can be concluded that the AWMCS provides a saving of 24 percent or $15.54 per month in winter when compared to a conventional greenhouse of the same square footage. The results derived show that effective greenhouse management can be achieved using automation and wireless communication.

Summary Statement

This project is aimed at optimizing the water use and electricity consumption for lighting and heating of a greenhouse using an automated, wireless approach in order to reduce annual cost of greenhouse maintenance and management.

Help Received

Mr. Larry Young of NASA Ames Research Center helped me by giving me very useful pointers on how to test my project at the sub-system and the system level. My mom and dad helped me solder the relays, understand the microcontroller software code and build a temporary greenhouse in my front porch..

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Trevor A. Swafford

Project Number
J0933

Project Title
Magnetic Propulsion: Does Coil Size Make a Difference?

Abstract

Objectives/Goals
The purpose of my experiment is to see if different size coils have an effect on the velocity of a given projectile with a controlled voltage. I believe the same voltage sent through a 3cm coil will shoot a projectile at a higher velocity than through a 5cm and 7cm coil.

Methods/Materials
I used three different length coils, each coil consisting of five magnetic copper wire wraps around a single pen casing. The circuit that was used to test each coil was created with a breadboard, a 1.5v AA battery, a circuit board and three capacitors from several disposable cameras. Using the same projectile, I tested the coils 20 times each at 315v per shot. Not having a direct way to measure the velocity of the projectile from the coil barrel, I used a parabolic method to calculate the velocity of each shot. The distance from the height of the coil barrel to the impact of the projectile on the target was measured and applied as the vertical drop in the parabolic equation. An average velocity per coil was determined using the calculated velocities.

Results
Using this method I was able to calculate that the 3cm coil averaged 16.7cm/sec, while the 5cm averaged 20.9cm/sec and the 7cm only averaged 11.2cm/sec. These calculations show that the 5cm coil produced shots at a higher average velocity.

Conclusions/Discussion
The experiment did not support my hypothesis as the 5cm coil shot at a higher average velocity than both the 3cm and the 7cm coils. My experiment could provide scientists with data to advance research on creating a faster vehicle that could transport a payload across vast distances in a faster amount of time.

Summary Statement
The experiment provided data to so that different coil sizes with a controlled voltage will affect the velocity.

Help Received
Father helped with creating coils and circuitry.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Utkarsh Tandon

Project Number
J0934

Project Title
Minimizing Microwave Radiation Disruption on Wireless Signal Using Reflection and Absorption Methods

Abstract

Objectives/Goals
The purpose of this engineering project was to design a cage apparatus for minimizing microwave radiation leakages that could potentially affect wireless signal, using methods such as reflection and absorption. Such a cage could be used on household microwave ovens to decrease any disruption on wireless signals.
Goals: 1. The cage cost should be under $15 dollars including all materials. 2. The cage should be reusable. 3. The design should increase wireless signal strength by 75% from when the cage is not used. 4. The cage should be very thin taking only some area like a jacket. 5. The radiation that leaks from the microwave should be absorbed, reflected, and absorbed again for less radiation disruptions.

Methods/Materials
I had two cage designs, #1 had just aluminum foil around a cardboard base and was made to a cage with masking tape, and #2 had added water tubes to the design. The general materials are put below.
Cardboard, Vinyl Tubes, Aluminum Foil, Wooden dowels, Match Sticks, Water, Water Mister, Scissors, Glue, Tape, Hammer,Wi-Fi Analyzer Android app,Wireless Router,Microwave.
Procedure:
1. Put either cage on the microwave oven and turn on Wi-Fi app on phone.
2. Place phone 50 inches from the microwave oven.
3. Place a cup of water in the microwave oven and set to 60 seconds.
4. Wait till meter stabilizes and then take reading in dBm.
5. Write readings into notebook.
6. Repeat steps 1-5, four more times for 5 trials.

Results
Analyzing the data there was a large reduction in wireless strength when turning the microwave on. To see the difference between both the designs I compared the percentage reduction in the signal drop. Getting 46.4 % reduction in signal drop for the design #1, and 78.6 % reduction in signal drop for the design #2. This shows that design #2 reduced the drop greater than design #1.

Conclusions/Discussion
Looking back at my engineering goals it is seen that design #2 satisfied all the goals. In design #1, only 3 of the 5 goals were satisfied making design #2 my better design.The design constructed has the ability to absorb and reflect external radiation emitted from a microwave device, making sure that the surrounding wireless devices are not affected by any radiation leakage.

Summary Statement
This project attempted to reduce microwave radiation disruption that could affect Wi-Fi using Reflection and Absorption methods.

Help Received
My brother for assisting me with the research portion of my project, and my parents for driving me everywhere to get my materials

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Rahul Tewari

Project Number
J0935

Project Title
Traffic Flow Improvement Using Automated Braking Distance Control

Abstract

Objectives/Goals
My goal is to build a system that will prevent automobile accidents caused by human error and in turn significantly reducing traffic congestion and improve traffic flow. I will achieve my goal by designing and constructing a proof of concept model for automated braking distance control. This system will synchronize traffic by keeping cars automatically flowing at the minimum safe braking distance from the car in front. My prototype will use a microcontroller, an ultrasonic sensor to measure distance, and a motor controller to control the speed. In real time my software will control my prototype such that braking distance follows an exponential relationship to the speed.

Methods/Materials
Arduino Microcontroller
Motor Control Module
Ultrasonic Linear Sensor
Model Car
I used breadboard to assemble and test my hardware. The program was developed in Arduino's programming environment. For testing, I measured the speed and the distance at which my model synchronizes with an obstacle. I tabulated the results and compared them with the theoretical braking distances for different speeds. To test my design in a real world environment, I drove my model on a treadmill with an obstacle in front. I had to install proximity sensors on the side of the car for this test to keep it centered on the treadmill. By varying the speed of the treadmill I tested if my car would pace itself. In order to test the prototypes practicality I also injected an obstacle while in motion to see if the prototype's reaction time was fast enough for it to be practical.

Results
The braking distance follows an exponential relationship with the speed. I used Distance=Speed^2/200 to calculate the theoretical braking distances for my model car. The arbitrary constant 200 represents the capabilities of my car's motor and sensor. The readings recorded were identical to the theoretical calculations.

Conclusions/Discussion
In real time, my program computes the braking distance, reads the distance to the obstacle, then decides whether my car should decelerate, accelerate, or stop. If the braking distance is greater than the sensor reading, the car automatically decelerates. It accelerates when the sensor reading is greater to catch up to the minimum braking distance.

Summary Statement
The goal is to build a system that will prevent automobile accidents caused by human error and achieve traffic synchronization using automated braking distance control in turn significantly reducing traffic congestion on the road.

Help Received
Father mentored in hardware design

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Maya Varma

Project Number
J0936

Project Title
Arduino-Based Foot Neuropathy Analyzer

Abstract

Objectives/Goals
Diabetes is one of the major causes of illness and premature death worldwide. Diabetes causes neurovascular complications, which result in the development of high pressure areas in feet and hands. Diabetic neuropathy causes nerve damage which can lead to amputation or ulceration. Locating abnormal pressure patterns under the foot enables early detection of neuropathy, preventing its serious consequences. My objective in this project is to design and build a low-cost pressure measurement and analysis system based on an Arduino microcontroller, which a patient can use at home to measure his or her foot pressure distribution. If the system detects a problem, it can send an alert to a doctor.

Methods/Materials
In my device, the foot pressure distribution is measured by a set of eight FlexiForce pressure sensors distributed under the shoe. The sensors are placed in the following areas: heel, metatarsal head1, metatarsal head (high pressure areas), metatarsal head5, toe, arch1 (medium pressure areas), fing, arch2 (low pressure areas). The FlexiForce pressure sensors are based on force-sensing resistors, whose resistance varies inversely with the applied force. By connecting it with an electrical circuit, this change in resistance is converted to a change in voltage, which is sensed by the Arduino microcontroller. This information is then transmitted through a wireless transmitter. A software application running on a cell phone, PC, or tablet can receive the signal and display it.

Results
I have successfully designed and built a prototype system using a set of eight FlexiForce sensors distributed on a shoe. An Arduino microcontroller is used to measure the pressure sensor outputs and transmit the information through an Xbee wireless transmitter. I have also built a display device that receives the wireless signal and displays the foot pressure information on an LED bar graph display.

Conclusions/Discussion
The device can be used to compare the pressure distribution against a reference distribution and show any anomalies. It can then alert a healthcare provider. The results show that such a device can be built at a low cost and can accurately measure the foot pressure distribution to detect anomalies.

Summary Statement
I designed and built a low-cost pressure measurement and analysis system based on an Arduino microcontroller, which a diabetic patient can use at home to measure his or her foot pressure distribution and detect neuropathy.

Help Received
Father helped buy components.