CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Anay Bhakat

Project Number
J1001

Project Title
Increasing Effective Range of Electric Vehicles Using Electromagnetic Induction

Abstract

Objectives/Goals
Using fossil fuel in vehicles significantly harms our environment by releasing about 1.5 Billion metric tons of CO2 and many other poisonous gasses into the atmosphere every year. Plug-in Electric Vehicle (PEV) can help alleviate these problems. However, the adoption of PEVs has been slow as the vehicle range is limited by its battery size.

The objective of this experiment is to demonstrate the possibility of wirelessly charging PEVs while driving along highways using Electromagnetic Induction technology. As a result of this, PEVs will have a much longer range without any additional cost and that would lead to faster adoption.

It is a Win-Win proposal for the environment, our long-term health, and the overall economy

Methods/Materials
We used a model track, an electromagnetic transmitter, an electromagnetic receiver, a car chassis, and an oscilloscope to demonstrate electricity transmission from the track to the car without wires. We also measured the frequency of change of the magnetic flux and the amplitude of the generated voltage.

Results
We demonstrated that electricity can be transmitted from the road to the car without wires. The efficiency of the voltage generated in the receiver was measured by changing the number of coils and the distance between the transmitter and the receiver.

Conclusions/Discussion
My tests have shown that wireless charging for electric cars is a viable option. Further enhancements have to be made for safety and efficiency before it is ready for commercial usage.

Summary Statement
My experiment proves that wireless charging is a viable option for charging electric cars using electromagnetic induction.

Help Received
I designed the track and the experiment myself. I received theoretical knowledge about Electromagnetic Induction and Oscillator from Rajib Bhakat and Khan Academy's Course on Electromagnetic Induction

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Matthew S. Brawders

Project Number

J1002

Project Title

Automating Cross Polarized Lenses to Control Lux Levels Received by a Sensor

Abstract

Objectives/Goals

My objective is to make a device utilizing crossed polarized lenses to control the amount of light hitting a light sensor. I will see how many total lux I can reduce the light source by and how much range my project has to control light entering the system. Finally, I will try to reach a preset equilibrium by programming the device to either let in more or less light.

Methods/Materials

Light dependent resistor as a light sensor. Light emitting diode used as a meter to display light intensity, a servo motor to control polarized lens orientation. An Arduino board programmed to analyze input from the light dependent resistor, control the light emitting diode meter, and turn the servo motor in response to the light dependent resistor input. Two polarized lenses, breadboard, wires, resistors, flashlight, and various wood items to make platform for lenses and flashlight.

Results

The servo motor could easily turn the lenses to control the light to a preset level when exposed to varying degrees of light. When the lenses were aligned the light was decreased by 95%. Crossing the polarized lenses decreased the light by another 95% which came out to be 99.75% total.

Conclusions/Discussion

My project was mostly a success. The lenses dramatically reduced the total amount of light to the sensor and my device worked well to adapt to light levels to keep a constant amount of Lux on the sensor. Unfortunately, the range of light passing to the light dependent resistor was very limited. The aligned polarized lenses blocked 95% of light, allowing only a 5% range to be controlled by the device I made. One way I could try to improve my project is by using multiple sets of less pigmented polarized lenses to give me a better range or control of how much light enters the system.

Summary Statement

I created an automated system that uses crossed polarized lenses to effectively control the light levels hitting a sensor from a varying light source.

Help Received

My Dad helped me when I got stuck with coding and assembling the project. The Arduino website has circuitry diagrams and coding tutorials.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Faith J. Bray

Project Number
J1003

Project Title
Testing Tesla: Creating Amplified Sound without a Traditional Speaker and Wireless Energy

Abstract

Objectives/Goals
The objective of this project was to find out if I could create amplified sound without a traditional speaker. This lead to wireless energy.

Methods/Materials
Plasma Speaker, CD player, and light bulb. Built Plasma Speaker using a Solid State Tesla Coil, and used it to play amplified sound. It also caused a light bulb to light up without wires.

Results
I took a Solid State Tesla Coil and made a plasma speaker. I used 75 feet of magnet wire and had to tune it by cutting the wire down and testing how much arc was being produced. The amount of arc is dependent on the length of overall wire. Tuning the resonator was very difficult and caused many MOSFET failures. When I got everything in tune, and turned on the CD player. I could hear music coming from the arc on the Resonator. It also caused a lightbulb to light up without wires.

Conclusions/Discussion
My conclusions were what I expected. I could make amplified sound without a traditional speaker. What I didn't expect was the difficulty in repeating the results. It took a lot of trial and error to repeat my results. Many MOSFETs failed and fuses blown. It was very hard to tune the resonator. I am still learning and have more to learn especially in the area of wireless energy.

Summary Statement
I showed amplified sound could be made without using a traditional speaker.

Help Received
I built the plasma speaker with help from my dad, Troy Bray. I had help understanding how the resonator worked from Hoyt Yeatman.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Andrew C. Chiang

Project Number

J1004

Project Title

Manipulation of Ultrasonic Force Field

Abstract

Objectives/Goals

The goal of the project is to generate an ultrasonic force field to levitate and manipulate small objects.

Methods/Materials

I developed a computer simulation algorithms using MATLAB to calculate the needed amplitude and phase configuration of the phased-array transmitter in order to generate a given field pattern.

I also experimentally verified the simulated field pattern by designing and building an ultrasonic phased-array transmitting system and a field scanning platform. I used an Arduino DUE to manage the amplitude and phase configurations, an FPGA to control the phases (FPGA code developed by others), digital potentiometers to attenuate the signal, and fixed gain amplifiers to drive an array of ultrasonic transducers. The field pattern was measured by an ultrasonic receiver mounted on an XYZ stage built by LEGO Technic parts and controlled by an Arduino MEGA through Bricktronics Megashield.

Results

Simulated 1-D field pattern matched very well with measured field strength pattern. It was found that uniformly spaced arrays showed strong spurious interference spikes. Smaller spacing in uniformly spaced arrays pushed spurious interference spikes further apart. Larger overall array dimension yielded smaller focal spot size. Randomly spaced arrays showed lower spurious interference spikes.

Levitating effect was observed that very light objects were moved by the ultrasonic field. However, full suspension of an object was not achieved. It was probably caused by insufficient field strength.

Conclusions/Discussion

The simulation program using gradient descent algorithm could effectively produce transducer amplitude and phase configurations to yield any arbitrary field strength pattern. Uniform amplitude algorithm was fast and did not require regression. It could maximize transducer output amplitude. However, it could only generate a single focal spot. Experimentally measured ultrasonic field matched with simulation very well. The generated field strength was sufficient to move small objects, but not enough to fully suspend objects.

Summary Statement

I simulated and experimentally verified a phased-array ultrasonic transmitter for generating a force field to levitate small objects.

Help Received

I designed and built all of the circuits and the testing platform. I wrote all of the Arduino code and MATLAB code, except for the Verilog code for the FPGA which was written by the mentor.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Wyatt DeCraemer; Sergio Lozano

Project Number
J1005

Project Title
Wireless Transmission of Electricity

Abstract

Objectives/Goals
The objective of this project is to design an effective way to transmit useful electricity wirelessly.

Methods/Materials
A solid-state wireless electricity transmitter (Tesla coil) with input of approximately 30 volts. A smaller receiver coil with a full bridge rectifier to produce useful DC, and a few florescent light bulbs. Improve the transmitter with the engineering design process to yield greater distance.

Results
Six different versions of the design had varying levels of success. The final and most efficient was a 30 volt power transistor driven transmitter with up to a meter in range.

Conclusions/Discussion
Repeated trials proved that higher voltages yield greater power and distance, but as a disadvantage, a proportionally increasing amount of heat. It is concluded that the greater the performance becomes.

Summary Statement
We showed that a low voltage Tesla Coil is an effective way to transmit long range wireless power.

Help Received
NA

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Ankita B. Deep

Project Number
J1006

Project Title
Feed-O-Meter: A Smart Watering System that Detects and Responds to a Plant When It's Thirsty

Abstract

Objectives/Goals
Wouldn't it be cool to have our plants talk to us just like how we interact with each other?
Well here you have it # Feed-O-Meter, a project using a moisture sensor to tell you if your plant is thirsty, feeling good, or drowning in water.
My engineering objective was to devise an inexpensive and a smart watering system that waters the plants only when the moisture level in the soil is really low, at other times it should be able to bypass the watering cycle.

Methods/Materials
Materials:
Arduino, Computer, ProtoPalette Kit, Jumper wires, Mini USB Cable. Moisture Sensor, Servo motor, Plant with varying levels of soil moisture.

Method:
I am using an Arduino micro-controller, to read the moisture values from a moisture sensor to detect how wet or dry the soil is. These values were calibrated with a single plant over a period to understand what is needed for a healthy, over watered, and a dry plant. I used these ranges to power LEDS to tell us when to water the plant and when to stop watering the plant. This also powers an LCD screen where a message is displayed as if the plant were talking to us. I then connected a servo motor and attached it to a watering drip to control the amount of water that is used to get the plant from a dry state to a healthy state.

Results
The circuit I devised allowed me to water the plant only when the soil was really dry, by finding out the values I should use for a dry soil using the moisture sensor. The water system is based on a rotation of the motor which is attached to a drip. In addition, the plant is able to communicate its soil state to the circuit by using a message in the LCD panel and the LEDs on the Protopalette kit.

Conclusions/Discussion
Its fairly easy and inexpensive to create a smart watering device using components and sensors to detect when the plant is thirsty or need to be fed. I believe that this will help in conserving water and keeping plants healthy.
In future, I would like to extend this project to include different plant types and their water needs, weather conditions and harness rainwater to use for watering plants.

Summary Statement
I created a smart watering system using a micro controller and sensors for both indoor and outdoor use. The system detects the moisture state for the soil before triggering or cutting off the irrigation cycle.

Help Received
I studied the different sensors and components required to make the circuit. I sought help from my father to understand how the wiring for the LCD panel works and took some help in configuring the Arduino Yun to work on the wifi

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Sarah Ertl

Project Number
J1007

Project Title
Creek Power

Abstract

Objectives/Goals
My objectives were to see how much emissions-free electricity I could generate from the creek which is in my backyard with a homemade generator.

Methods/Materials
In essence I created a generator that uses magnetic induction to create a current of free electrons. This required two main parts: creating a stator and a rotor. The stator was made with copper coils and the rotor was made with neodymium magnets.

Results
The result was that I created electricity; albeit not as much as I had hoped. I generated about .023 kwh.

Conclusions/Discussion
In conclusion, I gained a lot of knowledge about how generators work and I have formulated hypothesis about how to increase the energy output of the generator that I made. Emission-free energy is crucial step to reducing the effects of climate change on our planet.

Summary Statement
I created a hydroelectric generator and used it in a creek to generate emission-free electricity

Help Received
My science teacher Amy Schwedtfeger and my dad Jeremy Ertl

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Nicholas R. Fish

Project Number
J1008

Project Title
Quantum Levitation

Abstract

Objectives/Goals
The objective of my project was to test if changing the angle of a neodymium magnet would affect the amount of time it would hover over a superconductor.

Methods/Materials
For my project, I used a superconductor, four Neodymium magnets, liquid nitrogen, a stopwatch, and a Dewar container to hold the liquid nitrogen. I got the superconductor, neodymium magnets, and the liquid nitrogen container off Amazon. I got the liquid nitrogen from a company called Praxair. To conduct my experiments, I first poured some liquid nitrogen into a plastic bowl. Then I placed the superconductor in the liquid nitrogen for about 1 minute. Then I placed it onto the table and immediately placed the neodymium magnet array above at one of the four angles, and also started the stopwatch. When the magnet completely fell to the ground, I stopped the stopwatch and recorded the time. I repeated this three times for the four angles.

Results
The shallower the angle of the neodymium magnet, the longer it was quantum locked above the superconductor. When the neodymium magnets were are 0 degrees, the average hovering time was 30 seconds. When the magnets were at 30 degrees, they hovered for around 26 seconds. When the magnets where at 60 degrees, they hovered for around 9 seconds. Lastly, when the magnets were at 90 degrees, they hovered for around 1.5 seconds.

Conclusions/Discussion
When the magnet was at a more shallow angle, the magnet hovered for a longer time. This could theoretically allow hover trains to hover for a longer period of time.

Summary Statement
I showed that changing the angle of a neodymium magnet hovering over a superconductor has a significant affect for the amount of time it hovers.

Help Received
For safety purposes, my father helped me handle the liquid nitrogen.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Bella Ganocy; Ella Ganocy

Project Number

J1009

Project Title

Construction of a Modular Vertical Axis Wind Turbine and Study of the Performance of MagLev vs. Conventional Bearings

Abstract

Objectives/Goals

The purpose of the science project was to build and then study the performance of a magnetically levitated vertical axis wind turbine (VAWT) compared to a vertical axis wind turbine using conventional bearings. The hypothesis is that the performance of a wind turbine can be improved by using frictionless magnetic bearings rather than conventional bearings at the base of a vertical axis wind turbine. This may allow for improved efficiency and, as a result, greater clean electricity production which our world so desperately needs.

Methods/Materials

A modular wind turbine model with interchangeable magnetic bearings, conventional ball bearings, and wheel bearings was built and subsequently, the performance of the turbine was studied at wind speeds of 5 mph and 10 mph.

Results

Our model using magnetic bearings reached steady velocity of 192 and 310 rpm (revolutions per minute) at wind speeds of 5 and 10 mph, respectively. However, when testing the model using wheel bearings and conventional ball bearings at the same wind speeds, the forces of friction were so high that the turbine did not turn at all.

Conclusions/Discussion

Our model using magnetic bearings was far superior in terms of performance when compared to using conventional ball bearings and wheel bearings at the wind speeds studied. A vertical axis wind turbine (VAWT) with magnetic bearings may be a useful platform for producing more green energy in the future. Our model may serve as a basis for future study.

Summary Statement

After building our modular vertical axis wind turbine, we studied its performance and found that the model using magnetically levitated bearings was far superior to the one using conventional bearings.

Help Received

My twin sister (also my team mate) and I developed the idea, performed the experiments and completed the project. Our dad (T. Kent Ganocy MD MBA) helped us build the windmill, and used all the dangerous power tools needed.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Spencer S. Green

Project Number

J1010

Project Title

Sonification of Accelerometers for the Training of Elite Gymnasts

Abstract

Objectives/Goals

Inspired by my own gymnastics training and an article I read about sonification used for training Olympic swimmers, I wanted to apply the techniques of sonification to aid in the development and mastery of gymnastics skills. The goal was to build a prototype device small enough for a gymnast to wear, which produced a clear sound that both the gymnast and coach could monitor during skill development.

Methods/Materials

Recorded the acceleration and angular rate of a gymnast executing giants on a strap bar. Processed the measured data through the Sonification Sandbox 6.1 Toolkit from Georgia Tech to explore different algorithms. Developed a breadboard prototype using the SparkFun Digital Sandbox Electronics Kit. Developed a compact, wearable prototype using the Arduino Pro Mini 328. Tested and iterated the design through table top testing and strapped to a gymnast.

Results

The recorded data showed inertial sensors do capture unique signatures for each skill. The Sonification Sandbox application was difficult to use, but it provided guidance on possible algorithms. The breadboard prototype proved the concept and helped experiment with algorithms, but it was too big, required a computer power source, and lacked a clear tone. The wearable prototype achieved the final objective of a compact device with clear sound for real-time feedback.

Conclusions/Discussion

The prototypes demonstrated that real-time auditory feedback can aid in the training of elite gymnasts. Accelerometers were tested first due to their simpler analog-to-digital interface to the Arduino processor. Angular rate sensors should be explored in the future due to their better ability to distinguish good versus poor technique. The magnitude to frequency algorithm proved to be the best among the algorithms investigated. Sound quality can be further improved with custom coding rather than the open source Tone function used in this prototype.

Summary Statement

This project investigated techniques and developed working prototypes for transforming acceleration measurements into acoustic sound for use in training elite gymnasts.

Help Received

I designed, built, and tested the prototypes myself. I learned Arduino programming at an iD Tech summer camp. I used lab equipment from Controlled Dynamics Inc. under the supervision of Mr. Brian Weltmer and Dr. Scott Green.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Roy D. Gross

Project Number

J1011

Project Title

Radiocartography: Mapping the Unseen World of Radio

Abstract

Objectives/Goals

My project goal is to create a system that will map radio propagation across a city, allowing the user to visualize the abilities and limitations of their radio system.

Methods/Materials

To construct the signal generated map I created a transmitting unit and a receiving unit. The transmitting unit included a transceiver that transmitted a mostly continuous radio signal onto the air through an antenna.

To avoid overheating and meet FCC requirements, I wrote an Arduino program running on an Arduino Uno to activate a relay that would stay on for 20 seconds and off for 2. This relay was connected electrically to the push-to-talk pin and ground pins so it would activate the transceiver when it was on.

The receiving portion consisted of an antenna hooked up to an SDR receiver that was interfaced with a computer program. Every second the program recorded the time and signal strength coming into the receiver. An Android phone logged GPS data and recorded the position and time every second.

The GPS, the logging system, the receiver, and it#s computer logging system were loaded in a car and the transmitter started transmitting.

To conduct the experiment, the car was driven around on roads that were picked systematically to be spread slightly apart. Once enough signal and GPS data had been gathered, the components were all stopped and the data was uploaded to a spreadsheet on a computer.

The data was analyzed by matching time stamps and the signal strength with the location. Finally the locations and corresponding signal strength were loaded onto Google Earth and averaging software (GNUPlot) was used to make the radio propagation map complete.

Results

My system generated a signal strength map showing radio propagation around Palo Alto. The map showed propagation decreasing with distance and terrain loss. I compared my map with professional software radio modeling (SPLAT!) and I found that SPLAT was similar but had lower resolution and details.

After looking at the outcome, I repeated the experiment using a handmade directional antenna. This antenna showed much worse propagation, despite using the same power, location and transmitter.

Conclusions/Discussion

My system is a low-cost way of generating a radio propagation map. However, it takes a long amount of time.

Summary Statement

Designing and testing a system for mapping radio propagation.

Help Received

I designed and built all the parts of the mapping system. My parents drove me around the city to collect signal data.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Danny Han

Project Number
J1012

Project Title
Investigation in Regenerative Braking of AC Induction and DC Brushed Motors

Abstract

Objectives/Goals
The objective of this investigation is to determine whether AC induction motors or DC brushed motors are superior in efficiency during the process of regenerative braking in electric vehicles.

Methods/Materials
An Arduino Uno microcontroller loaded with a self-programmed code to control the test circuit; a self-designed test circuit to supply power to the motor and capture the regenerated electrical energy; a 10W 1350 RPM induction motor using 50Hz 120V AC electricity; a 10W 1350 RPM brushed motor using 12V DC electricity; a computer with the Arduino IDE development environment; a multimeter to measure voltage, and a DC power supply to supply power to the circuit.

Results
After several trials, the electrical energy generated from the DC brushed motor is found to be far greater than the energy generated from the AC induction motor. This indicates that brushed motors are more efficient than induction motors during the process of regenerative braking.

Conclusions/Discussion
Multiple trials revealed that DC brushed motors consistently produce a greater amount of electrical energy than AC induction motors when connected to the regeneration circuit.Therefore, it could be concluded that brushed motors offer a better efficiency than induction motors during the process of regenerative braking.

Summary Statement
Through the experiment, I found that the regenerative braking capability of a DC brushed motor is far superior to that of its AC induction counterpart due to its permanent magnets and simpler, more efficient circuit.

Help Received
No help was received throughout the span of the experiment. I have designed the test circuit and conducted the experiment myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Aditya Indla

Project Number

J1013

Project Title

A Microcontroller and Air Pollution Sensor Based Smart Air Filter Controller

Abstract

Objectives/Goals

The objective of this project is to create a smart air filter controller that can control any standard air filter based on the level of particulate matter air pollution. The design criteria are to make sure that the controller is inexpensive and easy to use.

Methods/Materials

I designed and built a circuit using an Arduino Teensy micro-controller. I used a IRED-based particulate matter sensor to determine the pollution in the air. I programmed the Arduino Teensy using C programming language. The program reads raw data output by the sensor and translates it into the amount of particulate matter density. That amount is compared to the EPA air quality standards to control a relay switch. The circuit also contains an LCD and LED's, which provide visual representation of pollution.

Results

I tested the sensor using smoke from an incense stick, and compared it to a commercial sensor. Both sensors were placed a set distance away from the incense stick and exposed to smoke. This process was repeated for multiple trials . Both sensors proved to have similar values, showing that the controller would be accurate and effective. The algorithm was also very consistent, only turning the filter on when it was needed, and turning it off when not needed.

Conclusions/Discussion

As long as the air filter can be connected to a standard outlet and fulfills HEPA filter standards, it should perform effectively. This controller is shown to be cheaper than smart air filters currently on the market, as the controller price is about $80, while commercial smart air filters cost about $400, not including the existing air filter being thrown away. Two design criteria were achieved, making the controller inexpensive and making sure it worked with any standard air filter.

Summary Statement

The objective of this project is to create a smart air filter controller that can control any standard air filter based on the level of air pollution.

Help Received

I built an programmed the circuit myself. My mentor, Dr. Aneesh Sharma, taught me the basics of electronics in a similar project and guided me when I was stuck.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Jonathan Lopez-Hernandez

Project Number
J1014

Project Title
Magnets That Charge

Abstract

Objectives/Goals
The goal for this project is to allow people that have a phone to use a kinetic energy as a charging source.

Methods/Materials
This device works by using Faraday#s Principle, when it gets shaken the magnets go back and forth causing the electrons to excite in the copper wire. That energy is taken through wires to a convergence board that has a battery and then gets transferred to a USB port. Once done, the USB wire connects to the phone to charge.
The investigation was conducted in three engineering cycles. First, it was broken apart and studied, and next it was connect to USB port. Lastly, it was put into a water bottle.

Results
The success was that the charger worked to register the phone as charging. The bottles were also connected for the flashlight case. The growth points for the project are to keep the bottle from leaking and to have the battery percentage go up while charging.

Conclusions/Discussion
In the future to perfect this idea by reducing the size so it fits in my pocket and increase the charging capability. This can be done by make it tall enough to relate the same amount of energy of my present project. This means that it will be smaller and work better.

Summary Statement
My project works by using Faraday's Principle; a magnet gets shaken to send electricity through a copper wire up to a convergence board that later sends the energy to a USB Port.

Help Received
I made the design based on a shaker flashlight that I saw on Amazon. I looked up information on how the flashlight worked and got information from a teacher at Tenaya. I recieved help soldering from two men, Brian Reid and William Shambaugh.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Daniella A. Luciani

Project Number
J1015

Project Title
Light Tracking Robot

Abstract

Objectives/Goals
The objective of the project is to see how fast a light tracking robot moves in different intensities of light surroundings.

Methods/Materials
Built a light seeking and directed robot with a breadboard, wiring, photo resistors, MOSFETs, battery holder, potentiometers, toothbrushes, vibration motors and other parts for the circuit obtained from sciencebuddies.com. Used a timer and flashlight to conduct experiments testing robot speed and direction based on three surrounding light settings, high-lit, medium-lit, and non-lit.

Results
The results of my experiments demonstrated that the robot traveled 3 feet faster directed by a flashlight, in a non-lit room. In 4 trials the robot had an average speed of 3 feet per 5.7 seconds performed in the non-lit. The medium-lit room had average of 3 feet per 6.83 seconds, and the high-lit room with an average of 3 feet per 10.73 seconds.

Conclusions/Discussion
I determined that a light seeking and directed robot traveled faster with no surrounding light in the room. In the other tested light surroundings, high-lit and medium-lit, the ambient light in the room negatively effected the performance of the robot.

Summary Statement
I built and created a light tracking robot and learned it has a faster speed with a non-lit light setting in its surroundings.

Help Received
I built the robot,wired the circuit, and conducted the experiment myself. I was given the design and basic instructions from sciencebuddies.com.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Tatum J. Mahoney

Project Number

J1016

Project Title

Danger! Radiation Box

Abstract

Objectives/Goals

The goal of my experiment was to discover if a microwave seal is not working properly which means it may be leaking radiation. I used a cell phone inside different microwaves and used another cell phone to call and text the first cell phone. I predicted that seventy-five percent of the microwaves tested would allow the calls and texts to occur. This would mean that the microwave seal is not working properly and could be leaking radiation.

Methods/Materials

The materials needed to conduct my experiment were two cell phones, a variety of microwaves, Wi-Fi, sticky notes and color coding stickers, and a scientific journal to keep track of data. My method of testing was I went to a variety of stores and tested all the microwaves by putting one cell phone in the microwave and using the other cell phone to call and text the other phone. If a call or text went through, then I put a green sticker on a sticky note with the microwave specifics. If the call or text did not go through, I used a red sticker which indicated the microwave stopped the call.

Results

I tested 44 microwaves, 15 different microwave brands, and out of the 176 trials of cell phone calls and text messages, a total of 137 calls and text messages went through. This is 78% of calls and texts were getting through the microwave seals and this would suggest that the microwave seal was not working properly and could be leaking radiation.

Conclusions/Discussion

My hypothesis was correct and at least 75 % of the microwaves tested allowed calls and text messages to go through. This experiment is significant because many people may be unaware of the dangers and radiation exposure from their microwaves. This can be harmful to a person#s health, especially if a person wears a pacemaker. I want to invent a color-detecting device with possible use of Manganese that would be on all microwaves and shows consumers by turning a certain color if there is any radiation leaking. I want to also invent a phone app designed to scan if a microwave is leaking radiation.

Summary Statement

My project is about using cell phones to test different microwaves to see if microwave's seals are are working improperly and leaking radiation which can cause health issues, especially amongst people with pacemakers.

Help Received

Carly Mahoney, my science fair mentor, helped drive me around to the stores to conduct my experiment.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Aditya J. Mangalampalli

Project Number
J1017

Project Title
The Smart Stick

Abstract

Objectives/Goals
The white cane that is currently used by visually impaired people, lacks obstacle detection from knee to head height. I was trying to develop a modular attachment for the typical white cane that would enhance its capabilities.

Methods/Materials
Using an Arduino and a few other materials, I was able to develop an attachment that takes advantage of an ultrasonic sensor to provide haptic feedback about the distance of an incoming obstacle using a vibration motor.
This device could be attached to any white cane that visually impaired people typically use.This would ensure the safety of the person using this device as opposed to using the typical white cane that wouldn#t detect an obstacle even though it is taller than knee height towards the user. This attachment easily detects those obstacles by sending out ultrasound waves and receiving them to estimate the distance of the obstacle.

Results
The device puts all the components into a compact form factor that would keep the walking stick light. This device could be easily enhanced to accommodate other attachments and sensors that could provide other forms of feedback.

Conclusions/Discussion
This device could be sold for a relatively low price to many visually challenged people. Due to the device#s low cost, it could be provided everywhere around the world including developing countries. In summary, this inexpensive device can make a typical white cane smarter by alerting the user about obstacles that cannot be detected by a typical white cane.

Summary Statement
I was able to develop a modular attachment for the typical white cane that detects obstacles from knee to head height which is light and inexpensive.

Help Received
I designed and programmed this modular component at home with some online learning about Arduino programming and advice from my father.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Derek M. Nasalroad

Project Number
J1018

Project Title
Energy Production of Various Water Types

Abstract

Objectives/Goals
I wanted to know if salt water passed through a turbine would produce more electricity than other water types, such as tap water, distilled water, and filtered water. My hypothesis was that the heavier the water type, the greater amount of electricity it will produce when passed through the turbine.

Methods/Materials
I built an experimental set-up using a 2-liter bottle, Lego bricks, a turbine, and a multimeter. I ran several trials dispensing each water type from the 2-liter bottle, down the chute and into the turbine and measured the electrical current produced in milliamps.

Results
My results showed that the average current produced by salt water was greater than the other water types. Tap water produced the second most, followed by filtered water producing the third most electricity and distilled water producing the least amount.

Conclusions/Discussion
My results supported my hypothesis. I thought salt water would generate the most electricity, and this is what happened. This information might be useful as we look to the future of water supply and energy needs. For instance, it might be possible to build a desalination plant that can create energy by flowing incoming salt water through a turbine before it goes through the process of desalination. I learned from my experiment that salt water can be more efficient at producing electricity than fresh water.

Summary Statement
My project is about comparing the hydroelectric production of 4 water types when passed through a turbine.

Help Received
I designed, constructed, and tested my experiment on my own.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Raj Pabari

Project Number
J1019

Project Title
AquaGuard: Smart Water Sensor and Electronic Alert System (Internet of Things Device)

Abstract

Objectives/Goals
The goal of this project is to design and build a prototype of a smart water sensor that will send an electronic message alert when a water leak is detected, creating a next generation Internet of Things device. Because water sensors on the market today provide passive (ie. visual or audible) alerts, they are limited in their usefulness. If a person is not home to notice the alert, he/she will not know that the water sensor has detected a leak. By the time they come home, the damage will be done. AquaGuard is an active water sensor that sends out an email immediately upon detecting a water leak allowing the home owner to proactively address the problem and reduce the resulting water damage.

Methods/Materials
A smart water sensor prototype was designed by connecting a fluoropolymer (water sensing) wire to an Arduino microcontroller in a way that once water hits the water sensing wire, it acts as a conductor and closes the circuit. Once the circuit is closed, an electric current signals the Arduino software which then triggers Python#s email-sending software and an electronic alert is sent. A branded case was designed and 3D printed to protect the hardware. Additional experiments were performed to compare the water sensitivity of the fluoropolymer wire to other, household materials.

Results
The design and construction was successful, and the goal was met with AquaGuard detecting water leaks and sending an electronic message. Due to its sensitivity, conductivity and design, the fluoropolymer wire was determined to be the better material to use for the AquaGuard prototype.

Conclusions/Discussion
The engineering goal was met. AquaGuard sends an electronic alert once water is detected. Adding a fluoropolymer water sensing wire combined with the email alert feature enables home owners to act quicker and mitigate the water damage, making it a more effective solution. Next steps would be to remotely trigger a solenoid valve to automatically shut off water flow as soon as a water leak is detected and then send an electronic message confirming the action taken. While water is the focus of this project, the possibilities for an active sensor with an electronic message alert system are endless, and could be applied to heat sensors, smoke sensors, air and light sensors.

Summary Statement
To design and build a prototype of a smart water sensor that will send an electronic alert when a water leak is detected.

Help Received
To build the prototype I used Arduino tutorials and designed the software with the help of internet research. Ian Moore from the Carlsbad Library helped me with the TinkerCAD and 3D Printing. My parents provided general advice and guidance, and purchased my materials.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Anjo Pagdanganan; Matthew Sanchez

Project Number

J1020

Project Title

The Gauss Rifle: Magnets and Momentum

Abstract

Objectives/Goals

The objective of our project is to determine how the amount of stages in a Gauss Rifle affect the speed of the projectile launched.

Methods/Materials

A stopwatch, a measuring tape, a calculator, a wooden rail, packs of cylindrical neodymium magnets, and ball bearings were used for this project, along with a prop that raised the rail up by two degrees. Gradually the amount of stages in the Gauss Rifle were increased until resources were exhausted. The first stage was used as the control group.

Results

The speed of the projectile launched increases as the amount of stages in the Gauss Rifle increases. We found that the speed plateaus gradually as well.

Conclusions/Discussion

After several trials, our hypothesis of the speed of the projectile increasing or decreasing in correlation to the amount of stages was proven to be true. However, we also showed that the speed slowly plateaus, showing that either the pull force of a magnet will only accelerate objects if they are going slow enough; or that inevitably friction and air resistance will limit the speed. We think our results will be useful as a study on how magnets accelerate projectiles.

Summary Statement

In our Gauss Rifle, we found that if you increase the amount of stages, the speed of the projectile launched increases as well, eventually reaching a plateau.

Help Received

None, apart from parents who bought supplies. Matthew and I designed, built, and conducted the experiments with the Gauss Rifle ourselves.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Srinath Somasundaram

Project Number

J1021

Project Title

A Novel Design and Evaluation of Temperature Controlled Smart Sock with Fuzzy Logic Control

Abstract

Objectives/Goals

Currently, there are not many options to heat or cool the body without adding or dropping layers. Additionally, there is no way to intelligently increase and decrease one#s temperature except by using electric clothing, heaters, or some other alternative which requires user intervention. The goal of this project is to change this and correctly apply a certain amount of heat to the user#s foot using an electric sock based on the temperature measured inside and outside the shoe and on the activity level of the user. The system would be deemed successful if it kept the user's temperature at a comfortable 30º C in all conditions without the user intervening.

Methods/Materials

First, I connected the microcontroller to my smart phone through an application, so I could see the data gathered. Next, I allowed the microcontroller to control the heat by creating a circuit in which I used two transistors to control the heating element. Then, I added the three sensors to the circuit, so the microcontroller could sense the temperature and the user#s movement. After, I coded the microcontroller to use fuzzy logic to determine how much heat is needed. I tested the system in three temperature conditions while both staying still and moving. They were i) hot temperatures for which I used a hair dryer for the heat, ii) normal temperatures for which I used normal lab conditions, and finally iii) cold temperatures for which I used a bucket of ice.

Results

The data gathered verified that the system did maintain the user's temperature at a comfortable level for the hot and normal conditions. Additionally, the cold situation where I was not moving made the heating element output lots of heat which brought my foot temperature significantly closer to the wanted comfortable temperature. That being said, while I was moving and my foot was cold, the fuzzy logic in the microcontroller caused the output to be around 50% which meant that my foot stayed cold and uncomfortable.

Conclusions/Discussion

In conclusion, the fuzzy logic system paired with the electric sock did help keep the foot at a comfortable temperature though changes in the fuzzy logic system to allow movement to have less of an impact on the output may be necessary to further optimize the system.

Summary Statement

This project is aimed at creating a smart sock that uses fuzzy logic in conjunction with three sensors to accurately output a level of heat that is comfortable for its user.

Help Received

I conceptualized, created, and tested the whole system while my mentor, Dr. Ismail, supervised me.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Kaoru Takashima

Project Number
J1022

Project Title
Electromagnetic Launcher

Abstract

Objectives/Goals
Investigating CLEAN and GREEN next generation object launcher. Especially experimentally confirm how number of current sources (Capacitor) and number of wrapping of coils affect flying distance of an object (Nails) which is electro magnetically accelerated.

Methods/Materials
Methods:
Attach capacitor and battery circuit to coil wrapped around straw
Put in an object (nails)
Charge capacitor and discharge
Record data (how far the nail moved)
Attach one more capacitor and/or increase # of wraps

Materials:
Disposable camera (for capacitor and main circuit)
Extra capacitors
Copper wire (copper is the most conductive)
Straws
Tape
Nails

Results
Adding more capacitors will increase the power of the device.
Increasing the # of wraps of the magnet didn#t really do much.

Conclusions/Discussion
Conclusions: My hypothesis was partially proved to be correct.
Adding more capacitor did increase the power of the device.
However, the # of wraps did not affect the movement of the nail.

Future Plan:
Maybe the direction of the wrap (Clockwise, Counter clockwise) did matter. We will double check.
Diameter of the coil was not tested, We will double check with it too.

Summary Statement
My project is about effectively accelerating an object by electro magnetism which is potentially a clean and green solution for launching objects, such as commuter vehicles in space in future.

Help Received
My dad for helping me get materials and helping me build my project. My Mom gave me a constructive criticism on my presentation;-)

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Nathaniel P. Warfield

Project Number

J1023

Project Title

IR Drop: Testing Resistance on Wire Metals

Abstract

Objectives/Goals

The objective of this project is to find the sum of voltage drop in multiple different wires made up of different metals. Then concluding which wire is the most effective based on performance and price. There are different types of metal that can be used to conduct electricity. All wires have a flaw and that is voltage drop, otherwise known as IR drop. Voltage drop is, due to Ohm's law, where it states that voltage leads to current, but resistance impedes it causing IR drop.

Methods/Materials

The experimenter laid out two wires (one for positive, outgoing current and one for the negative incoming current) about an inch off the ground using PVC risers. Then the experimenter would take the voltage of the 1.5-volt watch battery to have a baseline for that wire. Then attach the battery to the wire and an assistant takes the voltage at the other end. Wide range of wire metals like copper, Kanthal A1 alloy, brass, and silver were tested. In addition, the variables of this project were: independent, the measurement of the end voltage of the wires; dependent, the amount of drop based on the end voltage compared to the start voltage; controlled, wire length, voltage tester, battery, testing conditions, and gauge of the wire.

Results

It was found that brass held its charge with less voltage loss over 25 feet better that the other metals. The resistance of the wires in ohms where, copper: 4,000 ohms, brass: 1,000 ohms, Kanthal A1: 3,000 ohms, & Silver at : 2,000 ohms.

Conclusions/Discussion

The experimenter found that brass wire had the lowest amount of resistance. However it appeared to the coating on it acting as insulator. The silver wire had the next lowest amount of resistance, but due to its price, it wouldn't be suitable to run long distances. Silver wire could have a more effective role in small electronics. The next best replacement would be the Kanthal A1 alloy, with least amount of resistance under silver. It is very inexpensive and suitable for everything from short to great distances and cost efficiency. By measuring the voltage through the four metals, I found that there was a difference in the IR drop and resistance between all them.

Summary Statement

By measuring the voltage through the four metals, I found that there was a difference in the IR drop and resistance between all them.

Help Received

I built and design the experiment by myself. I receive assistance from Tim Meehan, PhD (electrical engineer) in understanding principals of Ohms Law.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Ayana R. Wilmot

Project Number
J1024

Project Title
LED Gloves: A Communication Solution for the Hearing Impaired in the Dark

Abstract

Objectives/Goals
The purpose of this project was to come up with a way for people who are hearing impaired to be able to communicate in the dark using American Sign Language (ASL).

Methods/Materials
Black gloves, black sewing thread, conductive thread, 30 LilyPad LEDs with built in resistors, 10 coin cell battery holders with switches, 10 coin cell batteries.
I sewed a prototype glove as a proof of concept and to refine my sewing technique. For the final gloves, I sewed five parallel circuits on each glove. I used sewing thread to attach the battery holder and 3 LEDs to one finger (each one slightly above a finger joint) of the left glove. I used conductive thread to connect the 3 LEDs with the battery holder. I repeated the process for each of the fingers on the left glove. Then I repeated the procedure on the right glove and checked that every circuit worked when the battery was inserted and the switch was turned on. I used 15 red LEDs on the right hand and 15 blue LEDs on the left hand. I compared pictures of my hands making ASL signs in a normal room with my gloves making ASL signs in a dark room. I used the gloves to sign letters and simple phrases at an intermediate sign language class.

Results
The gloves were tested at home as well as at an intermediate sign language class with 19 participants. 10 letters and 3 phrases ("Hello, how are you?", "What is your name?", "Thank You") were tested. The rate of accurate identification varied based on the letter and the phrase signed, as well as how familiar the participant was with ASL. The average accuracy percentage was 70.4% for the letters and 68.3% for the phrases tested but one hearing impaired participant was able to correctly identify 100% of the letters and phrases signed.

Conclusions/Discussion
The gloves did work and can be used to sign ASL. They worked best for signs where you can see all or part of the knuckles. Future improvement plans include sticking adhesive reflective strips on the palm of the glove and the inside of the fingers, so you can see the pattern on both sides, instead of just the back. I plan to sew a white LilyPad LED on the center part of the wrist of the glove. The light would reflect off the strips and make them visible in the dark. I will then re-test these gloves at the same intermediate sign language class as well as a wider audience at the special school for the hearing impaired in San Jose.

Summary Statement
LED Gloves project could be used to allow people who are hearing impaired to communicate in the dark.

Help Received
I sewed all the circuits on the final gloves myself after my grandma, Mollie Wilmot, taught me how to sew when I was working on my prototype. Michele Maloney, Instructor at the Oster School Deaf Program in San Jose, allowed me to test my gloves in her sign language class.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Yusuf Z. Amanullah

Project Number

J1099

Project Title

A Novel Shower Usage Monitoring System that Promotes Water Conservation

Abstract

Objectives/Goals

California experienced a historic drought between 2011 and early 2017. To comply with water usage restrictions, different costly water saving methods have been available for households which include low flush-dual flush toilets, smart shower heads, rain-water harvesting, automatic shutoff valves, etc. Showers are frequently mentioned as a potential area for reducing water wastage, since the average shower head uses about 2.5 gallons per minute and much more water is wasted during showers than any other household activities. The objective of my project is to design a user-friendly, inexpensive, easy-to-install, electronic device that can be used for consistent shower water usage monitoring. The device will be able to provide automatic feedback to the user based on his or her shower usage habits over a period of time. This feedback will allow users to take notice of their shower habits and then instead of forcing water conservation, it will motivate the user to use less water.

Methods/Materials

An Arduino microcontroller was used as the programming platform for my device to which three sensors were connected, namely, water flow meter, temperature and humidity sensors. The data from the sensors were sent to the Thingspeak website through a Wi-Fi module on my device. Also an app was developed on the smart phone that displays different statistics on the use of water over different period of time. The device also displays visual warning when shower usage exceeds a set time.

Results

The device functionality was tested multiple times near bathroom shower. The water flow sensor was tested for accuracy by running the water for a fixed period of time and comparing the water flow reported by the sensor with the measurement made manually with beaker. The humidity sensor was tested by observing the humidity reading from the sensor as it increased or decreased as shower water in the bathroom was turned on and off. Several readings were recorded for different size bathrooms. The graphs plotted on Thingspeak were checked against the actual data. If the shower duration exceeded a certain threshold (10 mins) the LED light would begin flashing red.

Conclusions/Discussion

My shower water-usage monitoring device was able to perform accurately and reliably in a real world setting and according to the design goal of the project.

Summary Statement

I developed an inexpensive, easy to install shower water usage monitoring system with a user friendly interface which has the potential to motivate the user to conserve water.

Help Received

Father explained how to make circuits.