

3 April 2015

**2015 Alabama Science and Engineering Fair (ASEF)
Special Awards in Optics and Photonics**

The Huntsville Electro-Optical Society (HEOS) was able to award over \$1200 in scholarships at the 2015 Alabama Science and Engineering Fair (ASEF) for Special Awards in optics and photonics related projects. The award funding was generously provided by SPIE, NASA, and HEOS. HEOS would like to thank all the volunteer judges for taking the time out of their schedules to participate in this event. The volunteer judges for this year were:

Tommy Cantey – Optical Sciences Corporation
Phil Stahl – NASA MSFC and SPIE President

These judges were responsible for evaluating the merit and application of photonics in the science fair entries. All winners received SPIE or HEOS certificates and award scholarships. HEOS is greatly appreciative of the opportunity to help inspire the nation's future scientists and engineers. HEOS is about community and our optics community only works with continued dedication and participation of our membership.

SPIE Awards

Senior Division Awards

First Prize (\$250) – Michael McGinnis

“Input Power Dependency of White Light Generation”

11th grade, Jefferson County International Baccalaureate School,
Sponsor Debbie Anderson (PH-803)

Second Prize (\$150) – Rohan Palanki

“Gold and Silver Nanoparticules for Skin Cancer Chemoprevention and Therapy”

12th grade, W. P. Davidson High School (ME-744)

Third Prize (\$100) – Nath Tumlin “The Flying, Spying Pi”

12th grade, Alabama School of Fine Arts
Sponsor Carol Yarbrough (CS-603)



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ABSTRACT

It is an autonomous, flying drone with four Raspberry Pi, GPS, and camera. The drone is search and rescue situations. It creates aerial maps, searches the pre-designated area for any color-coded objects, plots and logs all the coordinates of the found areas. The drone is programmed written in Python that uses the Flask library to stitch together individual pictures combined photos of the entire search area. The Flask library is also used to analyze the image to find the indicated color. The Raspberry Pi can coordinate its flight path as the image given the target color was taken from and the altitude it flies is used to calculate the GPS coordinates of the image that match the color being searched for with the program a user connects the computer via Ethernet to a network, sets up a server and color, and connects the Raspberry Pi to the Flask library in Python, clicks to connect, and disconnects the ethernet cable. This is managed by the quadcopter, the Raspberry Pi camera could be attached to any flying vehicle better range or save costs if search is required over a large area and didn't need a lot of space of this drone.

ENGINEERING GOALS

- Create a program to divide an area into an array of green and red rectangles.
- Use the Raspberry Pi camera module to capture the entire area, given that the pictures are taken at some designated height.
- Create a web-based interface for this program using the Flask library.
- Run this program on a Raspberry Pi connected to a GPS and a camera module. Take pictures at the calculated coordinates.
- Modify the program to stitch together the images taken at each point to create one large image of the entire area.
- Create a quadrilateral, directed by the Raspberry Pi, to carry the imaging module.
- Connect the quadrilateral and Raspberry Pi to create a functioning unit capable of scanning an area and giving the latitude and longitude of places within the scanned area that match a given color.

- The motors of the quadcopter are limiting flight time to approximately 10 minutes due to the weight limits the size of the area the device can fly in.
- The software calculates latitude and longitude within the image by interpolating the latitude and longitude of the four corners of the image. However, some error for the corners of the image occurs, although this is negligible for images imaged by this device due to the small size of the image.
- The Raspberry Pi is a small, inexpensive micro-processor, but it also lacks the processing power of a desktop computer. Raspberry Pi can be slow to take flight when processing an image, although for a few seconds, taking away time for the user.
- Sensor efficiency is introduced by the software for the program that can be used to control the quadcopter.
- The quadcopter must maintain altitude throughout the flight and does not avoid obstacles. The need to take the same altitude throughout from an aerial perspective is not a problem, but it is a problem at a low altitude and large latitude and longitude of points on the ground.

quadcopter is a helicopter propelled by four rotors, two turning clockwise and two spinning counter-clockwise. Raspberry Pi is an inexpensive, low power computer, approximately the size of a credit card, with multiple General Purpose Input/Output pins used for interacting with other hardware.

Our project uses a Raspberry Pi to direct a quadcopter fitted with a camera and GPS to take aerial photographs for image analysis.

The images captured and analyzed by the Raspberry Pi are used to find the latitude and longitude of areas of interest identified through image analysis by interpolating the latitude and longitude from the edges of the picture.

Current aerial drones are expensive. Search and rescue operations are not only expensive but dangerous for rescuers. This project aims to build a device that functions inexpensively and to rescuers searching for people or things, such as a lost hiker in rough terrain.

- Rewrite the control script in a C++ or Python language to remove the computational costs of MATLAB.
- Replace the current battery with a battery for longer flight times and safety.
- Calculate latitude and longitude of the robot to account for the curvature of the Earth, which becomes inaccurate on larger scales.
- Add in obstacle avoidance when fly pictures are taken.
- Use a LIDAR system to map the ground, removing the need to take pictures of ground at a predetermined altitude.
- Add more advanced image recognition for one color.

SPIE Awards

Junior Division Awards

First Prize (\$150) – Miles Thompson

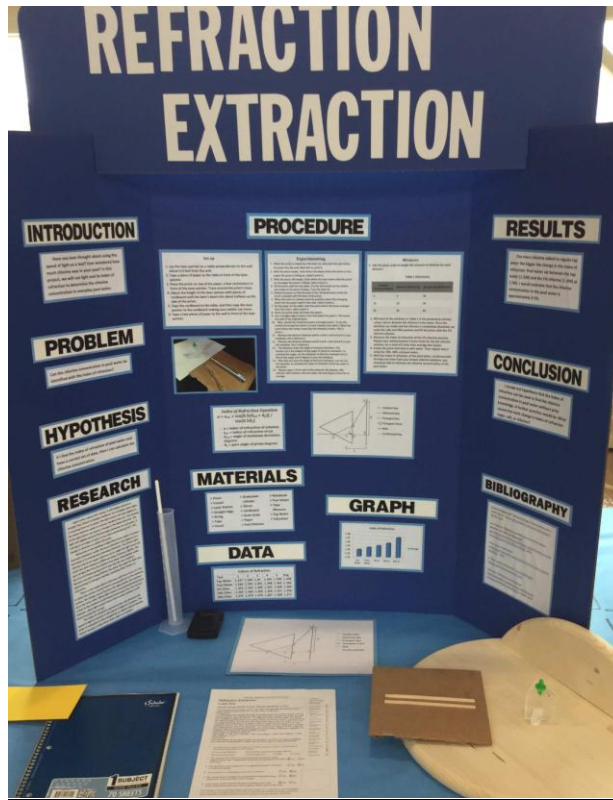
“Which Disc is Groovier?”

6th grade, St. Joseph Regional
Catholic School,
Sponsor Rita Magrini (Z-385)

Second Prize (\$100) – Caleb Kirk

“Refraction Extraction”

8th grade, Muscle Shoals Middle School,
Sponsor Christina Crunk (Z-379)



Purpose

The purpose of this project is to design a solar energy system for mobile low-power applications. The system is designed to provide power to a variety of devices, including a laptop, a mobile phone, and a digital camera. The system is designed to be portable and easy to use.

Abstract

This project is designed to provide a solar energy system for mobile low-power applications. The system is designed to provide power to a variety of devices, including a laptop, a mobile phone, and a digital camera. The system is designed to be portable and easy to use.

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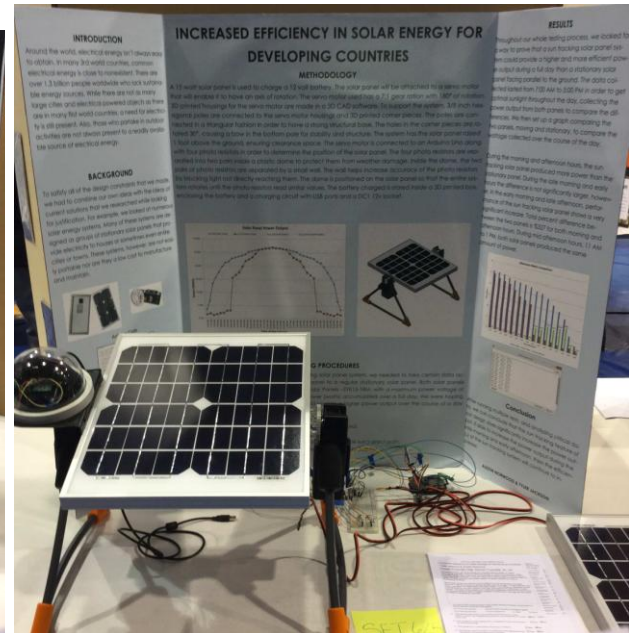
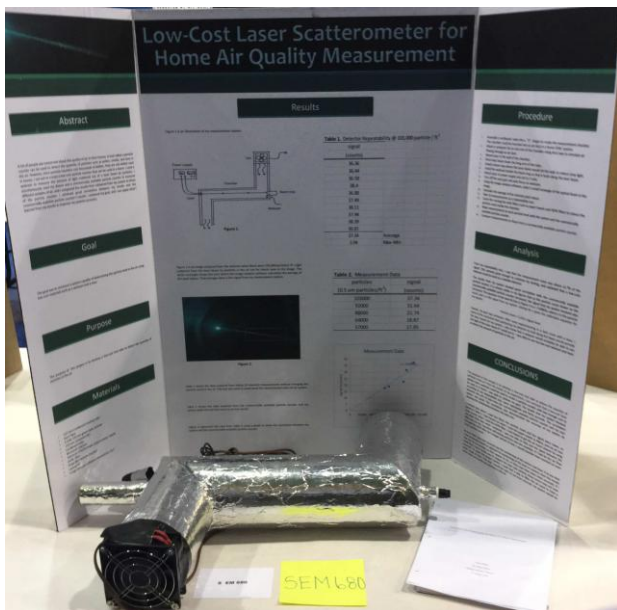
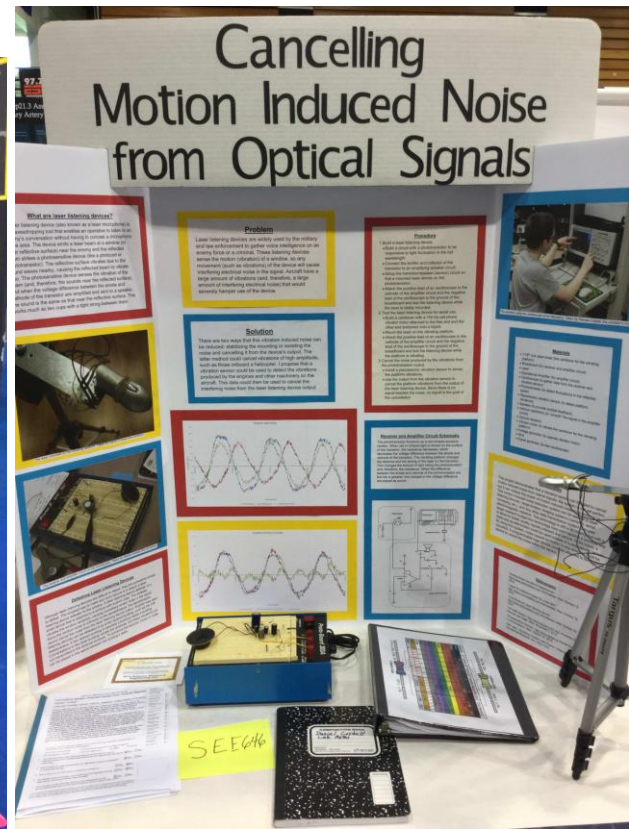
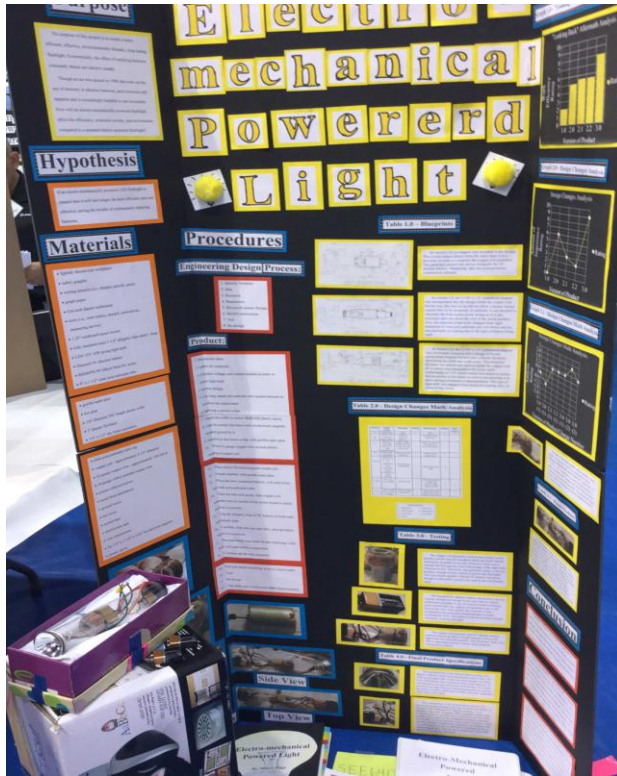
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