CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
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Project Number
S1504

Project Title
Helios Anchor Light: A Novel Approach to the Design and Engineering of Anchor Lights with LED's to Increase Efficiency

Abstract

Objectives/Goals
The objective of this project was to design and engineer the most efficient anchor light on the market. To achieve this, my plan was to utilize LED's placed under a parabolic reflector, so that all the light goes exactly where it is needed most, strait out.

Methods/Materials
The LED's are placed in a circle around a central, cone like reflector. To calculate the amount of LED's required in the prototype to prevent blind spots (places where no light is shining), I first had to find out the degrees in which light was being emitted. The LED's I used for my first prototype were quite directional, with a light output of 18 degrees. This ment I had to have 20 LED's in order to have no blind spots. I then had to make the cone shaped parabolic reflector. To do this, I first calculated the light focusing parabola, assuming that the LED was the focus. I then had to cut 20 pieces of high reflective cardboard paper in such a way that when they were all adheased together, they assembled into a cone with the calculated parabola above each LED. To do this, I had to simply break up the parabola into nearly 100 triangles with excel. When I did that, I could find the length of the parabola line, given a certain point on the porabola. I then assumed that the length I found was the hypotenuse of a triangle. This length is then seen as the "y axis" of the 20 pieces that were to be put together. The "x axis" point was then found using basic triganometry acording to the "y axis". With several points I was able to come out with the parabolic curve of these pieces.

Results
The light emitted from the LED's was a perfectly focased horizontally spreading beam. The beam was in fact four times more focased than if the LED's had no parabolic reflector. This means that the prototype was around 2.5x more effecient than the conventional meathod of mounting LED's on there side. The matierial used for the parabolic reflector was also extremely reflective, coming in with about 96% reflectivity. The prototype consumed a mere 1.8 watts, and emitted a beam of 1190 lux at 1 foot. The same LED without the parabolic reflector emited 500 lux at 1 foot.

Conclusions/Discussion
My idea of placing LED's under a parabolic reflector to focus the emitted light all where it is needed most was a success. The outcome was a product that was 2.4x more effecient than even then the most effecient LED anchor light available.

Summary Statement
The objective of this project was to design the most efficient anchor light available using LED's placed under a flawlessly calculated parabolic reflector so that all light emitted is focused perfectly horizontally.

Help Received
Teacher bought supplies and helped with electrical equations. Father helped with some mathimatical equations.