***The Governor’s STEM Competition***

***Bishop Shanahan High School***

***Regional Competition Project Plan***

**“Brilliantly Bright Solar LED Street Signs”**

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**Proposal**:

By designing and implementing a folding mechanism for road signs with a LED lighting system powered by solar energy, we hope to create a safer standard for roadways while maintaining energy efficiency.

**Real World Problem**:

The nation’s roadways are the scene of countless accidents, injuries, and deaths each year. In an effort to contribute to safety on the road, we propose the fabric action of visibly-enhanced stop signs, wired with an LED lighting system. Further, in an attempt to conserve energy, we endeavor to make these stop signs solar-powered. These stop signs will increase visibility and, as a result, will hopefully lessen the probability of accidents. Also, these folding high-visibility signs will have a special application during inclement weather, as they will aid drivers in seeing and preparing for stops and as a result will make the roads safer.

**Background Research Information (B.R.I):**

A study on safety effects of LEDs embedded in STOP signs, conducted by the Texas Transportation Institute in 2004, found:

* A 28.9 percent reduction in the number of vehicles not fully stopping; and
* A 52.9 percent reduction in the number of vehicles moving through the intersection without significantly slowing.

A similar study, conducted by the Virginia Transportation Research Council in 2007, found:

* A statistically significant decrease in vehicle approach speeds ranging from 1.9 to 3.4 miles per hour (mph) with an average of 2.7 mph (7% decrease) indicated that LED STOP signs positively affected driver behavior.
* Speed decreases tended to be greater during the night than during the day.

Light also conveys a powerful stimulating signal for human alertness and cognition and has been routinely employed to improve performance.

**Risks and Safety Information**: (Risk Assessment Form Previously Submitted)

**Identification of a Community Need:**

1. The safety of drivers and passengers as well as promoting the safe flow of traffic during nighttime.
2. Convenience of unfamiliar drivers who may not notice the stop sign while driving on unfamiliar roads.
3. Increased safety for those drivers who have to be dispatched during harsh winter weather.

**Budget Documentation ($500): (see attached Budget sheet)**

**Procedure:**

1. Take a standard size folding stop-sign and drill 16 holes on each side, ¾” apart.
2. Run the lights across the back on the sign, and place one bulb in each hole.
3. Cover the wires neatly with duct tape.
4. Hook up the solar panel by using bracers to secure it to the sign.
5. Run the electro tape across the front sign to provide a greater intensity of brightness.
6. Secure the aluminium bar onto the back of the sign using heavy duty bolts.
7. Attach heavy duty magnets to secure the stop sign when folded (to prevent from opening inadvertently)

**Experimental Testing:**

In order to test and validate the usefulness of our light-enhanced signs, we propose to run our own research experiment. This experiment would involve first measuring an average distance of visibility with non-enhanced signs, which would be calculated from a pool of subjects. Then, we will measure the average distance of visibility with a light-enhanced sign, calculated from the same pool of subjects. The two results will be compared. Our hypothesis is that when enhanced with light, the distance of visibility will be greatly increased, leading to greater reaction times and longer average distance to stop or comply with the signs instructions.

**Costs of Improvement:**

To improve the project, our main development would be the automation of the opening of the stop signs so police and township roadway workers would not have to travel out to open these signs. We then could implement a computer program that would automatically dispatch a wireless signal that would open them across the township. Additionally, a more durable and weatherproof back casing could be designed and implemented to protect the batteries and wires. We can also expand the system to other types of road signs and demonstrate applications in those areas. As for the costs of these improvements, they all depend on the price of a motor and wireless transmitter and receivers.

**Future Application**:

Pennsylvania, and in particular the Philadelphia area, is unfortunately prone to severe weather. During heavy storms, most notably snowstorms, the visibility of signs is dramatically reduced. Drivers may have to drive in harsh winter conditions and the probability of accidents increases. Also, the risk is posed for drivers who have to be dispatched to lift the stop signs in the event that the power goes out. With the future development for this project, the risk for crashes of these drivers would drastically be reduced.

**STEM Professions** **Required for Actual Product:**

Electrical Engineers to design and create the solar power connection to the LED lights

(Electromechanical Engineers to design the rotating solar panel)

Statisticians to predict the effectiveness of our signs, and compare to the standard sign

Traffic Engineers to analyze the traffic patterns and usefulness of the stop sign at intersection

AutoCAD Specialists to draw final design of the signs

**Business/Corporate Connection:**

Downingtown Engineering Consultants

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| 315 East Lancaster Avenue, Downingtown, PA 19335, United States  Works Cited |
| Ed. Arnold, Jr., and K. E. Lantz, Jr., "Evaluation of Best Practices in Traffic Operations and Safety: Phase 1: Flashing LED Stop Signs and Optical Speed Bars."  Gates, T.J., Carlson, P.J., and Hawkins, H.G., Jr., "Field Evaluations of Warning and Regulatory Signs with Enhanced Conspicuity Properties."  "How Light Affects Our Brain's Performance: Photic Memory for Executive Brain Responses." ScienceDaily. University of Liege, 10 Mar. 2014. Web. 14 Jan. 2015.  Rice, Ed. "Embedded LEDs in Signs." FHWA. N.p., May 2009. Web.  Snyder, Edgar. PennDOT Releases 2012 Pennsylvania Crash Facts & Statistics. Edgar Snyder & Associates. N.p., 01 July 2013. Web. |