1. PROBLEM [minimum length: two single-spaced pages]

1.1 Historical Introduction

The crosswalk is one of the most commonplace structures on city streets and has been for centuries. Paved roadways have been in existence since 4000 B.C.E, and crosswalks followed in A.D. 79 [1, 2, 3]. In 1868, the first illuminated crosswalk symbol was designed but required manual operation of a gas-lamp [4]. Even though crosswalk lighting technology has progressed since then, the first pedestrian fatality due to an automobile accident was in 1896, and the number of crosswalk-related fatalities has increased every year [5, 6]. More than 4000 pedestrians were killed in traffic accidents every year between 2003 and 2012, most of whom were hit at night [6]. However, pedestrians are far less likely to be injured while using an illuminated crosswalk than while using a traditional crossing [7]. Therefore, the number of pedestrian-related injuries and fatalities could be substantially reduced by adding dynamic lighting to crosswalks.

1.2 Market and Competitive Product Analysis

The Smart Crosswalk Dynamic Lighting System (SCDLS) is the only smart crosswalk system available that does not require direct pedestrian interaction. Most commercially available crosswalk illumination systems are either always on, push button activated, or require the laborious installation of bollards, or short vertical posts, around the crosswalk to sense pedestrians and activate the lighting system. However, the vast majority of these other systems require significant alterations to the road during installation, such as running high voltage wires under the road from an external distribution box to the system. In addition to the high cost of the installation, most of these systems cost significant amounts of money to even obtain. For example, one manufacture offers a system costing $19,885 for a two-lane road that blinks for a pre-set amount of time. Their system requires the pedestrian to push a button to activate the system [8]. Finally, few systems offer smart capabilities, such as data gathering.

The primary consumer of lighted crosswalks and traffic utilizes are municipalities and road maintenance companies. As such, SCDLS will be marketed towards the same clientele. Given the reduced costs and ease of installation of SCDLS compared to systems already available on the market, municipalities may be interested in implementing SCDLS in a small number of crosswalks as a case study to determine if they would be interested in wide scale adoption.

1.3 Concise Problem Statement

SCDLS seeks to prevent collisions between vehicles and oncoming crosswalk pedestrians by lighting the crosswalk in a way that alerts both the motorist and pedestrian automatically. This solution will be an improvement on the competition as a result of its integrated sensors. These enable the units to sense pedestrians in the crosswalk and alert pedestrians and vehicles of hazardous conditions. The unit itself will be cost effective, easy to maintain, and easy to install – without having to run cables or cut into the roadway. A typical SCDLS module will comprise of the following: a solar panel for power harvesting, a lithium ion battery to store the power produced by the solar panel, a 2.4 GHz wireless module for communication between modules, sensors to determine if pedestrians are actively using the crosswalk, and LEDs to alert pedestrians and drivers of hazards by varying blink rates and color. By using such a vast array of components and sensors, this device can collect and transmit real-time data to other units as well as transportation authorities. SCDLS is a dynamic road information mesh network that will help avoid crosswalk collisions and ultimately save lives.

1.4 Implications of Success

The intended result of implementing SCDLS in crosswalks is to reduce the number of pedestrian fatalities and injuries resulting from motor vehicle crashes. The benefits include the prevention of death or injury due to reduced collisions as well as gathering data for use by municipalities. Reductions in pedestrian fatalities and injuries will cut back on the annual $99 billion spent on automotive crashes as indicated in a 2010 CDC study [9]. Along with economic advantages, the use of the SCDLS will improve driver engagement with the road, which could in turn reduce the number of crashes resulting from distracted driving. Additionally, through use of SCDLS' pedestrian traffic data gathering capabilities, municipalities could improve their city planning with regards to pedestrian traffic.

Large scale adoption of SCDLS could also have effects on the market for crosswalk and pedestrian safety devices. Competing crosswalk lighting devices may begin to include some of the smart features used by SCDLS, such as pedestrian sensors and traffic data gathering capabilities. However, the primary result of large scale adoption of SCDLS will still be the protection of human life. Additionally, the design of SCDLS modules allows for the possibility for these to be adapted for other applications to warn drivers of road hazards.

Works Cited

[1] M. Lay, Ways of the World, Sydney: Primavera Press, 1992, p. 401.

[2] A. Wallace-Hadrill, "Pompeii: Portents of Disaster," 29 03 2011. [Online]. Available: http://www.bbc.co.uk/history/ancient/romans/pompeii_portents_01.shtml.

[3] N. Zeldes, "Pedestrian crossing in antiquity," 17 12 2010. [Online]. Available: http://designblog.nzeldes.com/2010/12/pedestrian-crossings-in-antiquity/.

[4] "The man who gave us traffic lights," British Broadcasting Corportation, 22 7 2009. [Online]. Available: http://www.bbc.co.uk/nottingham/content/articles/2009/07/16/john_peake_knight_traffic_lights_feature.shtml.

[5] A. McFarlane, "How the UK's first fatal car accident unfolded," BBC News Magazine, 17 8 2010. [Online]. Available: http://www.bbc.com/news/magazine-10987606.

[6] National Highway Traffic Safety Administration, "Traffic Safety Facts 2012 Data: Pedestrians," 04 2014. [Online]. Available: http://www-nrd.nhtsa.dot.gov/Pubs/811888.pdf.

[7] R. L. Knoblauch, M. S. Nitzburg and R. F. Seifert, Pedestrain Crosswalk Case Studies, District of Columbia, 2000, p. 15.

[8] LightGuard Systems, 2 Ln Rd W-MSRP Brochure.

[9] Center for Disease Control and Prevention, "CDC Study Finds Annual Cost of Motor Vehicle Crashes Exceeds $99 Billion," 25 8 2010. [Online]. Available: http://www.cdc.gov/media/pressrel/2010/r100825.htm.