

# Zebra Vision Project Proposal

## Aiding the Visually Impaired to Navigate Zebra Crossings

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### I. INTRODUCTION

This project aims to create a tool for the visually impaired that provides aid for navigating Zebra crossings. According to the World Health Organization (WHO), approximately 2.2 billion people suffer from vision impairments or blindness [1]. Furthermore, 270,000 pedestrians per year lose their lives on roads, making up 22% of traffic fatalities [2]. These statistics indicate that a large proportion of pedestrians are at danger when crossing roads; and, as for the visually impaired (making up a significant size of the population), it is crucial that despite limited vision, this process should be made safe and easy.

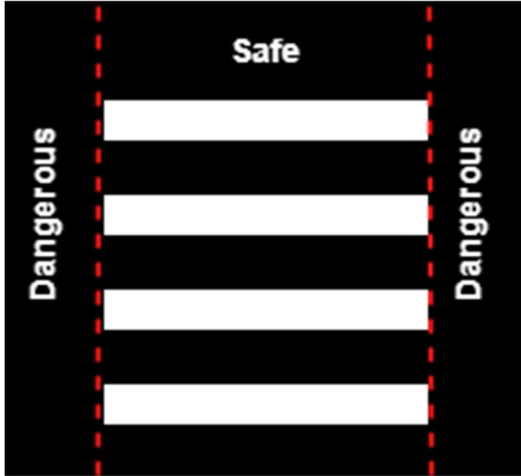


Figure 1: Zebra Crossing Boundaries

The goal of the software is to keep the pedestrian within the Zebra crossing boundaries. As seen in Figure 1, the crossing will be divided by a boundary at the vertical edges of the crossing. It will then be able to inform the pedestrian if they are in a “safe” or “dangerous” position on the crossing. This tool

should be robust to varying quality of the Zebra crossing. Despite the existence of tactile tools and visually-impaired-friendly Zebra crossings, there is a substantial amount of old, worn, and hard to navigate crossings. It is the hope that this software improves the safety and quality of life for the blind and visually impaired while crossing Zebra crossings.

### II. TECHNICAL APPROACH

To solve this problem, the Hough Line Transform line detection technique will be utilized. Hough Line Transformation finds straight lines given a grayscale image. It will be used to detect the vertical straight lines of the Zebra crossings (the boundary between Safe and Dangerous as seen in Figure 1). Two straight lines should be formed by this technique. From this, in order to identify the user location, a centre point  $x$  and  $y$  position of the image will be used to act as the user position. Thus, when this centre point crosses the line boundary, the user will be alerted.

As a prototype, the software will use text (e.g. 'you are in a dangerous location' or 'you are in a safe location') to alert the user instead of a more visually-impaired-friendly method such as vibrations or sounds. In addition, only generically striped Zebra crossings (large, white, horizontal rectangles) will be used. The image dataset for this project will be created by myself. To test robustness, worn and damaged crossings will be introduced. Initially, only static images will be used, however, if time permits, video will also be attempted.

Concerns and considerations:

- a) *How can we get the Hough Lines Transform to read the vertical boundary lines only?*
- b) *How will the system respond to only half the crossing being shown? (occlusions)*

c) *What is an appropriate and accurate way of representing the user position with regards to the proposed centre point pixel approach?*

### III. EXPECTED OUTCOMES

It is expected that, given an image of a Zebra crossing, the algorithm will be able to identify the two vertical boundaries using Hough Line Transformation, then, using the center point position, identify if it has passed either of these boundaries. When it passes a boundary, it should give a 'danger' message, and when it has not, it should give a 'safe' message (see Figure 2 for example). The software should work for static images (and eventually video).

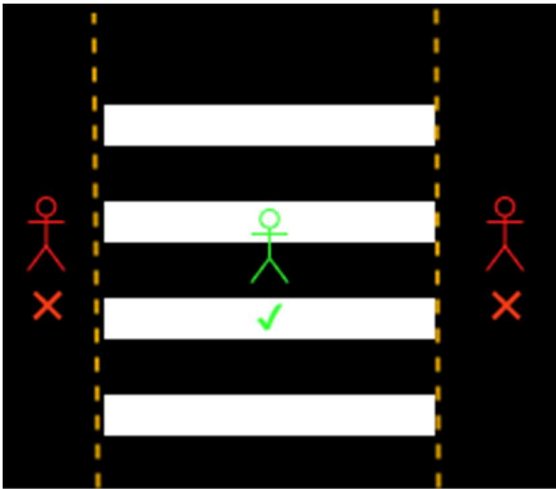


Figure 2: Safe and Dangerous Positions Example

### IV. MILESTONES

**19<sup>th</sup> September** – Performing Hough Line Transform on a Zebra crossing image to detect its vertical lines.

**22<sup>nd</sup> September** – Experimenting with optimal parameters for the Hough Transform. Also testing robustness to old, worn Zebra crossings.

**26<sup>th</sup> September** – Using a center point x and y position to represent the user's location. And making alerts when this position crosses the line boundary.

**3<sup>rd</sup> October** – Project documentation

### REFERENCES

- [1] World Health Organization (2018). *Blindness and vision impairment*. [online] Who.int. Available at: <https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment>.
- [2] World Health Organization, Fia Foundation For The Automobile And Society and World Bank (2013). *Pedestrian safety: a road safety manual for decision-makers and practitioners*. Geneva: World Health Organization.