Intelligent Radar Implemented System I.R.I.S.

Crosswalk System for Visually Impaired with Computer Vision Pedestrian Detection

Erik Jonsson School of Engineering & Computer Science
The University of Texas at Dallas

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Mentor: Dr. John Hansen

Mutasim Chowdhury (CE), Daniel Del Nero (EE), Brett Friedheim (EE), Francisco Lopez (EE), Travis McKinney (EE), Eric Sanders (EE)

Mutasim.Chowdhury@utdallas.edu, Daniel.DelNero@utdallas.edu, Brett.Friedheim@utdallas.edu, Francisco.Lopez1@utdallas.edu, tcm150130@utdallas.edu, Eric.Sanders@utdallas.edu

Background

National Highway Traffic Safety Administration: Pedestrian Safety.

The National Highway Traffic Safety Administration records 6,283 pedestrian deaths in 2018 – the most deaths since 1990. 13% of traffic accidents in the U.S. are incidents at crosswalks.

Problem

How walkable is your community?

Many communities in the U.S. do not have the proper technology to aid pedestrians with disabilities such as visual impairment. Handicap aid can cost up to $1,100, and these systems do the minimum to assist handicapped pedestrians. A cheaper more efficient solution is required.

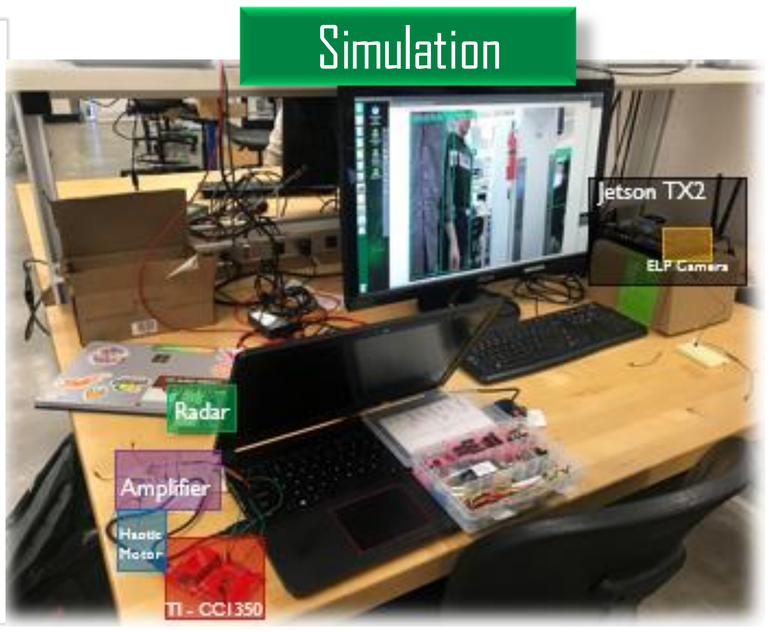
Objectives

- Detect pedestrians with 95% computer vision accuracy. (*performance metric*)
- Implement 3 distinct signals with maximum packet transmission period of 6ms.
- Provide aid for visually impaired on less accessible roads.

Hardware Design

Sensors
- OPS243C Radar
- ELP Camera

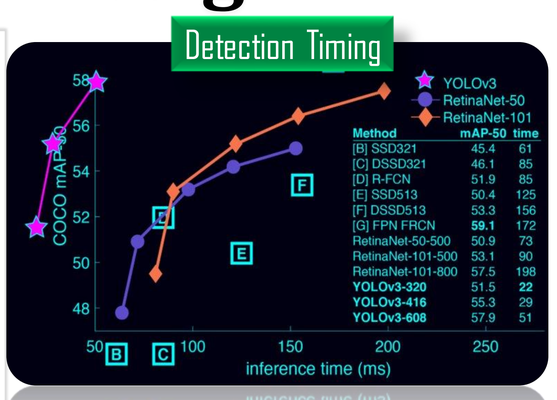
Controllers
- Jetson TX2
- TI Launchpad CC1350



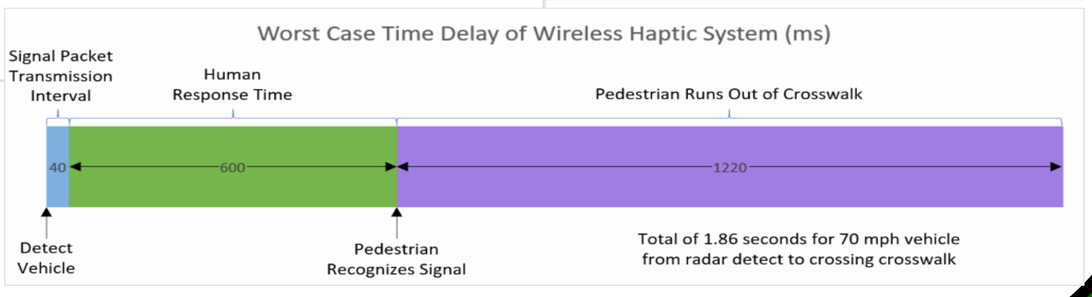
Software Design

Computer Vision
- YoloV3
- TensorRT
- Python

Launchpad Controller
- C with CCS



Data taken from "YOLOv3: An Incremental Improvement" by Redmon, Joseph, and Farhadi, Ali



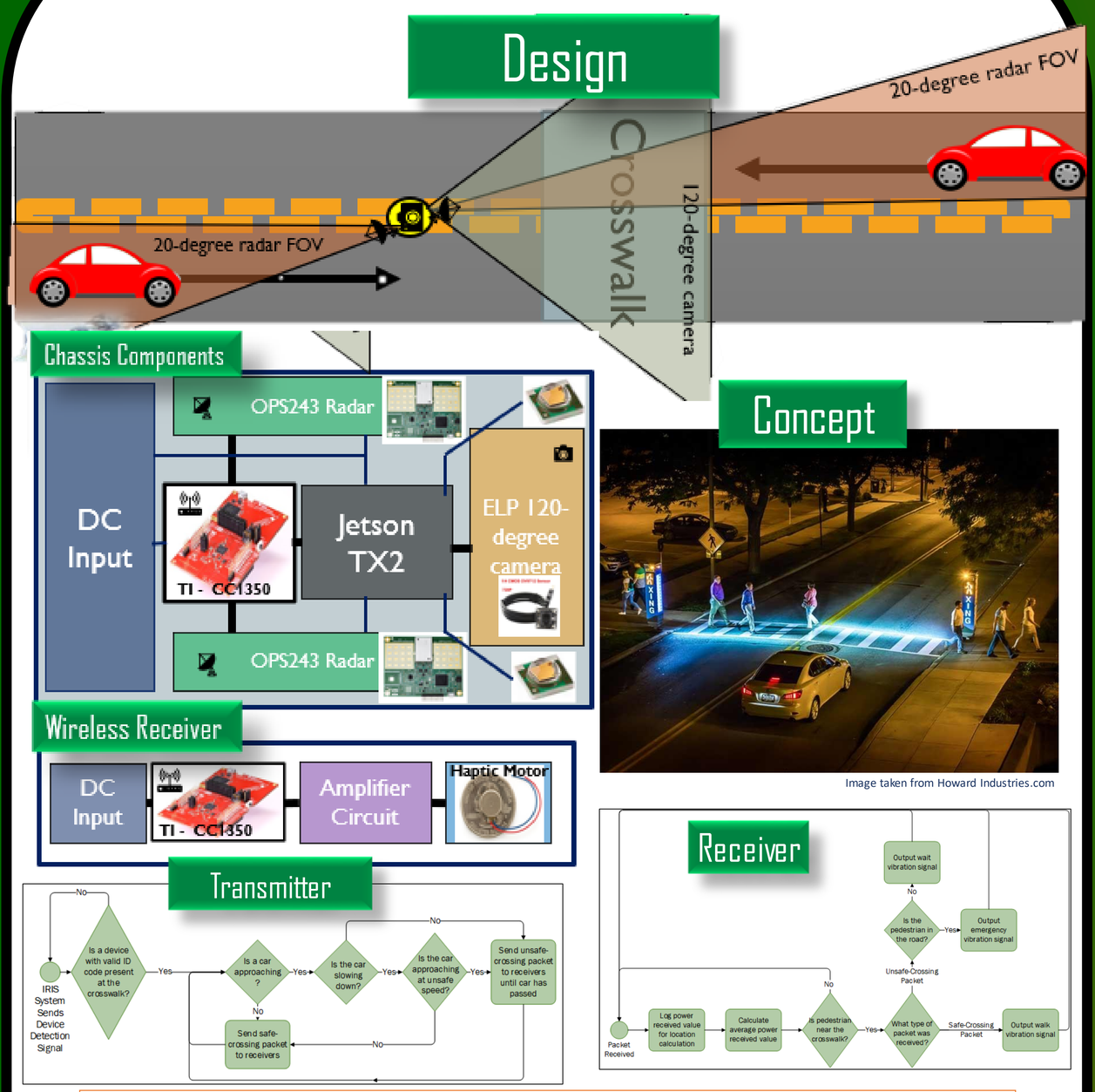


Image taken from Howard Industries.com

The IRIS system is an easily deployable, one-way communication system designed to provide haptic and visual feedback based on the instantaneous safety of the crosswalk where the system is deployed. The system detects if pedestrians are present at the crosswalk, determines the safety status of the crosswalk, then provides the proper feedback to the pedestrian to make crossing the street a safer experience. IRIS is composed of six subsystems: computer vision, wireless haptic feedback devices, the main chassis, power delivery, LED signaling, and vehicle detection.

Evaluation:

Using the I.R.I.S. at crosswalks and environments with little or no aid for visually impaired can reduce traffic accidents for both vehicles and pedestrians alike while keeping the implementation costs low, as well as increasing the effectiveness and deploy-ability.

- **Successfully transmitted 3 distinct wireless signals.**
- **95% computer vision-based confidence level achieved (Meets performance metric).**
- **Successful detection of vehicles within velocity threshold.**

Ethics

- Ensuring public safety and compliance to ethics.
- Making honest and realistic claims based on realistic data.
- Taking honest criticism and improving upon errors.

Organization

Mutasim Chowdhury: *Software Developer*
Brett Friedheim: *Testing and Analysis*
Travis McKinney: *Hardware Assembly/CAD*
Daniel Del Nero: *Power Management*
Francisco Lopez: *Product Development*
Eric Sanders: *RF Design & Coding*

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