xWALK

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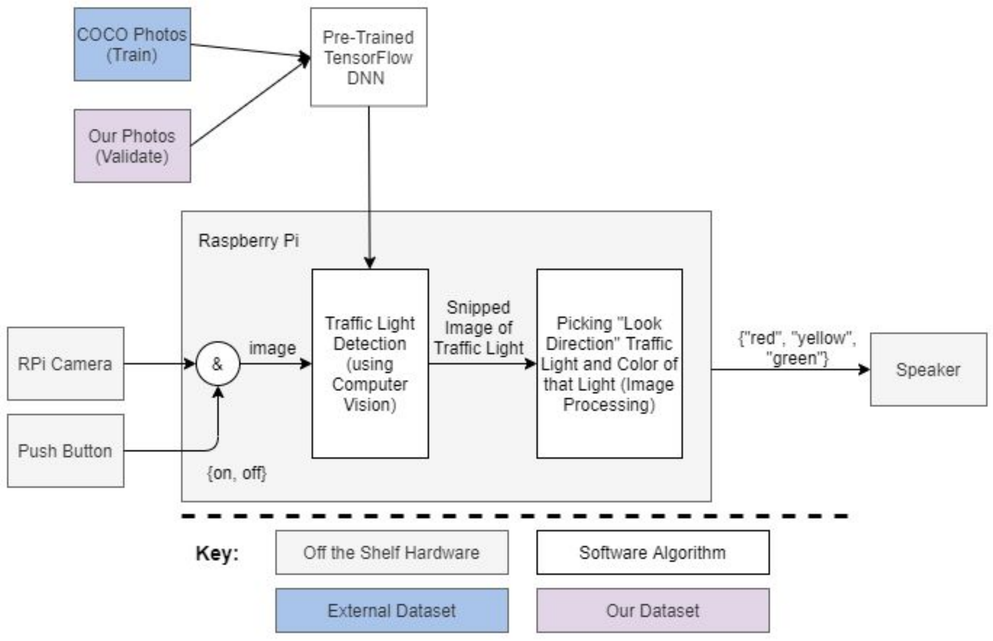
Product Pitch

Many intersections lack features to facilitate crossing for the visually impaired, some even without crossing signals. Therefore, these users need assistance in knowing **when to cross** such intersections. A solution to this problem must be **>90% accurate** with **<1% false positive rate** and a **system latency of < 0.5 sec**. Our Signals and Software based approach is a wearable device that captures a **photo** of the intersection and, **based on the traffic lights**, deduces when the user should cross. Our primary target base are those visually impaired people who are **training to cross** these intersections, as this device can help validate their own decisions throughout the learning process. To date, we have been able to achieve a **90% accuracy, with 3% false positive rate, and an overall system latency of 26 seconds**. Further work could consist of improving the image processing and CV robustness as well as using a different processor.

System Architecture

Overall System Block Diagram

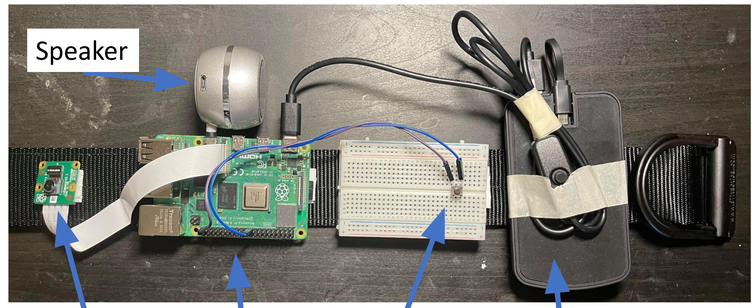


System Description

Wearable belt with a Raspberry Pi, camera, and speaker attached that guides users when to cross.

1. Individual starts at crosswalk
2. If applicable, user turns on device and waits for beep
3. Presses button to start
4. Device takes a picture and then beeps
5. Device processes the color of the traffic direction facing the individual
6. Outputs “red”, “yellow”, “green”, or beep to indicate traffic light is not found
7. User can press the button again

Assembled Product: Stationary (Top) and Worn (Bottom)



System Evaluation

Overall Performance Metrics

Metric	Calculation	Original Requirements	Validation Statistics
Latency	Software runtime reports from RPi	< 0.5 sec	26 seconds
Traffic Light and State Detection Accuracy	% frames with correctly identified lights; % correct light states	> 90%	89.7% *
State Detection False Positive Rate	% red traffic lights labeled as green	< 1%	3.4%*
Battery Life	use time before power off	9 hours	6 hours

Tradeoffs and Design Changes

	Swapped Out	Swapped In
CV Model	SSD_mobilenet_v1 (highest accuracy))	SSD_mobilenet_v2 (less accuracy, faster speed)
Stoplight Capture	Video (higher precision and complexity)	Image (lower complexity)
Device	Headband (better camera angle, uncomfortable)	Belt (less ideal angle, comfortable)
Speaker	Wired input	AUX input (easier integration)