Self-Powered Detection and Warning System for Pedestrians

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WeARE Research Area

The research area of this project focus on computer vision and image processing fields that detect instances of semantic objects of a certain class or label (such as pedestrians or person).

Motivation or Background

- ❑ Increase the safety of our students, faculty and staff at UTSA
- ❑ With UTSA strategic growing plan and vision, each semester will bring in an increase in vehicle and pedestrian traffic on campus and in the surrounding area. With the increase in traffic the potential for traffic accidents also increases.
- ❑ In addition to the safety issues, university goals for sustainability is to expand and improve pedestrian transportation while promoting their safety.

Objectives

The main objective of this project is to implement innovative smart techniques to create self-low powered and low cost active signage at pedestrian crossings as well as unsignalized intersections on campus to warn vehicles of traffic control devices. This system uses an embedded system to detect passing pedestrians, and then provide active signage to alert motorist of potential dangers in real-time. In addition, the warning signage is activated only when a vehicle and/or pedestrian is detected by the device.

Methodology

In this study, a raspberry Pi NoIR Camera is used as the detection module. The camera can see at night as it uses a photoresistor to measure the light sensitivity in the ambient area, when it begins to get dark outside the camera switches from standard video capture to NoIR mode. The detection module is to be mounted on a pole anywhere from 3-5ft high and 1.5ft - 2 ft from the shoulder of the roadway in order to have a safe distance from the road. The module is designed to monitor a two-lane road or pedestrian crossing.

The second part of the methodology is to write a script to use the NoIR camera as the input feed into the object detection classifier (convolutional neural network) to determine whether there is a person in the frame.

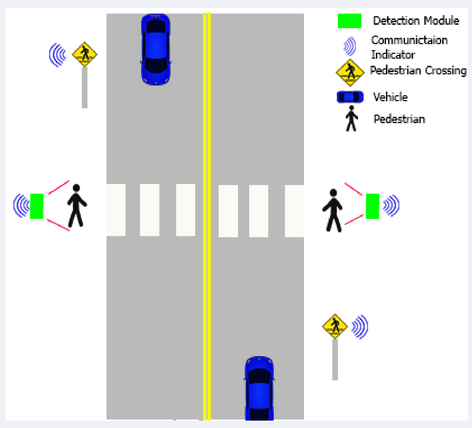

Fig. 1
Pedestrian Detection System Configuration

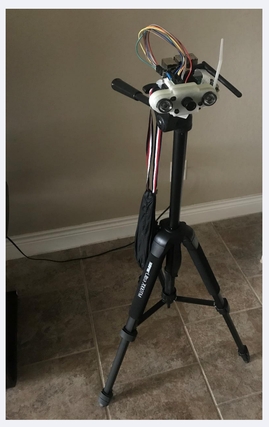

Fig. 2
Detection module

Fig. 3
Testing setup on campus

Results

This research demonstrates that it is possible to accurately detect pedestrians on a two lane roadway (24ft) using a lightweight convolutional neural network on a microcomputer. The system managed to achieve an overall accuracy of 95.37%. The system is also able to run real time and does not require the use of a graphics processor unit. The system is embedded and can be installed on any crossroad intersection. A big contribution is the night time detection accuracy, the system was able to achieve an accuracy of 94.28% and 93.15% at different times at night or early in the morning. The camera was angled down in order to mitigate sun glare issues with the detection module. While testing on multiple crosswalks the system still managed to maintain the same level of accuracy, there were only five false positives recorded during testing. The use of the NoIR switching camera proves to be a very effective method for close range nighttime detection. And using two modules together can potentially cover up to 50ft which is enough to monitor a four-lane roadway.

Skills and Experience

The skills that I have in this subject is a lot of experience in coding, in languages such as C/C++ and Python, also some experience in Machine learning and CNN. Experience that I got from this is that I was able to get is to use a program to be able to identify the objects that would later be used to train the system and the code to identify pedestrians.

What I Learned

What I have learned from this experience is how to make a system with Machine Learning and being able to use Anaconda at a better level, also using the software to be able to identify the items that are going to be used to train the system. I learned the process that is taken to train a system.

Future Plans

The future plans for this research would be to be able to finish the microgrid project that got delayed because of COVID-19. Finishing the microgrid that would be powered by Solar Panels that are connected to an inverter and also it is powered by a wind turbine that is also connected to an inverter, because DC and AC voltage cannot be mix as it would lead to the circuit being shorted and it being broken. Then goal of this is to make a large off-grid system where it would eventually get more power.

Acknowledgments

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References

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