Automated Emergency Braking (AEB) on Pedestrian Detection

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CSCI 513: Autonomous Cyber Physical Systems

AGENDA

MOTIVATION

Focus on Enhancing Pedestrian Safety	• Addressing the risks and causes of pedestrian injuries • Advocating for infrastructure improvements and awareness to reduce pedestrian fatalities
Promote Safer Driving Practices	• Encouraging drivers to stay focused, avoid distractions, and yield to pedestrians when required • Reinforcing the importance of defensive driving to prevent pedestrian accidents
Statistics	• In the U.S., pedestrian deaths occur at a rate of roughly one every 64 minutes, amounting to approximately 7,500–8,000 fatalities annually [5] • Pedestrian fatalities represent a significant portion of road traffic deaths, underlining the urgent need for proactive safety measures

PROJECT TOPIC

Proposal: Development of an Automated Emergency Braking (AEB) System with Pedestrian Detection

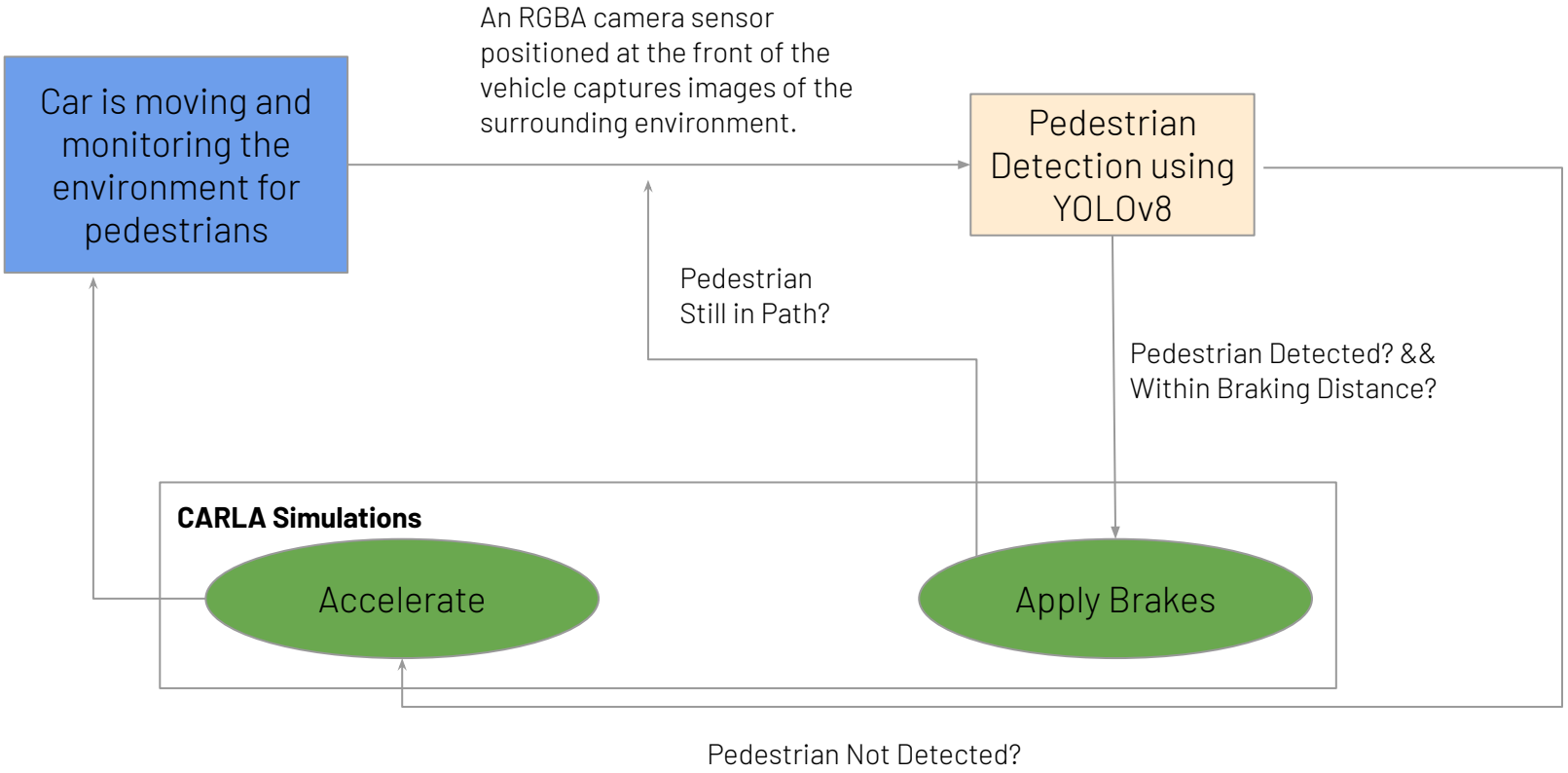
Introduction:

- To address the pressing issue of pedestrian safety, the implementation of Automated Emergency Braking (AEB) systems equipped with pedestrian detection technology offers a promising solution
- AEB systems use sensors to monitor the vehicle's environment and, when a potential pedestrian collision is detected, can automatically apply the brakes to either avoid or mitigate the impact

Focus:

- Enhancing pedestrian and vehicle safety by integrating deep learning models for pedestrian detection into the AEB system
- System will be designed to detect pedestrians and trigger the brakes automatically in real-time to prevent or reduce the severity of collisions

SYSTEM ARCHITECTURE



PEDESTRIAN DETECTION using YOLO

Datasets

- COCO (General object detection)(~330k images)
- CrowdHuman (Human detection in crowds)(~15k images)
- HiEve (Human detection in events) (~32k frames)
- Penn-Fudan (Pedestrian detection)(~170 images)

Models Explored

- Histogram of Oriented Gradients (HOG) with Support Vector Machines (SVMs)
- Faster R-CNN
- YOLO (You Only Look Once)
- RetinaNet

Dataset Collection

- Collected 70K images from the various datasets
- Custom python scripts to filter images from datasets of size 300K-1M images

Model Building

- Used YOLOv8 model
- Pre-calculated the weights
- Tested on Penn-Fudan Dataset

SCENARIO WALKTHROUGH

Scene 0
Car is moving on straight road and pedestrian is detected

Scene 1
Pedestrian Detection in low light/fog

Scene 2
Pedestrians occluded behind another car, who make a sudden appearance

Scene 3
Pedestrians that are visible, get occluded and then become visible again

Scene 4
Right turn on green light where a pedestrian is crossing

Scene 5
Pedestrian with strange object

DEMO

TIGHTEN YOUR SEAT BELTS (VROOM VROOOOM . . .)

Questions?

THANK YOU

REFERENCES

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[5] Stats → https://www.cdc.gov/pedestrian-bike-safety/about/pedestrian-safety.html

[6] COCO Dataset → https://cocodataset.org/#home