Project Mission

Pedestrian Crash Avoidance and Mitigation in ADAS

Introduction

“Advanced Driver Assistance Systems (ADAS) are electronic systems that help the vehicle driver for driving and during parking. When designed with the safe Human Machine Interface, they are intended to increase car’s safety and generally road safety.” -- Wikipedia

According to the survey, most of the on-road accidents take place on account of human error. On an average, around 270,000 pedestrians are killed every year accounting to human errors in the world. There is also annual increase of accidents in Germany every year since 2018. Therefore, advanced driver assistance techniques are taken into consideration to avoid such incidents. Some of the other features that are directed to assure safety and avoid potential accidents arising due to human errors include Adaptive Cruise Control and Collision Avoidance System.

As the technology keeps evolving, more and more safety systems are developed to avoid such accidents. One of the salient features of ADAS includes Pedestrian crash avoidance and mitigation system or simply known as Pedestrian Crash Avoiding Mitigation (PCAM). Vehicular crash avoidance systems are mainly of two types, viz. Forward Collision warning and Automatic Brakes system. Collision Mitigation Systems are basically the Radar-based systems that provide audio as well as visual warning while driving the vehicle as soon as any moving or stable object is detected by the radar.

Collision Avoidance and Mitigation for ADAS are mostly used in the area of Commercial Vehicle Technology that helps to avoid the accidents occurring due to human errors and loss of control crashes and thus making the system more feasible. According to current research, Front Crash Avoiding Systems like Auto braking System and Radar-based techniques are proved to be more efficient than any other techniques in the market yet.

This document provides basic ideas, analysis of problem statement and the suggested solution considering all the factors that can be fruitful in the long-run.

Problem Description

As stated in GLOBAL STATUS REPORT ON ROAD SAFETY 2018 by WHO, “More than half of all road traffic deaths are among vulnerable road users: pedestrians, cyclists and motorcyclists”. Out of which 26% are pedestrians & cyclists’ deaths. Major reasons for Pedestrian crashes are:

1. Driving at high speeds
2. Pedestrian outside of crosswalk
3. Drivers are under the effect of Alcohol or other sedatives
4. Crowded streets & improper differentiation between crosswalk & roads

5. Environmental conditions like rain, storms, darkness etc.

Pedestrian Crash avoidance & mitigation systems aim at avoiding a frontal crash by using technologies such as computer vision & artificial intelligence. These systems work towards detecting the pedestrians & once pedestrian is detected feedback is sent to the driver or emergency triggers for autonomous brakes or steering are sent.

One of the major challenges faced in implementation of these systems is the detection of the pedestrian because of the great variety of backgrounds (scenarios, illumination) in which persons are present, as well as variation in appearance of the pedestrians.

Along with this, if only camera is used for detection, it might not work in low light conditions, in case of storms and rains, hence increasing the risk of crash.

Another challenge faced by these systems is, they are mostly ineffective if speed of the vehicle is above 25mph.

Most of the PCAM systems are present in high end cars due to high cost involved which decreases its affordability and availability for common people.

Solution

The proposed technique has two modes where camera and radar will be used for achieving different objectives viz. Parking and Driving mode .In Parking mode, camera detects a static obstacle like wall and be used to safely park a vehicle. In Driving mode, camera will be used to identify an moving obstacle. The radar will measure the distance between vehicle and the said obstacle continuously .During this process, if the said obstacle is still detected when distance is equal to or less than 200 meter, the speed will be automatically set to minimum. A warning signal will be set off to indicate the driver. If the distance further falls to 100 meters, the headlights of the vehicle will be turned on and off at few milliseconds time interval to warn the obstacle. At 50 meters, if the obstacle is still detected, brakes will be applied automatically and the car will be stopped. Since the camera and radar modules are mostly already available in a smart vehicle, we can reuse this in such a way that cost of the implementation can be kept to minimum.