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# A Survey on Blind Spot Detection System Using Vision Sensor and Deep Learning Algorithm

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**ABSTRACT**: With the increasing rate of road accidents and traffic density, modern automobiles are equipped with various intelligent systems such as Adaptive cruise control, Lane Departure Warning System, Tyre Pressure Monitoring System and many more. Blind Spot Detection System (BSDS) is one such safety system. This paper presents a method to detect the present vehicles from side and rear for Blind Spot Detection System with vision system incorporating deep learning algorithm. The system would use stereo camera as vision sensor. The real image obtained from vision system gives more accurate information to detect the target vehicle and gives satisfactory result compared to the existing methods of BSDS. The output from the stereo vision sensor is fed to the controlling unit. Yolo (You Only Look Once) based real time object detection is used to determine the presence of the vehicles in the frame. Depth map for the vehicles located in the vision frame is obtained with help of stereo camera System Development Kit (SDK). The distance information is compared with the current vehicle speed to avoid the false alarms in vehicle stop conditions. On Board Diagnostic System (OBD) port of the vehicle gives the speed from ECU to the processor. A warning signal is generated when a vehicle presence is detected within the safety distance by the controller and its fed into the Heads up Display (HUD).The real time video feed of blind spot area with necessary information about the vehicles is display on a LCD display.

**KEYWORDS**: BSDS, Deep Learning, Vision Sensor, ECU, OBD, HUD, YOLO, SDK

## I. INTRODUCTION

Blind spot detection is a key technology among driver aids that provide 360 degrees of electronic coverage around the car, whether it is at speed or moving slowly. This circle of safety also includes adaptive cruise control, lane departure warning, rear and front parking sonar, the rear traffic alert, and parking cameras (ranging from rear-only through four cameras providing a birds-eye view of the car as you snake into and out of tight spaces). The alert stays active until the car in the adjacent lane is in front of your car, or at least directly alongside. It doesn't care if you are in your lane or have drifted a bit into the next and are at risk of sideswiping another car.

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Fig 1 Electronic Coverage of BSDS

The name comes from the blind spot to the side just behind the car where the driver may not see a car because the mirror does not cover and if he/she turn his head, it could be obscured by the B-pillar (the one between the front and back seat on four-door cars). The visual alert is a yellow (usually) indicator in the side mirror glass, inside edge of the mirror housing, or on the A pillar inside the car. It lights when it senses a car in the blind spot and flashes if the turn signal is flashing. The driver also gets an audible alert (beeping) or an induced vibration or light shake of the steering wheel if the turn signal is flashing Fig 2.


Fig 2 BSDS Alert Signal to the driver

The methodology presented in this paper uses two stereo cameras as input device which constantly captures the images at the blind spot area and information shared to the main controlling unit. The incorporation of deep learning algorithm which is a new area of Machine Learning research, which has been introduced with the objective of moving Machine Learning closer to one of its original goals: Artificial Intelligence would help in enhancing the picture quality and blur or cancel the background images probable of misreading the target image.

## II. RELATED WORKS

One of the well-known technologies regarding this is two radar sensors which are mounted in the rear bumper of the vehicle [1]. An electromagnetic wave, which is used to measure a distance between a radar-equipped vehicle and an approaching vehicle, is the key technology in terms of the radar sensors-based BSMS [1]. So the alternative way is a camera-based BSMS which helps drivers check the passenger-side rear areas in real time [2]. However, there are several issues regarding this system as there is no alarm system and the driver has to look to at the dashboard keeping eye away from the road. Very often the camera gets blurred due dust, rainwater etc. In [3] the author presents a scope for IoT based hardware design and development including interface architecture and design and the introduction of the idea for object detection in the blind spot based on the deep learning methodology. [4] Proposes an algorithm for the detection and tracking of rear-side vehicles on highway roads. Some of simple image processing is applied to extract information of an object vehicle and the signal level vehicle detection algorithm is used to defame the target vehicle from the processed image.

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## III. METHODOLOGY

The first task the system is to identify the object at the blind spot with Zed Stereo Camera. There will be two sensors in the stereo camera and we will get two frames. For object detection we need only one. The frame will be captured by open CV. The frame will be stored in one variable. The image will be given to the YOLO (You Only Look Once)[5] which is a Deep Learning Model [6] for object detection.

The second task would be to calculate the distance between the object detected and the host car. The coordinate of the frame detected will be examined with the help of SDK (System Development Kit) software present in the stereo camera such. With the help of this coordinates we calculate the approximate distance between the host car and the object. The calculated distance is compared with the prefixed safety distance say. If the approximate distance is less than the safety distance, then the system can start generating the alert signal. Also the system makes sure if the vehicle is in motion. This is facilitated by the OBD and the ECU which provides the speed of the vehicle.

The real time video feed of blind spot area with necessary information about the vehicles is display on a HDMI (LCD) display. Fig 3. A warning signal is generated when a vehicle presence is detected within the safety distance by the controller and it is fed into the HUD.

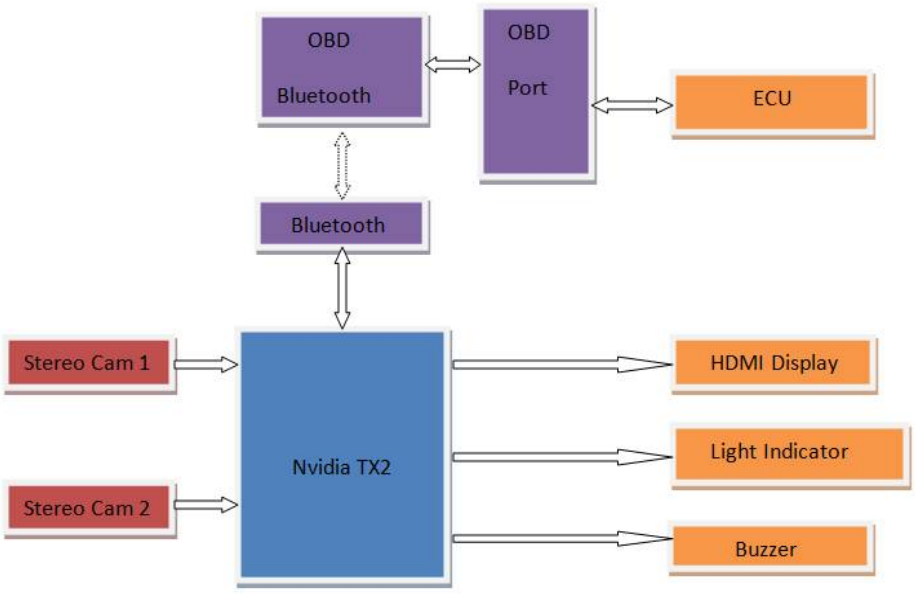


Fig 3. System Block Diagram

## IV. ADVANTAGE

The system would provide real time image of the object along with the distance such that the driver is alerted and his focus is also not away from the road. The function to check the current speed of the car also helps in reducing the false alarm as the driver would not need an alarm when the vehicle is parked. Also the paper introduced us with a concept of deep learning algorithm.

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## V. CONCLUSION

This paper has given a brief idea on object detection present at the blind spot area of a vehicle and also to find distance between the host vehicle and the object detected. This could be implemented in the real time application and could contribute in mitigating the possible road accidents in the near future which lead to loss of life and properties.

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