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Collision Avoider Using Lane Departure Warning

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Abstract- Today, one of the largest areas of research and development in the automobile industry is road safety. Many deaths and injuries occur every year on public roads from accidents that technology could have been used to prevent. The latest vehicles sold boast many safety features that have helped to lower the number of accidents on the roads. Even today, a person has to manually monitor the vehicles coming from behind through their rear view mirrors and any sort of mistake while monitoring can lead to fatal accidents. Several systems for Obstacle Detection and assist are present namely Lane Departure Warning, Reverse Assist, Drift assist, Blind Spot Monitoring etc. All these systems exist in the high end vehicles but as we know that a driver driving a low end car also has a life that is precious too. So, a system should exist that must be present in these vehicles so that they can avoid themselves from being getting trapped in the mishap. This concept is completely new. This system is mostly used at the time of overtake on highways. If the distance of the vehicle coming from behind is in your vicinity, then our vehicle is not allowed to overtake the vehicle in front of us. If the distance of the vehicle coming from behind is outside the vicinity then our vehicle is allowed to overtake the vehicle in front of us. Here we will also calculate the drift in the vehicle and avoid it from getting collided.

Index Terms- Lane Departure Warning, Obstacle Detection, Arm processor, PIC Controller

I. INTRODUCTION

ACCORDING to the National Highway Authority of India (NHAI), 41% of the total traffic accident casualties are the results of the abnormal lane switching/departure on the road, which is also the major cause of the traffic accident in the list. Driving under toxication, tiredness, inattention, and etc. are among the common causes of abnormal lane departures. Thus, developing a method to keep the vehicles on the normal lane and path is a core issue of the research and development of the intelligent transportation system. A Lane Departure Warning system is a utility which can assist drivers to maintain proper driving within the lane and also warns them when the vehicle is departing from the current lane so that the driver is reminded in time to make appropriate actions, such as checking the neighboring objects and signaling the turning lights. The system can also alarm the drivers with lights and sounds to recover the drivers from unexpected/abnormal driving situations as mentioned earlier so as to minimize the accidents caused by this kind of abnormal driving. In the earlier studies of the Lane Departure Warning system, a powerful computing machine and large size memory are required to conduct the heavy calculation of the computer vision and graphic processing algorithms [2]. This kind of hardware platforms cannot be applied directly to the general vehicles for real life operation because of the issues of cost, size, durability, reliability, and etc. In order to develop a realizable implementation of the Lane Departure Warning system, this study has to find a easier method but still reliable approach so that it can be conducted in the embedded system which costs less resources and space and can be accepted by the general drivers and carmakers.

There are methods of image processing used to detect the Lane departure but as we know it's an expensive approach and also it has several constraints like an LCD should be present to display the drift and hence, we are here trying to implement this system which should have a very low cost and should be applicable in all the vehicles. Instead of image processing technique we will achieve the Lane Departure Warning using sensors.

Here, in this system we are trying to implement two technologies namely Obstacle Detection System and Lane Departure Warning. By combining these two technologies, we are going to create a system that will help you to avoid the collision on high speeds. Overall speaking, to implement a real time Lane Departure Warning system on the embedded platform, an easier approach has to be developed which motivates this study. In this paper, the system functionality and hardware structure will be reviewed first, followed by the concept of lane recognition method developed by this study. The project is mainly divided into following modules that are combined together to achieve the desired goal of Obstacle Detection. They are as follows:

1. Lane Departure Warning: If a vehicle unintentionally departs from its lane then the driver is notified.

2. Obstacle Detection: The basic aim is to achieve avoidance of collision.

3. Blind Spot Monitoring: There are several spots in the vehicles from which the driver cannot see. So in order to avoid the collision these spots have to be monitored.

Manufacturers of road vehicles have also been working to reduce the number of accidents. They have used the latest of today's technology to make vehicles that are much safer than their predecessors. Advances in computers, materials, electronics, and other areas have allowed them to decrease the number of accidents that their vehicles are involved in, and improving the chance of the occupants walking away from an accident without injury. Today, many buyers of new vehicles list safety as one of the highest priorities when choosing a car. Manufacturers have long known this, and use safety as one their main selling points for their products, as can be seen in most Volvo, Mercedes Benz, or Renault advertisement. A new and fast growing area of vehicle safety is collision detection and avoidance. This has only come about lately from the advances made in computer technology, image processing, electronics, and

the falling price of the cost of the hardware. Companies like Mercedes Benz utilize a radar system ("Pre-safe") on the S series cars that can detect obstacles in the path of the vehicle, and apply the brakes faster than the driver can. It also uses this system to have adaptive cruise control. This allows the car to regulate its speed according to the car in front under cruise control.

Our method is based on ARM processer and several sensors that will work in real time to acquire the information from the surrounding environment and pass this information to the processor for processing and decision making and thus will guide the driver if the overtake is allowed or not.

In section II related work is discussed. In section III Hardware implementation is described. In section IV Lane Departure warning is described. In section V Obstacle Detection and Blind Spot Monitoring is discussed .The conclusion is presented in section VI.

II. RELATED WORK

In recent year, Din-Chang Tseng and Chun-Wei Lin have used DSP based embedded system devices. Since the computing power and memory size of the embedded system are not as good as those on a personal computer, special techniques have been applied in the algorithm to enhance the performance of lane recognition while maintain the reliability of the results**.** Furthermore, the edge enhancing filter can washout the foreign objects in the region of interest and keeps the lane markings with tilt/slope pattern. Using these two tools as the basis, the applied algorithm can detect the event of lane departure and alarms the warning to assist drivers for driving safety on the road. The system is implemented and tested on a DSP based embedded platform which can perform the required processes in real time under various weather conditions**.** This paper describes a lane recognition method for the lane departure warning system of smart vehicles and the algorithm implemented in a dual core ADIBF561 600MHz DSP embedded system to verify the functionality**.** The key function of the Lane Departure Warning (LDW) system is to help the drivers continuously monitor the lane markings on the roads. When drivers behave abnormally, because of tiredness, illness, or inattention, the vehicles will move away from the center of lanes unexpectedly. The Lane Departure Warning system can emit lights and/or sounds warnings to alert the drivers to correct their driving to avoid possible traffic accidents. However, to avoid a false alarm, the system will not alert if the turning light is signaled by the drivers while switching lanes, which is deemed as a normal operation.

Diarmaid O Cualain,Dr. Martin Glavin have worked on both Lane Departure Warning and Obstacle Detection using Blind Spot Monitoring to create a system that will help the driver to keep the vehicle in the lane and avoid any unwanted lane changes. They have done several studies regarding the Lane Departure Warning and have used image processing technique for the same .For Lane Departure Warning they have used Clustering Algorithm to find the amount of deviation that arises when a vehicle deviates from its position and then depending on the cluster center the corrective action is taken. And for the Obstacle Detection System and Blind Spot Monitoring they have used Edge detection Algorithm. Advances in computers, materials, electronics, and other areas have allowed them to decrease the number of accidents that their vehicles are involved in, and improving the chance of the occupants walking away from an accident without injury. Today, many buyers of new vehicles list safety as one of the highest priorities when choosing a car. Manufacturers have long known this, and use safety as one their main selling points for their products, as can be seen in most Volvo, Mercedes Benz, or Renault advertisement. Here in the paper, several automobile manufacturers have been discussed where these technologies are being used. Many automobile manufacturers are starting to equip their vehicles with video cameras positioned at various places around the body of the vehicle. This is done in a bid to remove any "blind spots" that he or she may have when driving or reversing. The cameras are also finding applications in other areas of road safety. Honda has developed a system that utilizes one of these mounted beside the rear-view mirror that recognizes the lane the vehicle is travelling in. It applies this information in steering to keep the vehicle centered in the lane.

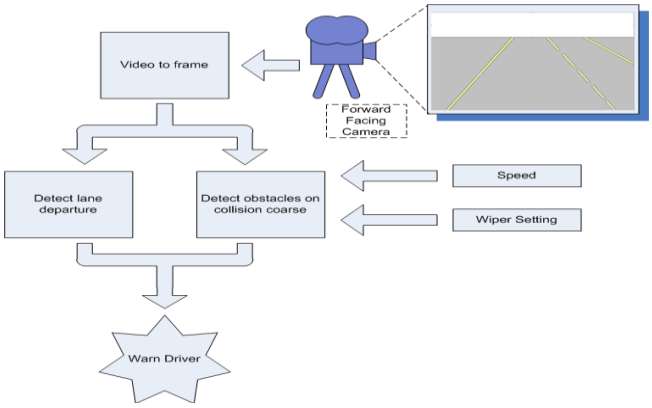

Fig 1: The basic description

Zehang Sun, George Bebis and Ronald Miller have worked on vehicle detection using optical sensors. In this paper they have shown that with the use of optical sensors the vehicle detection gets much easier. Also as we know, the most common approach to vehicle detection is using active sensors such as lasers, RADAR, or millimeter-wave radars. They are called active because they detect the distance of an object by measuring the travel time of a signal emitted by the sensors and reflected by the object. Their main advantage is that they can measure certain quantities (e.g., distance) directly requiring limited computing resources. Prototype vehicles employing active sensors have shown promising results. Optical sensors, such as normal cameras, are usually referred to as passive sensors because they acquire data in a non-intrusive way. One advantage of passive sensors over active sensors is cost. Also, the majority of methods reported in the literature follow two basic steps: (1) Hypothesis Generation (HG) where the locations of potential vehicles in an image are hypothesized, and

(2) Hypothesis Verification (HV) where tests are performed to verify the presence of a vehicle in an image

Thus we have seen that lot of work is being done in the passenger safety and vehicle collision avoidance but all these features and systems are present only in the high end cars and none of such safety features are available in the low end cars

anywhere. Also the proposed system combines two techniques to create a much efficient system for vehicle detection and collision avoidance.

III. HARDWARE SET-UP

The system for object detection and Lane Departure Warning is based on ARM. The data is acquired using the sensors that are IR and Ultrasonic sensors.Also, if there is a collision the message is passed to the emergency services or the kin of the passenger with the use of GSM informing about the crash. ARM processor used is LPC 2138 along with the peripherals and a speaker system for the announcements. In order to get the speed, here, we are using the RF module and the speed will be displayed on the LCD panel. the block diagram for the system is as followed in Figure 1.

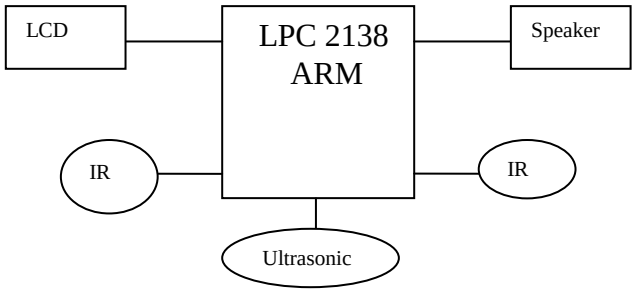

Fig 2: Hardware used in implementation

IV. LANE DEPARTURE WARNING

A lane departure warning system is a technique designed to warn a driver when the vehicle is moving out of its lane (unless a turn signal is on in that direction) on freeways and arterial roads. These systems are designed to reduce accidents by looking into the main causes of collisions: driver error, distractions and drowsiness. There are two main types of systems:

1. Systems which warn the driver if the vehicle is leaving its lane (visual, audible, and/or vibration warnings).
2. Systems which warn the driver and, if no action is taken, automatically take steps to ensure the vehicle stays in its lane.

Lane warning/keeping systems are based on:

1. Video sensors are used (placed behind the windshield, typically integrated beside the rear mirror)
2. Laser sensors (placed on the front of the vehicle)
3. Infrared sensors (placed either behind the windshield or under the vehicle)

As we know, this system has bee implemented in several cars by various automobile makers. This technology was first used by BMW motors. It helps driver to avoid any unintentional lane change and thus prevents collision.

V. BLIND SPOT MONITORING

A collision avoidance system is an automobile safety system is made to reduce the affect of an accident. It is also known as precrash system, forward collision warning system or collision mitigating system; it uses radar and sometimes laser and camera sensors to detect an imminent crash. Once the detected, these systems either provide a warning to the driver or take action without any driver input (by braking or steering or both).This system is often used with a Blind Spot Monitoring technique.

A blind spot monitor is a vehicle-mounted sensor device that can detect other vehicles placed towards driver's side and rear. Warnings may be be visual, audible, vibrating or tactile. Also, blind spot monitors may be even more than just monitoring the sides. It can be "Cross Traffic Alert," "that alerts driver backing out of a parking space when traffic is approaches from the sides.. This method was first given by George Platzer in a 1995 paper. The method takes some time getting used to it. Hence trained drivers are used to calculate the time and distance, and thus, this method is cheap for testing of the expensive technology instead of automating the drive test. Thus based on the calculated time, drivers can take the time to set up and use their mirrors properly.

George Platzer received a patent for the blind spot monitor, and it has been incorporated into various products associated with Ford Motor Company. The blind zone mirror has been touted as "an elegant and relatively inexpensive solution "to this problem. BLIS stands for *Blind Spot Information System*, a system of developed by Volvo. This system was first introduced on the 2007 Volvo S80 sedan and produced a visible alert when a car entered the blind spot while a driver was switching lanes, using two door mounted lenses to check the blind spot area for an impending collision. The system utilizes two ultrasonic sensors for the vehicle to detect objects, including other vehicles, pedestrians and other possible obstacles, in the blind-spot area. The information feedback received from these sensors is transferred to a processing unit. Once any object is detected within a predefined area or a specified distance, the application alerts the driver that the object is in the blind-spot.

The rear-view mirror is unhelpful when an overtaking car is in the blind spot. In this contribution we describe the software implementation of an algorithm to monitor vehicle overtaking processes. The original sequence is pre-processed using the Sobel edge detection. This system helps drivers to avoid a crash with a vehicle in the neighbouring lane by continuously screening the blind spots to the side of the vehicles. The blind spot is the area not covered by the driver's line of sight and mirrors. This is particularly dangerous when changing lanes on a multi-lane road. Blind Spot Monitoring uses radar, camera or ultrasonic technologies to monitor the blind spot area of the vehicle. If a moving object is detected within the specified zone, a warning signal is issued. Warning signals vary from one version of the system to another and include visual, audio or haptic signals.

VI. CONCLUSION

Thus, we can combine the techniques of Lane Departure Warning, Obstacle Detection and Blind Spot Monitoring to create a system that would be much efficient as far as a single technology is concerned. This technology can be effectively

implemented in lower segment vehicles and the class of the vehicle will hold no importance for this technology to be implemented. So, by using it, we can assure the reduction in the number of mishap that do occur on the highways and make driving a pleasure instead of worry.

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