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Blind Spot Detecting Car with Accident, Drowsy Driver Detection and Alert system

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Abstract: On an increase in demand of vehicular transportation, the vehicular traffic has increased. This resulted in need for constant alertness of the drivers, especially for the four wheel drivers. They have to maintain their proper state of driving to maintain safety of goods and people. In this paper we are studying about the driver's condition for driving and driver's safety. The general reason for the road accident are the drowsy condition of the driver and the blind spot region while lane changing or overtaking. These two are the main highlighted things to be considered in this paper. Firstly, for the detection of drowsiness the eye blink detection is used, in which the eye blink rate is taken as parameter for determining the drowsiness of the driver. The drowsiness detection system is implemented using Android App. In our project we are going to use Ultrasonic sensors, as image processing will take more time for processing than sensor processing. We are going to check whether there is vehicle in the sensor range or not. If vehicle is detected, immediate alert will be given to the driver, from which side there is chance of crash if we try to change lane. In addition we are implementing a safety system in the vehicle which will detect the accident of the vehicle. And if accident is detected then immediately vehicles location will be sent to the number so that family members and Ambulance service provider will come to know about accident and both can take proper action.

Keywords: Blind spot detection, Drowsiness detection, Android app, Accident alert system.

I. INTRODUCTION

It is observed that with an increase in the traffic the number of accidents are increasing. This reminds us to implement the system for the driver's safety. The main reasons for the accidents are like drowsiness, lane changing and overtaking. When the driving is considered, it is necessary to determine whether the driver is in a state to drive or not. Drowsiness is the main problem of many of the accidents that occurred, in this condition, driver is not in a state to drive safely and is more likely to sleep while driving, leading to accident. For years there have been many approaches to study the driver's state for proper driving. If the state of the driver is found to be inappropriate for the driving then an alert will be generated in this condition. The conditions in which the driver's state, which are not appropriate for the driving can be, in drunk condition and in drowsiness condition. In this paper we are mainly concerned about drowsiness of the driver.

There have been many approaches to determine the drowsiness of the driver. The heart beat rate can be taken as a parameter to determine the drowsiness condition of the driver. It is found from the studies , if a person is tend to feel sleep, then the heart beat rate of the person tends to decrease. The heart beat rate is monitored with the help of the heart beat rate sensor, when the heartbeat rate decreases below some predefined value, alert is generated, so that the driver can give attention on driving or take some safety measures for drowsiness.
The eye blink rate is also considered a parameter for detection of drowsiness. When the eye blink rate is below a certain level, the drowsiness is detected and an alert is generated for the driver.
If in case, accident has occurred, every second is important, early help can save life. For that immediate message should be send to hospital helpline, relative and friends. So we have included a system for alert in case of accident.
This paper is broadly divided in three parts. Prior to discussion of sub parts of projects, an overview of the project is given. Firstly, study about the system and assistance method for the blind spot. Here the system introduction and description about the blind spot assistance to driver is provided. Second, system for drowsiness detection is discussed. An android app is developed which monitors the eye blink of the driver and gives alert when detecting the drowsiness. Third part consists of discussion about the alert system in case of accident. Finally the conclusion of the project.

II. SYSTEM OVERVIEW

As shown in the figure, the system consists of controller that is being connected to all the other peripherals. The connected peripherals are ultrasonic sensor, android app, GPS system, accident detector, motor driver and alarm system. As stated earlier the whole system can be categorized into three sub system.

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1) The blind spot detector: The blind spot detector mainly consists of the ultrasonic sensor. The ultrasonic sensor placed in the appropriate area to cover the blind spot region. As soon as any object comes to proximity of the ultrasonic sensor it gives an indication signal. And this signal is given to the microcontroller. The microcontroller on the basis of the received signal provides an alert to the driver.

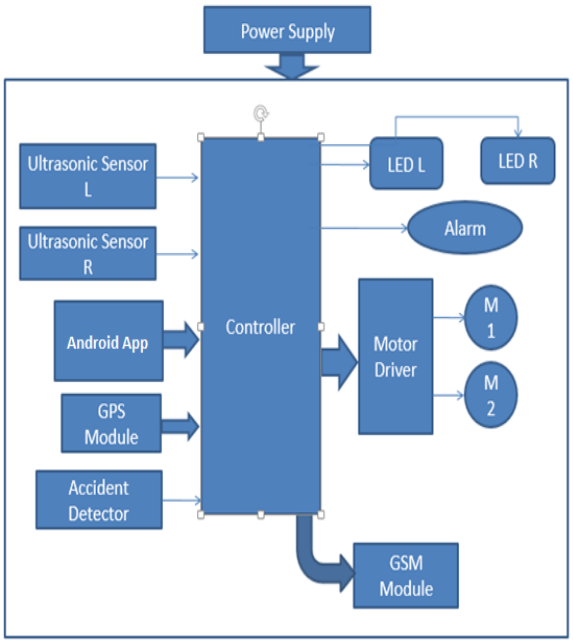

Figure 2.1. The block diagram of the system

2) Drowsiness detector: The drowsiness detector system consists of the Android app. The mobile device consists of the camera, which is used to capture the images of the driver. This images are then processed by the app. The app processes the image to detect drowsiness of the driver. If the drowsiness is detected the mobile app gives signal to the alert system. The mobile device and the alert system are connected wirelessly through the Bluetooth. The alert system consists of the controller and an indication system which can be a speaker or an LED indicator.

Figure: 2.2. Implemented system

3) Accident detection and alert system: The accident detection is done by the vibration sensor. The vibration sensor is calibrated according to the shock. If the intensity of the shock is Greater than that of estimated shock level during an accident, the vibration sensor gives a triggering signal to the microcontroller to which it is connected. As soon as the controller receives the signal from the shock sensor it gives alert message to the hospital, friends and family. The alert message is sent through the GSM module which is also connected to the controller.

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III. BLIND SPOT DETECTION

During driving, we tend to change the lane or may have to overtake the other vehicle. While driving a four wheeler, there are regions which are not visible to the driver, this regions are called as blind spot. There is a possibility that there is vehicle in these blind spot. So while overtaking or changing the lane, may cause crash with the vehicle in the blind spot region.

If driver is given information about anything that is in the blind spot then the possibility of crash can reduce drastically. The presence of any vehicle in the blind spot region is indicated by a system that is being proposed. In this project, we are using the ultrasonic sensor to indicate any vehicle in the blind spot area. If any vehicle is in the blind spot region than the ultrasonic sensor indicates the presence of it and gives an alert to the driver. So, this can avoid the occurrence of accident due to blind spot region, as the system used, gives the information about vehicle in the blind spot region.

Figure: 3.1 shows the blind spot region for the driver. As can be seen from the figure, the driver is unable to estimate any other vehicle in his proximity region, if he wants to change the lane or overtake. In such condition, if any other vehicle is in the blind spot region and the driver wants to change the lane or overtake, there is a very possibility of accident.

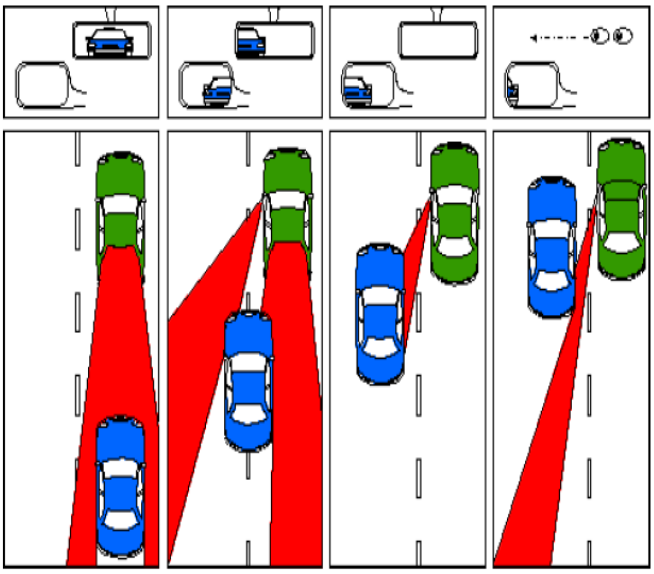

Figure: 3.1 Blind spot region

IV. DROWSINESS DETECTION

Drowsiness is one of the major reasons for accidents. Many approaches and studies has been conducted on this issue, to avoid or have some proper procedure to be followed in this case, approaches such as monitoring driver's eyelids width, the visibility of the pupil, motion of the head, monitoring driver's driving pattern, head motion of driver, etc. have been done. Other approaches such as monitoring heartbeat and reparation are also done. The main feature of many of the approaches which are to be followed includes that, the method should be user friendly and accurate.

In this project, the android app is developed to detect the eye blink rate. The eye blink rate is take as parameter for determining the drowsiness of the driver. Studies have shown that in the state of drowsiness the eye blink rate is reduced. The other approaches which are to be mentioned are requiring a bulk hardware or require some complicated setup. If the heartbeat monitoring is to be considered, the heart beat sensor must be in contact on the chest or at the hand. Apart from this, when compared with the eye blink detection, the results are better for eye blink monitoring system.

To build an Android app is preferred because the mobile Android app is user friendly and gives accurate results. In this project, the open CV library files are used to implement the eye blink detection method. The eye blink detection method is implemented by using the Haar cascade algorithm. With the help of this method we can monitor weather the eyes are closed or open. With which we calculate the rate at which the eye blinks. If the eye blinking rate is less than predefined value then an indication is done that the driver is tending to sleep, in other words, if the eyes are closed for some certain duration, alert is given.

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The other approaches for the drowsiness detection are to be discussed below:
1) Steering Wheel Feature analysis: This is a statistical type of approach. Initially a data a collected, for different driving states, ie. for drowsy and non-drowsy state. Then this data is processed to get statistical data for the driving pattern. This data can be classified in two categories as, driving pattern for drowsy state and for non-drowsy state. From the previous studies, it is concluded that the steering wheel is moved very randomly in drowsy state. In non-drowsy state, the driver generally rotates the wheel only by small regular movements and smooth rotations. In drowsy state the steering wheel is rotated at larger angle and in more random manner. This type to statistical is then processed to give the result, if the driver is drowsy or not. But this type of approach requires a lot of statistical data and the results are also not accurate.

2) Facial Expression Feature analysis: In this approach the facial features are analyzed. In this method, the face is detected using viola jones algorithm, along with it, data related to other facial and body parts is also extracted. With this the information about face, eyes, nose, mouth, upper body, head, etc. is obtained. Now, when a person is feeling drowsy, the head is tilted and eyes are closed. This data is used to detect the drowsiness. This approach is fairly accurate.

V. ACCIDENT AND ALERT SYSTEM

The time after an accident is very critical, every second counts. In this project we included a system which gives an alert to the hospital friends and family about the accident, if occurred. In case of accident, the system immediately gives alert. Here we used vibration sensor to detect the occurrence of accident it is connected to the microcontroller which with the help of the GSM module send the Alert.

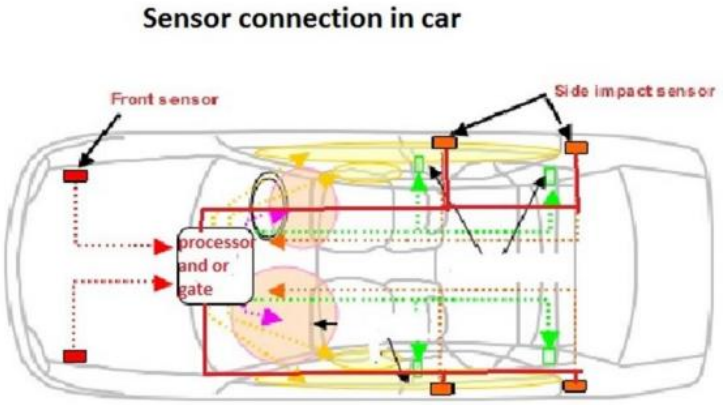

Figure: 5.1 Vibration Sensor connection in car

The vibration sensors be placed at appropriate position, so that the sensor can detect the shock of accident. Care should be taken for calibrating the sensitivity of the sensor. If the sensitivity is low, then the alarm can be triggered even with a small shock. If the sensitivity is set too hard, then even after the accident the sensor is not triggered. Both the above cases are not desired. So the sensitivity is to be set properly. The level of sensitivity is checked for different intensities of shock. A statistical analysis is done and then the sensitivity level for the vibration sensor is set.

VI. RESULT AND ANALYSIS

In this project, accuracy is the most important thing to be considered. The accurate detection of blind spot, drowsiness detection and immediate alert in the situation of accident is very important. In the blind spot detection system, the output provided by the ultrasonic sensor is faster to detect any vehicle in the blind spot region when compared with the blind spot detection using image processing. The range of the ultrasonic sensor is being calibrated according to the safe zone of the vehicle. If any vehicle approaches in the proximity of the ultrasonic sensor range the driver receives the indication for it.

For the drowsiness detection we have used to open CV library in the Android app. The open CV library is an advanced image processing library for detecting the face and other parameters related to it, which are required in our project for drowsiness detection. Here, the eye blink is detected. The face and eye blink detection is mainly done by using the haar cascade algorithm. As this is based on image processing the results may vary according to the light conditions. Drowsiness detection is even possible in the low light conditions. In the pic, the output for the drowsiness detection app is given.

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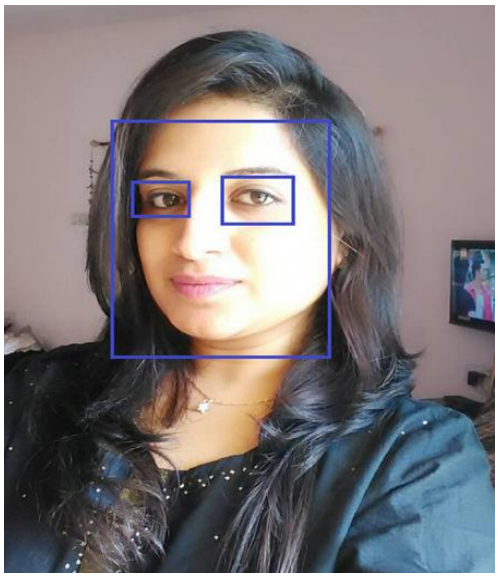

Figure: 6.1. Face features detection for detecting drowsiness

VII. CONCLUSION

The whole system is design to give safety features to the driver. We covered the situation of avoiding the accident, which may occur due to blind spot region and due to drowsiness, if in any case accident occurs, alert is generated for the hospital, friends and family. Thus the system ensures the total security for the driver.

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