DRIVER STATE MONITORING SYSTEM AND VEHICLE CONTROL

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Abstract: *Driver state monitoring system determines whether driver is able to take control over the vehicle. This system is based on Smartphones and arduino. It supports the driver to control the vehicle. This is through monitoring driver attention in addition to detect the drowsiness. As the drowsiness is detected it will send a signal to arduino and it works to control the vehicle and also wakes up the driver through alarm and takes the control of the vehicle for safe automatic parking.*

Key Words: Arduino UNO, Ultrasonic sensor, dc motor, servo motor

1. INTRODUCTION

The vehicle safety is of primary importance. In vehicle safety, the basic focus is control over a speed and effective braking system. Now a days, smart devices are merged with a verity of embedded sensors, that is, camera, ultrasonic sensor, GPS, gyroscope etc. This work gives a glimpse on how the sensor technology connected to a smart device and microcontrollers will help to take control of the vehicle once the drowsiness is detected. In this paper as the drowsiness detected by smartphone app, it will pass signal to arduino and it works to control the vehicle and also wake up the driver. And also if an object is detected in front of the vehicle by ultrasonic sensor, the system controls the speed of the vehicle. Once the Drowsiness is detected it will trigger the alarm and reduces speed of the vehicle, so that driver will be alert.

This project is helpful to avoid the accident that happens in highways. In most of the cases accident happens due to driver's behavior. So, to avoid these we go for the driver state monitoring system. We go for an ultrasonic sensor which has very high frequency as compared to other sensors. Ultrasonic sensors are used to detect object in front or back side of the vehicle.

2. CONCEPT AND METHODOLOGY

In the area of driving assistance, the use of mobile phone for the evaluation of driver state has also emerged as a topic of research. Dynamic car data for the evaluation of driver state and driving performance is a part of research. The use of a steering wheel angle assist, the system by Mercedes Benz, is dependent on visual driving data. In Volvo, the driver alert control is based on a road feature tracking. In case of BMW, driving assist is incorporated for high detection and automatic braking in case of road object detection.

Effective mobile application covers the capability of detecting the road traffic, monitoring the road and alerting the driver about the potentially unsafe zone, for example, vehicle collision, lane departure and speed control.

In case of driver state, one of the factors for driver ineffectiveness can be a fatigue. In the references cited below, many authors describe lots of indication of fatigue in driver, such as slower reaction and responses, yawning etc. The system described in this paper is based on arduino which is a micro controller board. The model UNO R3, which is having six analog input and 16Mhz quartz crystal. It works at the brain to the system which control all the actions and also sense and actuate the system. In our project we focus on safety of the driver as well as vehicle.

The concept used in our project is totally based on arduino UNO. And the components used in our project are described below.

The Drowsiness is detected by the android app through mobile. Usually, the human eye blinks at the rate of 15-20 blinks per minute and suppose if the eye blink rate changes, it will detect the drowsiness as per the blink rate by per close method. To recognize the driver state, whether driver is under fatigue and drowsiness, the mobile camera is located the face position of a driver which evaluates the duration of closed eye. The per close method calculates the percentage of eye closure time. If the calculated value exceeds the threshold limit, the system will trigger the alarm and simultaneously make aware, the driver situation. The alarm will remain on until the said calculations are under the threshold limit.

Once the signal passes to the arduino the arduino will actuate the side indicator light to blink so that back side vehicle get alert, and for detecting front vehicle the

ultrasonic sensor is used. Accordingly the vehicle speed will be reducing.

These speed control concepts consist of 3 major part of the system that is actuators, microcontrollers (arduino) and sensor. The actuator used in this is a dc motor, to which the output of the microcontroller is given. This system can detect drowsiness of driver and can reduce the vehicle speed for safety parking.

2.1 DROWSINESS DETECTION

The drowsiness detection for eye tracking is based on Kalman Filter (KF). The input given to the Kalman Filter is the distances obtain to the detected obstacle. The maximum acceleration and the time pass among the image capture are calculated for each frame. An alarm will make the driver awake of the situation and with the help of sound sensor the input signal will be passing to control the motor. The alarm did not stop unless it is under the calculated threshold value, so that the driver no longer under drowsiness. And also it takes control over vehicle.

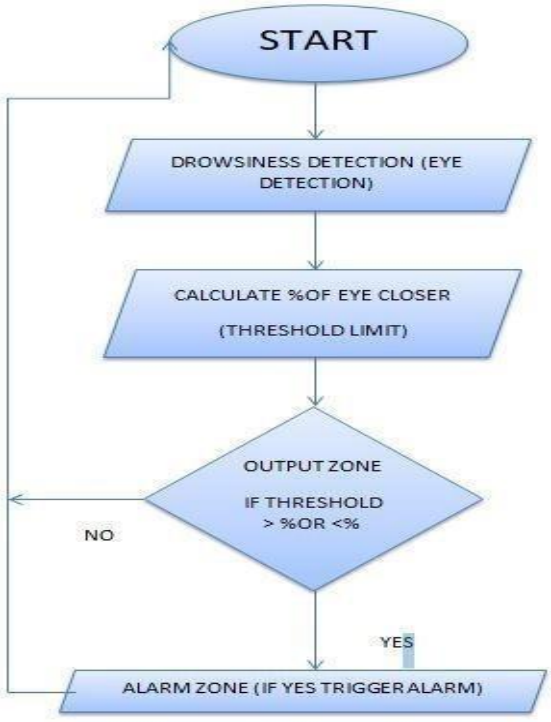

Fig 1. Eye Detection Flow Chart

2.2 OBJECT DETECTION AND ESTIMATION

Once the object is detected, the distance is calculated. The sensor used in our model is ultrasonic sensors HC-SR04 having a range to 2cm to 400cm with a noncontact functionality. The tracking zone was designed based on Nearest Neighbor. The tracking algorithm shows the object detection in front of the vehicle as well as the back side of the vehicle.

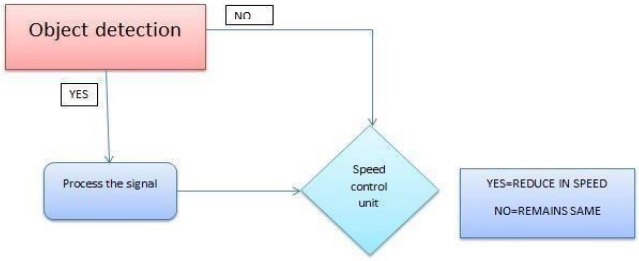

Fig 2. Flow diagram for object detection.

2.3 SIDING OF VEHICLE

Siding of the vehicle is occurs once sufficient gap is detected in front of the vehicle and to its left. For siding the vehicle towards the left, an ultrasonic sensor is used for detecting the edge of the road. By using H bridge circuit with 4 dc motors we are able to control the motion of wheel and safely park the vehicle.

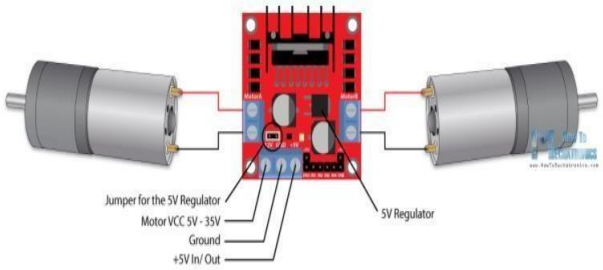

Fig 3. Bridge circuit for DC motor actuation

3. OVERALL WORKING

The overall working of the system is as follows. Drowsiness is detected by using android app namely 'Sleepy driver' and it will trigger the alarm. This alarm sound is captured by using sound sensor and used to initiate the control over speed of vehicle. Ultrasonic sensor fitted in front and corner of vehicle are able to detect the vehicles moving in front and the left side. When object is not detected it performs lane crossing and when pavement is detected, it will park the vehicle safely.

The system works in different stages according situation given to arduino. Overall, the first phase is drowsiness detection and second phase is object detection once the drowsiness is detected by the camera (which is based on eye frame rate). It first reduce the speed and check the object either side of the vehicle. The servo is used to use to steer the vehicle to road side.

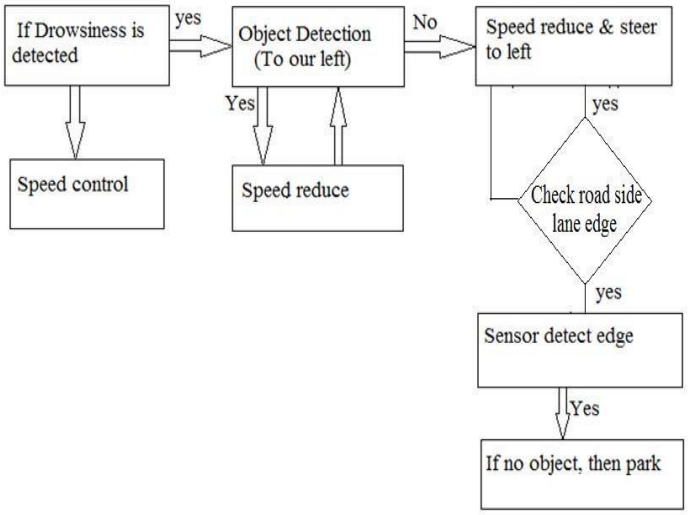

Fig 4 Overall flow diagram of the system

4. EXPERIMENTAL SET UP

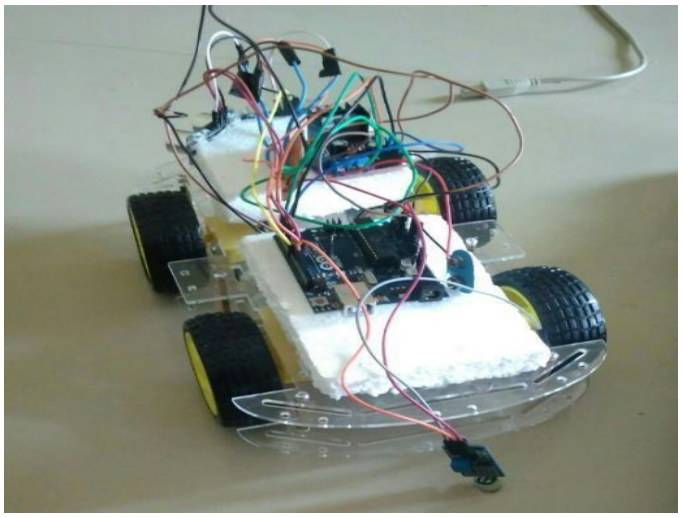

Fig 5. Experimental Setup - Prototype

The prototype set up is shown above in which various sensors, motors, controller, drives etc. are used to establish control. The ultrasonic sensors are used to detect the object. DC motor is used to drive the prototype with servo motor to steer the vehicle.

5. CONCLUSION

With the increasing number of accidents due to drowsiness of driver this system has a bright future for safety. The methodology has been implemented using smartphone devices, taking advantage of their integrated cost-efficient embedded sensors. By using this program in Arduino Microcontroller, we can generate a system with Speed Control and safe parking.

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