Driverless Eyes off Road Detection System

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Abstract- **Distracted driving is one of the main causes of vehicle collisions. Passively monitoring a driver's activities constitutes the basis of an automobile safety system that can potentially reduce the number of accidents by estimating the driver's focus of attention. This paper proposes an inexpensive vision-based system to accurately detect Eyes off the Road (EOR). The system has three main components: 1) robust facial feature tracking; 2) head pose and gaze estimation; and 3) 3-D geometric reasoning to detect EOR. From the video stream of a camera installed on the steering wheel column, our system tracks facial features from the driver's face. The system computes head pose and gaze direction. The head pose estimation algorithm is robust to non-rigid face deformations due to changes in expressions. Finally, using video based continuous image the system reliably detects EOR. The proposed system does not require any driver-dependent calibration or manual initialization and works in real time, during the day and night. To validate the performance of the system in a real car environment, we conducted a comprehensive experimental evaluation under a wide variety illumination conditions, facial expressions, and individuals. Our system achieved above 90% EOR accuracy for all tested scenarios.**

I. INTRODUCTION

Driver distractions are the leading cause of most vehicle crashes and near-crashes. According to a study distractions typically occurred within three seconds before the vehicle crash. Recent reports have shown that the number of people injured in vehicle crashes related to distracted driving has increased. Distracted driving is defined as any activity that could divert a person's attention away from the primary task of driving. Distractions include texting, using a smartphone, eating and drinking, adjusting a CD player, operating a GPS system or talking to passengers. This is particularly challenging nowadays, where a wide spectrum of technologies have been introduced into the car environment. Consequently, the cognitive load caused by secondary tasks that drivers have to manage has increased over the years, hence increasing distracted driving. According to a survey, performing a high cognitive load task while driving affects driver visual behaviour and driving performance. Drivers under high cognitive loads showed a reduction in the time spent examining mirrors, instruments, traffic signals, and areas around intersections. Especially concerning is the use of hand-held phones and other similar devices while driving. Texting, browsing, and dialling cause the longest period of drivers taking their Eyes Off the Road (EOR) and increase the risk of crashing by three fold. A recent study shows that these dangerous behaviours are wide-spread among drivers, more than 50% of motor vehicle drivers in the usually have a cell phone in their vehicles or carry cell phones when they drive. Monitoring driver activities forms the basis of a safety system that can potentially reduce the number of crashes by detecting anomalous situations. In a successful vision-based distracted driving detection system is built upon reliable EOR estimation. However, building a realtime EOR detection system for real driving scenarios is very challenging for several reasons: (1) The system must operate during the day and night and under real world illumination conditions; (2) changes in drivers' head pose and eye movements. result in drastic changes in the facial features (e.g., pupil and eye corners) to be tracked; (3) the system must be accurate for a variety of people across multiple ethnicities, genders, and age ranges. Moreover, it must be robust to people with different types of glasses. To address these issues, this paper presents a low-cost, accurate, and real-time system to detect EOR. Note that EOR detection is only one component of a system for detecting and alerting distracted drivers. Fig. 2 illustrates the main components of our system. The system collects video from a camera installed on the steering tracks facial features. The system estimates the head pose and gaze direction. Using 3D geometric analysis, our system introduces a reliable method for EOR estimation. Our system works at 25 FPS in MATLAB and does not require any specific driver dependent calibration or manual initialization. It supports glasses (including sunglasses) and operates during the day and night. The head pose estimation algorithm used that is able to handle driver facial expressions (i.e., yawning and talking), allowing reliable head pose estimation by decoupling rigid and non-rigid facial motion. Experiments ina real car environment show the effectiveness of our system.

Fig1: Camera arranged at the steering

II. SYSTEM DESCRIPTION

This section describes the main components of our system. There are six main modules: Image acquisition, facial feature detection and tracking, head pose estimation, gaze estimation and EOR detection. The image acquisition module is based on a low-cost camera placed on top.It facilitates the estimation of gaze angles, such as pitch, which is relevant for detecting when the driver is texting on a phone (a major threat to safety). (2) From a production point of view, it is convenient to integrate a CCD camera into the dashboard. On the downside, when the wheel is turning there will be some frames in which the driver’s face will be occluded by the steering wheel. For night time operation, the system requires an illumination source to provide a clear image of the driver’s face. Moreover, the illumination system cannot impact the driver’s vision. To this end, an IR illuminator was installed on the car dashboard. Note that the proposed system does not suffer from the common drawbacks of near-IR based systems, because it does not rely on the bright pupil effect. They build an object appearance and shape representation by computing Principal Component Analysis (PCA) on a set of manually labelled data. Non-parametric shape model that is better able to generalize to untrained situations (e.g., asymmetric facial gestures). Second, SDM uses a more complex representation (SIFT descriptor around the landmarks). This provides a more robust representation against illumination, which is crucial for detecting and tracking faces in driving scenarios.

This paper also proposes an automobile monitoring system using GPS module and GSM/GPRS technology and a ROR(camera based identification to provide better service and cost-effective solution for users. Vehicle monitoring systems were first implemented for the shipping industry because people wanted to know where each vehicle was at any given time. These days, however, with technology growing at a fast pace, automated vehicle tracking system is being used in a variety ways track and display vehicle locations in real- time. According to record data, one can observe the planet is encountering faster growth in Smartphone possession. Consequently, Smartphone clients are now more prevalent within the overall population than entrepreneurs of basic mobile phones. As Smart phones become more familiar to people and finding used in the lives, their influence on society is growing. The main driving force for this faster rise in Smartphone usage is the availability of a giant quantity of programs to fulfilthe needs of a range of clients. Inside our project we developed a Smart phone application combined with in-vehicle tracking device and video that can be recorded along with pre intimation. The Two parts interact to own most convenience for the clients simply because they become handy to follow vehicle locations in solid-time. A vehicle monitoring can be a prerequisite of the extremely basic function in many fleet management systems. A fleet management is the dealing with of the company’s transportation fleet. The fleet management product is targeted at improving the conventional and efficiency of the marketplace by figuring out major obstructions on the road and monitoring real-time locations from the fleet into the spotlight. A lot of the vehicles monitoring systems are created by using GPS navigation and GSM technology. In vehicle monitoring systems, a vehicle location is considered the most significant components. The location and time information anywhere in the world is provided by using GPS navigation technology. For wireless data transmission, GSM and SMS technology are generally used. The SMS technology through GSM network and GSM modem provide a user with vehicle location information. Use of SMS technologies has become popular because it does not require much cost. It is convenient and accessible way of transferring and receiving data with high reliability. Instead of using SMS, the recommended vehicle tracking system uses the Smartphone application to track and monitor a vehicle location obtained from the in-vehicle tracking device controlled by a ARM Processor. The essential reason behind a vehicle monitoring method is to follow a specific target vehicle or other objects. The monitoring device is able to relay information regarding the current location of the vehicle which is speed, etc. Nearly all such monitoring systems consist from the camera as usually placed in-vehicle and can be used monitoring motor bike, buses, and trains. The recommended method is getting Acquisition of an automobile's geographic coordinates and a vehicle's unique ID from an in-vehicle device in real time using the GPS navigation module, Transmission from the vehicle's location information and a vehicle's ID with a server carrying out a specified time interval while using the GSM/GPRS module, Database is built to store and manage received vehicle's location information, Every time a user necessitates automobile location, it might be accessed within the database and supervised on Google maps in solid-time employing a Smartphone application.

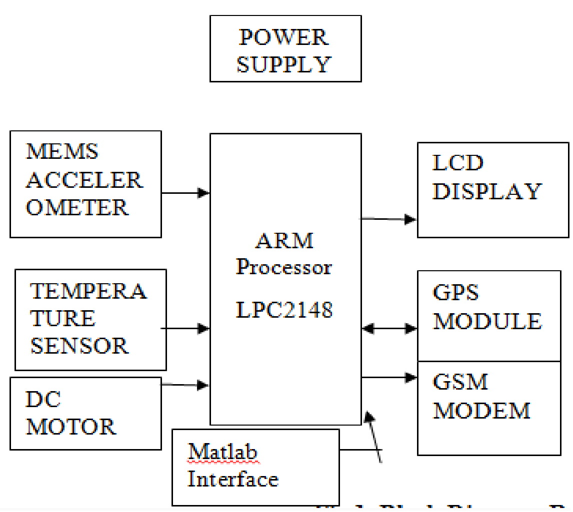

Fig.1. Block Diagram Representation

III. METHODOLOGY

In the development of the car monitoring system controlled having a microcontroller, hardware and software design techniques are crucial. The ARM7 microcontroller used since the brain to handle the vehicle tracking system. Arduino Shields can be used as the Gps navigation and the GSM/GPRS modules. A credit card applicator in program to handle them is written inside the C programming language, come up with and then saved to the microcontroller's flash memory.The GPS navigation in vehicle monitoring systems is generally familiar with provide clients with information such as the location coordinates, speed, time, and so on, anywhere on Earth. In this particular work, a GPS navigation module plus a GPS navigation receiver available within the Spark fun website, is adopted to implement the in-vehicle device. The GPS navigation module gets the navigation receiver with antenna. There are 2 slide switches then one push button switch. The GSM/GPRS module is accountable of establishing connections between in-vehicle oral appliances a web-based server for transmitting the vehicle's location information, using TCP/IP reference to the GSM/GPRS network. Cellular shield for just about any microcontroller includes all the parts needed to interface the microcontroller by getting an SM900 cellular module. The SM900 nick round the GSM/GPRS shield is a tight quad-band cellular module. A Sim and a cellular antenna are functionally needed for coping with a GSM/GPRS module [4]. The Sim produced by AT&T needs enough data quantity for testing. The GSM/GPRS module as well as the cellular antenna was bought through the Sparkfun website. A GSM/GPRS module, a SIM card (pre-compensated or from your phone), plus a cellular antenna are necessary to use the recommended vehicle tracking system. Items like modems utilize the so-referred to as AT instructions to communicate as well as other items. AT instructions are employed to control TCP/IP on SM900. The AT instructions for TCP/IP and their parameters for SM900 can be found. A HTTP communication happens usually through TCP/IP connection [2]. The traditional port for HTTP servers is 80.To have the ability to send data on the web, a power outlet connection needs to get established. In this particular work, the socket is useful for working with this particular server plus it enables clients to find out a TCP socket connection for delivering data.

The socket is characterized by three primary organizations, a protocol, an Ip / several names, plus a port number. A free of charge internet hosting services are utilized to have an internet server construction. An online page was comprised of simple PHP that can directly interact with and manipulate a database table. A Google maps API for iOS may be used to show a vehicle location around the Smartphone application in solid-time using an HTTP request. Google's maps API instantly handles access for the Google Maps servers, shows map, and responds to user gestures for instance clicks and drags.

IV. RESULTS

Motor is running when vehicle is moving in a normal path.

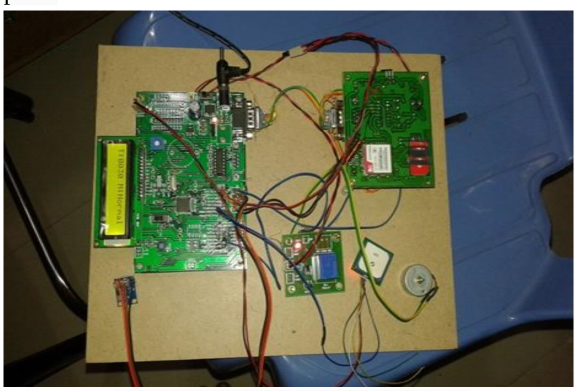

Fig.3. Hardware Implementation

V. CONCLUSION

This paper describes a real-time EOR system using the video from a monocular camera installed.The main novelties of the proposed system: (1) Robust face landmark tracker based on the Supervised Descent Method, (2) accurate estimation of 3D driver pose, position, and gaze direction robust to non-rigid facial deformations, (3) 3D analysis of car/driver geometry for EOR prediction. The proposed system is able to detect EOR at day and night, and under a wide range of driver's characteristics (e.g., glasses/sunglasses/no glasses, ethnicities, ages, ...). The system does not require specific calibration or manual initialization. More importantly, no major re-calibration is necessary if the camera position is changed or if we re-define a new onthe-road area. Hence, the installation of the system in different car models does not require any additional theoretical development. The system achieved an accuracy above 90 % for all of the scenarios evaluated, including night time operation. In addition, the false alarm rate in the on-the-road area is below 5 %. Our experiments showed that our head pose estimation algorithm is robust to extreme facial deformations. While our system provided encouraging results, we expect that improving the facial feature detection in challenging situations (e.g., profile faces, faces with glasses with thick frames) will boost the performance of our system. Currently, we are also working on improving the pupil detection using Hough transform-based techniques to further improve the gaze estimation.

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