IMPLIMENTATION OF INTELLIGENT CAP WITH DROWSY DETECTION AND VEHICLE MONITORING

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Abstract

"Drowsiness", a state which is often seen in drivers now-a-days has become a serious issue in road mishaps. Driver fatigue resulting from sleep deprivation or sleep disorders is an important factor in the increasing number of accidents. The development of technology for preventing drowsiness at the wheel is a major challenge in the field of accident avoidance system. . Sleepy drivers often do not take correct action prior to a collision. For this reason developing a systems for monitoring driver's level of vigilance and alerting the driver, when he is drowsy and not paying adequate attention towards road, is essential to prevent accidents Therefore, a system that can detect driver fatigue, a decline in driver alertness and issue timely warning could help to prevent many accidents, and consequently reduce personal suffering. This paper presents implementation of cap with multiple tilt sensors which detects the drowsiness of drivers via head movements and control the speed of the vehicle according. This paper also aims to provide reliable indications of driver drowsiness based on the characteristics of driver–vehicle interaction.

Keywords - Drowsiness, head tilt or movement, fatigue

INTRODUCTION

The driver's loss of attention due to drowsiness or fatigue is one of the major contributors in road accidents. Driving fatigue, which is described as a feeling of drowsiness due to extended driving period, monotonous road condition, adverse climatologically environment or drivers' individual characteristics are direct or contributing factor to road accidents. Research is being conducted into a large number of on-board driver monitor systems as a means of reducing traffic accidents. In order to improve the effectiveness of these systems, it is necessary to detect the driver behaviour and mental and physical state immediately before an accident, and to inform or warn the driver of the danger, or else to send an intervention signal to the pre-crash safety system and other advanced vehicle safety systems. Previous research has been conducted for conditions of apparent risk, and has used drive recorders to analyze the causes of accidents and to investigate and analyze driver behaviour and other factors which are present immediately before an accident. People in fatigue exhibit certain visual behaviours that are easily observable from changes in facial features such as the eyes, head, and face. Visual behaviours that typically reflect a person's level of fatigue include eyelid movement, gaze, head movement, and facial expression. To make use of these visual cues, another increasingly popular and non-invasive approach for monitoring fatigue is to assess a driver's vigilance level through the visual observation of his/her physical conditions.[1]

In the trucking industry, 57% of fatal truck accidents are due to driver fatigue. It is the number one cause of heavy truck crashes. Seventy percent of drivers report driving fatigued. The National Highway Traffic Safety Administration (NHTSA) estimates that there are 100 000 crashes that are caused by drowsy drivers and result in more than 1500 fatalities and 71 000 injuries each year. With the ever-growing traffic conditions, this problem will further increase.[3] 20% of all the traffic accidents are due to driver's inattentiveness and drowsiness due to long journey Sleep related vehicle accidents (SRVA's) are a common type of road crash. They typically involve one vehicle colliding with the rear of another one, or drifting off the road and hitting other objects. The most dangerous times of day have a symmetry that makes them easy to remember. 2am-6am, and 2pm-6pm, and this 'time of day' factor is said to be just an important as the length of the journey. Working hours, and in particular shift-work, is an important aspect of these incidents.

Drowsiness in passenger vehicle and combination unit truck crashes.

Two vehicle types are of greater interest for such prevention efforts: passenger vehicle (i.e. cars and light trucks) and combination unit truck (i.e. tractor, semitrailers, including bobtails). Based on 1989-1993 GES data, drive of passenger vehicles represented 95.9 percent of drowsy driver crash involvement, while those of combination unit trucks (tractor-trailers) represented 3.3 percent.

The term "drowsy" is synonymous with sleepy, which simply means an inclination to fall asleep. The stages of sleep can be subdivided into the following stages:-

- Stage I: Transition from awake to asleep (Drowsy)
- Stage II: Light Sleep
- Stage III : Deep Sleep

In order to analyse driver drowsiness, stage I, which is the drowsiness phase, a drowsy detection system using head tilt method has been proposed in this paper.

FACTORS CAUSING DRIVING DROWSINESS

Driver Fatigue is often caused by four main factors: sleep, work, time of day, and physical. Often people try to do much in a day and they lose precious sleep due to this. Often by taking caffeine or other stimulants people continue to stay awake. The lack of sleep builds up over a number of days and the next thing that happens is the body finally collapses and the person falls asleep. Time of day factors can often affect the body. The human brain is trained to think there are times the body should be asleep. These are often associated with seeing the sunrise and sunset. Between the hours of 2 AM and 6 AM, the brain tells the body it should be asleep. Extending the time awake will eventually lead to the body crashing. The final factor is a person's physical condition. People sometimes are on medications that create drowsiness or have physical ailments that cause these issues. Being physically unfit, by being either under or overweight, will cause fatigue. Additionally being emotionally stressed will cause the body to get fatigued quicker**.** [2]

METHODOLOGY

SYSTEM DESIGN:

The proposed system consists of the transmitter and receiver unit as shown below:

Transmitter unit:

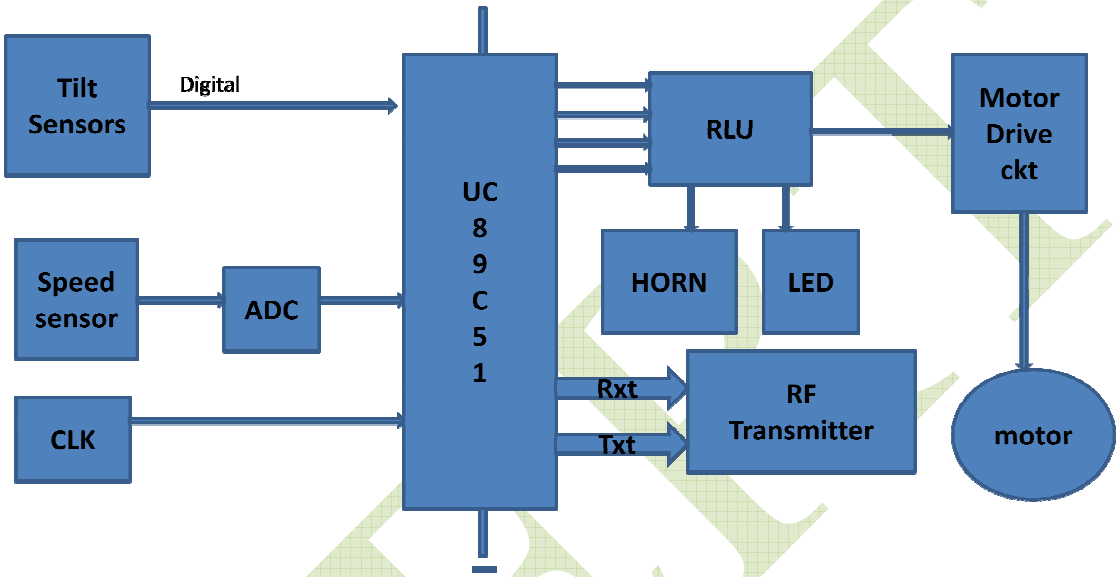


Fig1: Transmitter Unit

Receiver unit:

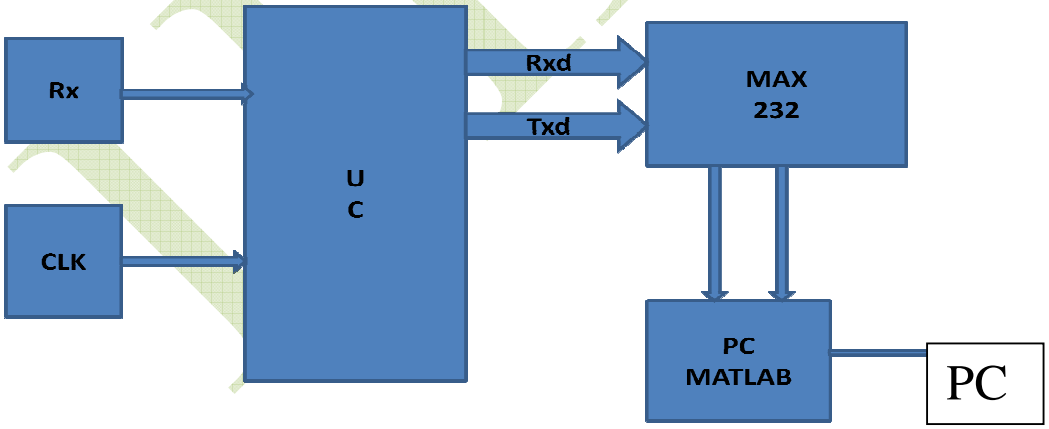


Fig2: Receiver Unit

BASIC IDEA

The cap will include tilt sensors and microcontroller. The system basically consists of a transmitter circuit and the receiver circuit. The transmitter circuit transmitter circuit will be implemented in the bus and the receiver circuit will be implemented in the bus and the receiver circuit will be implemented in the control room. The speed will be automatically controlled according to the program feed in the microcontroller. Road accidents claim a staggeringly high number of lives every year. From drunk driving, rash driving and driver distraction to visual impairment, over speeding and over-crowding of vehicles, the majority of road accidents occur because of some fault or the other of the driver/occupants of the vehicle.

HEAD TILT DETECTION METHOD

This paper presents the Head Position Detection method. The head movement or tilt can be detected by tilt sensors. Tilt sensors are the device that can measure the tilting of an object in often two axes. Tilt sensors allow you to detect orientation or inclination. They are small, inexpensive, low power and easy to use. This technology simply determines the head tilt angle. When the head angle goes beyond a certain angle, an audio alarm is transmitted in the driver's ear.[4]

This system uses head movements as the sole input method; more precisely head's tilt angles are used. Head tilt angles define how much the head is rotated along an axis. There are three possible head tilt movements, which are shown in Figure 3, and they are defined as:

- Pitch, the vertical head rotation movement (as in looking up or down)
- Roll, the head rotation that occurs when tilting head towards the shoulders

The device measures deviations from the reference head coordinates, which are a learned upon System Reset, to determine head movement.[4]

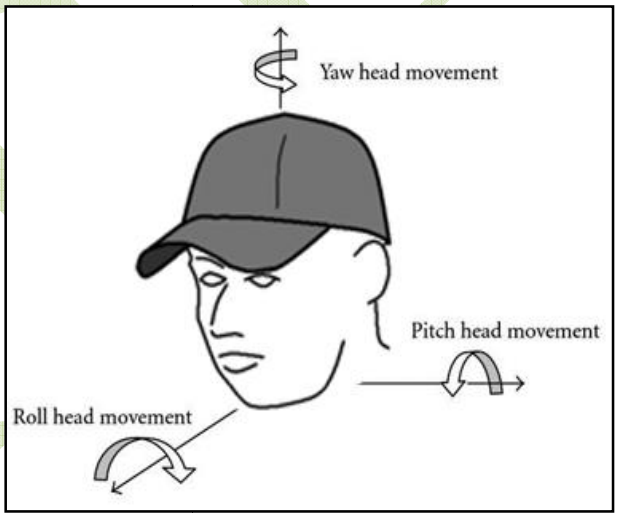
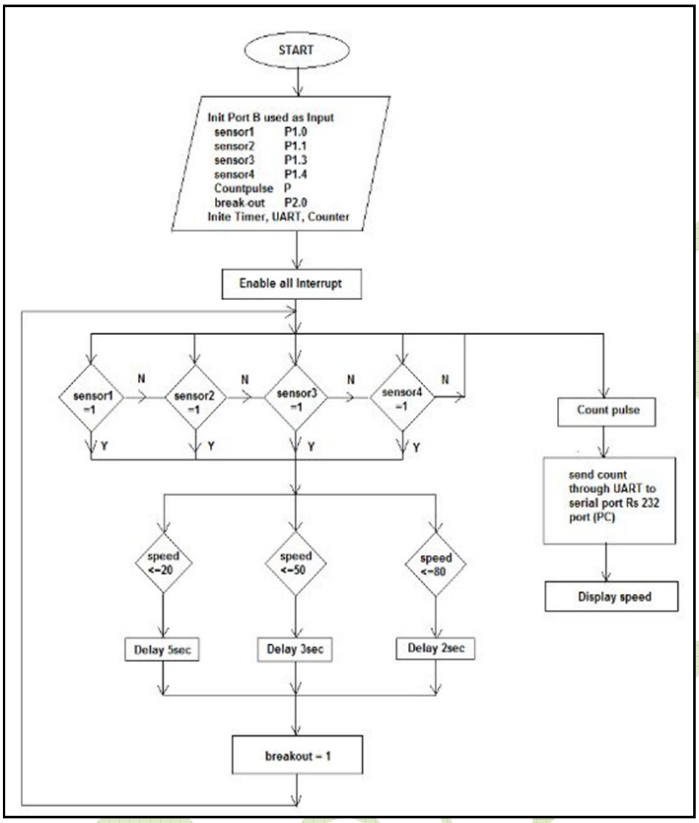


Fig.3: Three possible head tilt movements

FLOWCHART



TECHNIQUES USED

The techniques used in the system consist of wireless sensor network and MATLAB simulation. With a name like "wireless", you may be surprised at how many wires are involved in making a simple point-to-point link. A wireless node consists of man components, which must all be connected to each other with appropriate cabling. You obviously need at least one computer connected to an Ethernet network, and a wireless router or bridge attached to the same network. Radio components need to be connected to antennas, but along the way they may need to interface with an amplifier, lightning arrestor, or other device. Many components require power, either via an AC mains line or using a DC transformer. MATLAB is a technical computing environment for high-performance numeric computation and visualisation. MATLAB integrates numeric analysis, matrix computation, signal processing and graphics in an easy-to-use environment where problems and solutions are expressed just as they are written mathematically without traditional programming. The name MATLAB stands for MATRIX laboratory. MATLAB was written originally to provide easy access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming. These factors make MATLAB an excellent tool for teaching and research.[2]

LITERATURE SURVEY

Recalling the history, in 2002 Ji and Yang.[5] (2002) has presented a detection drowsiness system based on infrared light illumination and stereo vision. This system localizes the eye position using image differences based on the bright pupil effect. Afterwards, this system computes the blind eyelid frequency and eye gaze to build two drowsiness indices: PERCLOS and AECS. Bergasa and his colleagues.[6] In 2004 developed a non-intrusive system that also used infrared light illumination, this system computes driver vigilance level using finite state automata with six eye states that computes several indices, among them, PERCLOS; on the other hand, the system is able to detect inattention through face pose. Horng et al.[7] (2004) has shown a system that uses a skin color model over © space for face detection, edge information for eye localization and dynamical template matching for eye tracking. Using color information of eyeballs, it identifies the eye state and computes the driver's state. Brandt et al.[8] (2004) has shown a system that monitors the driver fatigue and inattention. For this task, he has used VJ method to detect the driver's face. Using the optical flow algorithm over eyes and head this system is able to compute the driver state. Tian and Qin. [9]

RELATED STUDY

From the previous researches, it has been seen that the Drowsiness detection system had been implemented by various methods like
A. Eye Blink detection OR Eye Ball detection
B. Mouth opening OR Yawning analysis
C. Facial gestures.
A. Eye Blink detection OR Eye Ball detection.

Detection method	Advantages	Disadvantages
Viola-Jones	Accurate and very fast	Has more false positives than the face detector, needs learning
Valenti and gevers	Reliable and very fast	Misdetects the eye corners as the eye centers
Timm and barth	Very accurate in eye center detection	Slower than detector by Valenti and Gevers

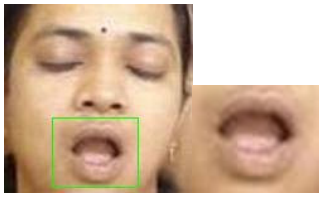
Table1: Advantages and Disadvantages of various Eye Detection

It is necessary in our working to find the blinking of eye, since it is used to drive the device and to operate events. So blink detection has to be done, for which we can avail readily available blink detectors in market.

B. Mouth opening OR Yawning analysis.

State	Normal	Yawning	Correct rate
Normal	260	40	86%
Yawning	7	30	81%

Table2: Results of classification of Normal and Yawning mouths



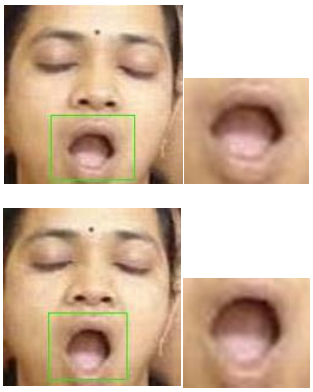


Fig4: Displays the list of Images used, Mouth Detection and extracted Mouths

Facial gestures

Detection method	Advantages	Disadvantages
Ellipse detection	Matches well the shape of human head	Very slow, higher number of false positives
SIFT	An excellent method for object matching	Very high sensitivity to changes in illumination condition
SURF	An excellent method for object matching, faster than SIFT	Very high sensitivity to changes in illumination condition
Viola-Jones	Accurate and very fast	Smaller number of false positive, long training procedure

Table3: Advantages and Disadvantages of various Face Detection method

Face detectors are implemented using several methods. These methods include face detection by means of searching for ellipses, detection using SIFT and SURF features, application of Viola-Jones face detector, and use of feature extraction module.

CONCLUSION

As described throughout the paper, we have reviewed the various methods available to determine the drowsiness and distraction state of the driver. Driver behaviour such as visual features, non-visual features and driving performance behaviour are explored to detect driver drowsiness. Many technologies exist to detect driver fatigue. This paper tries to look at the emerging technologies and determine the best approaches in trying to prevent the number one cause of fatal vehicle crashes and detection of drowsiness in drivers. The primary goal of this project is to develop a real time drowsiness monitoring system in automobiles. Four features that make our system different from existing ones are:

(a) Focus on the driver, which is a direct way of detecting the drowsiness
(b) A real-time system that detects face, iris, blink, and driver drowsiness
(c) A completely non-intrusive system, and
(d) Cost effective

The analysis and design of drowsy driving detection system is presented. The proposed system is used to avoid various road accidents caused by drowsy driving. Driver distraction is detected using head pose and gaze direction. Driver distraction may lead to larger lane variation, slower response to obstacles, and more abrupt steering control. Thus, distraction should be monitored for developing a safer driver-monitoring

system. For active driver safety systems, it is desirable to predict unsafe driving behavior. We have explained prediction methods based head movement. Based on head tilt, the driver's drowsiness and distraction detected, which is helpful in predicting driving behavior.

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