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Alertness Detection Of Driver Using MEMS & Eye Blink Sensor

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Abstract
This paper presents analysis of eye state and head pose (HP) for continuous monitoring of alertness of a vehicle driver. Most existing approaches to visual detection of non-alert driving patterns rely either on eye closure or head nodding angles to determine the driver drowsiness or distraction level. The proposed scheme uses features such as eye index (EI), pupil activity (PA), and HP to extract critical information on nonalertness of a vehicle driver. EI determines if the eye is open, half closed,or closed from the ratio of pupil height and eye height. PA measures the rate of deviation of the pupil center from the eye center over a time period. HP finds the amount of the driver's head movements by counting the number of video segments that involve a large deviation of three Euler angles ofHP, i.e., nodding, shaking, and tilting, from its normal driving position. HP provides useful information on the lack of attention, particularly when the driver's eyes are not visible due to occlusion caused by large head movements. Experimental results show that the proposed scheme offers high classification accuracy with acceptably low errors and false alarms for people of various ethnicity and gender in real road driving conditions..

I. INTRODUCTION

DRIVER drowsiness has been one of the major causes of fatal car accidents. According to a 2014 poll conducted by the National Sleep Foundation, one in five pilots admit that they have made a serious error, and one in six train operators and truck drivers say that they have had a "near miss" due to sleepiness [1]. In 2013, the National Highway Traffic Safety Administration estimates that 100 000 police reports on vehicle crashes were direct results of driver drowsiness resulting in 1550 deaths, 71 000 injuries, and $12.5 billion in monetary losses [2]. Driver inattention might be the result of a lack of alertness when driving due to driver drowsiness and distraction.Driver distraction occurs when an object or event draws a person's attention away from the driving task. Unlike driver distraction, driver drowsiness involves no triggering event but, instead, is characterized by a progressive withdrawal of attention from the road and traffic demands. Both driver drowsiness and distraction, however, might have the same effects, i.e., decreased driving performance, longer reaction time, and an increased risk of crash involvement.

Three main approaches have been developed to detect driver inattention, i.e., physiological, driving-behavior- based, and visual-feature-based approaches. Physiological approaches involve analysis of vital signals such as brain activity, heart rate, and pulse rate. Electrooculogram and electrocardiogram signals. However, physiological approaches often require electrodes that are attached to the driver's body, which are intrusive in nature and, therefore, may cause annoyance to the driver.Driving-behavior-information-based-approaches evaluate the driver's performance over time. Based on the variations in the lateral position, speed, steering wheel angle,acceleration, and breaking, the system determines if the driver is alert or not.

II.Overview

The main aim the paper is "To check alertness of vehicle driver with an analysis of eye state and head pose & to prevent accidents".

This paper presents analysis of eye state and head pose (HP) for continuous monitoring of alertness of a vehicle driver. The proposed scheme uses visual features such as eye index (EI), pupil activity (PA), and HP to extract critical information on nonalertness of a vehicle driver. This paper presents analysis of eye state and head pose (HP) using a Micro Electro Mechanical System for continuous monitoring of alertness of a vehicle driver . The proposed scheme finds in real time the eye and pupil centers and HP angles by using MEMS & IR Sensor. The proposed method brings eye state and HP together to make a decision if a driver is not alert.

Driver inattention might be the result of a lack of alertness when driving due to driver drowsiness and distraction. In 2014, the National Highway Traffic Safety Administration estimates that 100 000 police

reports on vehicle crashes were direct results of driver drowsiness resulting in 1880 deaths, 91 000 injuries, and $14.55 billion in monetary losses. Recently on 24th july 2014 major accident has been occurred at medak in telangana district because of driver non alertness .In that accident many children died.

This paper based on cortex M3 and ARM9 processor which detects the driver alertness depends on driver Eye Index and Head Pose.

Normal eye blinking of a human being is 17 closures/min…so if a driver closes his eyes less than the normal rate ...then he enters in to sleepy condition or drowsy condition.

III. Hardware components

Microcontroller (ARM Cortex M3-LPC1768).

- Micro Electro Mechanical System (MEMS device)
- GSM Module 900A
- Buzzer
- Power supply
- Eye Blink Sensor
- Global Positioning System (GPS)
- LCD Display

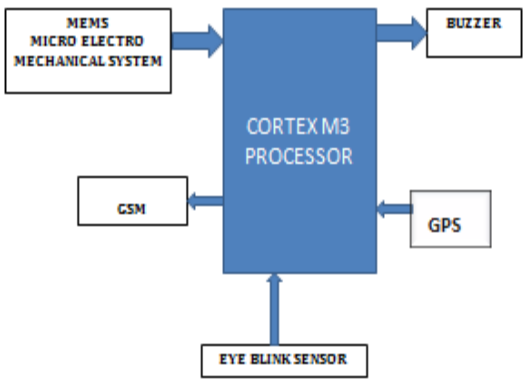

Fig.1.Block diagram

IV. MICROCONTROLLER (ARM CORTEX M3-LPC1768)

The LPC1768/66/65/64 are ARM Cortex-M3 based microcontrollers for embedded applications featuring a high level of integration and low power consumption. The ARM Cortex-M3 is a next generation core that offers system enhancements such as enhanced debug features and a higher level of support block integration. The LPC1768/66/65/64 operates at CPU frequencies of up to 100 MHz. The ARM Cortex-M3 CPU incorporates a 3-stage pipeline and uses Harvard architecture with separate local instruction and data buses as well as a third bus for peripherals. The ARM Cortex-M3 CPU also includes an internal prefetch unit that supports speculative branching. The peripheral complement of the LPC1768/66/65/64 includes up to 512 kB of flash memory, up to 64 kB of data memory, Ethernet MAC, USB Device/Host/OTG interface, 8-channel general purpose DMA controller, 4 UARTs, 2 CAN channels, 2 SSP controllers, SPI interface, 3 I2C-bus interfaces, 2-input plus 2- output I2S-bus interface, 8-channel 12-bit ADC, 10-bit DAC, motor control PWM, Quadrature Encoder interface, 4 general purpose timers, 6-output general purpose PWM, ultra-low power Real-Time Clock (RTC) with separate battery supply, and up to 70 general purpose I/O pins. The LPC1768/66/65/64are pin-compatible to the 100-pin LPC236x ARM7-based microcontroller series.

V. Micro Electro Mechanical System MEMS

The MMA7660FC is a ±1.5 g 3-Axis Accelerometer with Digital Output(I2C). It is a very low power, low profile capacitive MEMS sensor featuring a low pass filter, compensation for 0g offset and gain errors, and conversion to 6-bit digital values at a user configurable samples per second. The device can be used for sensor data changes, product orientation, and gesture detection through an interrupt pin (INT). The device is housed in a small 3mm x 3mm x 0.9mm DFN package

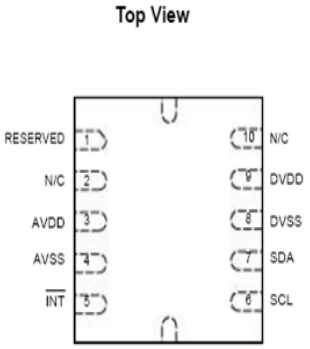

Fig.2.MEMS PIN Configuration

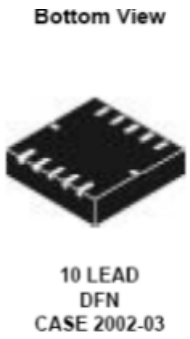

Fig.3.MEMS Bottom View

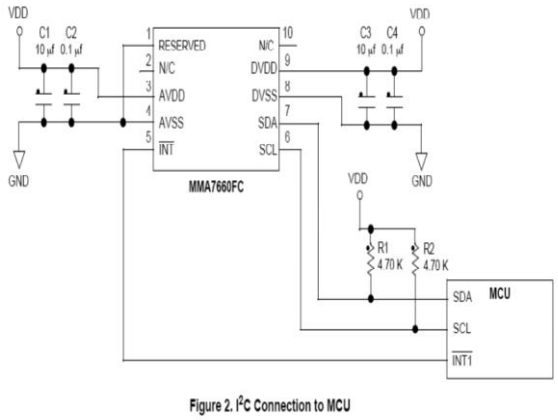

Figure 2. I²C Connection to MCU

Fig.4.MEMS Device

VI.PIN DESCRIPTION

Pin #	Pin Name	Description	Pin Status
1	RESERVED	Connect to AVSS	Input
2	N/C	No Internal Connection, leave unconnected or connect to Ground	Input
3	AVDD	Device Power	Input
4	AVSS	Device Ground	Input
5	INT	Interrupt/Data Ready	Output
6	SCL	I²C Serial Clock	Input
7	SDA	I²C Serial Data	Open Drain
8	DVSS	Digital I/O Ground	Input
9	DVDD	Digital I/O Power	Input
10	N/C	No Internal Connection, recommended to connect to Ground	Input

Table.1.Pin description

VII.EYE – BLINK SENSOR

The eye is illuminated by an IR LED, which is powered by the +5V power supply and the reflected light is recorded by an IR photo diode.

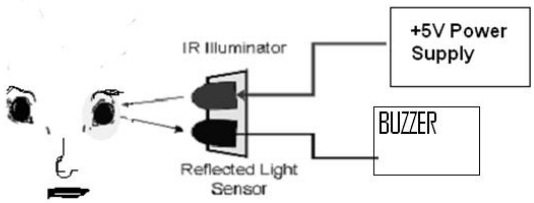

Fig.5.Eye blink sensor

This Eye Blink sensor is IR based , . The Variation Across the eye will vary as per eye blink . If the eye is closed means the output is high otherwise output is low. This to know the eye is closing or opening position. This output is give to logic circuit to indicate the alarm.This can be used for project involves controlling accident due to unconscious through Eye blink.

VIII.DESIGNING

The main intension of the paper is to design and implement a Driver alertness detection by using Eye Index and Head Pose.This will detects the alertness of driver based on eye index and head pose i.e., whether he is in drowsy or sleepy condition. In order to fulfill this design there are few steps that has been performed …

The steps are as follows :
1) Designing of the power supply for the entire circuitry.
2) Selection of microcontroller that suits our application.
3) Selection of Micro Electro Mechanical Systems (MEMS Device).
4) Selection of Eye Blink Sensor.
5) Selection of GSM Module (SIM 900A).
6) Selection of Max232.
7) Selection of LCD Display.
8) Selection of Buzzer.

Complete studies of all the above are useful in developing this. In-order to work with any components basic requirement is power supply. In this section there is a requirement of two different voltage levels, those are 12V DC and 5v DC.The Driver Drowsiness Detection System consists of Cortex M3 LPC 1768 Microcontroller,Micro electro mechanical system MEMS,Eye blink Sensor,GSM module,MAX232,LCD Display,GPS module.First initialize all the components by giving proper power supply to all the devices.After giving power supply first MEMS device has been initialized and then IR sensor initialized.By using EMBEDDED programming we have programmed the predefine anglein the MEMS device .i.e,.. 45 degrees.if the person in the vehicle nods or shakes his head and if the angle of his head exceeds more than the predefine angle the buzzer activates and simultaneously registered user gets an SMS that the driver in the vehicle has been non-alerting stage along with a particular location because we have kept GPS also to get location of the vehicle. By the same way EYE BLINK SENSOR has been activated in the vehicle to detect the drowsiness of person by detecting eye blinks using IR sensor.After giving powr supply to the circuit IR Sensor has been initialized and then if the person in the vehicle goes in to sleepy condition i.e.,his eye blinking rate is less than the normal eye blinking rate 17 closures/min the buzzer has beed activated and gives us sound it indicates he has to alert..simultaneously registered person gets an SMS about the drivers alertness.

The Embedded C programming language and the Keil software have been used to program the microcontroller.So by this we can control the accidents occurring in our dailylife by alerting driver …To avoid accidents this has been proposed.

IX.RESULTS

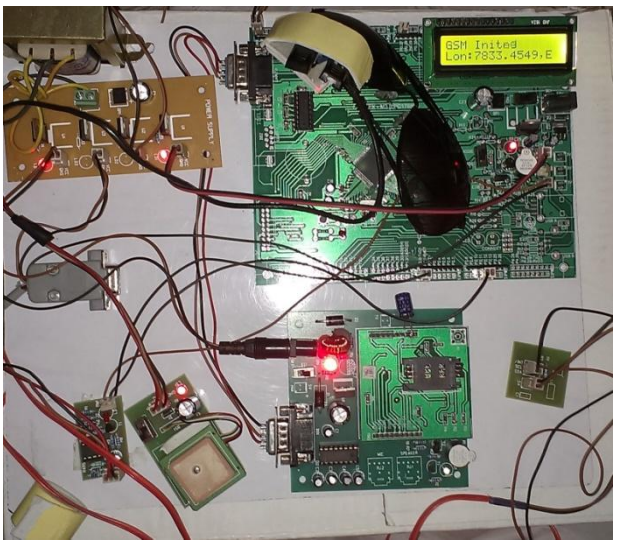

Figure.6 .Module

In this Module there are components like MEMS device,Eye Blink Sensor,GSM Module,GPS module will gets initiated...after gets initiated MEMS device will checks the HEAD POSE i.e., at what angle person will nodding or shaking his head,Eye blink sensor will checks the eye blinks whether he blinks less than the normal rate or normal rate...if any error occurs in these then immediately alarm i.e.,buzzer has been activated .....

So ,along with these the location of the vehicle also been detected by using GPS module & the location of the vehicle has been send to customer who has registerd earlier by using GSM module.

X.CONCLUSION

This paper has presented analysis of eye state and HP using a Eye blink sensor & Micro Electro Mechanical Systems for continuous monitoring of alertness of a vehicle driver.

XI.FUTURE SCOPE

In Future this project will extends ,whenever driver becomes drowsy then buzzer will be activates immediately then after that the vehicle will get slow down automatically.

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