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DETECTION SYSTEM FOR DRIVER'S DROWSINESS AND HEAD POSITION

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Abstract— Drowsiness is a position near to sleep, a strong desire for sleep. Drowsiness refers to being unable to keep your eyes open, or feeling sleepy or tired also called excess sleepiness. Feeling abnormally sleepy or tired is commonly known as drowsiness. Driver fatigue sometimes results in road accidents every year. It is not easy to estimate the exact amount of sleep related to accidents, but research presents that driver fatigue may be a contributing reason in up to 20% in road accidents. These types of accidents are about 50% more expected to result in death or serious hurt. They happen mainly at higher speed impacts.To avoid this a detection system - Drowsy Driver Detector is developed to reduce the number of accidents from drowsy driving. With the two monitoring steps, the system can provide a more accurate detection. In the detecting stage, the eye blink sensor always monitors eye blink moment. It continuously monitors the eye blink moment and once the monitoring stage is over, the collected data will be transmitted to a microcontroller, and the microcontroller digitizes the analog data. If the warning feedback system is triggered, the microcontroller makes a decision which alert needs to be activated. And the second stepis to detect the head position by using MEMS sensor. Based on the detection results from sensor,alert signal for the driver is generated through alarm.

Keywords — : *Drowsiness, MEMS,PERCLOS*

I. INTRODUCTION

Drowsiness may lead to forgetfulness or falling asleep at inappropriate times. It can be accompanied by weakness, lethargy, and lack of mental alertness. People feel drowsy at some point or another, at improper times, indicates a sleep disorder or other medical problem as well. Depression, sorrow and stress are also associated with compromised sleep.

DROWSINESS :

Minimizing or treating these conditions can very much progress the ability to fall asleep and stay asleep. Now drowsiness of person driving vehicle is very important. It may not be due to some medical disorders but long driving by a tired driver. This may cause drowsiness so there is a need to detect this to avoid miss happening.

DRIVER FATIGUE AND ROAD ACCIDENTS:

Drowsiness reduces response time which is a serious element of secure driving. It also reduces alertness, vigilance, and concentration so that the capacity to perform attention-based activities i.e. driving is impaired. The speed at which information is processed is also reduced by drowsiness. The quality of decision-making may also be affected. It is clear that drivers are aware when they are feeling sleepy, and so make a conscious decision about whether to continue driving or to stop for a rest. It may be that those who persist in driving underestimate the risk of actually falling asleep while driving. Or it may be that some drivers choose to ignore the risks in the way drivers drink. Crashes caused by tired drivers are most likely to happen on long journeys on monotonous roads, such as motorways, between 2pm and 4pm especially after eating or taking an alcoholic drink, between 2am and 6am, after having less sleep than normal, after drinking alcohol, it driver takes medicines that cause drowsiness and after long working hours or on journeys home after long shifts, especially night shifts.

MOTIVATION OF THE PROBLEM :

Driver drowsiness is a serious hazard in transportation systems. It has been identified as a direct or contributing cause of road accident. Driver drowsiness is one of the major causes of road accident. Drowsiness can seriously slow reaction time, decrease awareness and impair a driver's judgment. It is concluded that driving while drowsy is similar to driving under the influence of alcohol or drugs. In industrialized countries, drowsiness has been estimated to be involved in 2% to 23% of all crashes. Systems that detect when drivers are becoming drowsy and sound a warning promise to be a valuable aid in preventing accidents.

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II. LITERATURE REVIEW

Pooneh. R. Tabrizi et al. (2008) had proposed an easy algorithm for pupil center and iris boundary localization and a new algorithm for eye state analysis, which there was incorporation into a four step system for drowsiness detection: face detection, eye detection, eye state analysis, and drowsy decision. This new system required no training data at any step or special cameras. Their eye detection algorithm used Eye Map, thus achieving excellent pupil center and iris boundary localization results on the IMM database. Novel eye state analysis algorithm detected eye state using the saturation (S) channel of the HSV color space.

Pia M. Forman et al. (2013) had focused to develop a method for detecting driver drowsiness at more moderate levels of fatigue, well before accident risk was imminent. Eighty-seven different driver drowsiness detection metrics proposed in the literature were evaluated in two simulated shift work studies with high-fidelity simulator driving in a controlled laboratory environment. Twenty-nine participants were subjected to a night shift condition, which resulted in moderate levels of fatigue; 12 participants were in a day shift condition, which served as control.

III. EXISTING SYSTEM

The Existing system for this process is based on the fuzzy logic algorithm and neural networks which can only detect the gray scale. The major drawback of the system is that it is limited to vehicle type and driver condition. All the existing system takes time to process the inputs and there will a delay while generating the output so no immediate alert can be expected. All the components should be set up manually and switched ON in order to operate the system. Auto drowsy detection was not there in the existing system. Due to the lack of technologies and improved systems the image processing was not accurate. So the results often lead to failures or fake alarms. Since the system should be set up manually, adaptability of the system was very poor. And even simples mistakes or shortage in circuits lead to the total failure of the system and which could even lead to the road accidents.

So the major disadvantages of existing system are as follows:

- No immediate alert
- Auto drowsy detection was not there
- Image processing techniques
- No self-control

IV. PROPOSED SYSTEM

Drowsy Driver Detector is a system that can reduce the number of accidents from drowsy driving, here we are proposing a system which has a combined prototype of both the system which has been used to detect the head position and eye blink sensor. . With the two monitoring steps, the system will provide a more accurate detection.

By combining the head position detection system using MEMS, arduino and the eye-blink sensor which uses the perclos method to detect the eye blink sensing, by recording the output generated from both the methods combined the proposed system can process better results there by proposing a chance to avoid the accidents occuring because of the drier drowsiness more effectively.

A brief description about the methods followed in the head position detection and the eye blink sensor are given as follows. To analyze the eye movement and tracking, image processing technique is employed which treats images as two dimensional signals while applying already set signal processing methods. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. The images from camera are converted into digital form that are thereby enhanced and performed some filtering and logic operations on them, to extract some useful and desired information for this purpose the percales method is used to record the eye blink.

In the head position detection system the process of head position detection is done by using the MEMS which has AD302 microcontroller in it with the help of which the head position is computed. The MEMS which is being connected to the AD302 microcontroller which is used to sense the head position on the driver. The result is being recorded as values of x,y,z coordinates which is then shown as output by the variations in the x,y and z coordinates which makes the output being made out as an alarm. By combining these two methods to record the head position and eye blink sensing, we have a better way of sensing the driver drowsiness. The major advantage of this proposed system is that one way or the other it proposes two methods to sense the driver drowsiness providing more chances to have a better way of detecting the driver's drowsiness.

This project uses Mems sensor for the distraction in head position and Eye blink sensor for counting the normal eye blinks of the driver. The Block diagram for the system is explained in detailed below

All electronic circuits works only in low DC voltage, so we need a power supply unit to provide the appropriate voltage supply for their proper functioning .This unit consists of transformer, rectifier, filter & regulator. AC voltage of typically 230volts rms is connected to a transformer voltage down to the level to the desired ac voltage. A diode rectifier that provides the full wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation . A regulator circuit can use this dc input to provide dc voltage that not only has much less ripple voltage but also remains the same dc value even the dc voltage varies somewhat, or the load connected to the output dc voltages changes.

FIG:1 Architecture of mems and eye blink sensor

TRANSFORMER :

A transformer is a static piece of which electric power in one circuit is transformed into electric power of same frequency in another circuit. It can raise or lower the voltage in the circuit, but with a corresponding decrease or increase in current. It works with the principle of mutual induction. In our project we are using a step down transformer to providing a necessary supply for the electronic circuits. Here we step down 230volts.

V. SYSTEM IMPLEMENTATION

The driver drowsiness and fatigue detection system has many components associated with it which make the system works effectively. The two major components are as follows.

- **Ardinuo**
- **Microcontroller**

A micro-controller is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/ output peripherals .The important part for us is that a micro-controller contains the processor (which all computers have) and memory, and some input/output pins that can control. (often called GPIO - General Purpose Input Output Pins).

Arduino Uno board is used in this system. This combines a micro-controller along with all of the extras to make it easy for you to build and debug your projects. The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario chip can be replaced for a few dollars and start over again.

SOFTWARE TIPS :

When bootloading na Atmega8 chip with Arduino 0010, there is a command (-i800) that makes bootloader delay 10 minutes. So, if needed to use bootloader, use command line instead of IDE, removing "–i800" command and adding "–F" command, or use Arduino 0007 IDE. To upload sketches Arduino 0010 works fine.

EYE BLINK SENSOR OPERATION :

The exact functionality depends greatly on the positioning and aiming of the emitter and detector with respect to the eye. For example, a relatively robust detection of blinking is easy to achieve by arranging the detector so that it is near the eyelid, mounting the detector to the rubber eyecup of an HMD has this effect. Detection of saccadic eye motion is more difficult but is still easier than detection of absolute position, due to the characteristically rapid change in the light reflected from the eye surface during the saccadic jumps.IR Sensors work by using a specific light sensor to detect a select light wavelength in the Infra-Red (IR) spectrum. By using an LED which produces light at the same wavelength as what the sensor is looking for, you can look at the intensity of the received light.

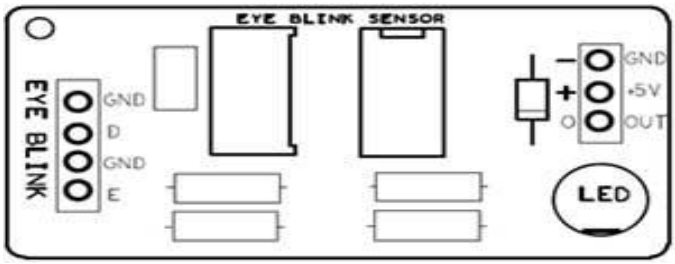

FIG 2 Eye Blink Sensor

When an object is close to the sensor, the light from the LED bounces off the object and into the light sensor. This results in a large jump in the intensity, which we already know can be detected using a threshold.

MEMS SENSOR :

Breakout board for the 3 axis ADXL335 from Analog Devices. This is the latest in a long, proven line of analog sensors - the holy grail of accelerometers. The ADXL335 is a triple axis MEMS accelerometer with extremely low noise and power consumption - only 320uA.The sensor has a full sensing range of +/- 3g.There is no on-board regulation, provided power should be between 1.8 and 3.6VDC.Board comes fully assembled and tested with external components installed. The included 0.1uF capacitors set the bandwidth of each axis to 50Hz.

PRODUCT FEATURES:

Accelerometers are used to sense both static (e.g. gravity) and dynamic (e.g. sudden starts/stops) acceleration. One of the more widely used applications for accelerometers is tilt-sensing. Because they are affected by the acceleration of gravity, an accelerometer can tell you how it's oriented with respect to the Earth's surface. An accelerometer can also be used to sense if a device is in a state of free fall. This feature is implemented in several hard drives: if a drop is sensed, the hard drive is quickly switched off to protect against data loss.

RANGE :

The upper and lower limits of what the accelerometer can measure are also known as its range. In most cases, a smaller full-scale range means a more sensitive output; so you can get a more precise reading out of an accelerometer with a low full-scale range. You want to select a sensing range that will best fit your project, if your project will only be subjected to accelerations between +2g and -2g, a ±250g-ranged accelerometer won't give you much, if any, precision. We have a good assortment of accelerometers, with maximum ranges stretching from ±1g to ±250g. Most of our accelerometers are set to a hard maximum/minimum range, however some of the fancier accelerometers feature selectable ranges.

INTERFACE :

This is another one of the more important specifications. Accelerometers will have either an analog, pulse-width modulated (PWM), or digital interface. Accelerometers with an analog output will produce a voltage that is directly proportional to the sensed acceleration. At 0g, the analog output will usually reside at about the middle of the supplied voltage (e.g. 1.65V for a 3.3V sensor). Generally this interface is the easiest to work with, as analog-to-digital converters (ADCs) are implemented in most microcontrollers.

Accelerometers with a PWM interface will produce a square wave with a fixed frequency, but the duty cycle of the pulse will vary with the sensed acceleration. These are pretty rare; we've only got one in our catalog. Digital accelerometers usually feature a serial interface be it SPI or I²C. Depending on experience, these may be the most difficult to get integrated with microcontroller. It is said, digital accelerometers are popular because they usually have more features, and are less susceptible to noise than their analog counterparts.

OPERATION :

An accelerometer output value is a scalar corresponding to the magnitude of the acceleration vector. The most common acceleration, and one that we are constantly exposed to, is the acceleration that is a result of the earth's gravitational pull. This is a common reference value from which all other accelerations are measured (known as g, which is ~9.8m/s^2).

DIGITAL OUTPUT :

Accelerometers with PWM output can be used in two different ways. For most accurate results, the PWM signal can be input directly to a microcontroller where the duty cycle is read in firmware and translated into a scaled acceleration value. (Check with the datasheet to obtain the scaling factor and required output impedance.) When a microcontroller with PWM input is not available, or when other means of digitizing the signal are being used, a simple RC reconstruction filter can be used to obtain an analog voltage proportional to the acceleration. At rest (50% duty-cycle) the output voltage will represent no acceleration, higher voltage values (resulting from a higher duty cycle) will represent positive acceleration, and lower values (<50% duty cycle) indicate negative acceleration. These voltages can then be scaled and used as one might the output voltage of an analog output accelerometer. One disadvantage of a digital output is that it takes a little more timing resources of the microcontroller to measure the duty cycle of the PWM signal. Communication protocols could use I2C or SPI. When compared to most other industrial sensors, analog accelerometers require little conditioning and the communication is simple by only

using an Analog to Digital Converter (ADC) on the microcontroller. Typically, an accelerometer output signal will need an offset, amplification, and filtration. For analog voltage output accelerometers, the signal can be a positive or negative voltage, depending on the direction of the acceleration. Also, the signal is continuous and proportional to the acceleration force. As with any sensor destined for an analog to digital converter, the value must be scaled and/or amplified to maximally span the range of acquisition. Most analog to digital converters used in musical applications acquire signals in the 0-5 V range.

The image at right depicts an amplification and offset circuit, including the on-board operational amplifier in the adxl 105, minimizing the need for additional IC components. The gain applied to the output is set by the ratio R2/R1. The offset is controlled by biasing the voltage with variable resistor R4. Accelerometers output bias will drift according to ambient temperature. The sensors are calibrated for operation at a specific temperature, typically room temperature. However, in most short duration indoor applications the offset is relatively constant and stable, and thus does not need adjustment. If the sensor is intended to be used in multiple environments with differing ambient temperatures, the bias function should be sufficient for analog calibration of the device. If the ambient temperature is subject to drastic changes over the course of a single usage, the temperature output should be summed into the bias circuit. Smart sensors may even take this into consideration.

The resolution of the data acquired is ultimately determined by the analog to digital converter. It is possible, however, that the noise floor is above the minimum resolution of the converter, reducing the resolution of the system. Assuming that the noise is equally distributed across all frequencies, it is possible to filter the signal to only include frequencies within the range of operation. The filter required depends upon both the type of acquisition as well as the location of the sensor. The bandwidth is primarily influenced by the three different modes of operation of the sensor.

BUZZER:

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise).piezo buzzers are used across many major industries as a means for audible identification or alert. From extremely compact 4 mm SMT buzzers to larger, high decibel models, this product family is well suited to address the needs of the most challenging audio alert applications.

FEATURES:

- Rated Voltage: Max 30 Vp-p
- Current Consumption: 12mA @ 10Vp-p Square Wave 4.1kHz
- Sound Pressure Level(10cm): 90dB @ 10Vp-p Square Wave 4.1kHz
- Flying Leads Fitted
- High and Clear Sound, audible for many meters - KPE-110
- Dimensions: 24mm Diameter, 5mm High, 29mm between mounting holes

FIG 3 Buzzers

VI. CONCLUSION AND FUTURE WORKS

Considering various factors such as road accidents due to driver's drowsiness and fatigue is very prominent. By introducing the driver drowsiness and head position detection system using MEMS and PERCLOS can reduce the rate of road accidents which is increasing at an alarming rate.

As the innovations along with the technologies increases, it overcomes certain limitations that had been recorded from the proposed system, it will be a very helpful and serving factor, if the proposed application is being implemented in private environment. The future works on this detection system can overcome the certain limitations in the proposed system.

VII. RESULT

Here we developed a system which can detect and track both the eye movement and head position using algorithms and use of hardwars like micro controllers. The system uses the combination of both techiques such as eye movement detection which involves the use of PERCLOS technique and head position detection

system which uses MEMS, during tracking the system wil be able to check whether the head position is seemingly okay and to detect the eye blinking and process the calculation to check whether the driver has fatigue or drowsiness. When the driver is found having a the above symptoms a warning signal will be given in the form of buzzer or alarm.

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