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An Automatic Driver's Drawsiness Alert System

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Abstract: *Drowsiness is the main cause for major accidents which leads to the injuries, deaths and damages. To overcome this problem, we propose a system which uses various sensors. These sensors are used to detect the driver drowsy and monitor the health of the driver. The buzzer is used to alert the driver whenever the driver feels drowsy. Whenever the sensor values are not in the range of threshold value, the motor stops. In case of emergency, the GPS module determines the location and this information is sent through GSM to the particular person or in charge ward. All these sensor operations are controlled by Microcontroller. With the help of this system, the major road accidents can be reduced by alerting the driver.*

Keywords: Drowsiness Alert, Sensors, Automation, GSM-GPS module, Accident Prevention

I. INTRODUCTION

Driver drowsiness is one of the main reasons for the accidents. About 50% of the accidents are road-accidents. The drowsiness of the driver has become a major cause for the road accidents. Some methods need to be developed to prevent the driver from his drowsiness during driving. This has become a major challenge to develop a system for the prevention of this issue. In earlier systems, visual analysis of eye state and head pose (HP) for continuous monitoring of alertness of a vehicle driver was used. The Raspberry pi camera and Raspberry pi 3 module were used to calculate the level of drowsiness in driver. A module for Advanced Driver Assistance System (ADAS) was presented to reduce the number of accidents due to driver fatigue thus the visual information and artificial intelligence were used. Researchers have attempted to determine driver drowsiness using the following measures: (1) vehicle-based measures; (2) behavioural measures and (3) physiological measures. The aim of this paper is to develop a prototype of driver drowsiness detection system. This system mainly focuses on monitoring of the driver's body temperature and eye blink rate. It also monitors the heart beat rate of the driver. These factors are measured using the appropriate sensors. The microcontroller compares the sensor values with the reference values provided. It alerts the driver if these values are out of the reference value range. Additionally, the GSM module sends the message to the concerned people to notify about the driver.

II. FACTS AND STATISTICS

Our current statistics reveal that just in 2015 in India alone, 148,707 people died due to car related accidents. Of these, at least 21 percent were caused due to fatigue causing drivers to make mistakes. This can be a relatively smaller number still, as among the multiple causes that can lead to an accident, the involvement of fatigue as a cause is generally grossly underestimated. Fatigue combined with bad infrastructure in developing countries like India is a recipe for disaster. Fatigue, in general, is very difficult to measure or observe unlike alcohol and drugs, which have clear key indicators and tests that are available easily. Probably, the best solutions to this problem are awareness about fatigue-related accidents and promoting drivers to admit fatigue when needed. The former is hard and much more expensive to achieve, and the latter is not possible without the former as driving for long hours is very lucrative.

When there is an increased need for a job, the wages associated with it increases leading to more and more people adopting it. Such is the case for driving transport vehicles at night. Money motivates drivers to make unwise decisions like driving all night even with fatigue. This is mainly because the drivers are not themselves aware of the huge risk

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associated with driving when fatigued. Some countries have imposed restrictions on the number of hours a driver can drive at a stretch, but it is still not enough to solve this problem as its implementation is very difficult and costly.

III. LITERATURE SURVEY

Previously, Automatic driver drowsiness can be detected using artificial intelligence and visual information. System is to detect, track and examine face and eyes of drivers for this different real vehicle image of drivers are taken to validate the algorithms. It is a real time system work in different light conditions [1].

The numbers of accidents are increased due to several factor, one of the main factors is that driver fatigue. Driver's sleepiness is also implemented using video-based approach. This system is non-invasive and human related elements are used. Band power and Empirical Mode Decomposition methods are used to investigate and extract the signal, SVM (Support Vector Machine) used to confirm the analysis and to categorize the state of vigilance of the driver [2]. The system designs to find the drivers drowsiness using the hypothesis of Bayesian networks. The interaction between driver and vehicle features are extracted to get reliable symptoms of driver drowsiness. It presents more suitable and accurate strategies to design drowsy driver detection system [3].

Brain and visual activity is used in drowsiness detection system. Electroencephalographic (EEG) channel used to monitor the brain activity. Diagnostic techniques and fuzzy logic are used in EEG-based drowsiness detector. Using blinking detection and characterization for visual activity monitored. Electrooculography (EOG) channel are used to extract the Blinking features [4].

Image processing and pattern classification used to take the driver facial pictures, tracking the features of driver face and categorizing the driver's sleepiness level. 17 different features. Points are determined after examining the facial muscle activities using Active Appearance Model (AAM). K-Nearest-Neighbor method applied to categorize sleepiness into 6 levels, driver's smile also detected with this method [5].

Head posture estimation method is used for detection of drowsy driver. In this method Viola and Jones algorithm for driver face detection [6].

This method is nonintrusive and sturdy for finding the driver drowsiness in real time. Support Vector Machine (SVM) is using for extracting the face from video frames and Circular Hough Transform (CHT) is useful for mouth and eye state analysis [7].

In this approach machine learning used to determine the human behavior during driver drowsiness, for these 30 different facial actions including eye blink, yawning and head movements are collected to detect the driver drowsiness [8]. farmer

III. PROPOSED SYSTEM

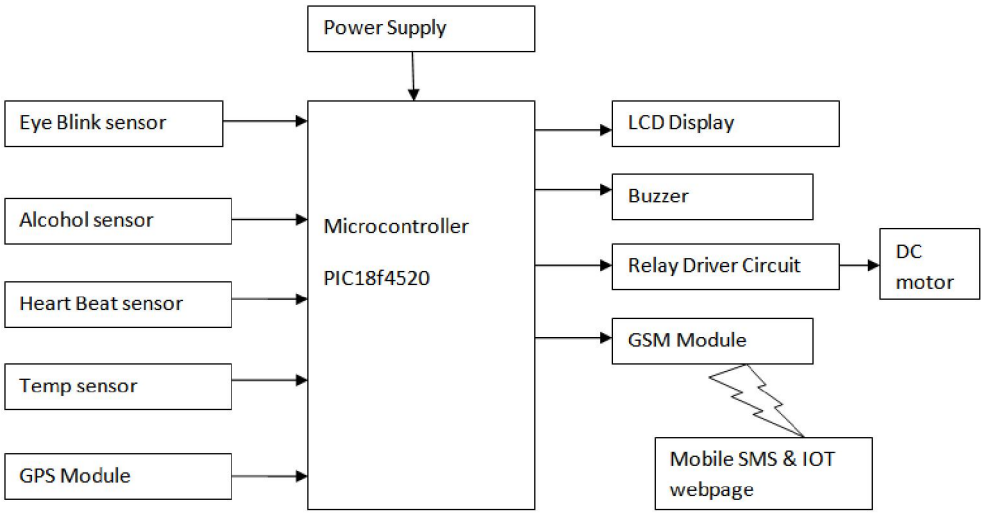

Fig. 1. Block Diagram

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Here, the proposed system can be easily embedded on any vehicle. The Eye blink sensor is fixed to the driver with the help of goggles. The eye blink sensor senses the movement of the eyeball. The sensor output is connected to a microcontroller. DC motor is used as an engine in this prototype. The motor is directly controlled by the microcontroller. If the sensor detects the no output from the sensor because there is no movement in the eyeball, it sends the signal to the microcontroller. The microcontroller gives warning signal and display the reason in an LCD. If repeatedly there is no movement in eyeball, then immediately microcontroller stops the engine. The system also uses heartbeat sensor and temperature sensor. Outputs of this sensor are analog, so we use ADC to convert signals to digital form so that they are processed by microcontroller. Initially the mention values for all sensors and phone numbers are stored in microcontroller memory. If any one of these three parameters is not in specified range of mention values the microcontroller automatically sends location information to the stored number with help of GSM. The normal blinking rate of eye is 20 closures per minutes. It will not have any effecton the performance of the system. When the driver falls asleep, his/her eyes will be closed; hence less light will be reflected from the skin part of the eye (as it is opaque). This produces maximum output of op-Amp. The op-amp output is given to micro-controller, which treats it as logic 1. The micro-controller will wait for 3 seconds. Then if it finds that the eyes are still closed, micro-controller sounds the buzzer. The status of operation will be shown using liquid crystal display (LCD)

3.1 PIC 18f4520 Microcontroller

It is an 8-bit enhanced flash PIC microcontroller that comes with nanoWatt technology and is based on RISC architecture. Many electronic applications house this controller and cover wide areas ranging from home appliances, industrial automation, security system and end-user products. This microcontroller has made a renowned place in the market and becomes a major concern for university students for designing their projects, setting them free from the use of a plethora of components for a specific purpose, as this controller comes with inbuilt peripheral with the ability to perform multiple functions on a single chip.

- Data Memory up to 4k bytesn Data register map - with 12-bit address bus 000-FFF
- Divided into 256-byte banks
- There are total of F banks
- Half of bank 0 and half ofbank 15 form a virtual (oraccess) bank that is accessibleno matter which bank isselected – this selection isdone via 8-bit
- Program memory is 16-bits wide accessed through a separate program data bus and address bus inside the PIC18.
- Program memory stores the program and also static data in the system.
- On-chip External
- On-chip program memory is either PROM or EEPROM.
- The PROM version is called OTP (one-time programmable) (PIC18C) The EEPROM version is called Flash memory (PIC18F).
- Maximum size for program memory is 2M n Program memory addresses are 21-bit address starting at location 0x000000

Fig. 2. PIC18f4520

3.2 Eye Blink Sensor

Here we use the CNY 70 IR transmitter. It is a reflective sensor that includes infrared emitter and phototransistor ina lead package which blocks visible light [1]. One main condition is that the IR transmitter and receiver should be ina

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straight line for optimum performance. The transmitter transmits IR rays into the eye of the driver. Depending on whether the eye is closed or open, there will be high output for closed eye and low output for open eye. The transmitted signal is captured by the IR receiver. This receiver is connected to the comparator. The comparator is an op amp where the reference voltage is given to inverting input terminal and the output of receiver is given to non-inverting terminal. When the IR transmitter passes the rays to the receiver, the receiver is conducting due to the fact that non inverting input voltage is less than inverting input voltage. Now the output of comparator is GND, so output is given to microcontroller.

Fig. 3. Eye Blink Sensor

3.3 Temp Sensor

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°Cover a full -55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35D is rated to operate over a 0° to +100°C temperature range.

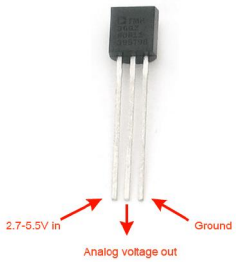

Fig. 3.Temp Sensor LM35

3.4 Heart Beat sensor

The Green Easy Pulse Sensor Heart Beat Sensor HRM2511E is a DIY pulse sensor that is designed for hobbyists and educational applications, It is used to illustrate the principle of photplethysmography (PPG), PPG is a non-invasive technique for detecting the cardio-vascular pulse wave from a fingertip. The Easy Pulse Sensor uses a transmission mode PPG probe (HRM-2511E) sensor. This Sensor uses an infrared light source to illuminate the finger on one side, and On the other side of the sensor there is a photo detector that measures small variations in the transmitted light intensity due to changes in blood volume inside the tissue.

- The onboard components & instrumentation provide a clean and filtered analog PPG waveform.
- The on-board LED also indicates the digital pulse output.
- The analog and digital signals are both synchronous with the heartbeat.

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Fig. 4.Heart beat Sensor

3.5 Alcohol Sensor

The alcohol sensor is technically referred to as a MQ3 sensor which detects ethanol in the air. When a drunk person breathes near the alcohol sensor it detects the ethanol in his breathe and provides an output based on alcohol concentration. If there is more alcohol concentration more LED's would lit.

Fig. 4.Alcohol Sensor

3.6 GSM Module (SIM800)

This GSM modem has a SIM800A chip and RS232 interface while enables easy connection with the computer or laptop using the USB to Serial connector or to the microcontroller using the RS232 to TTL converter. Once you connect the SIM800 modem using the USB to RS232 connector, you need to find the correct COM port from the Device Manger of the USB to Serial Adapter. Then you can open Putty or any other terminal software and open an connection to that GSM Module (SIM800) COM port at 9600 baud rates, which is the default baud rate of this modem. Once a serial connection is open through the computer or your microcontroller you can start sending the AT commands. When you send AT commands for example: "AT\r" you should receive back a reply from the SIM800 modem saying "OK" or other response depending on the command send.

Fig. 3. GSM Module

3.7 LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

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A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

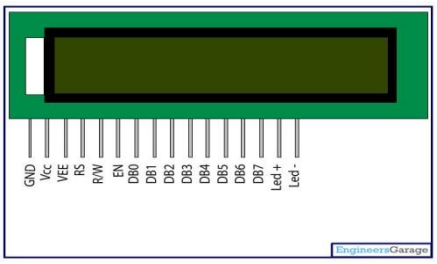

Fig. 4. LCD Display

3.7 Alcohol Sensor

An alcohol sensor detects the attentiveness of alcohol gas in the air and an analog voltage is an output reading. The sensor can activate at temperatures ranging from -10 to 50° C with a power supply is less than 150 Ma to 5V. The sensing range is from 0.04 mg/L to 4 mg/L, which is suitable for breathalysers. The MQ series of gas sensors utilize a small heater inside with an electrochemical sensor these sensors are sensitive to a range of gasses are used at room temperature. MQ135 alcohol sensor is a Sno2 with a lower conductivity of clean air. When the target explosive gas exists, then the sensor's conductivity increases more increasing more along with the gas concentration rising levels. By using simple electronic circuits, it converts the charge of conductivity to correspond output signal of gas concentration.

Fig. 5. Alcohol sensor

3.8 GPS Module

GPS KIT is a highly flexible plug and play with Rs232 Output. RS-232 through DB 9 pin connector. Use AC – DC Power Adaptor with following ratings: DC Voltage: 12V /1A. The GPS user segment consists of your GPS receiver. The receiver collects and processes signals from the GPS satellites that are in view and then uses that information to determine and displays location. GPS receiver does not transmit any information back to the satellites.

Fig. 6.GPS Module

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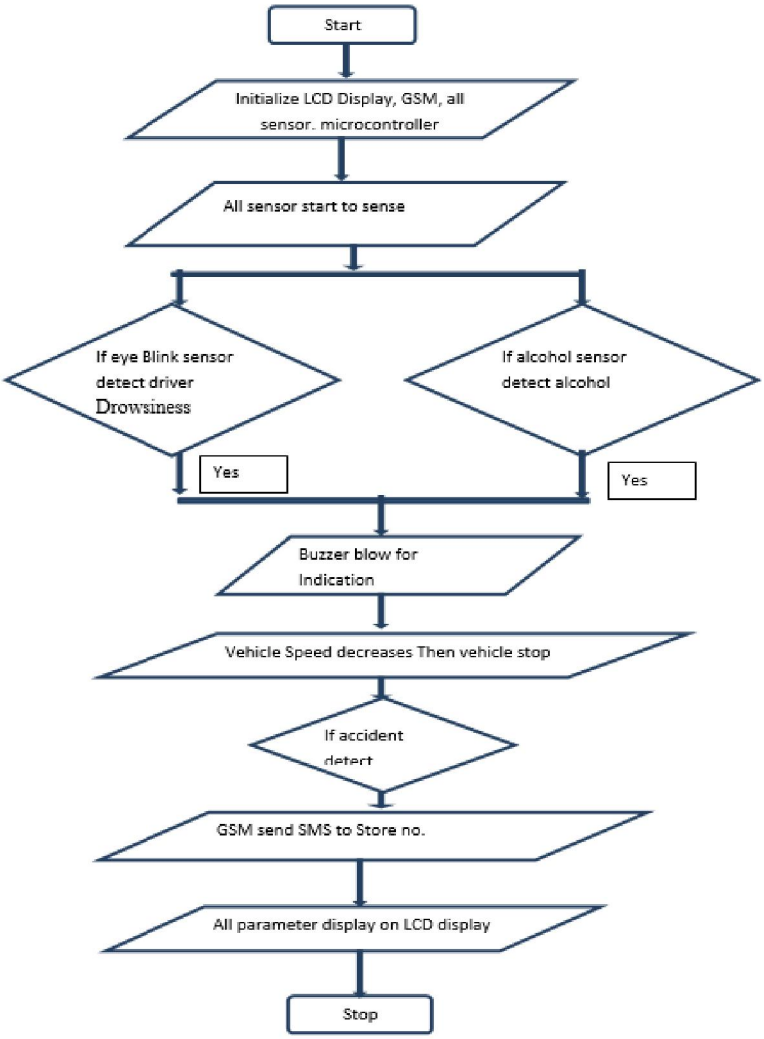
IV. FLOWCHART



V. CONCLUSION

This paper analysis and design the driver drowsiness detection and alert system. The proposed system is used to avoid the major accidents that are occurring due to fatigue and drowsy driving of driver. The model consists of Eye Blink sensor which determines the eye status (open or closed) and Heart Beat sensor is used to check the heart rate for every minute. When the parameter value is more than the threshold value the buzzer is raised to alert the driver. Thus, the accidents caused by the drowsiness can be overcome as much as possible by using such a system.

When eye blink sensor detects driver's drowsiness then buzzer blow first to alert driver. But after giving 1st alarm warning till driver not awake or eye blink sensor not detect any movement of eye then vehicle speed goes down then stop vehicle. After that controller takes location from GPS & send emergency SMS on stored mobile no.

VI. ACKNOWLEDGMENT

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