Automatic Driver Drowsiness Alert and Health Monitoring System using GSM

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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 monitors 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*— *LCD Display, Temperature sensor, eyeblink sensor, Heartbeat sensor, 8051 Microcontroller, GSM Module, GPS Module, DC Motor, Buzzer)

I. INTRODUCTION

Driver drowsiness is one of the main reason 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 were used [1]. The Raspberry pi camera and Raspberry pi 3 module were used to calculate the level of drowsiness in driver [2]. 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 [3]. Researchers have attempted to determine driver drowsiness using the following measures: (1) vehicle-based measures; (2) behavioral measures and (3) physiological measures [4]. 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. SYSTEM ANALYSIS

A. Limitation of existing system

In the existing systems, the drowsiness is detected by using support vector machine (SVM) which classifies a sequence of video segments into alert or non-alert driving event. The other methods used are based on the visual intelligence and artificial intelligence. It is also determined by frequency of head tilting, face recognition and eye blinking using image processing.

B. Problem definition

Measurement of different parameters of the driver such as Heartbeat, Body temperature and Eye blink using the sensors like Heart Beat sensor, Body Temperature sensor and Eye Blink Sensor respectively.

Monitoring the health status of the driver using sensors like Heartbeat, temperature sensor. GPS module is used to know the location of the driver and vehicle in case of emergency.

C. Proposed System Features

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 are not in specified range of mention values the microcontroller automatically sends location information to the stored number with help of GSM. The microcontroller

used here is nuvoton W78E052DDG, it has an inbuilt counter and the counter is used to count heartbeat.

III. SYSTEM DESIGN

A. Power Supply Unit

The step-down transformer is provided with Supply of 230v, 50Hz ac signal from main supply board. The transformer is selected based on its output ranges from 10v to 12v.This power supply is mainly used to provide voltage supply of +5v.

The transformer is provided with input ac voltage typically 230v, this transformer is used to step the ac voltage down. Initially, capacitor filter is used to produce a dc voltage from ac voltage. This dc voltage usually has some ripple or ac Voltage variation. To remove this ripple voltage a regulator circuit is used and thus the output is regulated dc. A proper number of voltage regulation IC units should be used to produce voltage regulation.

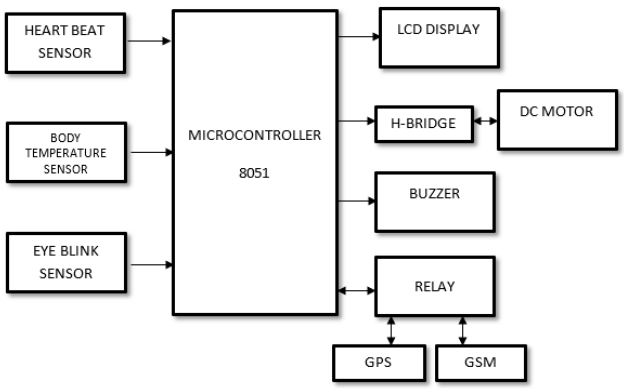

Fig. 1. Block diagram

B. Microcontroller

The Nuvoton standard 8051 series W78E052DDG is an 8-bit microcontroller which can accommodate a wider frequency range with low power consumption. The series is pin-compatible with traditional 12T 8051 and operating at 2.4V ~ 5.5V and -40℃ ~ 85℃ and provides 22.1184 MHz internal oscillator (1% accuracy at 25℃, 5V), Data Flash configurable and high immunity (8KV ESD, 4KV EFT).

The heart of the project is microcontroller because it used to control the devices that are interfaced and used to communicate with the peripheral devices based on the program being written.

C. Eye Blink Sensor

The 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 is to know the eye is closing or opening position. This output is given to controller circuit to indicate the alarm.

D. Heartbeat Sensor

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in accord with each heartbeat. This digital output can be connected to microcontroller directly to measure the Beat Per Minute (BPM) rate. A fingertip placed over the sensor will act as a reflector of the incident light. The amount of light reflected from the fingertip is monitored by the phototransistor. It works on the principle of light modulation by blood flow through finger at each pulse.

E. Temperature Sensor

Sensor we used here is LM35. We integrated this with the Microcontroller to measure the temperature. The microcontroller will then read this measured value from the LM35 and translate into degrees Fahrenheit and Celsius, which we will be able to read from the Microcontroller to the LCD. The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The output of sensor converted to digital that easy connecting with microcontroller.

F. GSM

GSM/GPRS RS232 Modem from rhydoLABZ is built with SIMCOM Make SIM900 Quad-band GSM/GPRS engine, works on frequencies 850 MHz, 900 MHz, 1800 MHz and 1900 MHz It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with RS232 Level converter circuitry, which allows you to directly interface PC Serial port. The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in Autobaud mode. This GSM/GPRS RS232 Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS as well as DATA transfer application in M2M interface. The modem needed only 3 wires (Tx, Rx, GND) except Power supply to interface with microcontroller/Host PC. The built in Low Dropout Linear voltage regulator allows you to connect wide range of unregulated power supply (4.2V -13V). Using this modem, you will be able to send & Read SMS, connect to internet via GPRS through simple AT commands.

G. GPS

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.

H. Buzzer

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave ovens, & game shows. The word "buzzer" comes from the rasping noise that buzzers made when they were electromechanical devices, operated from stepped down AC line voltage at 50 or 60 cycles. Other

sounds commonly used to indicate that a button has been pressed are a ring or a beep.

The buzzer is simplest sort of doorbell, an electromagnet is used to operate a self-interrupting circuit. A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystrokes.

I. DC Motor

A DC motor relies on the fact that like magnet poles repels and unlike magnetic poles attracts each other. A coil of wire with a current running through it generates an electromagnetic field aligned with the center of the coil. By switching the current on or off in a coil its magnetic field can be switched on or off or by switching the direction of the current in the coil the direction of the generated magnetic field can be switched 180°.

IV. FLOW DIAGRAM

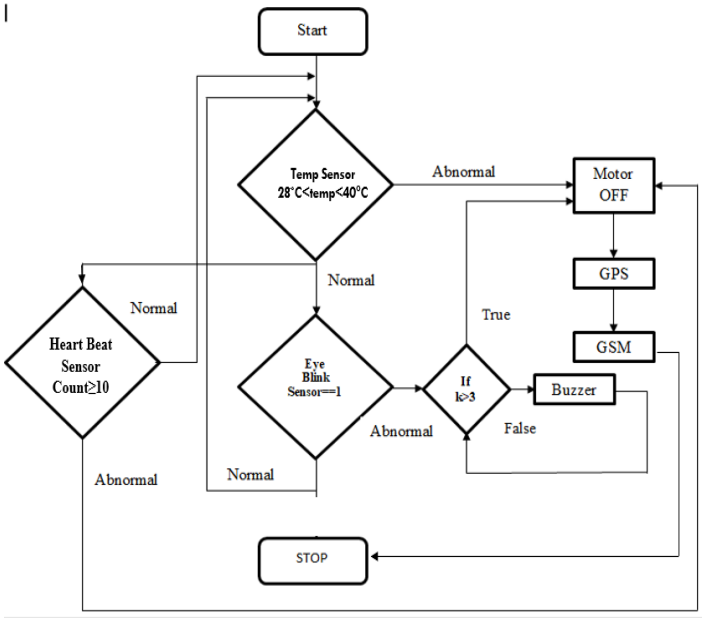

Fig. 2. Flow diagram

Initially, the system is turned ON. It waits for GSM and ADC module to be set. Then the actual process begins with checking the output of body temperature sensor and if it is found abnormal then the motor will be turned OFF and immediately microcontroller will switch ON to the relay, thus first GPS will be switched where location is captured. Then the relay is switched back to GSM which sends message to in-charge ward along with location. If the body temperature of driver is normal, then the next sensor is analyzed. The next sensor is Eyeblink sensor. This sensor is used to check the drowsy driver and gives an alarm if found. If the driver is drowsy then buzzer will be turned on and message will be displayed on the LCD. If the driver is drowsy for 3 or more times, then immediately the motor will turn OFF along with that relay will be switched. Thus, message will be sent to concerned person along with location. If the driver is active, then the LCD displays no drowsiness. For the heart beat sensor to be turned ON we need to switch that on using a push button. When turned on it instructs driver to place his/her finger on it. The heart beat rate is counted and if they do not satisfy the condition then motor will be turned off and message will be sent to specified number. Whenever motor is turned OFF, the LED glows. Thus, this process repeats and detects the drowsy driver.

V. HARDWARE AND SOFTWARE IMPLEMENTATION

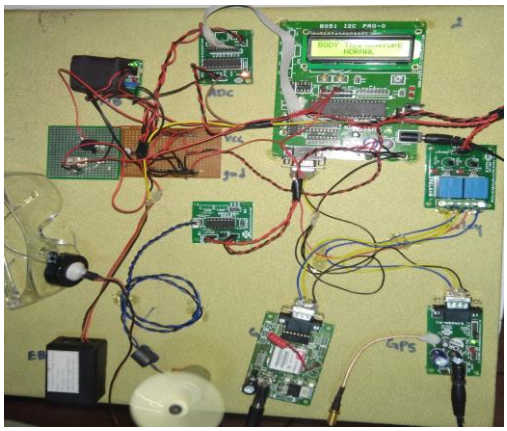

Fig. 3. Experimental setup

Software used over here is Keil µvision 4 and code is written in embedded C language.

VI. RESULT

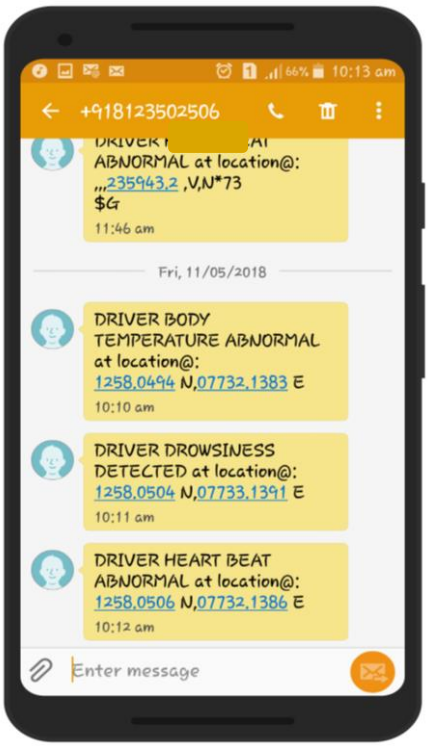

Fig. 4. Screenshot of messages received

The messages are sent through GSM along with the location obtained by GPS. First the driver's body temperature is measured and if it is found abnormal then the motor will be turned OFF and message is sent to in-charge ward. Next the driver drowsiness is monitored using eyeblink sensors and if the driver is drowsy for more than 3 times then again motor is turned OFF and message is sent. The heart beat sensor counts the heart beat rate. If found abnormal. Motor is turned OFF and the message will be delivered to specific person along with location.

VII. CONCLUSION AND FUTURE WORK

A. 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.

B. Future Work

Rather using alarm, we can use automatic braking system which will reduce the speed of the vehicle. By using automatic braking system, first will reduce the speed of the vehicle and concurrently will turn on the parking lights. Using pressure sensor on the automatic braking system can be set in the case of drowsiness. Using CAN protocol if the vehicle is stopped in between it can be moved from one place to another.

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