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Driver Drowsiness Detection System Using Sensors

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ABSTRACT

A low-cost and simple distributed sensors model that is particularly suitable for measuring eye blink of the driver, accident and hand position on a steering wheel. These sensors can be used in automotive active safety systems that aim at detecting driver's fatigue, a major issue to prevent road accidents. The key point of this approach is to design a prototype of sensor units, so that it can serve as platform for integrating different kinds of sensors into the steering wheel. Since the sensors are attached to the steering wheel, therefore they can't be detached by the driver. It will also detect dangerous stylish driving which may lead to fatal accidents. The major drawback is that the eye blink sensors frame worn by the driver can be removed causing the sensor non-operational. The outcome is that the vibrator attached to eye blink sensor's frame vibrates if the driver shuts his eyes for approximately 3 seconds and also the LCD displays the respective warning message. The wheel is slowed or stopped depending on the condition. This is accompanied by the vehicle's owner being notified through the GSM module, so the owner can retrieve the driver's location, photograph and a list of nearby police stations through an android mobile application. Therefore, driver can be alerted during drowsiness and the owner can be notified simultaneously.

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1. INTRODUCTION

Driver fatigue is a significant factor in an ample of vehicle accidents. Recent statistics estimate that annually 1,200 deaths and 76,000 injuries are a case of fatigue related crashes all over the world. Therefore, a technology to prevent and detect driver drowsiness is a major challenge in the field of accident avoidance systems. Since the drowsiness presents a hazard on the road, therefore counteractive methods need to be developed to deal with its effects. The aim of this project is to develop a prototype for drowsiness detection system which helps prevent road accidents on large scale. The focus is on designing a system that will accurately monitor the duration of open or closed state of the driver's eyes in real-time. By monitoring the eyes, the driver can be alerted well in advance to avoid accidents and this is possible if longer eye blinks are detected. The analysis of face images is a research area with following features and applications as virtual tools face recognition, and human identification security systems but this project focuses on IR transmittanceand reception by eye blink sensor and the system is designed to determine whether the eyes of the driver are opened or closed due to fatigue followed by accident detection. [1]

To accommodate each and every object which exists in this world or likely to exist in the coming future, the Internet of Things is the expansion of the current Internet services which constitutes this. This report focuses on the perspectives, challenges and opportunities behind a future internet that fully supports

the “things”, along with how these things can help in the design of a more synergistic future Internet. There are things which form part of internet of things having identities and virtual personalities operating in smart spaces using intelligent interfaces to connect and communicate within social, environmental, and user contexts. [2]

2. LITERATURE REVIEW

There are various ways to carry out detection but a few are mentioned under this section such as: sensing of physiological characteristics, sensing of driver’s eyes, vehicle response and monitoring the response of driver at any moment. These techniques can be implemented in two ways: by accurately or practically measuring changes in physiological signals, such as eye blinking; and real time measuring physical changes such as leaning of the driver’s head and the open/closed states of the eyes. Driver’s operation and vehicle behaviour can be implemented in following ways, by monitoring the steering wheel movements, accelerometer or brake patterns, vehicle’s speed, lateral acceleration caused and lateral displacements here. The final technique is by monitoring the response of the driver. The driver requires to consistently send the response but eventually this becomes tiresome and annoying for the driver. [3]

3. METHODOLOGY

The sensing of drowsiness, warning the drowsy driver through a vibrator which can be fit in the seat/steering and sending details to the owner are the most essential goals, however the performance of the system under real time constraints must also be achieved. [4]

3.1. System Architecture

Drowsy driver detection system is decomposed into sub-systems and these sub systems provide some related services. The identification of the major components of the system and communications between these components is considered under this.

The system architecture below portrays the blocks required for the implemented system. Figure.1 outlines the system architecture. The sensors need to detect respective parameters and pass the signals to microcontroller. The outputs from SST microcontroller are used as inputs by various output devices to control the speed and display the messages. [5]

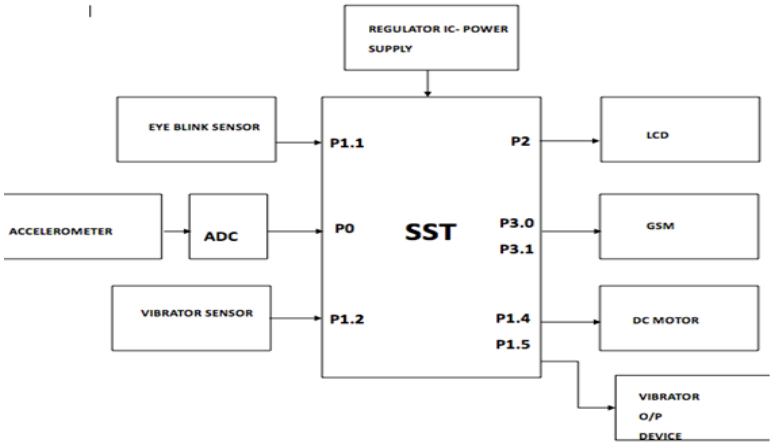

Figure 1. System Architecture

4. IMPLEMENTATION AND RESULT

The proposed ideology involves setting up a system for preventing on road vehicle accidents caused due to driver drowsiness. Keil complier is used for the functioning of the system. Android application helps notify the owner whenever an accident occurs with the driver’s location and photograph. [6]

Figure 2 depicts the schematic diagram of the SST micro-controller, consisting of ports, timers and PCA.

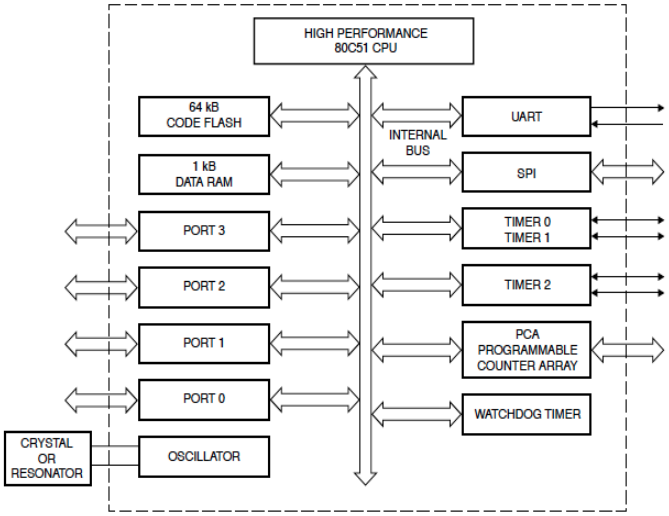

Figure 2. P89V51RD2 Schematic

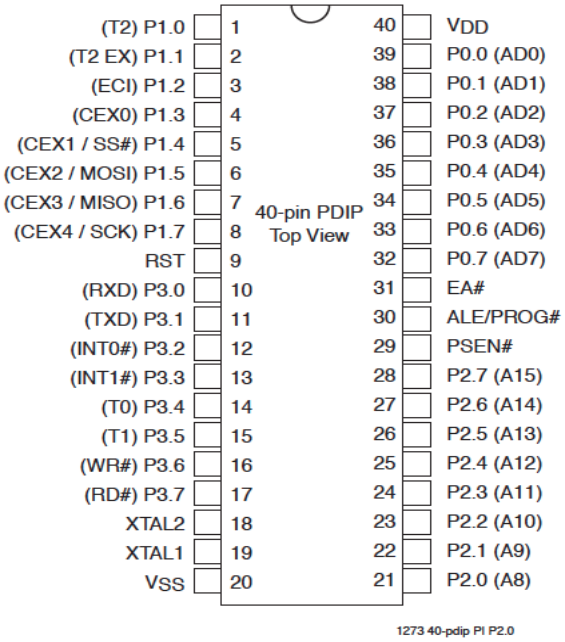

Figure 3. PDIP40 pin Configuration

4.1. Task Implementation

Implementation procedure of this system is split into various steps. Each step is necessary in order to achieve the end result. Steps are interdependent on each other. Step-wise approach gives a better clarity for development and implementation

a. Sensing Information: When the vehicle moves, the sensors would take the input from the eye blink rate of the driver, the speed of the vehicle and any shock/vibration caused due to accident. These inputs are then sent to SST microcontroller.
b. SST microcontroller: The microcontroller takes various inputs through ports and passes the signals to the output ports so that necessary actions could be carried out.
c. Outputs: The output is received through the SST ports and sent to LCD, GSM module and the vibrator. The following gives an account of the outputs:

Step 1: The GSM module alerts the owner of the vehicle by giving options as location, photograph view and details to be received in owner's mail. The nearest police station is alerted at the same time.
Step 2: The drowsy driver is alerted through a vibrator where in the vibration is sent to the glass of the eye blink sensor.
Step 3: The DC motor attached to output port is slowed down whenever the value received by accelerometer exceeds the threshold value.

d. Display: Every warning message generated due to any causality caused by the driver drowsiness is displayed on the LCD screen.
e. Performance Evaluation: The performance of the algorithm is evaluated by considering the effectiveness and correctness of comparison with the threshold values. The decision making capability of the algorithm is evaluated for accuracy and reliability. [7]

4.2. Result

a. The User Interface: The following are the results obtained for the user interface module of our system:
    1. The UI is on an android app which can be loaded into any android phone.
    2. The UI gives a good look and feel to the project.
    3. The user enters the owner's phone number in the app.
    4. The main application is in owner's phone for purpose of retrieving photograph, list of nearby police stations, location and tracking.
b. The Drowsy Driver Detection System: The results obtained by running the module are as follows:
    1. The owner's phone receives an audio warning message.
    2. The owner can retrieve the location of the driver by choosing the "location" option.
    3. The owner can also get a list of driver's nearby police stations. With this, the photograph of the driver can be sent to owner's email address as specified in the clamped phone.
    4. The wheel/motor is stopped as soon as an accident occurs, the vibrator in the eye blink sensor frame vibrates and displays a message on the LCD.
    5. When the driver falls asleep, the vibrator vibrates and the LCD displays the message. Along with this, the speed of the vehicle is reduced.
    6. When the accelerometer is tilted randomly, that acts as the steering, a message is displayed on the LCD the speed of the vehicle is reduced.
    7. With all of the above mentioned, the android applications send and receives details simultaneously.

4.3. Tilted Accelerometer

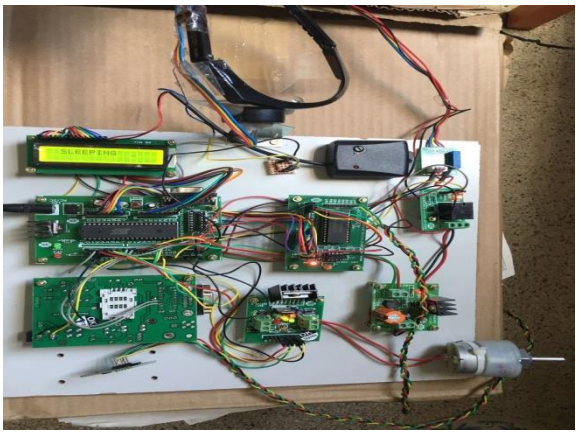

Figure 4. Tilted Accelerometer

Figure 4 shows that when the steering is tilted randomly, the vibrator vibrates and the wheel speed is slowed down. LCD displays a message "SLEEPING".

4.4. Eye is Shut

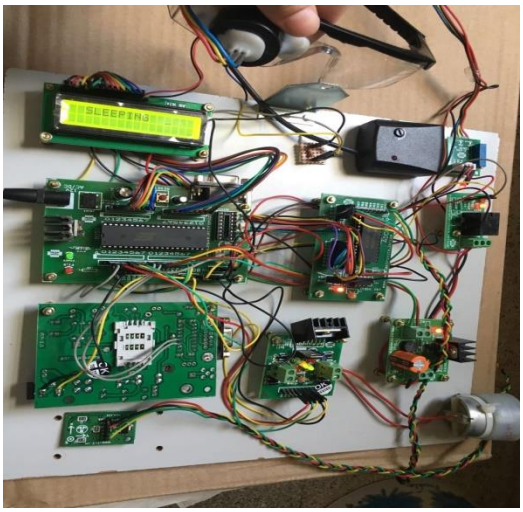

Figure 5. Eye is shut

Figure 5 shows that when the eyes are closed then the vibrator vibrates and the speed of the wheel is decreased. The LCD displays a “SLEEPING” message.

4.5. Owner’s Phone Android Application

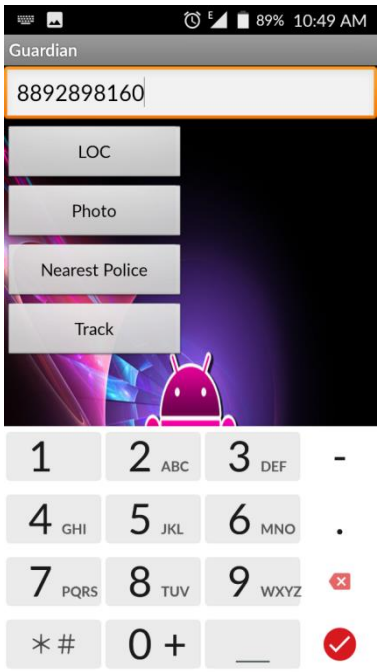

Figure 6. Owner’s Phone Android Application

Figure 6 shows the android application on the owner’s phone. The owner can choose from among various options and retrieve the required information from the clamped phone. Before this, the owner’s phone plays a warning audio message when notified by the GSM module of the system.

4.6. Clamped Phone's Activity Screen

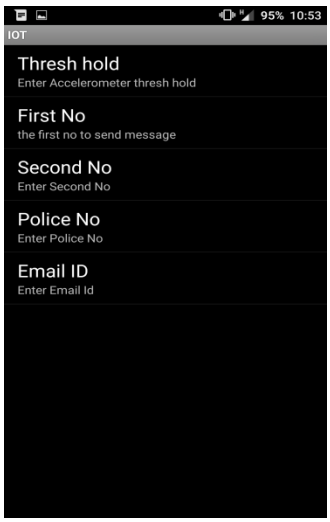

Figure 7. Clamped phone's activity screen

Figure 7 shows the activity screen of clamped phone where the details of the owner are to be entered. The email address is entered here so that the photograph could be sent to the owner's email-id.

4.7. Photograph sent to owner's email-id

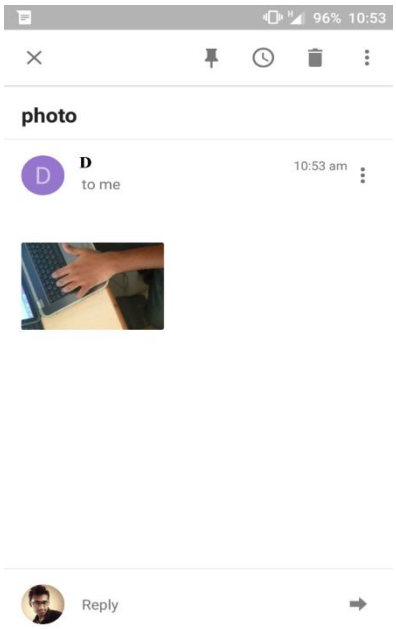

Figure 8. Photograph sent to owner's email-id

Figure 8 Depicts the photograph received in the email of the owner when the owner chooses the photograph option.

5. CONCLUSION

According to a study, 20% of the crashes are due to the driver drowsiness. Therefore, development of system for driver drowsiness detection is not only legitimate but also it is very necessary. The proposed system deals to alert the sleepy driver with the help of the vibrator and the LCD will display sleeping. Also, 2 android phones with different android applications are created, one where the owner has to access the driver's location and the other is in the car which is used to detect the location of the car and click the pictures of the driver. The nearby police stations can be accessed and the picture of the driver can be clicked and sent to owner's email address. In the hardware part the following sensors, such as eye blink sensor with a frame which the driver has to wear while driving, it detects blinking of the eye and intimates the driver with the help of the vibrator, an accelerometer which is attached to the steering which helps to detect if the driver is driving rashly. The DC motor slows down when the sensors detect that the driver is sleeping and stops if the vibration sensor detects any accident which has occurred. Simultaneously, the LCD in the car displays appropriate warning messages.

6. LIMITATIONS OF THE DROWSY DRIVER DETECTION SYSTEM

The following are the limitations of the drowsy driver detection system:

a. The driver has to wear the eye blink sensor frame while driving.
b. Only one DC motor has been used which represents only one wheel of the vehicle.

7. FUTURE ENHANCEMENTS

The following can be regarded as the future enhancements to increase the viability of the proposed system:

a. Four DC motors should be used which represent four wheel of the ca
b. Driver won't have to wear the eye blink sensor frame during driving

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