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Driver Safety -Iot Based Driver Gaze Tracking & Health Monitoring System

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Abstract:

Driver Safety - Fatal Road accidents can be easily avoided by understanding the psychological state of drivers. Majority of road accidents occur during night driving due to drowsiness state of vehicle drivers (Subject). The proposed work monitors Eye Blink Monitoring System (EBM) that alerts the subject during state of drowsiness. This physiological sleep state analysis of subject can be determined by monitoring subject's eye blink rate using an Open CV Library. A normal eye blink rate has no effect on the output of the system. However, subject is in extreme state of sleep cycle, then it will click picture of subject and send to web application, where administer is monitoring and send the message that will be converted into alarm is initiated to wake the subject. For Health Monitoring of driver we are making wearable device which will give the heart beat and body temperature of subject, so before boarding to vehicle admin should know the status of subject. For the proposed system the authors have used Bluetooth Technology to send sensor data to a Smartphone and also to web application for archiving and analysis. The information available on the web application can be supervised by the subject by using a Mobile application. Real tracking of driver will also track with mobile GPS.

Keywords: Internet Of Things (IOT),Raspberry Pi 3 Model B, Arduino Nano, Bluetooth (HC-05),Pulse sensor, Temperatue sensor(LM35),Webcam, Speaker.

I. Introduction

Internet of Things (IOT) is the interconnection of uniquely identifiable embedded computing devices within the existing Internet infrastructure. Typically, IOT offers advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M) and covers a variety of protocols, domains,
and applications. The interconnection of these embedded devices (including smart objects), is implemented in nearly all fields of automation enabling advanced applications like a Smart Grid. The term ―things‖ in the IOT refers to a wide variety of devices such as heart monitoring implants, Smart city & building, Smart Agriculture, Healthcare, Environment protection, Logistics, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, or field operation devices that assist fire-fighters in search and rescue. Current market examples include thermostat systems and washer/dryers that utilize Wi-Fi for remote monitoring.

FATIGUE, drowsiness and sleepiness are often used synonymously in driving state description [1]. Involving multiple human factors, it is multidimensional in nature that researchers have found difficult to define over past decades [2]–[3]. Despite the ambiguity surrounding fatigue, it is a critical factor for driving safety. Studies have shown that fatigue is one of the leading contributing factors in traffic accidents worldwide [4]. It is particularly critical for occupational drivers, such as drivers of buses and heavy trucks, due to the fact that they may have to work over a prolonged duration of the driving task, during the peak drowsiness periods (i.e., 2:00 A.M. to 6:00 A.M. and 2:00 P.M. to 4:00 P.M.), and under monotonous or boredom working conditions .

In this paper we propose a direct approach that makes use of vision based techniques to detect drowsiness. The major challenges of the proposed technique include (a) developing a real time system, (b) Face detection, (c) Iris detection under various conditions like dr iver position, with/without spectacles, lighting, etc (d) Blink detection, and (e) Economy. The focus will be placed on designing a

real-time system that will accurately monitor the open or closed state of the driver's eyes. By monitoring the eyes, it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident. Detection of fatigue involves the observation of eye movements and blink patterns in a sequence of images of a face extracted from a live video[5],[7],[8]. Hardware-based approaches to driver head pose and gaze estimation rely on near-infrared (IR) illuminators to generate the bright pupil effect [9], [10], [11], [12]. In this project we are presenting an internet based system entitled _"Eye Blink Monitoring System" which will help drivers to alert in drowsiness. This system is based on principle of monitoring eye movements of driver continuously using an Open CV Library[6]. If he/she falls asleep, then an alarm will ring to wake him/her up.

II. RELATED WORK

In this project we are implementing EBM (Eye Blink Monitoring Technique) to detect drowsiness of night drivers and preventing accidents. The other technologies that detect Drowsiness are EEG or Brain waves monitoring technique. Such a technique requires sophisticated system to map or monitor the brain of subject and determine the state of drowsiness based on the neurological sleep cycle. Though EEG technique is accurate to a larger extent, yet it is not cost effective and has a difficult implementation. On the other hand Eye Blink Monitoring Technique is dependent on physiological state of sleep of the subject and by understanding it, drowsiness can be detected and accident can be prevented. Drowsiness causing accident can be effectively prevented by designing an embedded system that is efficient enough to take critical decisions during emergency conditions. Majority of accident prevention systems come into picture when accident happens , however the proposed system is equipped with advantage of taking decisions by analyzing the symptoms of accident causing events. Brain wave technique only measures the drowsiness level but, EBM technique can be interfaced with a network of sensors in a cost effective manner to provide an efficient accident prevention system.

III.IOT based devices

1. Gartner, Inc. (a technology research and advisory corporation), there will be nearly 26 billion devices on the Internet of Things by 2020.
2. ABI Research estimates that more than 30 billion devices will be wirelessly connected to the Internet of Things (Internet of Everything) by 2025.
3. Pew research Survey indicates that a large majority of the technology experts and engaged Internet users who responded—83 percent—agreed with the notion that the Internet/Cloud of Things, embedded and wearable computing (and the corresponding dynamic systems) will have widespread and beneficial effects by 2025.

IV. GAPS IN LITERATURE

On comparison of proposed technology for accident prevention and existing similar technologies, the following factors were taken into consideration to enhance the functionality of design of proposed embedded system :

1. Majority of accident prevention technology take response after accident occurrence, causing delay in emergency response and could not be prevented.
2. From the literature review carried out it is found that dependence/load on Satellite services for tracking and locating (GSM and GPS) could be shared by smart grids but cannot be eliminated.
3. Standardized technologies governing IOT are not well defined on very large scale. Prominent standardization bodies, such as the IETF, IPSO Alliance and ETSI, are working on developing protocols, systems, architectures and frameworks to enable the IOT services.

V. AIMS & OBJECTIVES OF PROPOSED PROTOTYPE

This project prototyped is aimed to design & implement uniquely identifiable embedded computing devices within existing internet infrastructure for night vehicle drivers to locate and prevent road accident caused due to drowsiness.

The objectives of proposed model are summarized below :

I. Establish an eye blink & health monitoring sensor system for Drowsiness detection.

II. In case of drowsiness detected

a) Alert the driver via a wake call (vibration /Buzzer)

b) Reduce speed and stabilize vehicle.

III. Mediate the Sensor information and locate accident location using GPRS for help and rescue.

III. Display the activities of designed system on LCD display.

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5.1:PROPOSED SYSTEM:

FEATURES OF PROPOSED SYSTEM

The proposed system includes the following features as shown in Fig. 1.

a. Real-time supervision and analyzes of patient's health condition and early-detection or diagnosis of life threatening events.
b. Mobile application to monitor the patient vitals and gets notifications when these exceed certain limit.
c. Monitoring the eye blink rate during driving.
d. Alerts the driver through voice message or automatic voice message if the driver close his eye more than 5sec.
e. Programming the driversatety by sending configuration data (heartbeat,temperture) through mobile application.

5.2WEARABLE DEVICE(EXISTING SYSTEM)

The Existing system is to guarantee that the patient is managed by the doctor at any conceivable time with the end goal that wellbeing condition is looked after appropriately. A wearable gadget has been developed which are being interfaced with pulse sensor and temperature sensor to Arduino nano so that the information is sent to Smartphone through Bluetooth which is associated with Arduino through Serial communication. The information sent is received by the Smartphone through remote communication(Bluetooth) and is uploaded to cloud through Wi-Fi or GPRS as appeared in Fig 2. For this a versatile application is built with the end goal that the doctor can monitor the condition and can make a move when there is any dangerous trouble situation.

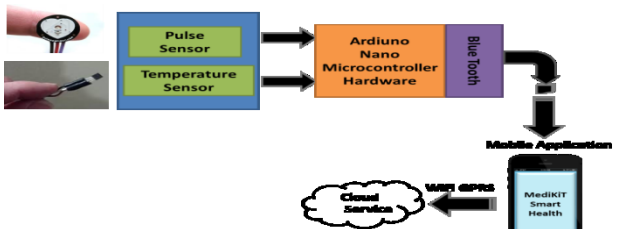


Fig 1: Functional Block Diagram of Wearable device

5.3SMART DRIVER SAFETY(PROPOSED SYSTEM)

The proposed system also includes a driversafety as shown in Fig 3 which ensures that the patient consues medicines as per schedule time table. This MediKit contains Raspberry Pi 3 Model B - Programmed hardware platform, webcam, speaker.

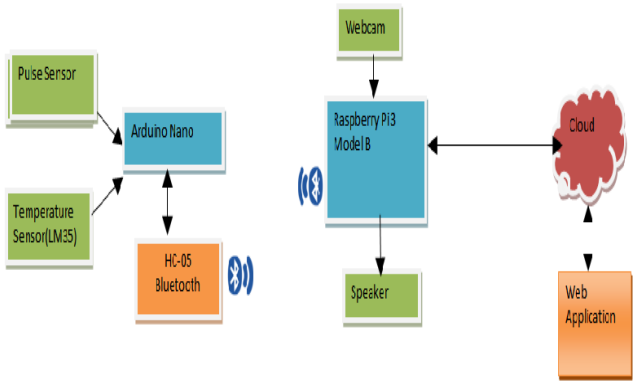


Fig 2: Block diagram of Smart driver safety

5.6 IMPLEMENTATION OF SMART DRIVER SAFETY

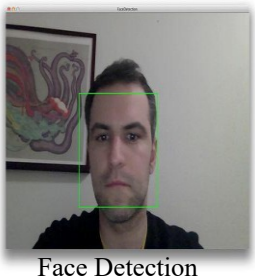
The process of working of above block diagram fig 3 is explained as follows.

This project involves measurement of eye blink ,facial feature tracking and fatigue detection using an Open CV Library. Open CV allows user to select us region of interest (ROI). In this region of interest is eye region. Eyes are detected with a rectangular box. System is also able to detect eyes when wearing spectacles. Open and close eyes are detected by system. Images shown are the rectangular extraction of the eye area from face. Fatigue detection can be achieved by detecting closed eyes.

If driver eyes are off the road or if he is drowsy then alert will be generated. System is robust as two methods are combined to find gaze. If one method is failed to detect properly, other will work. System is also robust under night or low light conditions due to use of IR illuminators and build on raspberry pi to be compact and low cost. Future work can include improving driver monitoring system with help of automatic calibration, determining vehicle states, weather conditions, vehicle speed etc.

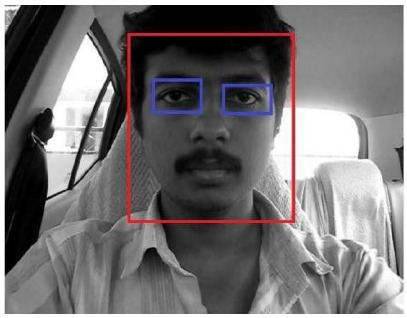
5.7Monitoring Eye movement

By monitoring the eye of a human being, we can determine whether he/she is sleeping or not. One common technique of monitoring eye blink rate is by measuring infrared (IR) light reflected from the surface of the eye. If the eye is closed then the output would be driver is sleeping ,otherwise the output is driver is not sleeping. To know whether the eye is in closing or opening position. The output is provided to a logic circuit for alarm indication and status will displayed on LCD display.



Face Detection

Eye Detection



Drowsiness Detection

VI. PROBLEM STATEMENT

The problem statement includes improving the quality of data acquisition about distraction-related crashes along with better analysis techniques. By analyzing the understanding of the extent and nature of the distraction problem. The main aim is to reduce the driver workload associated with performing tasks using both built-in and portable in-vehicle devices via limiting the visual and manual demand associated with in-vehicle device interface designs. Better device interfaces and integrated wearable computers will help to minimize the amount of time and effort involved in a driver performing a task using the device. Minimizing the workload associated with performing non-driving, or ―secondary,‖ tasks with a device enables the driver to maximize the attention they focus toward the primary task of driving. Keep drivers safe through the introduction of crash avoidance technologies. These include the use of crash warning systems to re-focus the attention of distracted drivers as well as vehicle initiated (i.e., automatic) braking and steering to prevent or mitigate distracted driver crashes. Educate drivers about the risks and consequences of distracted driving are performed by targeted media messages, drafting and publishing sample text messaging laws.

VII.IMPLEMENTATION:SOFTWARE TOOLS

The software tools used for the implementation of the proposed system are

- Arduino IDE
- Android Studio and MIT app inventor for development of mobile applications
- HTML and PHP for development of cloud and web application

VIII. NEED FOR PROJECT PROTOTYPE

The following are the motivating factors that determines the need for the development of the project prototype:

1. To develop a standard specification template to describe distraction detection and mitigation systems
2. With demand for portable electronic products, there is a need to design devices that could be accessed anytime in case of emergency.
3. It is required to enable the emergency services for quick response during road accidents.
4. To initiate advanced connectivity services that goes beyond machine-to-machine communication and covers variety of protocols, domains & application
5. To establish device systems that are Automatic, Intelligent and Response.
6. Provide a safety benefits framework for estimating the overall effect on driving safety
7. Develop alternative distraction detection and

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distraction mitigation design concepts.

XI. APPLICATIONS

1. Solution for Night drivers to wake them from drowsiness caused due to sleeplessness.
2. Prevention of Accident caused due to Substance abuse (Alcohol, Drugs, etc)
3. Solution for rash driving by automatically controlling the vehicle speed
4. Vehicle stability by maintain a better wheel grip through gravity sensors.
5. Tracking and locating the location of accident using GPS and plotting it on Google maps

X.RESULTS

The following conclusions can be made from the following proposed prototype :

1. The subject (night drivers) drowsiness can be effectively measured based on eye blink monitoring system.
2. If drowsiness is detected then automatic responses from designed embedded system is possible such as alarm
and reducing the speed of vehicle.
3. In case of accident occurrence the designed system is equipped with the capability of sending response messages to the host android device by means of an IoT enabled application. The response messages are in form of voice and text notifications.

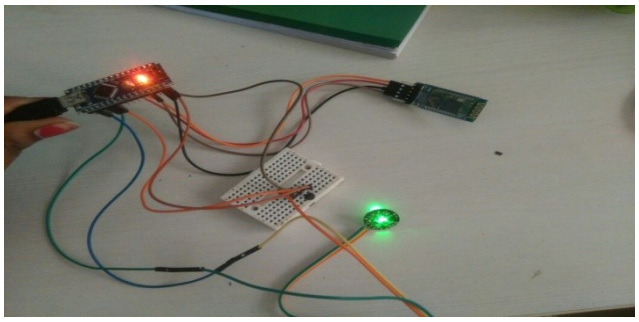


FIG 3:HARDWARE CONNECTION EXISTING MODEL

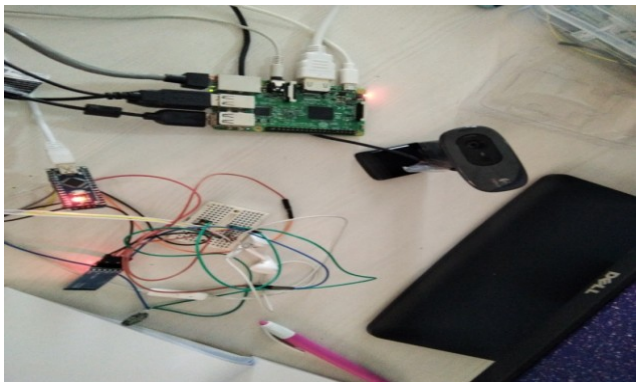


FIG 4:HARDWARE CONNECTION PROPOSED MODEL

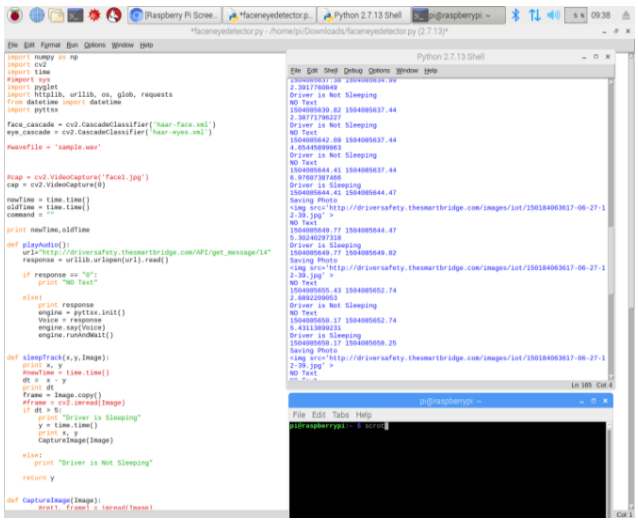
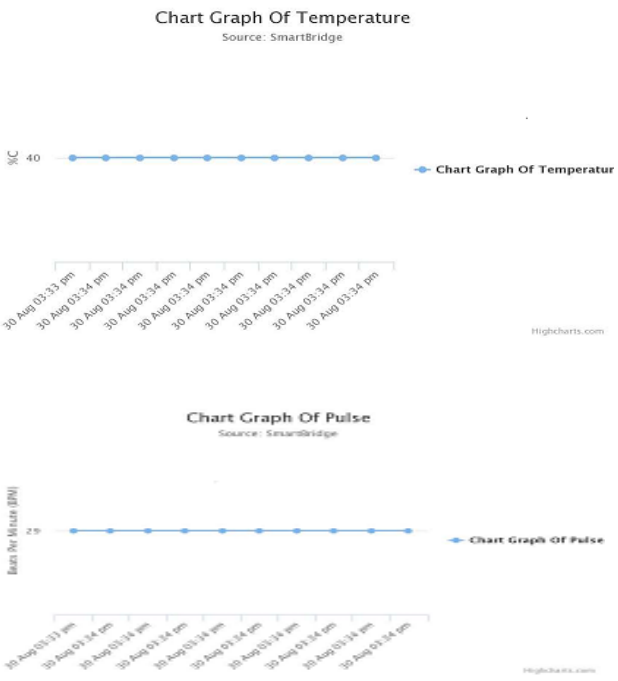


Fig5:Output of Drowsniess Alert Conditions

FIG6:LOGIN PAGE OF MOBILE APP

FIG7:LOCATIONTRACING THROUGH MOBILE APP



XIII. CONCLUSIONS AND FUTURE ENHANCEMENTS

Majority of portable devices are aimed at providing unlimited access to internet services for data storage and synchronization with other remote devices. Hence, there is a need of faster data acquisition and quick decision making of embedded computing system for real time applications for making vehicles safe, automatic, responsive and intelligent. Interfacing of simple sensors to various micro-controller platforms enables the ease of regulating the embedded system at a sophisticated levels of automation and mediating the sensor information over a smart grid enables large amount of data acquisition for taking accurate decisions over the emergency conditions. Further, the development of smart grids fascinates the overall process of communication between human and machine rather than machine to machine communication. Hence, IoT can revolutionize the way embedded systems interact and respond for variety of applications especially in case of vulnerable night drivers by monitoring the state of their drowsiness for a quick, safe and effective response for a safer road travel.

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