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Hermes : The Buddy For Drivers

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ABSTRACT

The recent report of WHO proves that there has been a soaring rise in road traffic injuries every year the lives of approximately 1.35 million people are cut short as a result of a road traffic crash. There were several efforts to develop safety. The goal of our system is to detect driver drowsiness and health monitoring. We use open CV for detecting behavior of the driver. In our proposed system healthcare monitoring unit is constructed as a wearable one where physiological sensors and transmitter are integrated into it. The physiological parameters such as pulse rate, breathing rate, temperature and etc. are measured. The Health care monitoring system will be connected to a gateway which consists of raspberry pi 3B with inbuilt BLE and a GPRS module to communicate with the Drivers Community. A webcam is connected into this gateway. This project provides an eye blink monitoring system that alerts the driver during the state of drowsiness. Separate machine learning along with human assistance is provided to evaluate the driver status. Thereby sending message that will be converted into speech is initiated to wake the driver. Our project aims to provide safety with a confirmation security system. From the conventional model with the help of machine learning data set, the training data from various components are analyzed and output is predicted in the form of a supervised learning procedure. A mobile application is also provided to inform the relatives and authorities about the driver's current status.

Keywords : Bluetooth, Raspberry pi, Machine learning, Open CV, GPRS

I. INTRODUCTION

Road accidents are a major problem that modern era is facing. Even though there is a well-maintained traffic system in our nation, level of accidents is less tending to decrease. Our traffic system emphasizes less neither on safety system nor on accident monitoring system. Accidents can occur due to health issues of the driver, due to drink and drive, drowsiness and reckless driving. The present system fails to take in account of information from pile of scenarios implemented for drowsiness, health care, drunk and drive into single unit, also failing in taking account on rash driving condition. During cases of any emergency as Heart attack or sudden fatigue driver may have to wait for another Pearson for help, this may make condition of driver worse and there has not been much of a development in these areas.

Hermes is a prototype for driver drowsiness alertness and health monitoring system. The system comprises of various modules such as a drowsiness detection system, health monitoring system, alcohol detection system and an accident detection system. Hermes makes use of technologies like IOT and machine learning. The system uses an eye blink sensor and camera that takes picture of the driver, if he closes his eyes more than 3 sec then drowsiness will be confirmed. Heartbeat and temperature is constantly monitored for checking health condition. An alcohol sensor is used to detect whether the driver is intoxicated or not. With the help of sensors information about drowsiness, health condition and

alcohol intake can be obtained and updated to the web page. The web page is maintained by an admin, who update the web page and inform the authorities if any adverse conditions occur.

In addition, Safety with conformation is provided with machine learning and IOT, the training data from various components are analysed and output is predicted in the form of a supervised learning procedure as separate unit.

The existing system only implements sensor based drowsiness detection ,while in our proposed system we take account of both drowsiness detection, alcohol detection and the health status of the driver and it also monitor any accident of the vehicle has happened or not. Providing human assistance for the driver at critical condition along with the current status of the driver with a picture. And an external machine learning analysis is provided for providing the state of the driver and vehicle emphasizing the clarity in accuracy in prospective of data processing and data gathering along with an effective cloud storage platform.

II. PROPOSED SYSTEM

The system provides driver alertness and health monitoring functions. The health care monitoring system measures various physiological conditions of the driver. The drowsiness alertness system comprises of an eye blink monitoring system that alerts the driver during the state of drowsiness. An android application is also used, which help to update the driver status to his loved ones and co-workers. The system has various modules such as, **Accident Detection, Drowsiness Detection, Alcohol Detection, and Health Care.**

Accident Detection: The accident detection is based on the change in the vibrations of the vehicle. For this we use a MPU-6050 sensor. The MPU-6050 sensor contains a MEMS accelerometer and an MEMS gyro in a single chip. The results from this sensor will be very accurate because it contains 16-bits analog to digital conversion hardware for each channel. Therefor it captures the x, y, and z channel at the same time. When no vibration is detected, Vibration sensor output will be 0 (low voltage), otherwise its output is 1(high voltage). When sensor detects rash drive with high vibration the system decide some accident happen. So system gives alert to particular department or guardian.

Drowsiness Detection: Eye Blink sensor is IR based. Here we use the concept that the variation across the eye will vary as per eye blink. The output will be high if the eye is closed otherwise output is low. This helps to know whether the eye is in closed or opening positions. This output is given to a logic circuit and which provides warning.

Alcohol Detection: The alcohol sensor we use is the MQ-3 sensor. This is a sensor that is not only sensitive to alcohol, but mainly ethanol, which is the type of alcohol that is found in wine, beer, and liquor. This sensor circuit can also be used as a breath analyser to check a person's blood alcohol level. Just as we exhale carbon dioxide when we breathe out, the drunken person will also breathe out some alcohol. Any Alco meter device can measure this alcohol content. The more ethanol in his blood, the more there is in the air on exhalation. This alcohol content gives a good indication for if a person is drunk and how drunk they are.

Health Care: The heartbeat sensor is based on the principle of photo phlethysmography. This sensor measures the change in volume of blood through any organ of the body which causes change in the light intensity through that organ. In case of applications where heart pulse rate is to be monitored, the timing of the pulses has atmost importance. The flow of blood volume is decided by rate of heart pulses and considering the fact that the light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses. The basic heartbeat sensor comprises of a light

emitting diode and a detector like a LED or a photodiode. If there any variations in blood flow the heart beat sensor output is 0 (low voltage), otherwise its output is 1(high voltage). It counts every pulse per minute. If the bpm is less or very high then system identifies that driver having some health related issues. Figure 2.1 shows the system design of the proposed system.

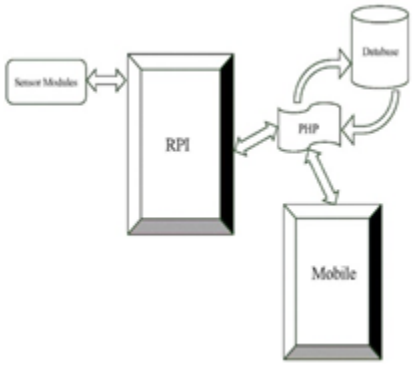

Figure 2.1. System design

All these modules are connected to each other and to the main server using IOT. The information from these sensors are monitored continuously either by an admin ore using supervised learning. Both of these options are implemented in our system. Despite of monitoring the driver status using either one of these, the collected information are updated into a web page for the use of admin and inform to respective authorities if any adverse condition occurs. The system also includes an android application which updates driver status to his relatives and co-workers.

This system could be a huge help to drivers and we can extend it for the use of driver communities which would bring down the accident rates.

III. LITERATURE SURVEY

[1] SAFETY DEVICE FOR DROWSY DRIVING USING IOT

IOT or the Internet of Things refers to the Interconnection of different devices or machines or things through any possible mode. The Internet of Things definition: "Sensors and actuators embedded in physical objects are linked through wired and wireless networks" IOT gives us the capability to control digital devices or things through a user friendly GUI over the internet. This paper presents a safety device for drowsy driving using IOT. In this paper a self-powered IRIS scanner will be fitted into the dashboard in front of driver that will be scanning the driver eyes. So whenever a driver is drowsy or feeling siesta his/her eyes may go shut very frequently and for longer durations the sensor will trigger the action and activate the alarm so the alarm makes the driver conscious. The general structure of this proposed safety device is a block of different processes clubbed into one so as to make it successful operation in the work of computation and in turn make it useful for the human – computer interaction as this is the main aim of the safety enhancement.

From this paper we have taken the concept of human –computer interaction for drowsiness alertness.

[2] DRIVER BEHAVIOR MONITORING THROUGH SENSORS AND TRACKING THE ACCIDENT USING WIRELESS TECHNOLOGY

Monitoring the behaviour of the driver is one of the ways to prevent the fatal accidents and it is necessary to alert the driver when they are drowsy or in a distracted state. In this new proposed system (sensors) there is a possibility of self-controlling the vehicle when the driver was drunk or reckless or fatigue in order to reduce the major accidents. The paper also give an over view about the driver behaviours as (i)normal behaviour which points to driving task by controlling speed of vehicles ii)Drunk behaviour is analysed when the driver is drunk or if there is sudden rise in acceleration (iii)Fatigue behaviour is assumed when there is no alcohol intoxication in blood but exhibits the behaviour of being drunk.(iv)Reckless behaviour is calculated when the driver drives at high acceleration, not maintaining proper line position and makes other traffic participant's at risk.

This paper also gives a possibility of tracking the location of the accident, if occurs, through wireless access technology like GSM or GPS so that proper measures are taken at a correct time. The GPS tracker will track the accident location from at least three orbiting GPS satellites. Then the related information is send to a server (computer), and it will display it on a web-based portal which is in-line with mapping software. The information system of accident will get activated and the message will transmit immediately to the respective authority whenever an accident occurs. This process is done by GSM.

From this paper we have taken the concept of classifying the driver behaviour and tracking accident location using GPS. The concept of web page to display driver status is also taken from this paper.

[3]ACCIDENT PREVENTION SYSTEM USING EYE BLINK SENSOR

This paper presents the design and implementation of the accident alarm system based with wireless network communications like ARM, GPS and GSM. This paper presents a system consists of wireless communication for communication with the accident sense system and the Pre-set of treatment centre. Individual vehicle is equipped with an accident sense system, which consists of GSM and GPS. When the accident occurred, Vehicles state and locations will be transmitted to the Pre-set of treatment centre though wireless communication technologies of GSM through short message format.

This paper also implements an alcohol sensor is suitable for detecting alcohol concentration on your breath. It has a fast and high sensitivity response time. It provide alarm, when detect alcohol engine will be stop and message with location sent to owner. Obstacle Detecting Sensor is used to detect objects and obstacles in front of sensor in a narrow angle useful in robotics applications. The system also uses an Eye Blink sensor for drowsiness detection. The output will be high if the eye is closed otherwise output is low. This helps to know the eye closing and opening positions. If the driver close his eyes more than 3 seconds it provide alarm, engine will be stop and message with location sent to owner.

From this paper we have taken the concept of using different sensors for drowsiness detection and health monitoring.

IV. HARDWARE IMPLEMENTATION

The various hardware component used in our system are Raspberry Pi 3 Model B, Heartbeat Sensor, Alcohol Sensor, Camera, Temperature Sensor, MEMS Sensor, Eye blink Sensor and Global Positioning System.

The proposed system uses a **Raspberry Pi 3 Model B** which is the third generation Raspberry Pi .The Raspberry Pi 3 Model B is a more powerful processor, than the first-generation Raspberry Pi. Raspberry Pi works in an open source platform. It has **1GB RAM**, **64 Bit CPU**, 4 x USB ports, 4 pole Stereo output and Composite video port, 10/100 Base Ethernet socket, CSI camera port for connecting the Raspberry Pi camera which we used for drowsiness detection, DSI display port for connecting the Raspberry Pi touch screen display, Micro SD port for loading your operating system and storing data. Micro USB power source helps in running the Raspberry Pi. The camera is connected to raspberry pi using the USB ports available on this board. Three GPIO pins are used , one for capturing an image, another for control and finally for shutting down the system respectively. The board is operated in such a way that the installed code starts executing when it is powered ON.

The heartbeat sensor is based on the principle of photo phlethysmography. This sensor measures the change in volume of blood through any organ of the body which causes change in the light intensity through that organ. In case of applications where heart pulse rate is to be monitored, the timing of the

pulses has atmost importance. The flow of blood volume is decided by rate of heart pulses and considering the fact that the light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses. The basic heartbeat sensor comprises of a light emitting diode and a detector like a LED or a photodiode. If there any variations in blood flow the heart beat sensor output is 0 (low voltage), otherwise its output is 1(high voltage). It counts every pulse per minute.

The MQ-135 Gas sensors are used in air quality control equipment's and is suitable for detecting or measuring of NH3, NOx, Alcohol, Benzene, Smoke, and CO2.In our system we use this sensor to detect whether the driver is drunk or not. The MQ-135 sensor module comes with a Digital Pin which makes this sensor to operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas. The sensor can be activated 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 breath analysis. Its Operating voltage range is 2.5V to 5.0V.

Camera is used to capture the image of the driver and it is also used to monitor the facial behavioral of the driver. Here we use a Logitech C270 HD Webcam with Focal length: 1.12mm, F value 2.2.

The LM35 series are precision IC temperature devices with an output voltage which is linearly-proportional to the Centigrade temperature. It also helps to monitor driver's health condition The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output in order to obtain convenient Centigrade scaling. It has low self-heating of less than 0.1°C in still air. The LM35 device is rated to operate over a temperature range of –55°C to 150°C. And it is Operates from 4 V to 30 V range.

MEMS Systems combines mechanical and electrical components. MEMS inertial sensors that include an acceleration sensor and an angular velocity sensor called gyroscope (simply "gyro") are the most popular devices.

Eye Blink sensor is IR based. Here we use the concept that the variation across the eye will vary as per eye blink. The output will be high if the eye is closed otherwise output is low. Eye blink sensor is used to predict whether the eye is in closed or in open position. The resultant output is given to a logic circuit to indicate the alarm. It is mainly used to prevent the accidents.

A liquid crystal display (LCD) is a flat, thin display device which is made up of number of monochrome or color pixels which are arrayed in front of reflector or a light source .The features of LCD are Energy efficient, cost effective, Space economy, reduction of radiation and lighter weight.

The Global Positioning System (GPS) is a navigation system it is used for detecting current position of the system. It sends and receives radio signals. One advantage of using GPS technology is that, one can determine the exact location, time, velocity, 24 hours a day, in any weather conditions & anywhere in the world. GPS receivers can be used for locating; positioning, surveying, navigating and determining the time. GPS are employed by both private individuals and companies.

Figure (4.1) shows various components connected to the Raspberry Pi.

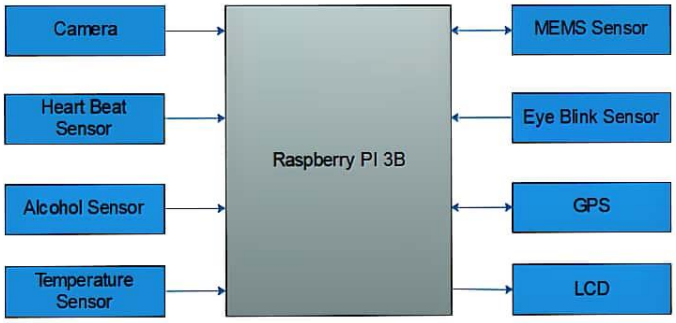

Figure 4.1. Block diagram

The figure 4.1 represents the block diagram of our proposed system. Here MEMS, Eye Blink, Alcohol

sensors, Temperature sensors, Heart beat sensor, GPS and camera module incorporated with in a microcontroller raspberry pi. The system operates by analyzing sensor signals the pi initiates camera if any abnormal condition is exhibited by the driver. Alert messages are passed and displayed on then LCD monitor.

V. SOFTWARE IMPLEMENTATION

Several softwares are used for the development of our prototype.

Raspbian OS: Raspberry pi works with Raspbian OS which is derived from the original Debian operating system. Raspbian is a Debian-based computer operating system used by Raspberry Pi. There are several versions of Raspbian are available including Raspbian Stretch and Raspbian Jessie. It has been officially provided by the Raspberry Pi Foundation as the primary operating system for the family of Raspberry Pi single-board computers since 2015. Raspbian was created as an independent project by Mike Thompson and Peter Green. The operating system is still under active development. Raspbian is designed in such a way that it is highly optimized for the Raspberry Pi line's low-performance ARM CPUs.

OpenCV-Python is a library designed to deal with computer vision problems. It is an open source cross-platform computer vision library which began as a research project at Intel in 1999 by Gary Bradsky, and the first release came out in 2000. It can be programmed using different programming languages like C, C++, Python, Java, etc. Using these we could create image processing functions and high-level algorithms. With the development of computer vision technology, Open CV has a number of algorithms for image processing. Open CV is a good image processing tool. We use open CV for image processing for face recognition.

Visual Studio Code (VS Code) is one of the sours code editor developed by Microsoft for Windows, Linux, and macOS. In addition to work as a code editor it includes support for debugging, embedded Git control, syntax highlighting, intelligent code completion, snippets, and code refactoring. It is also customizable, so that the users can change the editor's theme, keyboard shortcuts, and preferences. The source code is open source and released under the permissive MIT License. The compiled binary data are freeware and free for private or commercial use. We use visual studio code Editor for the development of Graphical User Interface (GUI) required for machine learning and several important developments of the proposed system using the python-PyQt5.

Spyder is used in Raspberry Pi for scientific programming in python. It is a powerful IDE used run programs written in Python. It contains many built-in popular scientific packages such as NumPy, SciPy, Pandas, IPython, QtConsole, Matplotlib, SymPy, etc. It has numerous built-in features and its functions could be extended further via first- and third-party plugins. In our system it is used as a PyQt5 extension library for the advanced editing processes.

Android Studio is the integrated development environment (IDE) for Google's Android operating system. It is built on JetBrains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on different OS such as Windows, macOS and Linux based operating systems. It can be used as a replacement for the Eclipse Android Development Tools (ADT) as the primary IDE for native Android application development. We use Android studio for developing an application for the driver relatives to know status of the ride/ physical state of the driver.

PyQt5 is a combination of Python bindings for Qt v5. It comprises of more than 35 extension modules and allows Python to be used as an alternative application development language on iOS and Android.

The given flow chart (fig 5.1) refers to the flow of execution of the proposed system. The explanation for this flowchart is as follows.

The figure 5.1 shows the working of the system. Firstly, initialize GPIO, serial, sysBus, Spi, and camera in the Raspberry pi. Then attach an interrupt for getting the pulse rate of the driver. The microcontroller is programmed to receive an interrupt for every pulse detected and it can also count the number of interrupts or pulses in a minute. The count value of pulses per minute will be the Heart rate in bpm (beats per Minute). Then check the gyroscope values, According to the previous values of coordinates(x,y,z) the system automatically detect the present condition of the vehicle. If the accident occurs by vibration of rotating machinery of the vehicle, immediately the exact location of the accident is identified by an authority person through Global positioning system (GPS) and message is sent via Global system for mobile Communications (GSM).Eye blink sensor continually monitoring drivers eye movements, if the driver close his/her eyes more than 3 seconds camera module capture the image and send it to the control room. Similarly heartbeat, Alcohol and temperature sensors continuously monitors the driver, if any kind of irregularities occurs the machine learning based control system alert the driver. An extraction process is performed to extract meaningful features from the received data; these features then serve as input models to an inference network to analyze the driver's vigilance level. The network predicts the driver's alertness state through a series of computations, and displays the computed results on the LCD screen. An alert system is triggered if the statistical results indicate that the driver's alertness is predicted to be low.

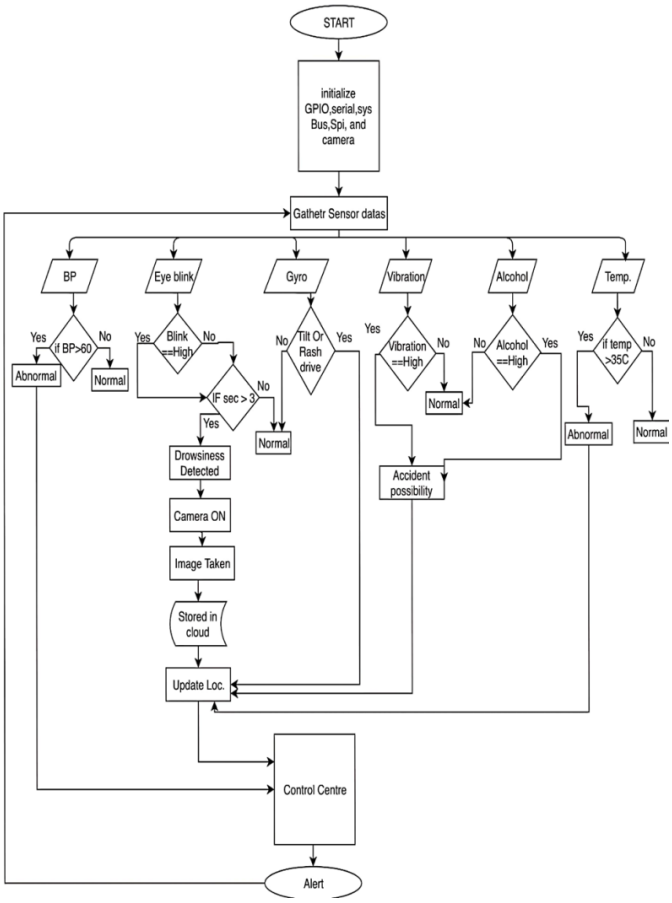

Figure 5.1. Flow chart

VI. OUTPUT

Hermes provides an embedded system that records aspects like accident detection, drowsiness detection, alcohol detection along with health care details of the driver, together with cloud services, android application and a php admin page; the system contains a separate machine learning analysis system. The embedded system is placed near to dash board near to the drive, containing camera, heartbeat, alcohol, temperature, MEMS, eye blink sensors, GPS and LCD Screen. The information from the embedded device is passed to an IOT cloud and viewed on an android application for external user, who wants to know about the whereabouts of the driver including details of normal conditions of vehicle and driver along with abnormal conditions if any. There is also an admin who monitors the state of driver and vehicle in a php domain containing all information's as that of android

app. The admin have special privileges of monitoring the profile of the driver, informing security numbers on abnormal conditions. An extra machine learning module is present which also take information from the cloud and predict whether the vehicle and driver states are in normal or abnormal mode. The result report module of project if found in drowsiness state help driver to stay alert and inform authority if any accidents occurs. It gives the current location of the driver along with his photo both in android app for viewers; also for admin in php domain. The system as a whole provides a best way to reduce accidents through drowsiness and alcohol detection and health monitoring.

VII. FUTURE ENHANCEMENT

In future, we can use for emergency speed control of vehicles, for rash driving by obstructing spark plug. In case of any violation of traffic rules, corresponding punishments can be given to the drivers when any connections are implemented to the traffic police system. It can be used for monitoring system for online taxi services like OLA, Uber etc. Voice based real time advice can be given for drivers by their loved ones when they are over drunken or rash driven.

VIII. CONCLUSION

Drowsiness and drunken driver are the leading cause of road accidents. In this paper, our proposed system helps to reduce the number of accidents due to the above mentioned causes. It also helps to monitor the health conditions of the driver. Interfacing simple sensors to various microcontroller platforms enables the ease of regulating the embedded system at a sophisticated level of automation and mediating the sensor information over a smart grid. This development fascinates the overall process of communication between human and machine rather than machine to machine communication.

IOT can revolutionize the way embedded systems interact and respond for variety of applications especially in case of vulnerable night drivers by monitoring them. It also enables large amount of data acquisition for taking accurate decisions over the emergency conditions. With the use of supervised learning process such as machine learning the output can be securely confirmed.

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