An IOT Based Accident Prevention And Health Monitoring System For Vehicle Drivers

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Abstract—The main objective of this project is to develop vehicle safety and security system to reduce the number of accidents caused due to alcohol consumption of the drivers, drowsiness state of the drivers and severe health problem of the driver like heart attacks. This project is developed by integrating the alcohol sensor, eye blink sensor and pulse/heart rate sensor with the microcontroller. The alcohol sensor used in this project is MQ-3 which detects the presence of alcohol content in human breath. An ignition system with spark plugs is build up as a prototype to act like the ignition starter over the vehicle's engine. The ignition system will operate based on the level of Blood Alcohol Content (BAC) in human breath detected by the alcohol sensor. Eye blink sensor involves measure of eye blink using IR sensor. Eye Blink Monitoring System(EBM) that alerts the subject during state of drowsiness. The physiological sleep state analysis of subject can be determined by monitoring subjects eye-blink rate using an IR sensor. A normal eye blink rate has no effect on the output of the system. However, if subject is in extreme state of sleep-cycle, then IR sensor receives abnormal eye blinking rate & an alarm is initiated to wake the subject. A pulse/heart rate sensor consists of a simple device that can receive a signal in the form of a pulse rate and calculate the heart beat signal in beats per minute. If the detected pulse level is greater or less than the normal pulse rate then vehicle automatically stops and a warning sent through GSM/GPRS. An Internet of Things (IOT) enabled sensors are used to transmit the entire data collected by sensors over a smart grid network for quick response team to take actions under emergency conditions.

keywords—Internet Of Things; Accident Avoidance; alcohol monitoring; pulse rate monitoring; heart beat monitoring; URL-universal resource locator

I.INTRODUCTION

The 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, 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.

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 IR sensor. If he/she falls asleep, then an alarm will ring to wake him/her up. Alcohol detection method to detect the alcohol concentration in human breath using MQ3 gas sensor and pulse/heart rate monitoring system to detect the heart rate of the vehicle driver using pulse/heart rate sensor and alerts the driver when the pulse rate is found to be abnormal by giving a warning.

II. PROBLEM DEFINITION

In this project we are implementing EBM (Eye Blink Monitoring Technique) to detect drowsiness of vehicle drivers and alcohol detection method to detect the alcohol concentration in human breath just like common breathalyzer and pulse rate monitoring system to detect the heart/pulse rate of the driver thus preventing accidents. 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. The following key points were considered while estimating the feasibility and wide expansion of 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 202.

III. METHODOLOGY

Methodology is the systematic, theoretical analysis of the methods applied to a field of study, or the theoretical analysis of the body of methods and principles associated with branch of knowledge. It typically, encompasses

concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques.

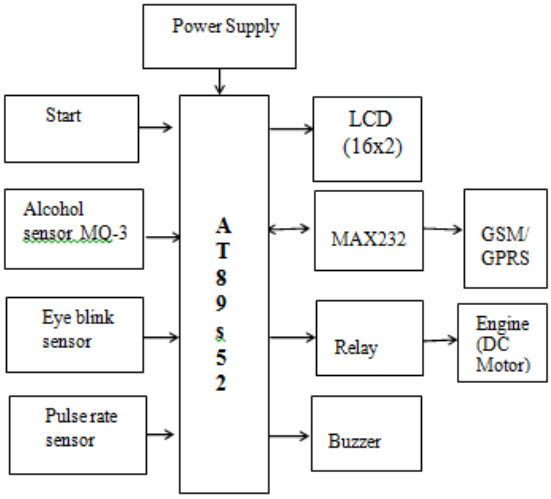

Fig1:block diagram of the system

The Block diagram of proposed prototype consists of the following Components:

1. LCD Display (16x2)

2. Alcohol sensor (MQ3)
3. Eye blink sensor (IR sensor)
4. Pulse/heart rate sensor
5. LM358 Comparator

6. Max232

7. Relay and Engine(DC motor)
8. buzzer

9. GSM & GPRS Module (Mobile phone)
10. Power Supply (12V 2Amp. DC+ SMPS)

The above components are integrated as per the block diagram given in Fig 1. The designed embedded system is interfaced with another mobile phone having an android platform through an IOT application. Such an application is designed on an android platform and it provides notification to the host about the status of embedded system in case of drowsiness and accident occurrence via alarms, text messages and voice notifications.

IV. COMPONENTS SELECTION

(a)Alcohol Sensor (MQ3):

The alcohol sensor used in this project is MQ3 sensor which detects ethanol in the air. It is one of the straightforward gas sensors so it works almost the same way with other gas sensors. It is used as part of the breathalyzers or breath testers for the detection of alcohol concentration in person's breath. This sensor is mainly used to know whether the driver consumed alcohol or not. If the alcohol concentration is above the threshold level then vehicle automatically stops and warning sent through GPS/GPRS to owner mobile.

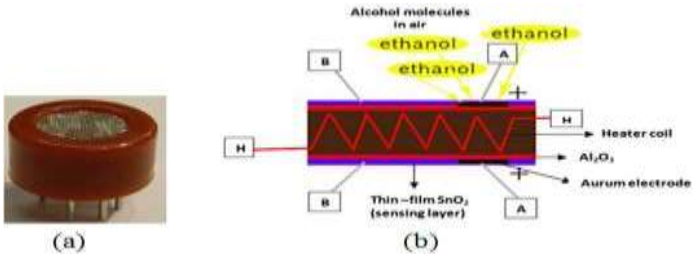

Fig 1: Semiconductor alcohol gas sensor (a) MQ3 device look-out (b) Cross-sectional view of thin –film MQ3 sensor design

(b)Eye Blink Sensor (EBS):

This project involves measurement of eye blink using IR sensor. The IR transmitter is used to transmit the infrared rays in our eye. The IR receiver is used to receive the reflected infrared rays of eye. If the eye is closed then the output of IR receiver would be high, otherwise the IR receiver output is low. 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. 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. The eye is illuminated by an IR LED, which is powered by the +5V power supply.

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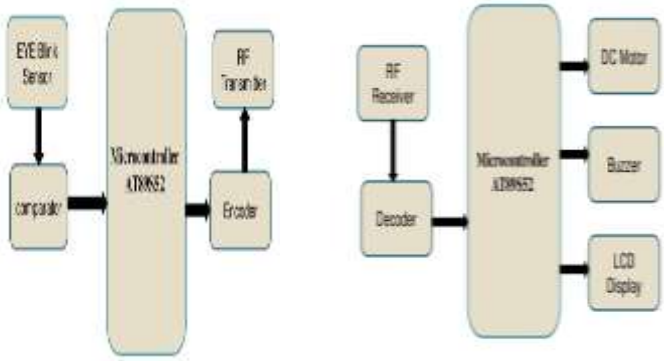


Fig 2: block diagram of EBS (a) EBS transmitter section (b)EBS receiver section

(c)Pulse/heart rate Sensor:

A Heart rate sensor consists of a sample device that can receive a signal in the form of a pulse rate and calculate the heartbeat signal in beats per minute. A normal human heartbeat is about 70 beats per minute for adult males and 75 beats for adult females. Many conditions affect heart rate. A normal heartbeat condition is called bradycardia and an abnormal heartbeat condition is called tachycardia. Heart rate sensor method is also used to measure the pulse rate. A system is set up to measure normal and abnormal pulse rates. If the detected pulse level is found to be abnormal, an amplified signal is fed to the controller. After receiving the signal, the controller checks the strength. An abnormal pulse rate usually means a high pulse rate. When this is found to be the case, the vehicle slows down and comes to a halt.

- If ignition is on the pulse rate is calculated every 20 seconds. Normal pulse rate is 72 beats per minute. If the calculated value is higher or lower than this value, the condition is abnormal. In this case, the vehicle automatically stops and a warning is sent through GSM/GPRS.
- If pulse rate is normal, the driver can drive without any restrictions.
- By adopting these avoidance measures, accidents can be reduced, especially when the pulse rate of the driver is found to be abnormal, this detection method can send this information to a nearby hospital or family and prevent death.

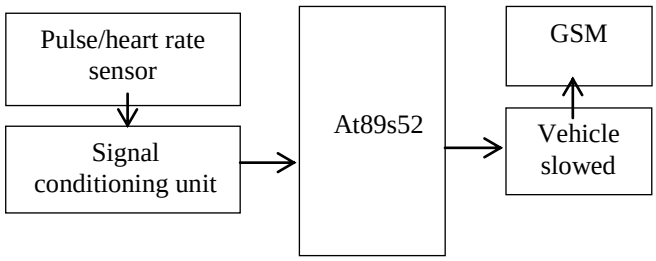


Fig 3: Pulse Rate Detection Method

(d)Microcontroller (AT89s52):

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

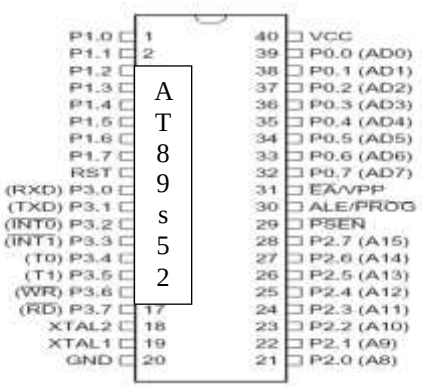


Fig 4: pin diagram of 8051 microcontroller

(e) GSM/GPRS Module:

General Packet Radio System is also known as GPRS is a third-generation step toward internet access. GPRS is also known as GSM-IP that is a Global-System Mobile Communications Internet Protocol as it keeps the users of this system online, allows to make voice calls, and access internet on-the-go. Even Time-Division Multiple Access (TDMA) users benefit from this system as it provides packet radio access. GPRS also permits the network operators to execute an Internet Protocol (IP) based core architecture for integrated voice and data applications that will continue to be used and expanded for 3G services. GPRS supersedes the wired connections, as this system has simplified access to the packet data networks like the internet. The packet radio principle is employed by GPRS to transport user data packets in a structure way between GSM mobile stations and external packet data networks. These packets can be directly routed to the packet switched networks from the GPRS mobile stations. In the current versions of GPRS, networks based on the Internet Protocol (IP) like the global internet or private/corporate intranets and X.25 networks are supported

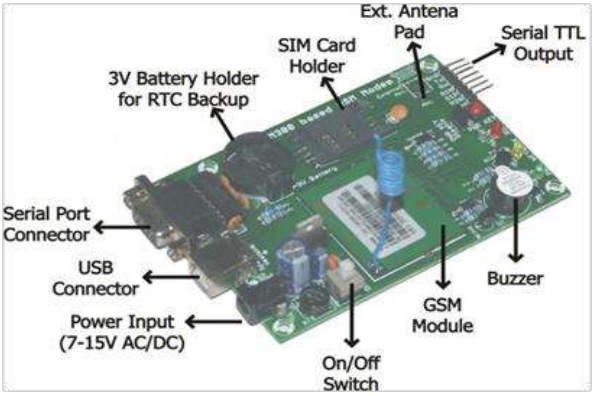
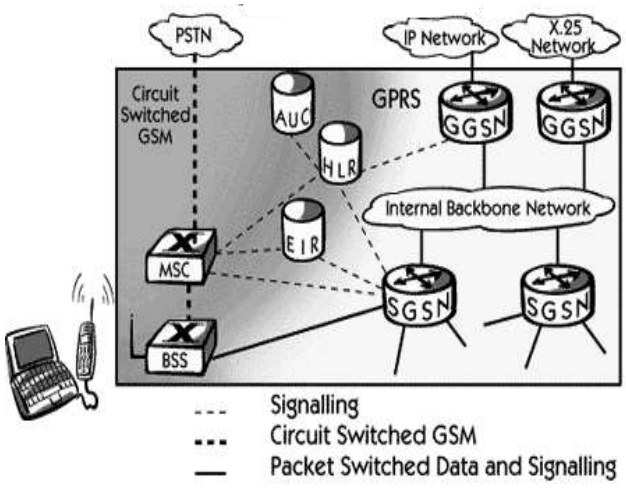


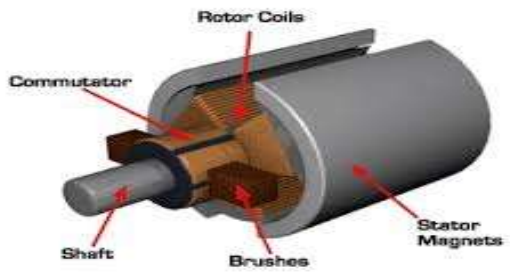
Fig 5: GSM/GPRS Module



(f) DC motor:

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic , to periodically change the direction of current flow in part of the motor.

DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances.



V.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.

4. The GSM module involved in the designed system is used to effectively track the location of the vehicle. The location of vehicle and nearby emergency service facilities are effectively displayed on the portable android devices of host device and embedded device through Google Maps.

Fig (a) depicts the IR sensors are connected to designed hardware for drowsiness detection and indicates the two sensor inputs into the designed embedded system. The drowsiness of driver is detected based on the threshold values on IR sensor and the corresponding results are shown on LCD screen mounted on the hardware. At the same time the required response in terms of physical alarm (vibration) and text messages are sent over IoT android application to intimidate driver and host emergency response in respective case of initial drowsiness and accident occurrence.

Fig (a) : IR sensor Fig(b): LCD display

Fig(b) indicates the LCD messages displayed during response of drowsiness detection conditions. LCD screen Shows ―Sleeping‖ message and initiates the physical alarm.

VI.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.

The following future enhancement can be made into proposed system by devising software algorithms, hardware implantations and interfacing sensors:

1. Solution for drink and drive cases.
2. Solutions for emergency speed control of vehicles.
3. Solution for rash driving by obstructing Spark-plug.
4. Solution for wheel grip using gravity sensor.
5. Voice based real time advice for drivers by their loved ones when they are over-drunk Or Rash-driving.
6. Solution For Preventing Accidents.
7. Solution For Detecting Accidents Using Impact Sensors.
8. Global Photos Transfer Using GPRS In Arm 11 Device And Mailing It To Required People.

REFERENCES

[1] EFFECTIVE CONTROL OF ACCIDENTS USING ROUTING AND TRACKINGSYSTEM WITH INTEGRATED NETWORK OF SENSORS (2013)Authors: R. MANOJ KUMAR, DR.R. SENTHIL DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION, PANIMALAR ENGINEERING COLLEGE, ANNA UNIVERSITY , International Journal of Advancements in Research & Technology, Volume 2, Issue4, April-2013 69ISSN 2278-7763

[2] The Research on Fatigue Driving Detection Algorithm(2013) Authors: Zhui Lin, Lide Wang, Jieqiong Zhou, Tao Wang, School of Electrical Engineering, Beijing Jiaotong University, Beijing, China

[3] Distraction Detection and Mitigation Through Driver Feedback (2013 A REAL TIME SYSTEM FOR DETECTING DROWSINESS OF DRIVER (2013) Authors: Puja Authors: John D. Lee, Jane Moeckli, Timothy L. Brown, Shannon C. Roberts, Chris Schwarz, Lora Yekhshatyan, Eric Nadler, Yulan Liang, Trent Victor, Dawn Marshall, Claire Davis, DOT HS 811 547A

[4] Malvadkar, Bhavana Pansar e& Sachin Pansar International Journal of Management, InformationTechnology and Engineering (BEST: IJMITE) Vol. 1, Issue 1, Oct 2013

[5] Detecting Driver Drowsiness Based on Sensors (2012) Authors: ArunSahayadhas *, Kenneth Sundaraj and MurugappanMurugappan AI-Rehab Research Group, Universiti Malaysia Perlis (UniMAP), KampusPauh Putra, 02600 Arau, Perlis, Malaysia Sensors 2012, 12, 16937-16953; doi:10.3390/s121216937

[6] Sleepy driving in truck drivers: Insights from a self-report survey (2011) Authors: Raymond Misa, Russell Conduit and Grahame Coleman, HFESA 47th Annual Conference 2011. Ergonomics Austral

[7] Controlled Inducement and measurement of drowsiness in a driving simulator. (2010) Authors: Helios De Rosario,a* José S. Solaz,a Noelia Rodríguez,b Luis M. Bergasac doi:10.1049/iet-its.2009.0110)

[8] Real-time Nonintrusive Detection of Driver Drowsiness (2009) Author: Xun Yu, Department of Mechanical and Industrial Engineering University of Minnesota Duluth

[9] Asleep at wheels : Report of special commission on drowsy driving (2009) Authors: Senator Richard T. Moore, Senate ChairJoint Committee on Health Care Financing Rachel Kaprielian, RegistrarMassachusetts Registry of Motor Vehicles, Massachusetts.

[10] Automatic recognition of vigilance state by using a wavelet-based artificial neural network (2005) Authors:AbdulhamitSubasi, M. Kemal Kiymik, Mehmet Akin & Osman Erogul Springer-Verlag London Limited 2005Neural Comput&Applic (2005) 14: 45–55DOI 10.1007/s00521-004-0441-0

[11] EEG-Based Drowsiness Estimation for Safety Driving Using Independent Component Analysis (2005) Authors: Chin-Teng Lin, Fellow, IEEE, Ruei-Cheng Wu, Sheng-Fu Liang, Wen-Hung Chao, Yu-Jie Chen, and Tzyy-Ping Jung, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS—I: REGULAR PAPERS, VOL. 52, NO. 12, DECEMBER 2005

[12] Driver Attention Detection System (DADs) (2002)Author : Mathew Parks U.S. DEPARTMENT OF TRANSPORTATION SMALL BUSINESS INNOVATION RESEARCH PROGRAM SOLICITATION NO. DTRS57-02-R-SBIR

[13] EEG-Based Drowsiness Estimation for Safety Driving Using Independent Component Analysis ; IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS—I: REGULAR PAPERS, VOL. 52, NO. 12, DECEMBER 2005

[14] EFFECTIVE CONTROL OF ACCIDENTS USING ROUTING AND TRACKING SYSTEM WITH INTEGRATED NETWORK OF SENSORS International Journal of Advancements in Research & Technology, Volume 2, Issue4, April-2013 69 , ISSN 2278-7763

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