MANTECH Publications
Recent Trends in Computer Science and Software Technology
Volume 2, Issue 1, January-April 2017

IOT based Smart and Safe Driving Application

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Abstract

Internet of Things (IoT) constitutes an environment where in things interact with each other intellectually to provide useful and meaningful services. The services provided by the IoT systems can be used in wide variety of applications related to health care, transportation, resource management, entertainment, e- shopping, security, etc. Recent advances in IoT is paving the way to the Intelligent transportation wherein the vehicles embedded with the set of sensors can absorb information from the environment (and from the vehicle) and feeding it to drivers and infrastructure to assist in safe driving. This paper presents a report on the prototype design of Smart and Safe Driving Application (SSDA).The proposed Application is designed to avoid fatal road accidents by providing context aware alert information related to fuel status, overall condition of the vehicle, objects surrounding the vehicle, traffic rules and drowsiness state of the driver. Majority of the road accidents occurs due to various reasons like drowsiness state of the vehicle driver, position of the vehicle in the traffic, unaware about the speed and condition of the other vehicles nearby, violation of traffic rules, abnormal condition of vehicle parts , abnormal driving of other surrounding vehicles , etc. .In this paper the authors have presented a system of IoT which captures the data from the environment and inside the vehicle using embedded sensors, wireless sensor network and internet to provide the contextual information for the driver to take timely actions for smooth and safety driving.

Keywords: *Internet Of Things (IOT), RFID, Eye Blink Monitoring System (EBM) , M2M- machine to machine communication, IPv6, URL- universal resource locator, URN- universal resource name, sensors, drowsiness, accident prevention system.*

INTRODUCTION

The problem of vehicle accident is part of an endless list of disasters that could occur anywhere anytime [9]. According to the Association for Safe International Road Travel, about 1.24 million die and 50 million are injured on the roads in the entire world every year. Statistically, they are considered the second leading cause of death [10-12]. To overcome such problems, many vehicle manufacturers and automobile device companies have attempted to develop speed control systems to maintain a vehicle safe distance. In this direction the attempt is made on designing anefficient safety driving app for automobiles using IoT. The proposed research work presented in this paper aims in designing and development of app for the given automobile say car.

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 paper we are presenting an IoT based system which will help drivers to drive the car safely and efficiently. This system consists of tracking and locating the location of accident using GPS and

communicates the co-ordinates via SMS using onboard GSM module, smoke detection using a gas sensor, obstacle detection in front and rear of car using ultrasonic sensor and simulation of physically unavailable sensors using logical functions.

[2] LITERATURE SURVEY

The related work is summarized as follows:

The authors in [1] have designed a prototype of autonomous intelligent car using Raspberry Pi, HD camera, Ultrasonic sensor along with the algorithms like lane detection and obstacle detection algorithms. The proposed design of the car was capable of reaching the given destination safely.

The effective predictive vehicle collision avoidance method was proposed by Sumit Garethiyal, etal [2]. The proposed collision avoidance system of a vehicle detected the obstacle present in front and blind spot of the vehicle. The driver is made alert via a buzzer and a LED indication as the distance between vehicle and obstacle reduces. In the system the ultrasonic sensor detected the state of the object whether it is in motion or static with respect to the vehicle. This system was used for detecting objects like motorcycle, bicycle and pedestrians that pass by the lateral side of vehicle.

V Sagar, etal [3] have designed and developed a system for detection and preventing the accident by alerting the driver about drowsiness and accidental events. The system also sends the message to authorized person so that they can take necessary actions to save the lives and reduces the damages.

Alcohol detection technique was embedded in the system proposed by M.H Mohamad , etal [4]. The system was developed using PIC 16F876A as the main controller, alcohol sensor as the input and three output such as ignition system, LCD display and alarm system. The system is capable to alert the driver about the level of drunkenness. The system also produce an alarm from buzzer to make the driver aware their own condition and to vigilant other people in surrounding area. In addition the system deactivates the ignition system as soon as the level of drunkenness is above the threshold level.

Narayan PandharinathPawar, and MinaksheeM.Patil, “Driver Assistance System based on Raspberry Pi” – (2014)

.Purpose of this paper is to provide the complete driver assistance about each & every movement of the car in particular direction. System based on the ARM Samsung platform so the operating frequency of this board is very high it fulfill the requirement of the system. The System is implement for to provide the complete driver assistance when driver driving the car on the road to avoid the damage of the car.

P.Raji, S.Ashok, "Development of GSM and GPS based Cost Effective Telematics Module" – (2015). The development of a vehicle tracking system's hardware prototype has been presented in this paper. The system is able to obtain a vehicle's GPS coordinate and transmit it using the GSM modem to the user's phone when the user sends an SMS to the GSM module which is present in the vehicle. If the message is not from the pre-defined number then the system will tell the user to send the password to confirm that the user is sending the message, if the password matches with predefined one, then the system will send the GPS coordinate to the number from which message has been received. And also the system was able to identify the accident by means of a range of vibration. It sends an accident SMS with GPS coordinates to the owner's number as well as to another number which was pre-defined already if the vibration crosses the range of accident.

[3] MODELING AND DESIGN OF THE PROPOSED SYSTEM

The proposed system is designed to be able to mount and install in an automobile like Car. The main processing unit of the system is Raspberry pi board which handles all data accumulation; process the sensor data and taking actions based the data. The proposed system consists of array of sensors like, ultrasonic sensors at the front and the rear, an MQ-3 alcohol sensor for alcohol consumption detection, a smoke sensor to detect fire or engine part malfunction and a triple axes accelerometer is mounted on the system to detect collisions and car positional stability. In addition the system comprises of GSM (Global System for Mobile communication) and GPS (Global Positioning System) for emergency assistance. During the event of any emergency situation, the positional data which is obtained from GPS module is communicated to a pre-registered phone number via SMS using GSM module.

The general architecture of the proposed system is as illustrated in Fig1. As

illustrated in the architecture all the sensors and modules are connected directly to Raspberry pi board to its GPIO (General Purpose Input Output) pins, and a centralized program monitors sensors and issues actions based on their status.

The description of different components of the system architecture is as illustrated below:

User Interface: The user interface is developed using Python on Windows IDE 3.0. The snapshot of User Interface is as illustrated in Fig2. The set of buttons are used to activate and receive data from the logical or physical sensors.When a button is pressed a pop-up window appears with text box for data reception, and after the data is entered /extracted the status of the particular sensor is displayed in an engine status window.

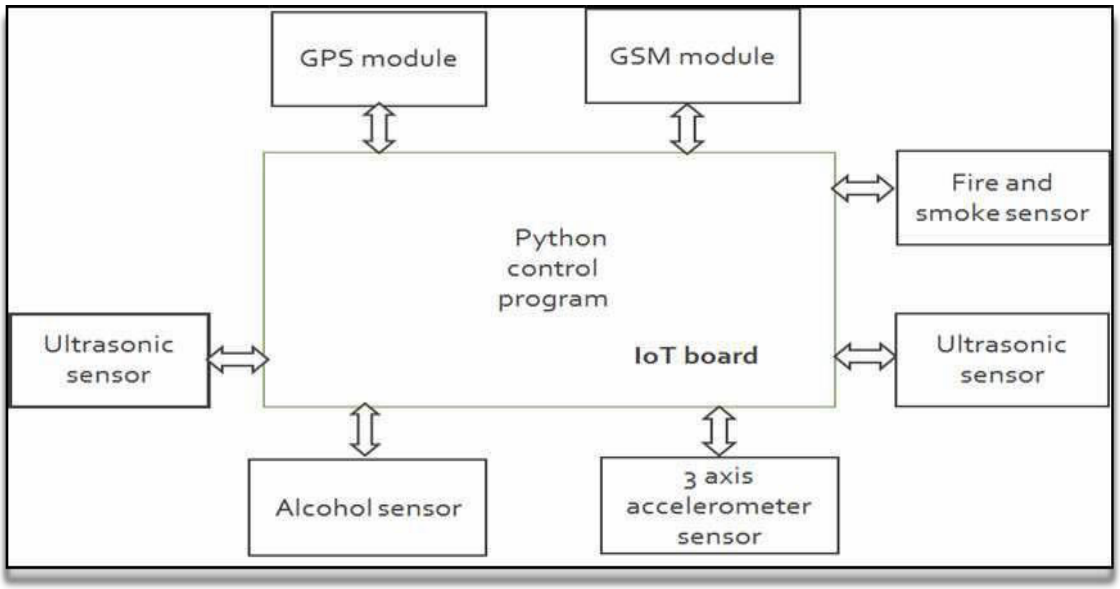

Fig 1: General Architecture

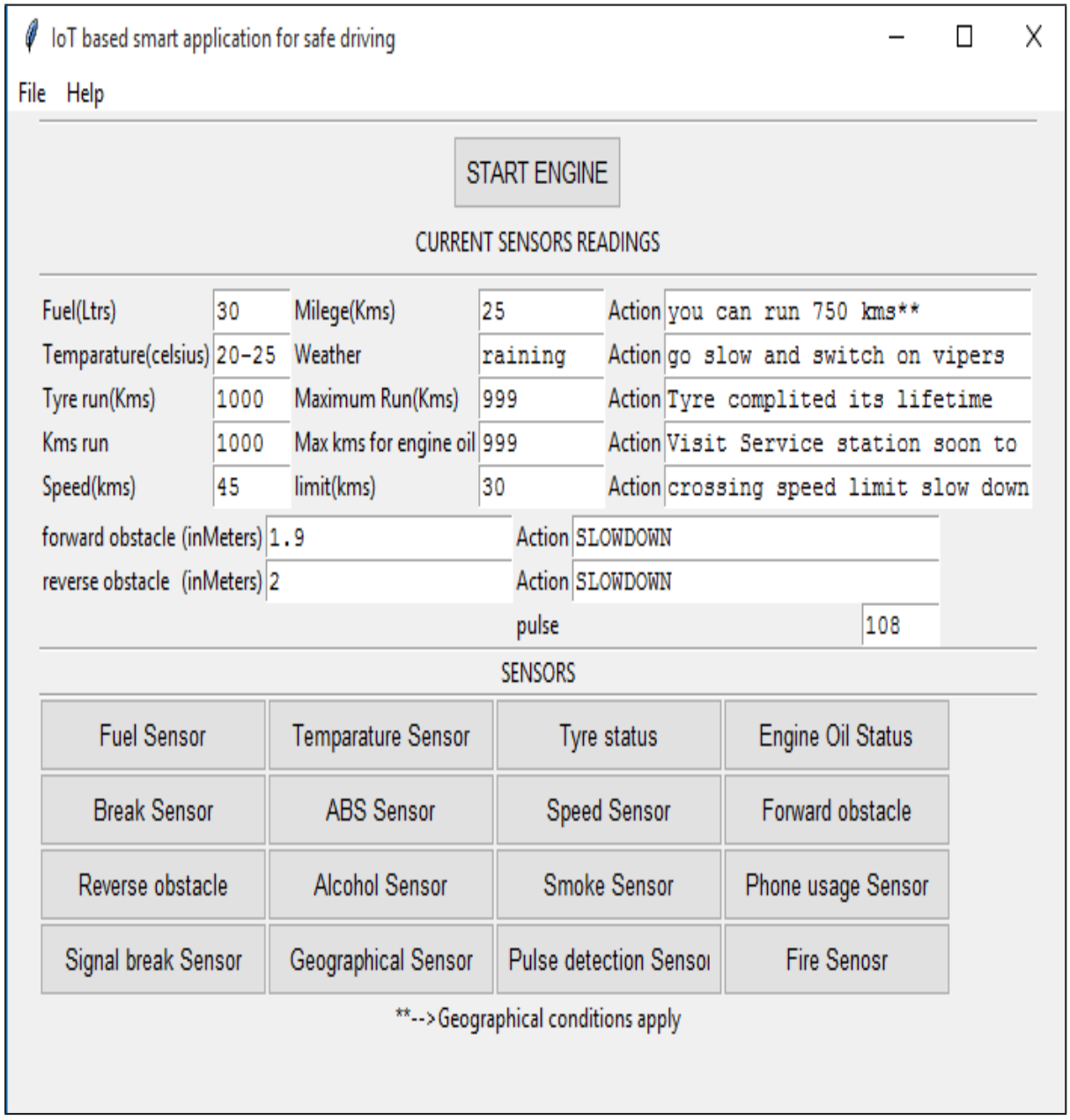

Fig2: Design of User Interface

The different sensors used in the system and their purposes are as illustrated in the table below:

Table: 1

Sl.NO	Sensor	Purpose
1	**Temperature**	temperature range and weather type like rainy, foggy, and normal
2	**Fuel**	
3	**Tire Status**	**Outdated or not , Gas volume /pressure**
4	**Engine Oil**	**Outdated or not**
5	**Break**	**To measure the strength of break system**
6	**ABS**	anti-lock braking system
7	**Speed**	for detecting over speeding
8	**Ultrasonic**	**To detect the obstacle**
9	**Reverse Obstacle**	
10	**Alcohol and Smoke**	To detect LPG, I-butane, methane, alcohol, Hydrogen, smoke and so on
12	**Phone Usage**	
13	**Signal Break**	
14	**Geographical**	To detect and notify the probability of natural hazard .
15	**Pulse Detection**	To detect fatigue and heart problems
16	**Fire**	**To detect the Fire**
17	**Accelerometer**	**To detect the possibilities of accident**
18	**GPS and GSM Module**	To keep track of the location of the vehicle and send coordinates of the vehicle to a pre-registered phone number.
19	**Traffic Rule Sensor**	To detect that whether driver is following traffic,

3.1 Experiment and Result Analysis:

Case Study: If the ABS system is inactive, then the system will produce the following output. **See figure 3.**

Case Study 2: Working of Alcohol sensor. Figure below shows initialization of alcohol sensor when button is clicked from main console.

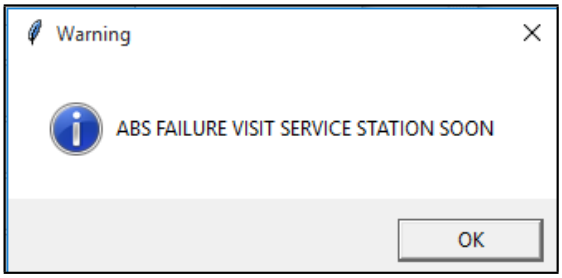

Fig3: Results for ABS status

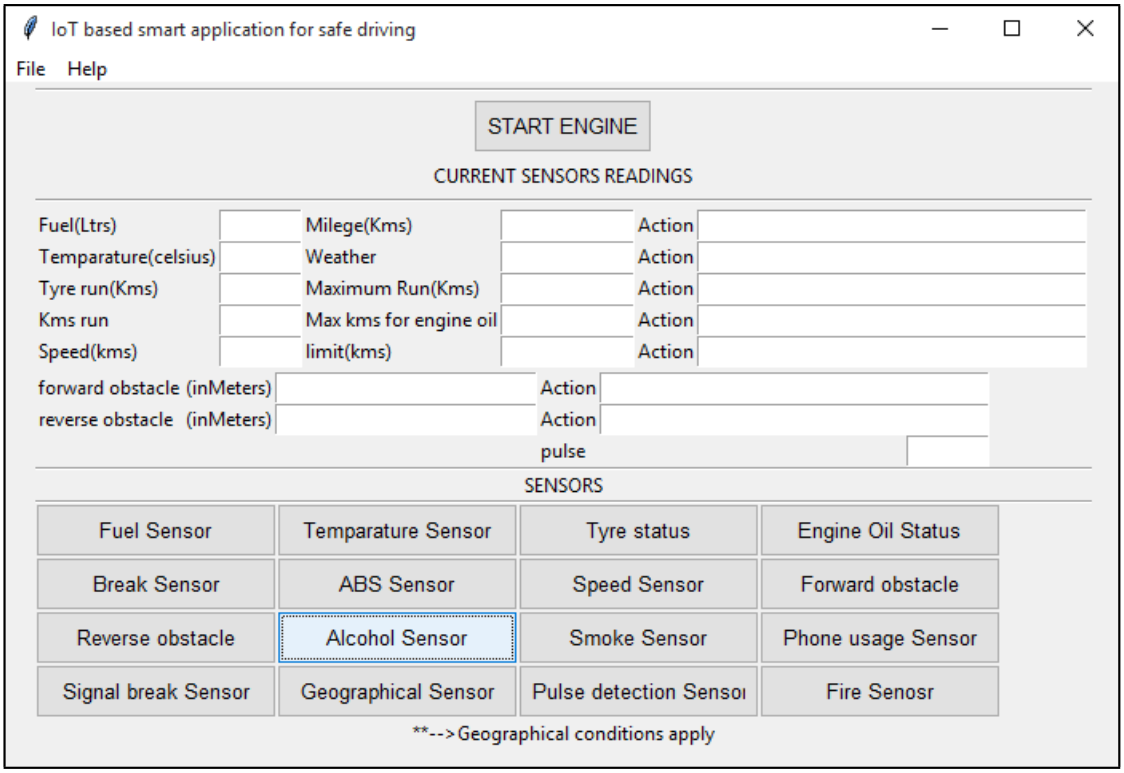

Fig4: Initializing alcohol sensor

If the alcohol sensor detects consumption level to be higher than the pre-set threshold then the system will be switch off the engine with following output:

Fig 5: Ignition turned off notification

Case Study 3: If the vehicles breaking system is failed, the safety driving system will produces the following output.

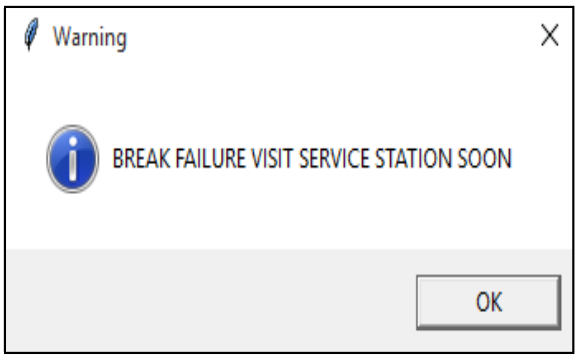

Fig 6: Results for brake sensor.

Case Study 4: In order to verify the working of Fuel sensor. The input in the fuel sensor console was entered as illustrated below:

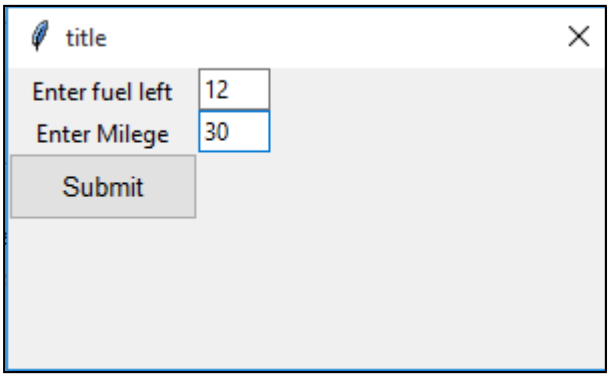

Fig 7: Fuel sensor console

Case Study 5: Figure below depicts the logical implementation of tire usage sensor which works on basis of tire life mentioned by manufacturer.

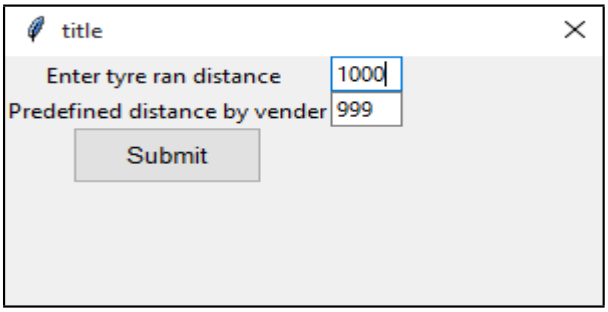

Fig 8: Tire usage Sensor

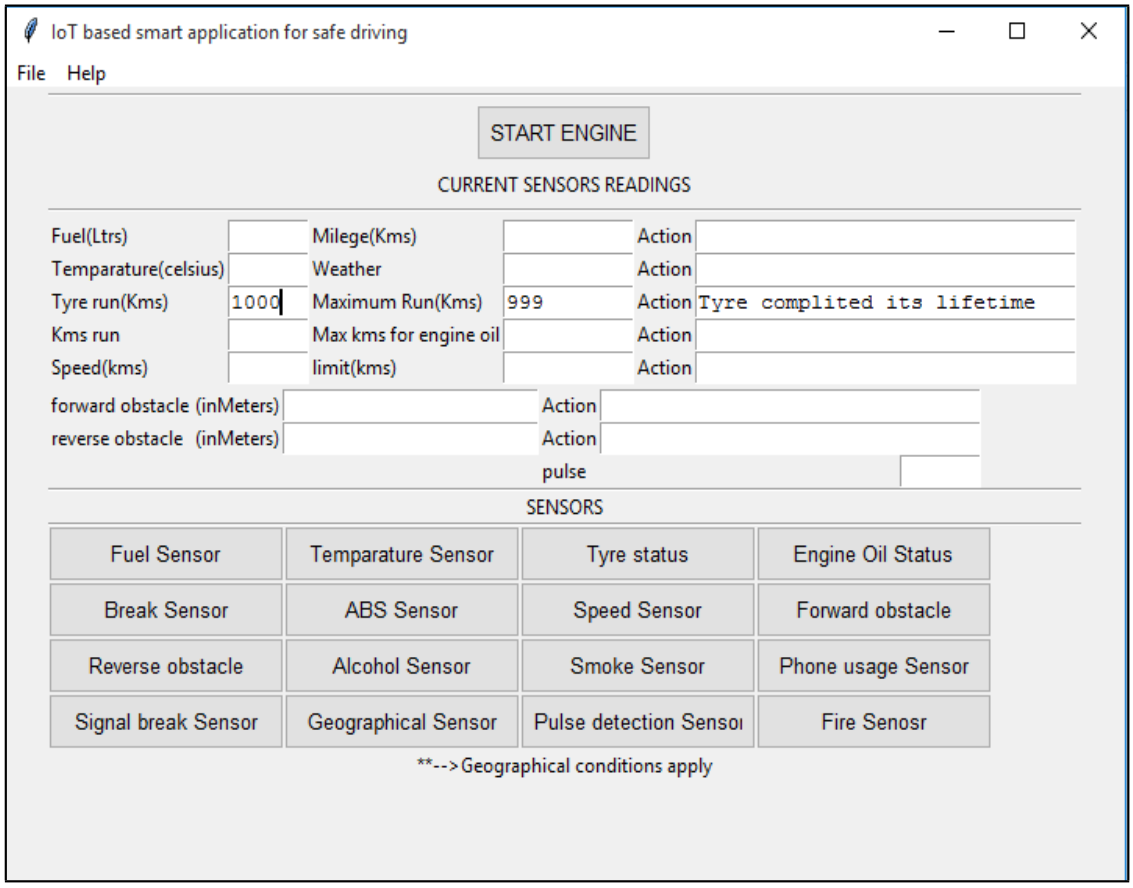

Fig 9: Tire sensor input and result.

CONCLUSION AND FUTURE WORK

Vehicular Accidents has always been a major catastrophe since the inception of Transport System, Statistics shows huge amount of innocent lives claimed by these accidents and Vehicular accidents have seen surge in recent years, advancement of technology can be used to deploy safety system. The research work proposed in this paper describes a prototype design of the safety driving system developed using sensors and Raspberry Pi , which can give timely suggestions and notifications along with recommending contextual actions to

Smart engine. The arrays of sensors are used to detect obstacle, driver's alcohol consumption, possibility of accident and to monitor the fuel status, Tire capacity and the life of Engine Oil. As a future work the system will be designed using more sensors and will be deployed in real time automobiles.

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