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A Smart Blackbox for Vehicle Accident Analysis

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Abstract. A new level of data services is fashioned by automobiles and computing technologies in vehicles. The smart Black Box has functions similar to an airplane black box. It is used to analyse the source ofvehicular accidents and prevent the loss of life and property arising fromvehicle accidents. This paper proposes a prototype of a smart Black Box System that can be installed into vehicles. The system aims to achieve accident analysis by objectively tracking of happenings occurs inside the vehicles. The system also involves enhancement of security by thwarting tampering of the Black Box data.

Keywords: Black-Box · Internet of Things · Vehicle accident analysis.

I. INTRODUCTION:

When an accident or a crime occurs, information related with those accidents is required to find out the source of the accident or the culprit of the crime. Conventionally that kind of information is congregated non-systematically by the investigator by means of gathering rumour's or asking for the observers who happen to pass by the place at the time of accident. Recently more and more cars are implementing the blackbox system to get apparent of clarifying which part is liable for the traffic accident. The conventional blackbox system is mainlycomposed of the image capture and video signal compression engine. Lots of information gathered and stored in blackbox is thrown away when the accident isnot directly related with the car even though that information can comprehendthe critical. In this paper we propose an intelligent safety information gatheringsystem using the smart black box system. We add several additional functionalities to the existing ordinary blackbox system. GPS engine also supplements the recording of time and driving route information, which are used to match the stored information with that demanded. Each minute that an injured victimin a crash does not receive emergency medical care makes a large difference intheir survival rate – Analysis shows that dropping the accident response time by one-minute correlates to a six percent difference in the number of lives saved.

In order to reduce the time notification and response, Automatic Accident Notification System (AANS) is incorporated in the smart black box. As soon asthe Black Box detects an accident, the AANS immediately notifies the nearest Emergency Service Provider (ESP), thereby empowering the immediate noticeof the medical and responsible personnel information .

II. LITERATURE SURVEY

Woranon et. al., proposes the importance of preventing road accidents using black box which include intelligent collision warning systems and intelligent braking systems. They have used Interactive accident-avoidance system with Two steps movement detection to reduce and prevent accidents with more efficiency. This study focuses on the feature of this system, which is forward movement detection and automatic obstacles' avoidance. However, such systems are not able to cover every case and could even cause more accidents.

Adnan Bin Faiz et.al., concludes that infringement of speed is one of the elementary reasons for a vehicle accident. So, external pressure and change of tilt angle with road surface blameworthy for this mishap. They have developedan Android-based application that detects an accidental situation and sends anemergency

alert message to the nearest police station and health care center. This application is integrated with an external pressure sensor to extract the outward force of the vehicle body. It measures speed and change of tilt angle with GPS and accelerometer sensors respectively on Android phones. Tiago DeFreitas Pereira and André Anjos proposed the task of Heterogeneous Face Recognition consists of matching face images which are sensed in different domains, such as sketches to photographs (visual spectra images), thermal images to photographs or near-infrared images to photographs. They suggested that high level features of Deep Convolutional Neural Networks trained on visual spectra images are potentially domain-independent and can be used to encode faces sensed in different image domains. They proposed a generic framework for Heterogeneous Face Recognition using adapting Deep Convolutional Neural Networks, so-called, "Domain-Specific Units." The adaptation using Domain-Specific Units permit the learning of shallow feature detectors specific for each new image domain. Besides, it grips the transformation to a generic face space shared among all image domains.

Iván García -Magariño and Sandra Sendra proposed The Internet of Vehicles (IOV) which affords the coordination of vehicles for enhancing safety and transportation performance. Vehicles can be harmonized for avoiding collisions by interacting their positions when near to each other, in which the information flow is indexed by their geographical positions or the ones in road maps. Vehicles can also be harmonized to ameliorate traffic jams by sharing their locations and destinations. However, IOV also brings security challenges, such as keeping safe from virtual hijacking. In particular, vehicles should perceive and insulate the hijacked vehicles ignoring their communications. They proposed a technique for enhancing security by applying certain prioritization rules, using digital certificates, and applying trust and reputation policies for detecting hijacked vehicles.The experiments engrossed on the scenario of avoidance of collisions with hi-jacked vehicles misinforming other vehicles.

Watthanawisuth et.al., developed the embedded controller for Car Black Box using SoC (System on Chip) technique. System on Chip (SoC) is the effective method to implement embedded system like car black box. The purpose of de-signing Car black box controller with the Global Positioning System (GPS) ina very simple and efficient way for positioning and tracking. The system is de- signed to provide information about location which can be helpful for services along with the emergency services by Sharvin Pingulkar et. al.

Bonyár, A et.al., gave an overview on the existing eCall solutions for autonomous car accident detection. They discussed about the requirements and expectations for such systems, considering both technological possibilities, legal regulatory criteria and market demands.
Amin, S et. al., proposed an accident detection system by determining the decel- eration from the accelerometers of a low cost Micro Electro Mechanical Systems (MEMS) based Inertial Measurement Unit (IMU).

III. PROPOSED SYSTEM

The proposed system makes use of acceleration movement sensor to record the various driving data parameters. It will also monitor the humidity and temperature level of the car, and additionally seatbelt status will also updated to the controller. The Raspberry Pi controller (RPi) and Arduino controllers are usedto regulate these sensors. The data received from the sensors are stored on theSD card mounted on RPi for retrieval after the accident. The system uses ex- ternal sensors such as camera and Global Positioning System (GPS) to collect video and location data. In addition, the Black Box sends an alert message toa pre-stored mobile number via Short Message Service (SMS) in the case of occurrence of an accident. And the analysis data and the accident intimation willalso update to the monitoring section through using Internet of things.

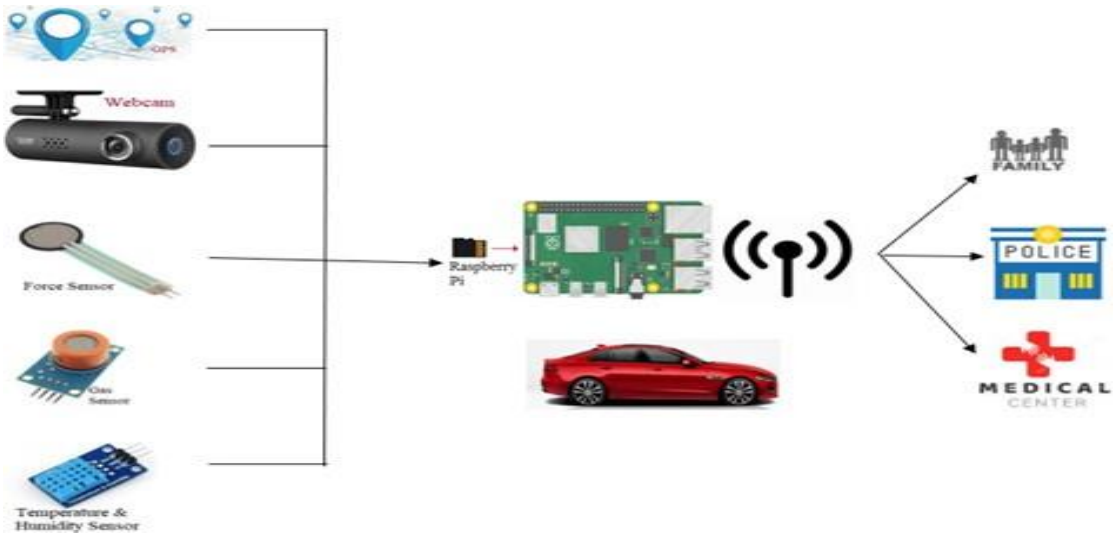

Fig. 1. Block Diagram of the Proposed System.

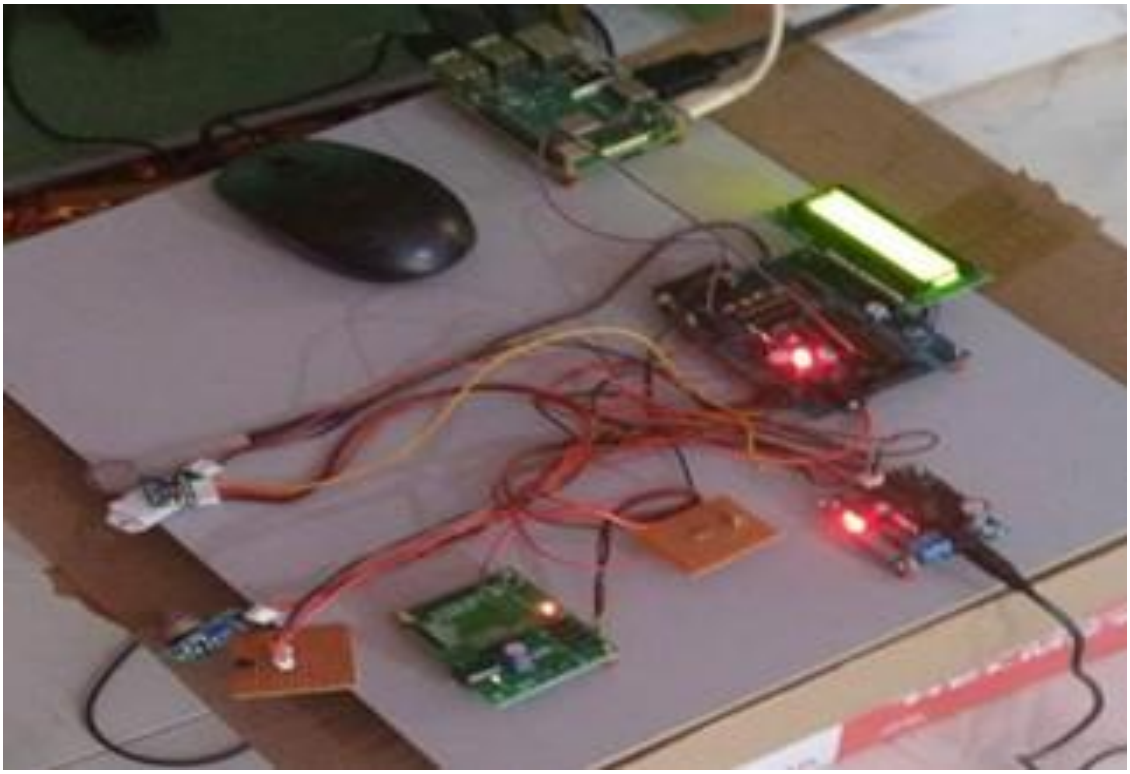

Fig. 2. Working Model of the Proposed system.

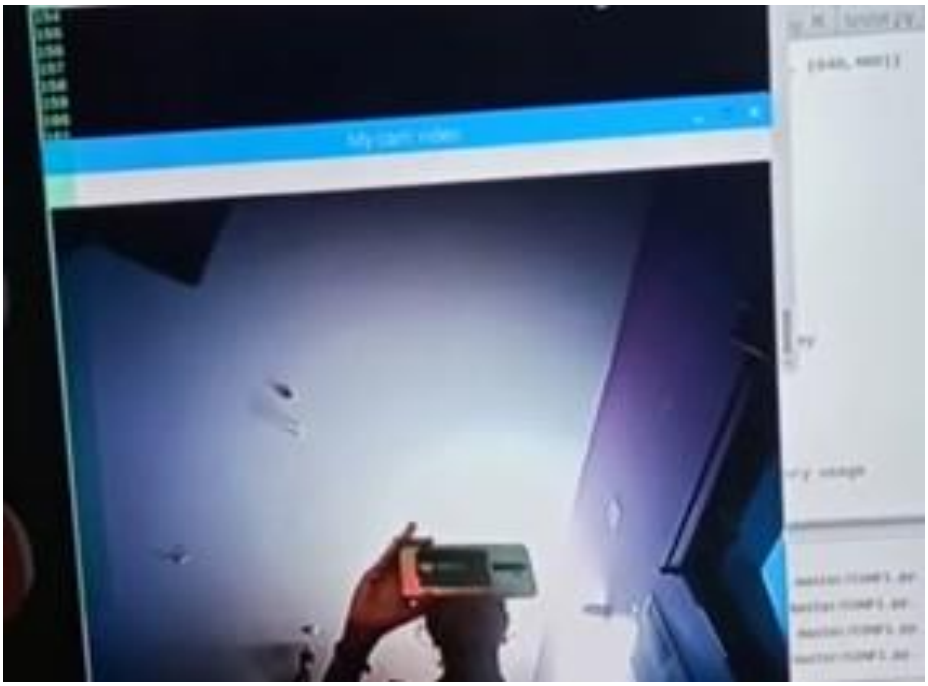

Fig. 3. Output from the Webcam.

Fig. 4. Output of the Gas Sensor.

IV. CONCLUSION:

The proposed smart Black Box would be the best and cost-effective solution forautomatic accident detection and notification, navigation, security, web-tracking and control of peripherals in all passenger vehicles. The black-box is expected to substantially reduce the road fatalities in all passenger vehicle occupant fatalities, due to reduced crash-to-Emergency Medical Service time. It has the greatest potential to prevent road fatalities in rural areas, given that the remoteness of the crash location leads to longer crash notification times in comparison to urban areas. Compatibility with the CAN devices provides an added feature to the Black Box

since most of the devices in vehicles are CAN compatible. A cost-effective Black Box has been designed and developed and the same has been presented in this paper. We hope that in the near day this work will help in making travel by car a better and safer experience.

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