Accident Information System using Open Source and IoT

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ABSTRACT: *In the rising world of human population, the demand on the manufacturing sector particularly the automobile sectors are given with a high pressure to improve safety on their automotive systems. As there in rise in population there is also a high risk on increase n number of accidents occurring on roads, a survey says that around every accident are occurring every minute across the country. The accident does only end with the damage of vehicle but also pushes the passengers to a fatal and emergency situation. This project uses open source to communicate the position and details of the owner of the car to the nearby hospitals, police stations, service stations and one neighbor. This AMS uses open source using raspberry pie, crash sensor, GPS module and cameras that uses IoT and have the facility of live recording in them. Thus, it communicates to the nearby hospital and police control hub thereby reducing the time delay for the medical treatment and the formality for further police enquiry.*

1. Introduction

On September 9, 1966, the National Traffic and Motor Vehicle Safety Act became law in the U.S., the first mandatory federal safety standards for motor vehicles. Effective in 1966, US-market passenger cars were required to be equipped with padded instrument panels, front and rear outboard lap belts, and white reverse (backup) lamps. In 1966, the U.S. established the United States Department of Transportation (DOT) with automobile safety as one of its purposes. The National Transportation Safety Board (NTSB) was created as an independent organization on April 1, 1967, but was reliant on the DOT for administration and funding. However, in 1975 the organization was made completely independent by the Independent Safety Board Act.

According to Times of India about 146,133 people were killed in road accidents in India every year. Unfortunately, about 30% of deaths are caused due to delayed ambulance. Sometime the innocent victims are not able to prove themselves to be innocent. Sometimes proofs are not sufficient to claim the insurance towards the damage during the accidents. In the recent survey taken in the highway road on the road accidents it is said that the total number of accident between two point and proposed with

different methods to improve road highway safety [1]. Peden. M totally designed an injury chart book and explained about the injuries happening in the crash and gave a graphical overview in a global burden on injuries [2]. The vehicle can be easily traced and tracked with the total distance it has covered and the data on location by the project and paper on real time GPS vehicle tracking system [3]. Thus by proposed by the method of the android application developed by the GPS and GSM module the vehicle place and running condition can be easily tracked around anywhere [4].

The above system had a lot of disadvantages that the system cannot access the car or vehicle when the vehicle is situated at non internet zone were communication is a big question [3]. Whereas the both the equipment uses highly equipped modules they are both complicated and are high in cost [3,4]. By studying all the important drawbacks in the above literatures we have created the system that does not use any kind of internet to transmit the primary information, thus the system send SMS or text messages to the send the Google map link to the hospital, police station and service stations.

2. Components Required

The following are some of the components used in the Accident Information System which are used in the system to make it work with good internet communication and good efficiency:

• Raspberry pie 3

• Crash sensor

• Camera

• Power control module

• GPS module

• Cloud storage

2.1. Raspberry pie
The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It does not include peripherals or cases. However, some accessories have been included in several official and unofficial bundles.

The organization behind the Raspberry Pi consists of two arms. The first two models were developed by the Raspberry Pi Foundation. After the Pi Model B was released, the Foundation set up Raspberry Pi Trading, with Eben Upton as CEO, to develop the third model, the B+. Raspberry Pi Trading is responsible for developing the technology while the Foundation is an educational charity to promote the teaching of basic computer science in schools and in developing countries.

2.2. Crash Sensor
A crash sensor, or shock sensor is in motor vehicles used to detect a collision of the vehicle against an obstacle. When the sensor detects an impact, it sends an electrical pulse to various control devices, which in turn activate various occupant protection systems. Depending on the equipment of the vehicle, this includes the airbags, belt force limiters , belt tensioners and roll bars . In some vehicle types, the unlocking of the vehicle doors is also initiated. The triggering of the crash sensor is recorded in the accident data memory.

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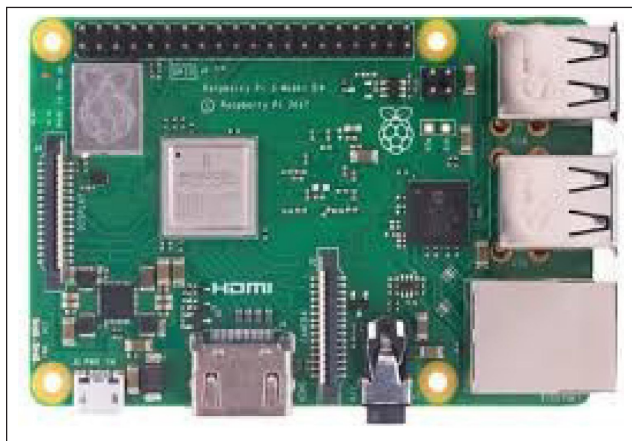

Figure 1. Raspberry pie

Crash sensors of older design only detect an impact per se and activate the occupant protection systems as soon as a predetermined threshold value of the vehicle deceleration is exceeded. By contrast, modern, so-called intelligent, sensors can detect the impact severity and activate different occupant protection systems depending on this, which can reduce the risk of airbag-induced injuries to the vehicle occupants.
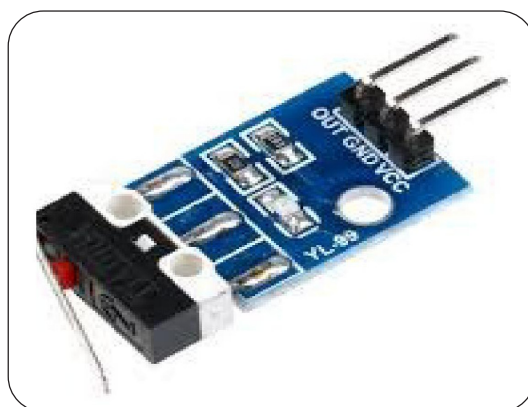

Figure 2. Crash sensor

2.3. Camera

A webcam is a video camera that feeds or streams its image in real time to or through a computer to a computer network.

The term "webcam" (a clipped compound) may also be used in its original sense of a video camera connected to the Web continuously for an indefinite time, rather than for a particular session, generally supplying a view for anyone who visits its web page over the Internet. Some of them, for example, those used as online traffic cameras, are expensive, rugged professional video cameras.

Figure 3. Camera

2.4. Global Positioning System (GPS) Module

The Global Positioning System (GPS), it is the system that provides us with the geological and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The GPS does not require the user to transmit any data, and it operates independently of any telephonic or internet reception, though these technologies can enhance the usefulness of the GPS positioning information.

3. Construction

The constructional arrangement of the accident mitigating system is given by a flow diagram shown in the *figure 4*.

There are totally four live cameras being placed in the front, rear and on either sides of the car. Then the cameras are being connected to the raspberry pie and are programmed to store the driving data. Thus, if no accident is being detected the video footage in the raspberry pie gets deleted.

The crash sensor is taken from the existing automotive systems for the air bag system and connected for the receiving of crash signals. This crash signals are to be verified thus the vehicles ECU is connected to the raspberry pie to find the data on confirmation of crash.

There is an additional GPS or an imbedded GPS system that is being used for finding the exact location of the car. Thus the cars raspberry pie being connected to the cloud network and GPS.

In the recent cars that comes up the intelligent navigation system, infotainment or with internet facility does not need a separate GPS module thus the systems in the car have their plugins given into the Raspberry pie ports and data can be transmitted to the users by the inbuilt systems through raspberry pie.

The below figure gives the construction of the stated system in a vehicle and thus the construction is proposed for the final and full scale project.
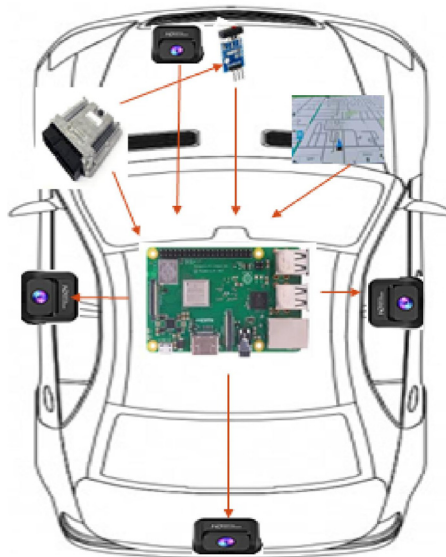

Figure 4. Constructional arrangement of Accident Information System

4. Working

Crash sensor detects the crash and sends the crash signal to the raspberry pie. The raspberry pie for confirmation gets the data from the ECU as it is used to stop the transmission after collision. Thus once the crash happens in the next few seconds the ECU totally stops the power transmission and this signal is send into the raspberry pie and the direct message from crash sensor is received and thus the raspberry pie starts the data transmission.

Then the live recording cameras last 5 minutes video footage before the detection of crash is being saved and through the internet source is saved into the cloud storage (Google drive, iCloud. Etc.).. these video cameras starts once the car is turned on and thus runs continuously until the car is turned off , during this period the camera continuously captured the video, if the car is turned off without any crash the whole video data inside the camera gets automatically deleted.

The GPS module sends the location of the vehicle through the open source to the nearest police station, hospitals and the OEM's service stations. Thus a mitigating message is directly send to a person or a neighbour. That is how the information system works and thus the messages are being received and sent via. Raspberry pie and location is sent as a data of latitude and longitude through the GPS.

Hence the time is being drastically reduced to inform the hospitals about the accidents position and the video footage is helpful during the formal police enquiry and can be handed over to the insurance over the formality and claiming of insurance.

5. Result

The following figures shows the results of the prototype model made. In the prototype from the given components there was only one camera used for stimulation purpose. Thus the locations and the text messages were received. Hence the Automotive Mitigating Systems results are as follows.

The *figure 5* shows the GPS location on the Google map and the data of the GPS was stimulated through the raspberry pie for the verification of the location of the system.
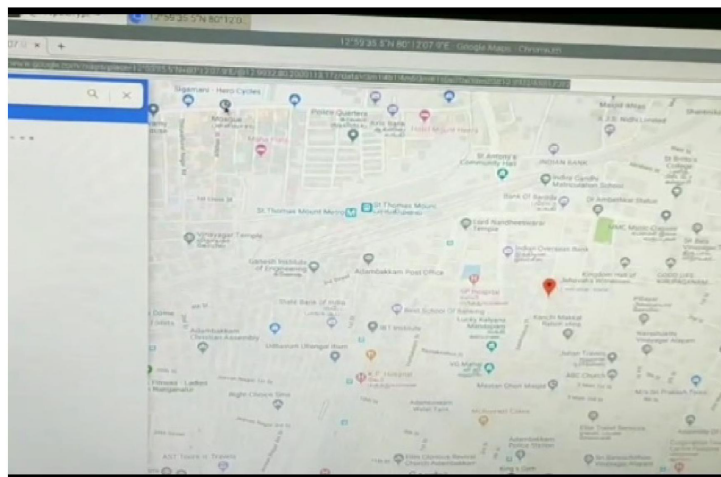

Figure 5. The location generated through the GPS address

The *figure 6* shows the Google map link generation and the message received by the mobile phones in the prototype, were each phones are assumed to be each network of hospital, police station, service station and close persons. The links of the location are sent through text messages as it requires only 2G connectivity to send the data.

The *figure 7* is the prototype model that was being used to stimulate live messages and *figure 8, 9 & 10* shows some screenshots taken during the running of the prototype.

6. Conclusion

The protection from accident has been increased as the system immediately communicates to the hospital ambulance and family members.

During formal police enquiry the videos footage from the live recording camera is being stored in the cloud drive. This can be shown as a proof to show the innocence towards the accident.
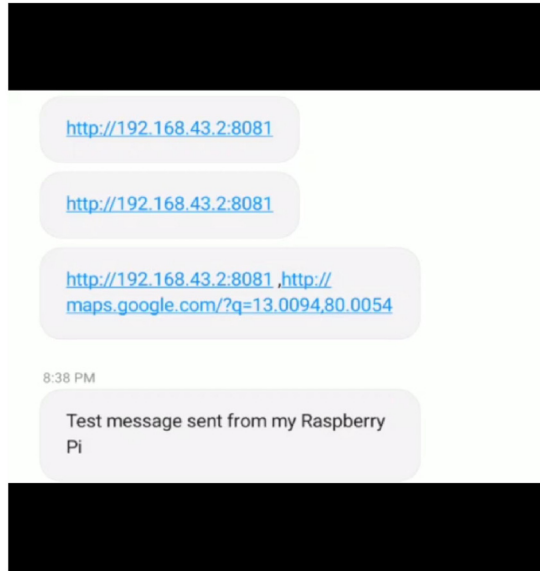
Figure 6. A stimulated text message sent from raspberry pie

Figure 7, 8 & 9. The sample photo of the prototype in working condition

The message sent to the service station is useful to retrieve and to do servicing as easy as possible.

The open source is quite a quick and a safe platform with very less time lag towards communicating the information.

This total system costs around rupees 3000 and the main advantage of the system is this system cannot be tampered.

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