Intelligent Accident Detection System based on IoT and OBD-II Devices

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***Abstract*--In the past few years, there has been a significant increase in the number of vehicles spotted on the road, which may eventually lead to increase in the probability of accidents, hence we propose an intelligent system which will allow us to spot the precise location of the accident for emergency services to provide assistance. This paper is an endeavour to build a system that is an instrumental cluster of [1]On-Board Diagnostics (OBD-II) interface, Trackers and Microcontroller. This particular setup will provide us with the G-force experienced by the passengers on impact, which is used alongside the airbag triggers to declare a particular scenario as an accident. It will register an event on a special database created for all the setup holders on having a positive detection, and further steps will be taken from the server-side, hence requiring less network connectivity. This system will not only reduce the number of casualties in a road accident but also the response time of the emergency assistance may significantly decrease.**

Keywords: OBD-II; Trackers; Raspberry Pi; G-force Analysis; Fastest Assistance.

I. INTRODUCTION

The smart vehicles are right around the corner and are being equipped with modern tech that helps them to communicate with the emergency services and ensure the safety of the passenger. However the existing vehicles, too have the right to be safer, hence in this paper, the system proposed will bring together the existing vehicles and the modern electronic advances like Raspberry Pi which will help in the improvement of road safety. The electronic industries have come up with smart and small microcontrollers over the years such as the Arduino and the Raspberry Pi which have the computational strength equivalent to the personal computers with the same amount of time consumption. In this solution, the Raspberry Pi will be used by giving it access to the internal bus of the vehicle wirelessly. The only requirement crisis in this solution is that the [2] OBD-II standards might not be supported by the vehicle but on the contrary, this standard has been a mandatory aspect of a vehicle manufacturing since 2001 hence this device will be supporting the cars which are less than 20 years old (as of 2020). The setup which consists of a tracker and Raspberry Pi will continuously monitor the vehicle speed, acceleration, deceleration, airbag triggers, seat belt latches to detect when the accident has occurred. The positive detection of an accident will be followed by just two simple steps of setting the flag to one and updating the crash coordinates in the special database created for the setup holders. These all the things will be carried out by the Raspberry Pi itself, and the data before the crash will be saved locally, which will result in less network usage and fast response. These two steps can be taken by the usage of the internet or by just sending an SMS to the server or making a phone call to the server.

The vehicle acceleration can be obtained from different sources (i) GPS Tracking (ii) Accelerometer (iii) Vehicle speed provided by OBD-II interface but the most efficient, reliable and accurate source, is the speed provided by the OBD-II as it is offline and quick. The following system is capable of fulfilling its purpose within the shortest time possible. This can be further improved and advanced by giving a call to the nearest hospital according to the location of the accident, also many parameters such as time of the accident, cause of the accident can be recorded and alerts can be provided to other setup holders regarding the accident-prone areas.

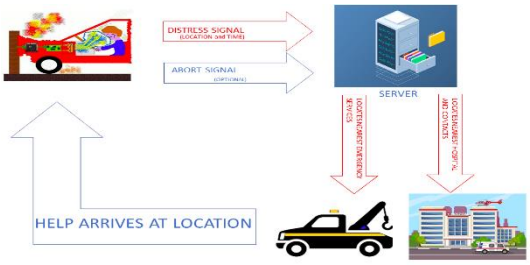

Fig. 1 Block Diagram

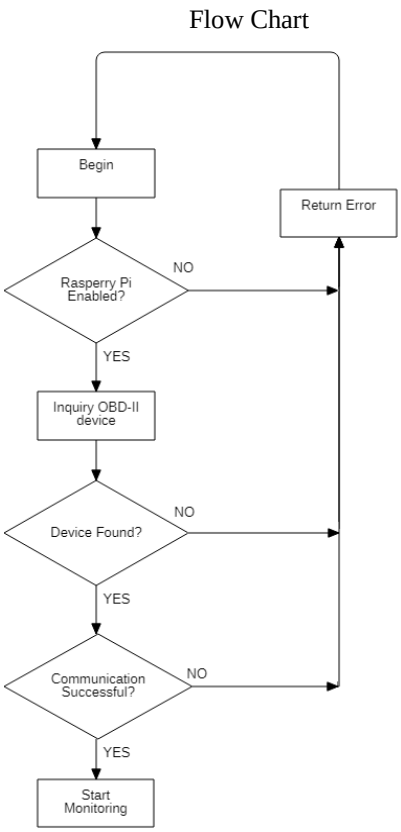

Fig. 2

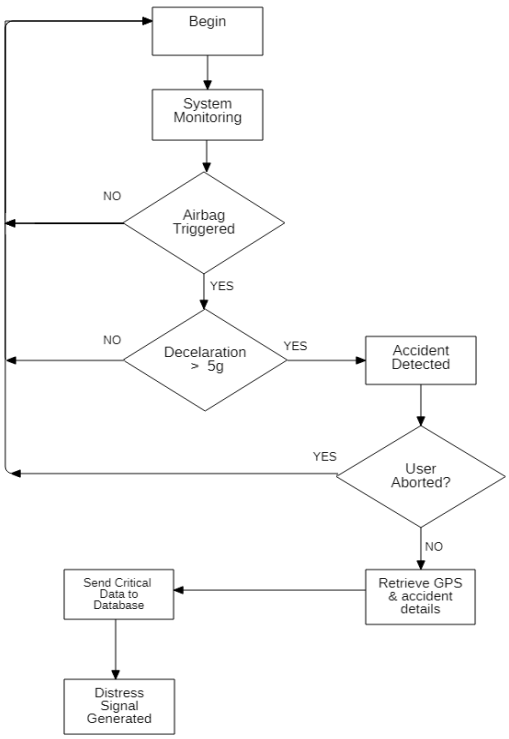

Fig. 2.1

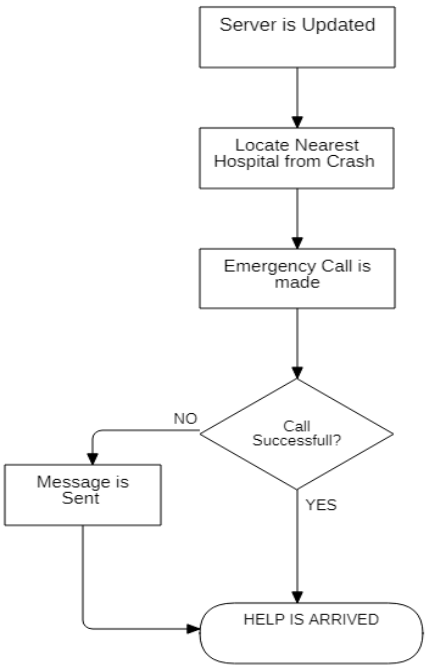

Fig. 2.2 Working

Getting Ready (Fig. 2):

[3]This solution is based on the platform Raspbian OS which is derived from the Debian. Raspbian is optimized for the Raspberry Pi hardware and comes with over 35,000 packages: precompiled software bundle. The first step of this system is initializing itself and checking the connectivity with all the peripheral devices i.e the Tracker and the Bluetooth-enabled OBD-II interface whose sole purpose is to establish connectivity between the Raspberry Pi and the Car's internal bus. Once the connection is achieved the next step for this system will be checking the communication with the database and Raspberry Pi. If these steps go as planned then the system will move on to the next step of monitoring the vehicle.

Monitoring (Fig 2.1):

After the system is ready, this is where the monitoring of the Airbag Triggers and the amount of the deceleration will start. Every car has an average of 4 airbag triggers all situated in each corner of the car. The deceleration is calculated by the Raspberry Pi using the data revised by the OBD-II interface. The system keeps on monitoring the airbag triggers for any change of state, if any of the triggers is activated then the deceleration is computed and if it exceeds the force by 5g then the event is identified as an accident. There will be a user-controlled button along with this system which will allow the user to

abort the distress signal in case of false detection due to some unfortunate events. If the distress signal is not aborted by the user then there will be some rapid actions taken by the system.

Rapid Actions (Fig. 2.1 and Fig. 2.2):

A)Raspberry Pi Communication:

Raspberry Pi will [4]communicate with the Tracker for the current location coordinates of the user and a brief report is created consisting of the location and the time of the crash which is sent along with a distress signal to the server. This signal can be sent to the server in 3 ways, one is by using the client-server protocols using the internet. Another is by making a call to the server or by sending an SMS if the internet is not available at that location.

B)Automated Alerts :

After the distress signal is generated it reaches the server, an event is registered in the database. The server then locates the crash and searches for the nearest hospital and emergency service and makes a call regarding the information of the crash. If the call is not successful a message is sent via SMS. Google Maps provides us with better transport management, less traffic and so the help may arrive by a much faster route possible. As most of the work here is done from the server, fewer network issues will be faced.

CONCLUSION

In this paper, we have come across a basic solution of sending a distress signal and location of the crash after it occrs, but this is not where the development stops. Further, we can add in a gyroscope which could help us for detecting the cause of the crash such as a car toppling. There are many advanced things we can do with python these days and can be used to predict the accident after looking at the inputs from the camera placed on the dashboard, hence resulting in a system that not only provides a location on a crash but also prevents accidents from occurring.

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