DESIGN, MODELING AND FABRICATION OF AN EFFICIENT CAR CRASH MANAGEMENT SYSTEM

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Abstract – With growing number of accidents happening all over the Country it has become a necessity to build proper systems to manage such calamities. Though there are systems available which focuses on how to avoid car crashes, it requires an overall system of automated vehicles and Wi-Fi networks that may not be feasible in a Country like India. Therefore, with the existing systems of manual cars and car crashes happening, we can develop a system to save the occupants and reach for medical help as fast as possible after a crash detection. This system is a notification system aiming towards notifying police, hospital and chosen close contacts of the driver after a car crash has taken place which will show details such as the location of the car, name of the driver and the time of accident. This all can take place over the phone being connected via Bluetooth through an app.

Keywords – Crash detection; Notification system; Bluetooth;app.

INTRODUCTION

Growing number of cars , mis-managed and not up-to date technologies controlling traffic has led to a vast number of accidents happening across the country. With such backdated systems and less availability of good connectivity over Wi-Fi has prevented control of traffic difficult. Therefore, many a times an accident may not be possible to be prevented ,however, a system can be prepared to find help and analyse the crash to some extent to help the victims. This project aims to prepare an app-based system , which will activate after it detects a car crash. Once activated ,it will start a count down . Once the countdown is heard ,the driver can close it , if it is not a major accident and he is fine. On the other hand, if the driver is unconscious or badly hurt and not able to close the system, the system will identify it as a major accident. It will automatically send messages and notifications for help ,to the driver's close contacts ,police and hospital for an ambulance. Along with notifications of help it will also send car details such as its location, identity of the driverand the time of accident . This will help the receivers to know where the victim is an estimate the accident and its cause. This way the victim can be found easily without having to wait for help and someone to identify and call for help. It is an efficient lifesaving systems and even seconds matter in such accidents. The location details will also help to find the exact place and find the victim faster and find him out at remote places.

Components used for the project

1.Arduino
2.Bluetooth IC
3.Pressure sensors
4.Air bag sensors

METHODOLOGY

Step1: The crash is detected

Sensors will be connected to the main impact zones of a car i.e. the front , side and back parts . The data will e taken from 2 types of sensors :-1) The air bag sensor . This sensor is connected at the front part under the headlight near the tyre . It detects sudden deceleration. At the time of deceleration, the airbags are inflated. Our system can also be connected to this sensor ,that already exists .

2) Pressure sensors: In addition to air bag sensors , we will connect pressure sensors at the sides and back impact zones. We can get the data of pressure impact on cars at time of pressure and calibrate the sensors accordingly to detect a crash.

Once these sensors detect a crash it will give a high signal back to our main controller i.e. Arduino.

Step 2: Countdown alert system activated

Once the Arduino receives high input from any one or all these sensors it will communicate to a Bluetooth IC device connected to it. Bluetooth device can communicate over to the smart phone of the driver. That can connect to its app

Once a crash data is given to the app,it will start a countdown that will call out the countdown. If the driver is fine and is thinks he will be able to handle , he can switch it off manually.

*Step 3:*Notification procedure

If the driver is not able to respond due to a serious injury and the countdown finishes, the app will automatically send notifications to his close contacts ,police and ambulance. The notifications will include the name of the driver , location , time of accident and speed of car right before the accident.

Connecting to the app and setting it up

The app can be downloaded using a link and it can be connected through Bluetooth to the. Bluetooth IC present .

On setting up the app , it will ask for close contacts to be notified in an emergency.

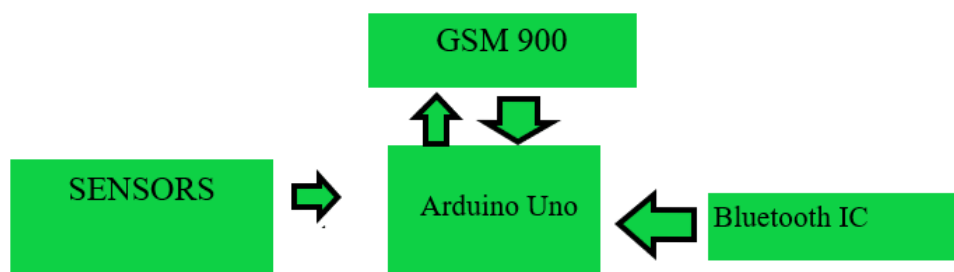The schematic of the system is presented below.

Fig. 1 Schematic of the System

PLACEMENT OF SENSORS

There will be array of sensors which will be placed on the front , rear and the sides of the car. 4 sensors in the front in the inner part of the bumper , 4 in the rear and two on the sides between of the front and rear the door , so there will be a total of 10 pressure impact sensors . The time pressure impact increases from the threshold value set , i.e. at the time of the crash , it will send signal to the MCU which in turn will start a counter of 10 seconds . If the counter is turned off the person in the car then the signal will not be sent , if it is not stopped then the GSM module in the MCU will call all the nearby police stations , ambulances and the close contacts chosen by the user ,along with that GPS location will also be sent to the same.
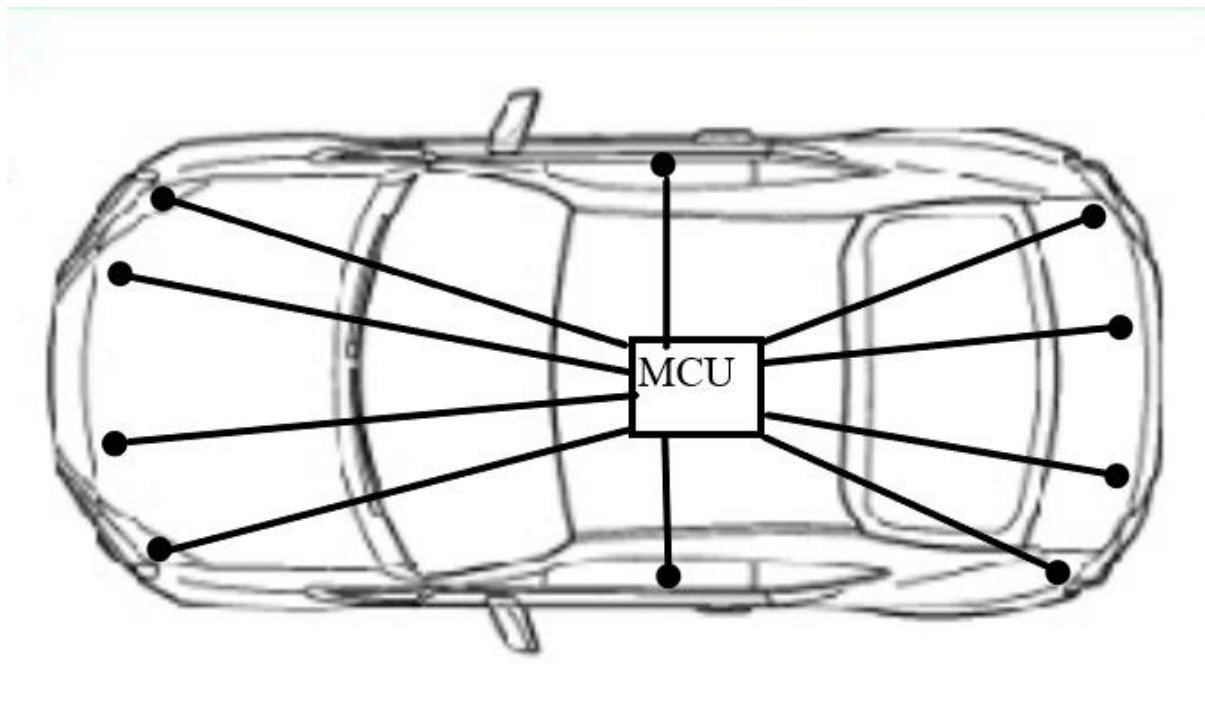

Fig. 2 Placement of sensors in the car

WORKING OF PROJECT

The pressure sensors will be connected as shown in the figure at the back , front and sides . It will be connected to a micro controller internally. The micro control used is Arduino Uno . A Bluetooth IC and a GSM 900 module is also connected to the Arduino. The Arduino will take inputs from pressure sensors . The pressure sensors will measure differential pressure and will give a high value when the value exceeds the calibrated value. The Arduino will also be connected to the air bag sensor that will already be present in the car .

Fig. 3. Interface of the application developed

During the event of a collision or accident, high impact force is created. The application is designed to generate a graph of impact force versus speed of the car. The graph is shown below:
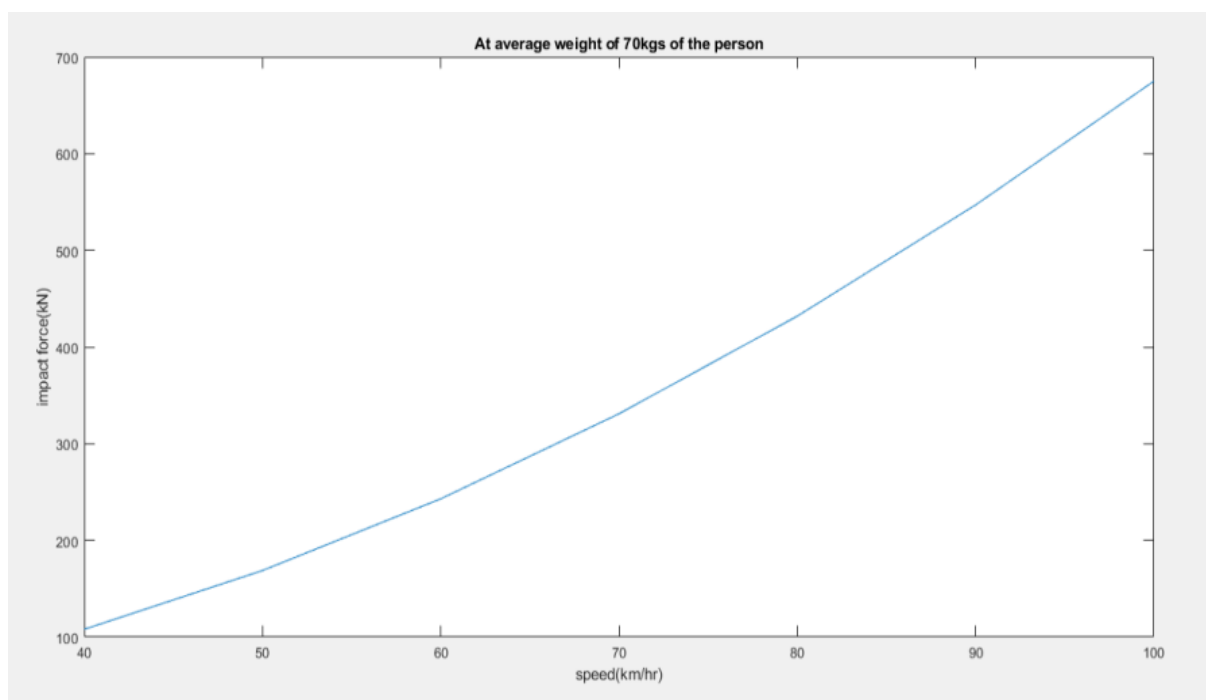

Fig. 4 Graph of Impact Force v/s speed of the car

If the Arduino gets a high value from any one or more of these sensors it will be sensed as a crash. Once a crash is detected the data will be sent through the Bluetooth IC to the app . The Bluetooth IC

will have to be connected to the app through Bluetooth. On receiving this data, a countdown will start automatically in the app. The countdown will be called out in speaker. The countdown time can also be set as the user wishes;however, it cannot be lesser than 10 seconds. If the driver isfine and does not need help or any false alarm is generated it can be eliminated by pressing the stop button in the app. If the countdown is not stopped it will generate messages to the police, close contacts and ambulance automatically. The details of the user will be stored beforehand in the app .The messages will contain information of:-

1) The name of the driver.
2) Location of the driver.
3) Time of accident.

Fig. 5 Counter generated when a crash is detected

CONCLUSION

The message sent at that time will also show the time at which the accident took place. As these are being sent through the app ,the same data that a crash is confirmed will be sent to the Bluetooth IC when the countdown finishes. This will activate the GSM 900 that will send messages to the same numbers . Both these methods are being done to eliminate changes of failure of the system. If there is poor or no internet connection along with low level of Wi-Fi connectivity, this will ensure that messages will be sent to the required numbers. Also, it might be that everyone might not have this app on their phone all around whenever required. Therefore, messages will be sent directly to their sim. The GSM 900 module is equipped with a GPS sensor . Therefore, we can get the location of the driver and car can be found from there itself, we will not have to use a GPS module separately. Once the messages have been sent to concerned authorities, it will ensure quick help service to the victim of the crash.

REFERENCES

[1] B. Sinclair, " IoT Inc: How Your Company Can Use the Internet of Things to Win in the Outcome Economy" .

[2] https://www.mdpi.com/journal/sensors

[3] https://www.tekscan.com/blog/pressure-mapping/force-and-pressure-sensor-technology-measure-impact-force

[4] https://ieeexplore.ieee.org/abstract/document/6063315/