

An IoT Based System for Accident Detection, Navigation and Emergency Services

Shrikrushna Chaudhari¹, Neha Chippa², Nilesh Vadar³, Siddhesh Raut⁴

^{1,2,3,4} Dept of Computer Engineering

^{1,2,3,4} Smt. Kashibai Navale College of Engineering

Abstract- According to the report of Association for Safe International Road Travel (ASIRT), near about 1.3 million people die in road accidents each year, 20 To 50 million are injured or disabled. The challenges imposed to local PSOs in saving human lives resulting from vehicles accidents have become a crucial concern. To provide a solution for such a problem we have proposed An IOT Based System For Accident Detection, Navigation and Emergency Services is an auto-detection unit system that immediately notifies an Emergency Contact . IoT based system which instantly notifies the rescue teams whenever an accident takes place and pinpoints its geographic coordinates on the map. Initially a passenger and vehicle detail is given to the server for monitoring the vehicle . When an accident takes place, a vibration sensor detects it. Then, an algorithm is applied to process the sensor signal and send the geographic location along with vehicle and passenger identification to the server , the server will not only notify about the accident to the nearest ambulance but also server transmit the passenger medical details and track the ambulance till it reaches to the accident spot. The whole procedure discussed above requires no human interaction .

Keywords- PSO : Public Safety Organizations , ASIRT :Association for Safe International Road Travel , IoT: Internet Of Things

I. INTRODUCTION

According to the report of Association for Safe International Road Travel (ASIRT), near about 1.3 million people die in road accidents each year, 20 To 50 million are injured or disabled.[11] The challenges imposed to local Public Safety Organizations (PSOs) in saving human lives resulting from vehicles accidents have become a crucial concern. As far as many injured could lose their lives, and since no on-site medical assistance has been provided because of: late accident reporting, inaccurate geographic location, and lack of injured medical information.

The current existing solutions that provide assistance to passengers in case of vehicle accident occurrence are mainly deal with user interaction after the incident happened.

Some of the mobile solutions require that the injured must launch the app and request help manually and that would not be possible if he/she is under critical situation. The situation becomes worse if passengers went under unconscious state.[10] Our proposed solution is a smart IoT system consisting of architecture, design, and implementation. This proposed system requires no user interaction during or after the accident instead it provides instant automated vehicle accident detection and reporting. This method is applicable for any vehicle used in transportation and mainly for cars accidents. The primary users of this solution are the public safety organizations rescue teams (Emergency Management Agencies, Law Enforcement Agencies, Rescue Squads, and Emergency Medical Services, etc.).[9]The main contributions of this paper are: (a) Developing anew smart IoT system which helps in reducing the death rate caused from vehicle accidents. (b) Ensuring that no passenger (injured) interaction is required during or after the accident. (c) Transmitting automatically the basic medical information needed to the rescue teams . (d) Collecting geographical information and transmit to the rescue team. (e)Implementing a navigation system to find the nearest rescue team to the crash.

II. RELATED WORK

This section overlooks similar existing solutions and examines their advantages and disadvantages.

An IoT Approach to Vehicle Accident Detection, Reporting, and Navigation is a system that detects an accident and notifies the rescue team and PSO head quarters.The system transmits the vehicle details , passengers medical details and location of accident . The main disadvantage of this system is that it uses NFC reader for which the user needs to use mobile phone that has NFC inbuilt and it. The system does not provide continuous tracking for ambulance. Accident Detection and Reporting System using GPS ,GPRS and GSM Technology is a GPS, GSM based application in which the GPS module checks the speed of the vehicle and detect the accident when speed is less than the specified speed and notifies the location and time and speed utilizing the GSM network .The disadvantage of this system is the speed does not

give accurate result of an accident apart from this it doesn't give the occupants relevant information to the doctors.

A Comprehensive Solution To Road Traffic Accident Detection And Ambulance Management by Hari Sankar S, Jayadev K, Suraj B and Aparna P [4], is the application that detects the accident by checking the speed and reports it to nearby ambulance. This application is beneficial but the accelerometer that checks speed. But it requires a complex circuit and sophisticated air bag arrangement with a very fast response time so that air bag opens in real time just after accident and also it doesn't provide basic information about the injured.

Accident Reporting and Guidance System with automatic detection of the accident is the system that uses smartphones application to detect the accident and send report to the server, the server compares the previous report and the current report to detect the accident and notify the nearest ambulance. The main disadvantage of this application is it uses mobile phone application that needs human intervention and the application need to be running continuously and doesn't provide users information.

The above mention systems have some drawbacks. This paper proposes a new method which overcomes the above stated applications drawbacks.

III. PROPOSED SYSTEM

In this section, we have discussed our proposed system: In the proposed method, the goal is to detect the accident and report it to the nearest possible ambulance along with the location, vehicle details and passengers (medical) details. The system will continuously track the ambulance till it reaches to the accident location and it reaches to the nearest hospital. Our method composes of:

- a) Vehicle registration.
- b) Passengers identification.
- c) Monitoring accident.

Vehicle Registration : In this phase, the owner of the vehicle needs to register to the website in order to generate a unique id for identifying the vehicle. Since the proposed method is generic to any vehicle, anyone who owns the vehicle should register to the website. After registration done an unique id is assign to each vehicle. If the accident occur using pattern matching algorithm passengers id is matched with vehicle id and transmits to nearest rescue team.

Passengers identification : The proposed system uses UID aadhaar details of the passengers to uniquely identify he or she. Fingerprint scanner is placed inside the vehicle. As passenger enters to vehicle he or she has to scan his or her finger to give their identity. Using pattern matching the passengers aadhaar information is extracted from the aadhaar database and matched with vehicle id. When accident occurs this information is sent to the ambulance.

Monitoring accident : When a passenger gets in the car and scans his finger, the passengers ID and the vehicles ID are transmitted and stored into the server database. Consequently, the database server establishes the mapping

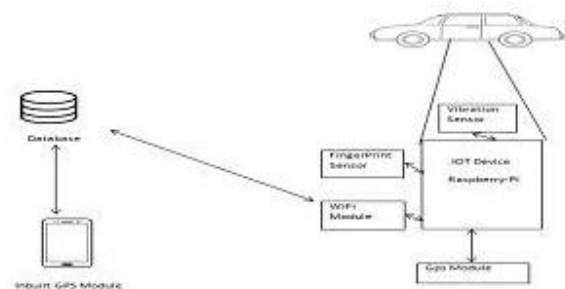


Fig. 1. System architecture[3]

between the aadhaar information of passengers and vehicle ID. As a result, the rescue team can recognize exactly the information of the passenger inside the vehicle. vibration sensors are used to detect the accident and GPS module is used to capture the accident location.

IV. DESIGN AND ARCHITECTURE

The below system architecture is the conceptual model that defines the structure, behavior, and more views of our proposed system.

This section discussed about the components used in the proposed method and their interface with system:

- 1) Raspberry-Pi: The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries. The Raspberry Pi contains CPU, GPU, USB, Audio Jack, Video Jack, Sd Card slot, USB LAN, HDMI port etc. [11]

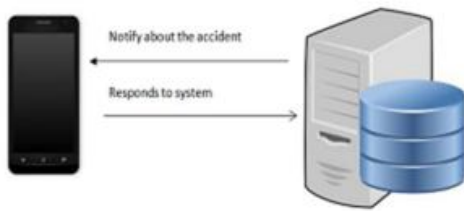
- 2) GPS Module: GPS navigation is a component that accurately calculates geographical location by receiving information from GPS satellites. [6] The SKM53 GPS module device is used to send to server the exact vehicle location.
- 3) Vibration Sensor: The vibration sensor with certain range of acceleration is fixed in the vehicle. In this project 3202 Vibration sensor is used which operates at the frequency of 315Mhz. When the vehicle is dashed with another or to any other obstacle, the vibration sensor detects whether the vibration is within the range or not. If it is greater, it reports as accident and activates the auto-dialer. It also consist of a switch which is placed in our convenient place. The vibration sensor waits for one minute to confirm the accident. If the person inside the car does not get injured, they can press the switch and stop the function of auto-dialer. This will helps us to avoid calling the ambulance when not needed. The range of the vibration sensor is 215-350Mhz. If the acceleration crosses this range, it detects the accident. For better operation this is placed in the center of the vehicles.
- 4) Raspberry Pi interface with sensor : The Raspberry Pi is a series of small single-board computers developed in the United Kingdom details of the board, so that the Raspberry Pi's OS is informed of the HAT, and the technical details of it, relevant to the OS using the HAT. CPU: 1.2 GHz 64/32-bit quad-core ARM Cortex System-on-chip used: Broadcom BCM2837 Memory: 1 GB LPDDR2 RAM at 900MHz. Vibration sensor is used to sense the occurrence of accident. Sensor is connected to raspberry-pi through GPIO pins.[11]
- 5) Raspberry Pi interface with GPS board: Raspberry Pi, interfaced with a GPS module, can be used for developing an advanced real-time navigation system. Incorporating the Pi's image processing, audio processing and web interface capabilities along with the GPS data we can develop advanced navigation schemes for real-time implementation. GPS module has four connection pins, namely: Vcc, GND, TX and RX. It requires a power input 5V 100mA, which can be provided using any suitable supply source. The RX pin of Pi, i.e the 10th GPIO pin on the RPi board, should be connected to the TX pin of the GPS module. The GND pin of the GPS module and the GND pin of the RPi.[11]
- 6) Raspberry Pi interface with Thumb scanner: Thumb Scanner is connected to raspberry-pi through USB port. If you have a sensor with 3.3V required input voltage, you can also connect this without USB converter directly to the GPIOs. Theoretically, you can do it also with 5V and a TTL converter, but I will not go into details in this tutorial. One advantage of the USB variant is that it is easier to check whether the sensor has been detected.
- 7) Communication Interface: Wi-Fi is a technology for wireless local area networking with devices based on the IEEE 802.11 standards. Devices that can use Wi-Fi technology include personal computers, video-game consoles, phones and tablets, digital cameras, smart TVs, digital audio players and modern printers. Wi-Fi compatible devices can connect to the Internet via a WLAN and a wireless access point. Such an access point (or hotspot) has a range of about 20 meters (66 feet) indoors and a greater range outdoors. Hotspot coverage can be as small as a single room with walls that block radio waves, or as large as many square kilometers achieved by using multiple overlapping access points.

V. USER INTERFACE WITH SYSTEM

This section describes how user interact with the system.

1. User Gives His Identity To System: In our proposed system we embedded a fingerprint scanner. As the passengers gets in the car they have to scan their thumb to give their identity to the system. scanned data is matched with aadhaar database to find the information related to the passenger. So it is mandatory for each boarded passengers to give their identity to the system through fingerprint scanner.

2. User Phone to server: In our proposed system one of the member of rescue team has Android phone with inbuilt Gps which helps while tracking them. As soon as accident is detected by the system, it will automatically notifies about the accident to the nearest rescue team through his mobile phone. If the receiver responds to system in limited time period the system start tracking the recipient otherwise the



VII. FUTURE WORK

1. In future in our proposed system we can use Government Aadhaar database to keep the details of each passengers.
2. Also in future we can avoid the need of user registration for his vehicle by accessing the Government RTO database.
3. Performance will be increased.

VIII. CONCLUSION

In a developing nation like India, with the rise in the total number of vehicles, road accidents are increasing at an alarming rate. If an accident occurs, the victim’s survival rate increases when you give immediate medical assistance. You can give medical assistance to an accident victim only when you know the exact location of the accident. Sometimes rescue team fail to reach the location due to insufficient information. Major accidents on highways, freeway and local roads can lead to huge social and economic impacts. Minor accidents may be resolved by the passengers themselves and do not airbags are deployed require immediate attention of authorities. The proposed method is auto- detection system that immediately notifies the nearby ambulance when accident occurs. The passenger on entering vehicle give the fingerprint and the adhar information of the respective passenger and the vehicle information is extracted when vibration sensor detects the accidents and this data (location, adhar information, vehicle data) is sent to nearby ambulance and the ambulance is provided with the navigation to reach the accident location ,in the whole process the ambulance is tracked till it reaches the hospital.

Activity Diagram

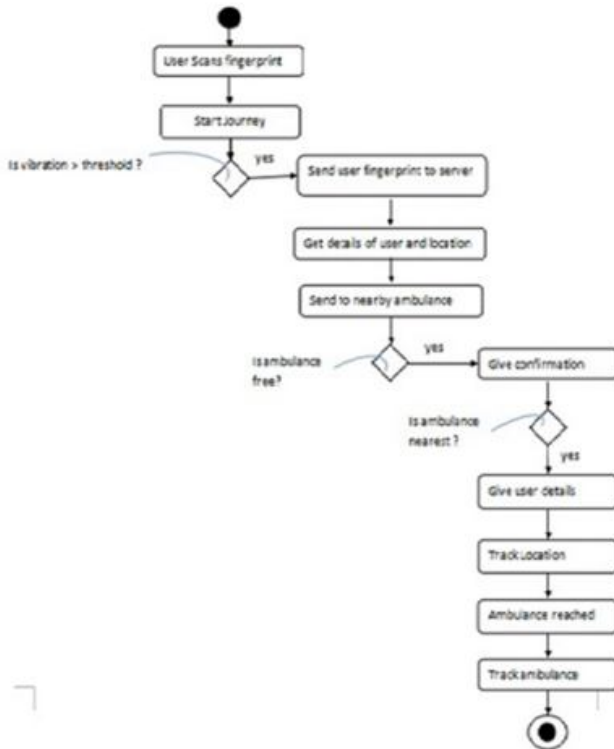


Fig. 2. User phone to system

Fig. 3. System Flowchart

system forwards the notifications to other nearest rescue team.

VI. ADVANTAGES

1. Quick solution to decrease the rate of road accidents.
- II. Any one who can afford car or any vehicle can use our system (low cost).
2. The Proposed system is generic and it Can be used in any vehicle.
3. The Proposed system is real time system which continuously track the ambulance.

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