A PROJECT REPORT ON

AUTOMATIC ACCIDENT DETECTION AND AMBULANCE RESCUE SYSTEM

SUBMITTED TO THE SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
IN THE FULFILLMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE

OF

BACHELOR OF ENGINEERING (COMPUTER ENGINEERING)

SUBMITTED BY

Aditya Chalikwar	Exam No : 71700771F
Aakash Chavan	Exam No : 71700780E
Piyush Chincholikar	Exam No : 71700788L
Karan Joshi	Exam No : 71700915H

DEPARTMENT OF COMPUTER ENGINEERING

PUNE INSTITUTE OF COMPUTER TECHNOLOGY

DHANKAWADI, PUNE - 411043

SAVITRIBAI PHULE PUNE UNIVERSITY

2019-2020

CERTIFICATE

This is to certify that the Project Entitled

AUTOMATIC ACCIDENT DETECTION AND AMBULANCE RESCUE SYSTEM

Submitted by

Aditya Chalikwar	Exam No : 71700771F
Aakash Chavan	Exam No : 71700780E
Piyush Chincholikar	Exam No : 71700788L
Karan Joshi	Exam No : 71700915H

are bonafide students of this institute and the work has been carried out by them under the supervision of **Prof. A. A. Jewalikar**, approved for the fulfillment of the requirements of Savitribai Phule Pune University, for the award of the degree of **Bachelor of Engineering** (Computer Engineering).

Prof. A. A. Jewalikar
Guide,
Dept. of Computer Engg.

Prof. Mrs. M. S. Takalikar
Head,
Dept. of Computer Engg.

Dr. P. T. Kulkarni
Principal,
Pune Institute of Computer Technology

Place: Pune
Date:

Acknowledgements

It gives us great pleasure in presenting the preliminary project report on **'AUTOMATIC ACCIDENT DETECTION AND AMBULANCE RESCUE SYSTEM'**.

We would like to take this opportunity to thank our internal guide **Prof. A. A. Jewalikar** for giving us all the help and guidance we needed. We are really grateful to them for their kind support. Their valuable suggestions were very helpful.

We are also grateful to **Prof. Mrs. M. S. Takalikar**, Head of Computer Engineering Department, PICT for her indispensable support, suggestions.

In the end our special thanks to the college for providing various resources such as laboratory with all needed software platforms, continuous Internet connection, for our Project.

Aditya Chalikwar
Aakash Chavan
Piyush Chincholikar
Karan Joshi
(B.E. Computer Engg.)

Abstract

Globally, a significant number of deaths occur each year, caused by excessive delays in rescue activities. For that systems based on the Internet of Things (IoT) have begun to be used to detect and report roadside incidents. Centralization and remoteness of cloud resources can result in an increased delay that raises serious concerns about its feasibility in emergency situations. To address the problem of latency, fog computing has emerged as a middle ware paradigm that brings the cloud-like resources closer to end devices. In light of this, the research proposed here leverages the advantages of sophisticated features of smartphones and fog computing to propose and develop a low cost and delay-aware accident detection and response system, which we term Automatic Accident Detection and Ambulance Rescue System. An Android application is developed that utilizes smartphone sensors for the detection of incidents. When an accident is detected, a plan of action is devised. Initially, a nearby hospital is notified about the accident that directs an ambulance to the accident site. In addition, the family contacts of the victim are also informed about the accident. All the required computation is performed on the nearby available fog nodes.

Keywords: Internet of Things, Fog nodes, real-time tracking, emergency services, accident detection.

Contents

List of Figures

List of Tables

CHAPTER 1

INTRODUCTION

1.1 Introduction

Catastrophes cause suffering, deaths and destruction of the environment, and infrastructure. In such scenarios, it is important to help out affected people on time, because delay could lead to the deaths. On the other hand, a smart plan of action could save major destruction and precious lives. In a report by the "Transport Research Wings" , there were 4,97,686 accidents reported in one country in 2011, whereas the deaths due to lack of an appropriate plan of action was 1,42,485. Similarly, the yearly financial loss estimated by the "International Road Federation" was $20 billion for the same nation. Further, due to the negligence of people and excessive use of the phone during driving were deduced as a major cause of road accidents which leads to the death of about 1.34 lakhs out of 1.4.

In such critical situations, technology can play an important role. Cars can be connected with various sensors to detect accidents. Fog computing is used in place cloud computing for processing data near the source. It works in a very fast response and decrease the delay. Therefore, a fog-based "automatic accident detection and ambulance rescue system" is proposed. The delay and network usage will be reduced by processing of data at the fog nodes.

1.2 Motivation

Nowadays, accidents have become a common phenomenon which is very unfortunate and saddening. Following are some unpleasant statistics in regards to accidents.

- Around 146,133 people died in road accidents in 2018, unfortunately about 30of deaths are caused due to delayed ambulance.
- According to the latest statistics, only three of England's 32 ambulance services reach a large majority of 'immediately life-threatening' call-outs within eight minutes
- 6536 people have died in accidents in Mumbai alone in the last year, according to a report in Times of India

Automobiles have evolved and become smart in convenience but there is not much development in the case of the safety of the people. The cars do have air bags to protect people from accidents but there is no solution to provide them immediate medication if needed.

1.3 Problem Definition

We aim to build an IoT system capable of detecting the small as well as fatal accidents and call the emergency services immediately. Project also includes guiding the ambulance to the accident spot by the best route using fog computing and other algorithms.

CHAPTER 2

LITERATURE SURVEY

- Arsalan Khan, Farzana Bibi, Muhammad Dilshad, Salman Ahmed, Zia Ullah, "Accident Detection and Smart Rescue System using Android Smartphone with Real-Time Location Tracking" International Journal of Advanced Computer Science and Applications(IJACSA), Vol. 9, No. 6, 2018.

  Abstract: A large number of deaths are caused by Traffic accidents worldwide. The global crisis of road safety can be seen by observing the significant number of deaths and injuries that are caused by road traffic accidents. In many situations the family members or emergency services are not informed in time. This results in delayed emergency service response time, which can lead to an individual's death or cause severe injury. The purpose of this work is to reduce the response time of emergency services in situations like traffic accidents or other emergencies such as fire, theft/robberies and medical emergencies. By utilizing onboard sensors of a smartphone to detect vehicular accidents and report it to the nearest emergency responder available and provide real time location tracking for responders and emergency victims, will drastically increase the chances of survival for emergency victims, and also help save emergency services time and resources.

- BilalL Khalid Dar, Munam Ali Shah, "Delay-Aware Accident Detection and Response System Using Fog Computing", IEEE Access, Special Section on Mobile Edge Computing and mobile Cloud Computing, date of publication May 1, 2019,

  Abstract: Emergencies, by definition, are unpredictable and rapid response is a key requirement in emergency management. Globally, a significant number of deaths occur each year, caused by excessive delays in rescue activities. Vehicles embedded with sophisticated technologies, along with roads equipped with advanced infrastructure, can play a vital role in the timely identification and notification of roadside incidents. However, such infrastructure and technologically-rich vehicles are rarely available in less developed countries. Hence, in such countries, low-cost solutions are required to address the issue. Systems based on the Internet of Things (IoT) have begun to be used to detect and report roadside incidents. The majority of the systems designed for this purpose involve the use of the cloud to compute, manage, and store information. However, the centralization and remoteness of cloud resources can result in an increased delay that raises serious concerns about its feasibility in emergency situations; in life-threatening situations, all delays should be minimized where feasible. To address the problem of latency, fog computing has emerged as a middle ware paradigm that brings the cloud-like resources closer to end devices. In light of this, the research proposed here leverages the advantages of sophisticated features of smartphones and fog computing to propose and develop a low-cost and delay-aware accident detection and response system, which we term Emergency Response and Disaster Management System (ERDMS). An Android application is developed that utilizes

smartphone sensors for the detection of incidents. When an accident is detected, a plan of action is devised. Initially, a nearby hospital is located using the Global Positioning System (GPS). The emergency department of the hospital is notified about the accident that directs an ambulance to the accident site. In addition, the family contacts of the victim are also informed about the accident. All the required computation is performed on the nearby available fog nodes.

- Tandrima Chowdhury, Smriti Singh, Dr.S.Maflin Shaby, "A Rescue System of an Advanced Ambulance Using Prioritized Traffic Switching", IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication Systems(ICIIECS)

  Abstract: Traffic congestion and tidal flow management are two major problems in modern urban areas which lead to road accident and loss of life. To implement this, we introduce Automatic Ambulance Rescue System (AARS). The main idea behind this scheme is ambulance can reach smoothly to hospital in time, by mechanically controlling traffic lights in path. The ambulance is controlled by control unit which gives the shortest path for reaching hospital and controls traffic lights. The sensor senses the spot and the nearest ambulance reaches the accident spot. The traffic lights in the path of the ambulance are controlled. The ambulance is guided to hospital by server through shortest route. The vehicle unit installed in vehicle senses the accident and sends the location of the accident to the main server in the ambulance section. The main server finds the ambulance, nearest to the accident spot and also shortest path between ambulance, accident spot and nearest hospital.

CHAPTER 3

SOFTWARE REQUIREMENTS SPECIFICATION

3.1 Introduction

3.1.1 Scope

- The User location is got using mobile GPS and accident is detected using mobile sensors
- The scope is bound within the advantages and limitations of the fog-server model and fog computing

3.1.2 Assumptions and Dependencies

- The person in the car has our app installed on his/her mobile and should be running in the background
- The mobile should have an active and fast internet connection with GPS on

3.2 Functional Requirements

- System should be able to detect the accident.
- System should be able to communicate with the help of request to the fog server.
- Fog server should give the best results regarding nearest available ambulance.
- Shortest path feature should be there for ambulance.

3.3 Non-Functional Requirements

- Capable of hovering at least 1 meter above the ground.
- Detect target within 3 meter from itself in the field of view or accident.

3.4 System Requirements

3.4.1 Database Requirements

- SQL Language
- Structured tables static data

3.4.2 Software Requirements

1. API's
    - Google Maps
    - Google Direction
    - Google Location
    - Google Places
2. Android Studio

3.4.2.1 Hardware Requirements

- NodeMCU
- Miid-tier Server
    - 64 bit system
    - 4GB RAM
    - 1.4 GHz processor or higher

3.5 Analysis Model: Agile SDLC Model

Agile SDLC model is a combination of iterative and incremental process models with focus on process adaptability and customer satisfaction by rapid delivery of working software product. Agile Methods break the product into small incremental builds. These builds are provided in iterations. Each iteration typically lasts from about one to three weeks. Every iteration involves cross functional teams working simultaneously on various areas like :

- Planning
- Requirements Analysis
- Design
- Coding
- Unit Testing
- Deployment

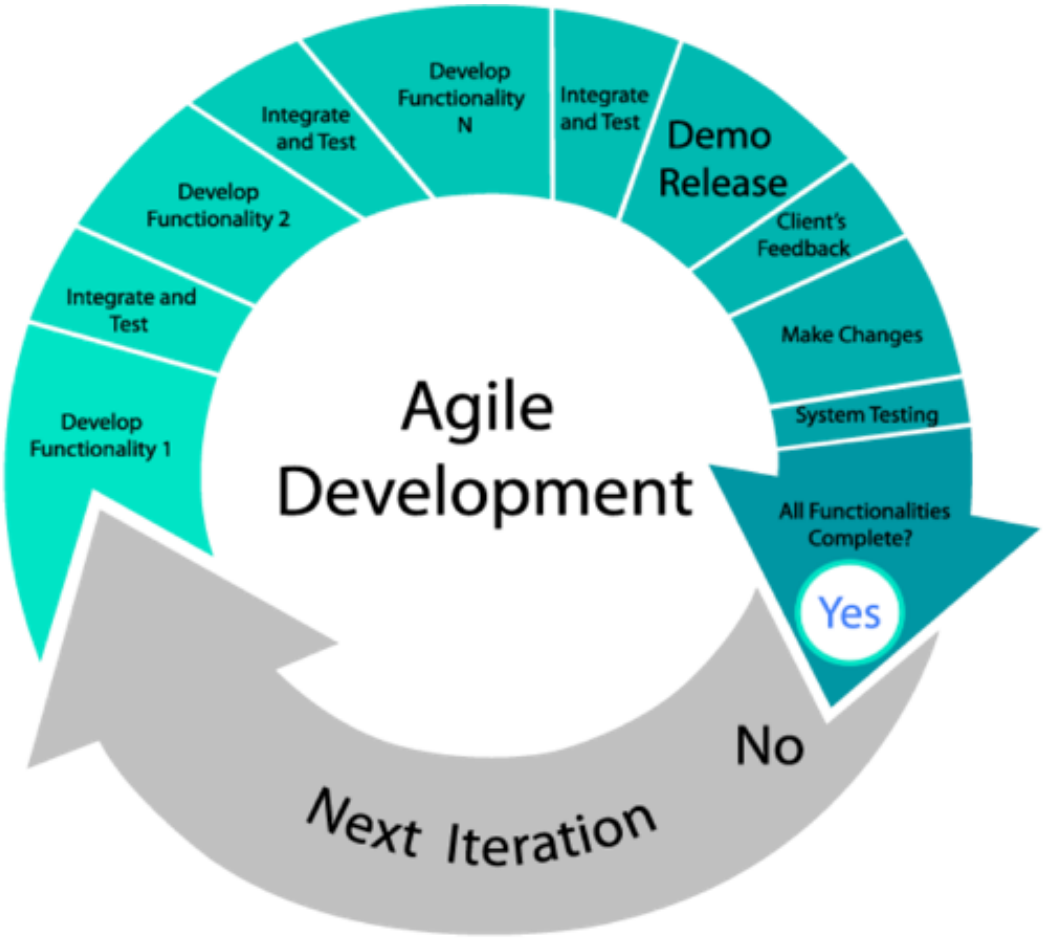


Figure 3.1: Agile Development Life Cycle

At the end of the iteration, a working product is displayed to the customer and important stakeholders. After each iteration, customers and stakeholders of the project can get a fair idea of the updated software that is being developed by the agile model. So, any change in the system can be addressed at any iteration. Customer Interaction is the backbone of this Agile methodology, and open communication with minimum documentation are the typical features of Agile development environment.

CHAPTER 4

OTHER SPECIFICATIONS

4.1 Advantages

- Fast Computing : Unlike cloud computing, Fog computing uses local storage for data processing. This will increase the speed of service which is very crucial.
- User Friendly : We are using an app for detecting accidents and providing service. People will find it easy to use an app for safety.
- Life Saving : Providing immediate medical service to affected people will save a lot of people from dying.
- Increase standards of living : This type of service will improve the way people travel and they will have a feeling of safety even in the worst cases

4.2 Limitations

- False Detections : This has very less chance but not ignorable. Sometimes the sensors may input the vibrations of the phone due to other factors like if the phone falls down or falls off the car. So user will have to make sure the phone is in the right position throughout the journey.
- Only Mobile Sensors : We are now using only sensors of the smartphone, so all the type of detections can't be made. Moreover, if the smartphone switches off due to the accident, the accident may not be detected.

4.3 Applications

- Detection of accident.
- Find nearest ambulance in the area.
- Notify nearest hospital about the accident
- Prioritised signal switching system for Ambulance

CHAPTER 5

SYSTEM DESIGN

5.1 System Architecture

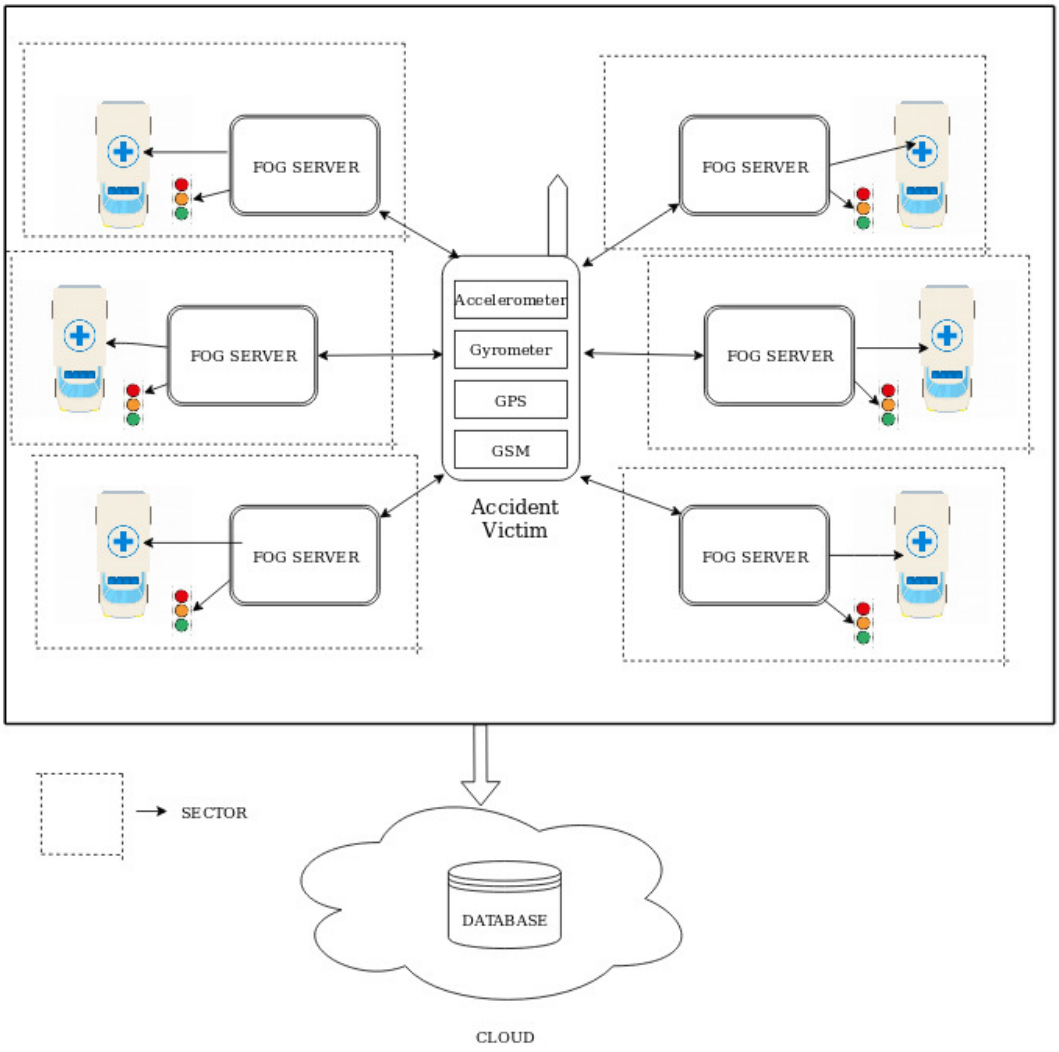


Figure 5.1: System Architecture

5.2 Data Flow Diagram

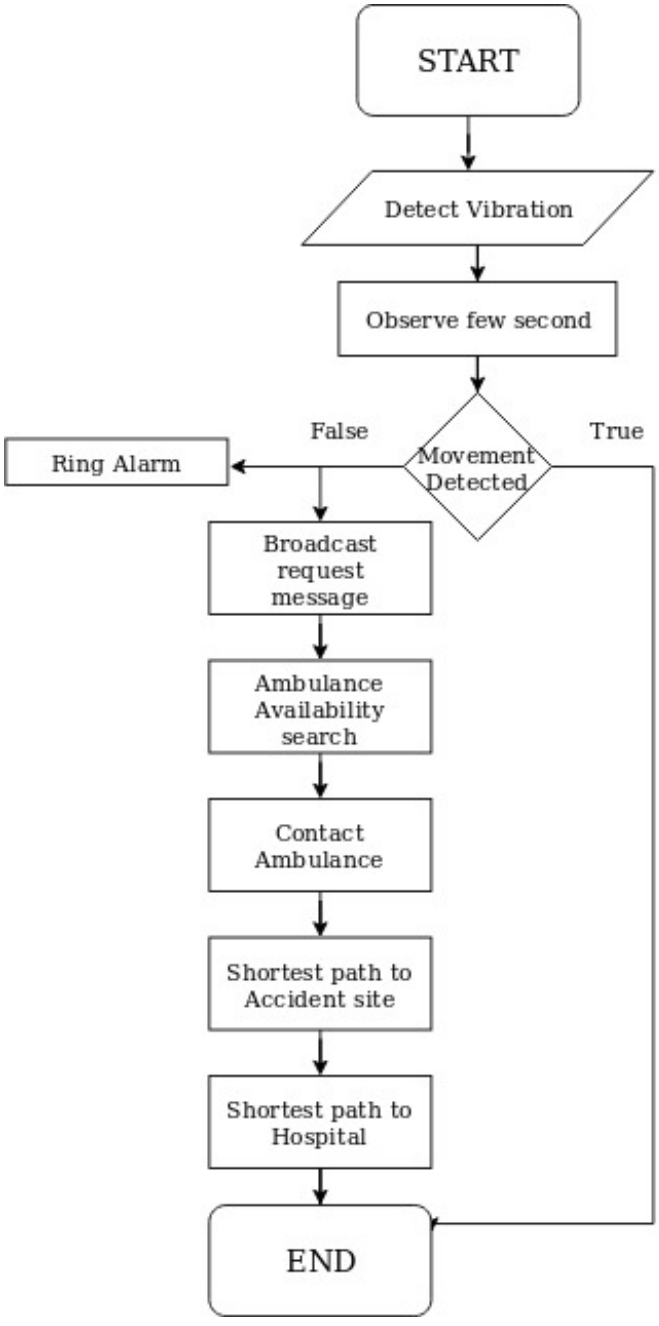


Figure 5.2: DFD Level 0

5.3 UML Diagrams

5.3.1 Use Case Diagram

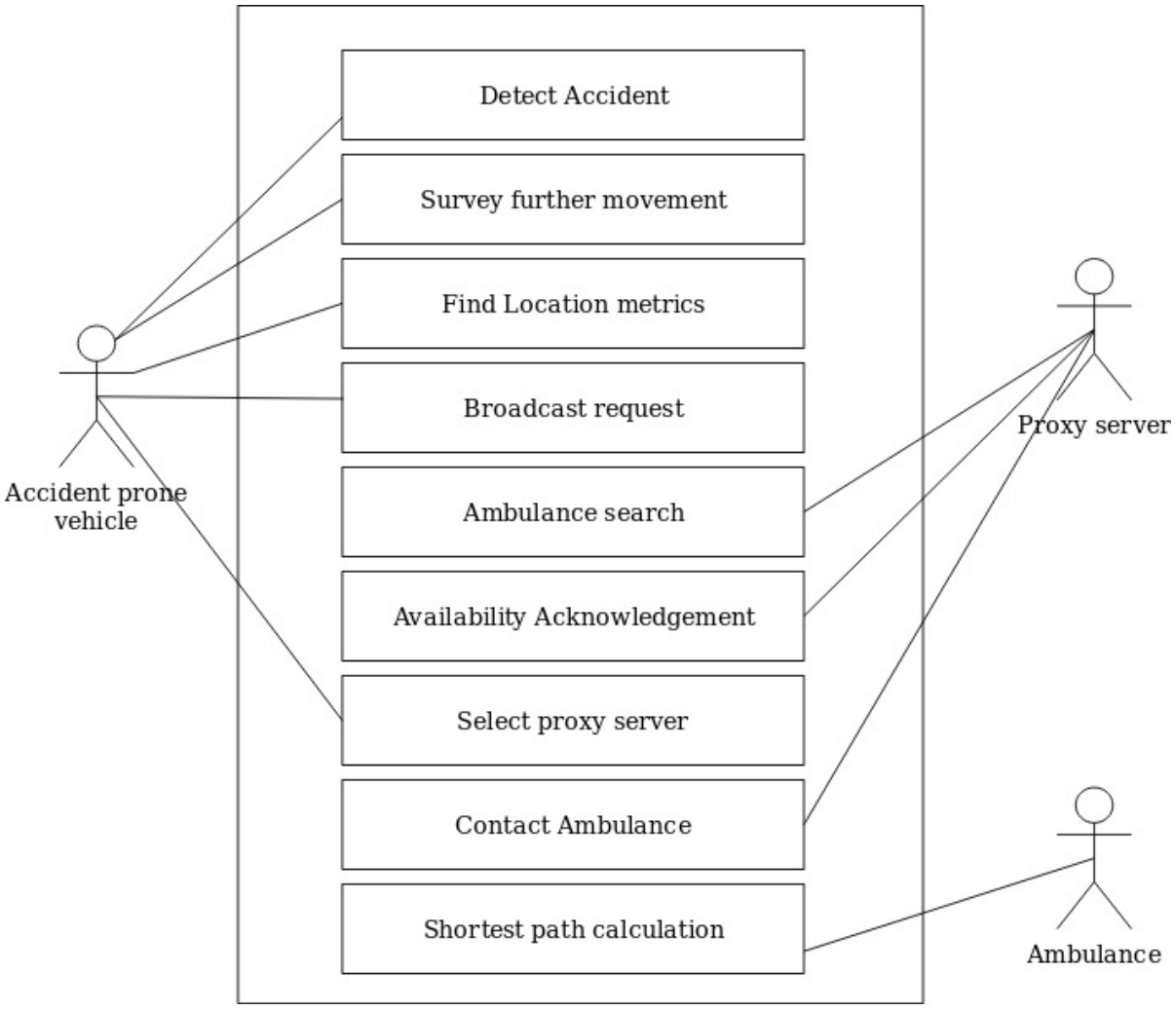


Figure 5.3: Use Case Diagram

5.3.2 Class Diagram

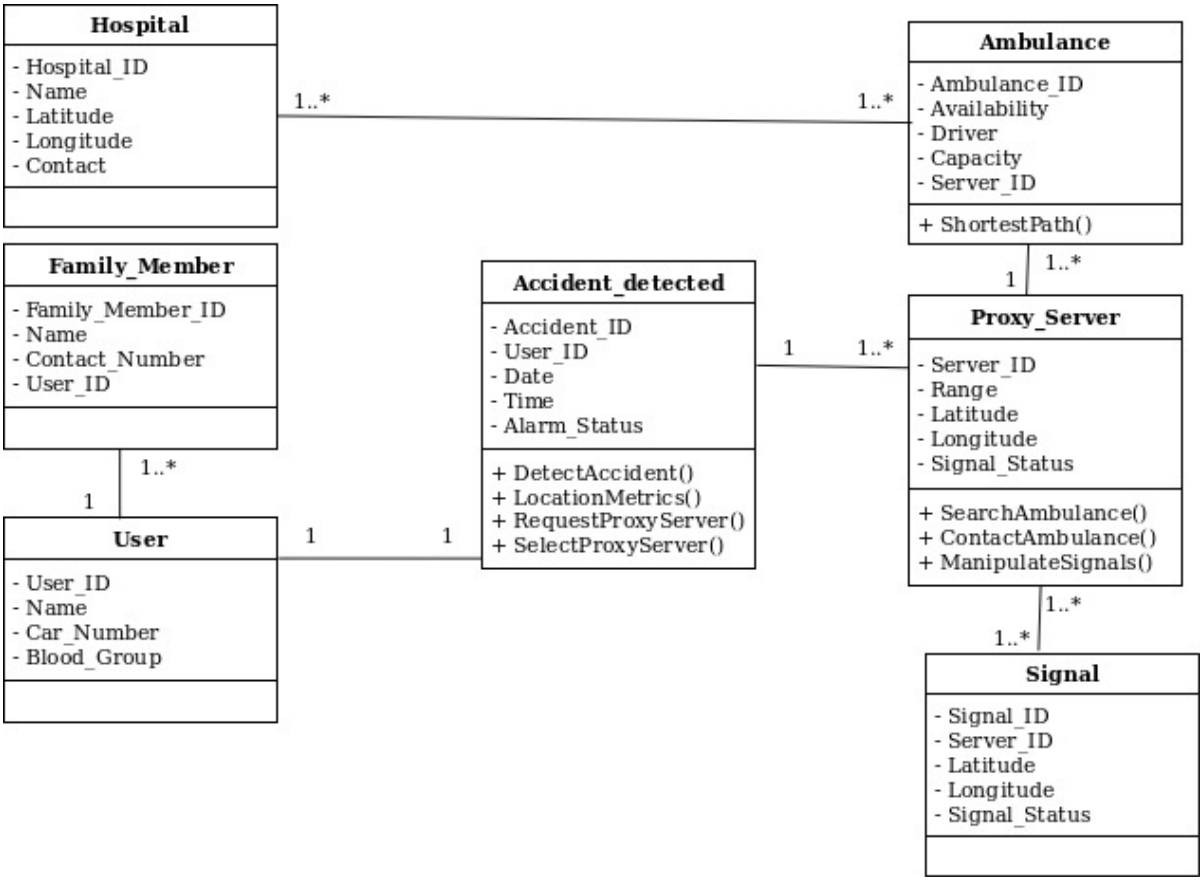


Figure 5.4: Class Diagram

CHAPTER 6

PROJECT PLAN

6.1 Project Resources

6.1.1 Human Resources

- Number of people: 4
- Skills:
  - Android Studio
  - Fog Computing
  - Arduino

6.1.2 Development Resources

- Hardware:
  - 2.6 GHz processor
  - 4 GB RAM
  - 250 GB disk space
- Software:
  - Arduino IDE
  - Android Studio
  - Git
  - Apache Tomcat Server

6.2 Risk Management

6.2.1 Risks Identified

Risk ID	1
Description	False Accident Detection
Category	Software bug
Probability	Low
Impact	Medium
Response	Mitigate
Strategy	Pop up to cancel the false detection
Status	Identified

Table 6.1: Risk 1

Risk ID	2
Description	Inevitable Traffic
Category	Environmental
Probability	Medium
Impact	High
Response	Immediate
Strategy	Go for optimal path
Status	Identified

Table 6.2: Risk 2

6.3 Risk Justification

- Risk ID1 is certain to occur as mobile inbuilt sensors are not much reliable use of MEMS sensors will be help to reduce risk.
- Risk ID2 is certain to occur as traffic is dependent on the time of day and can't be predicted.

6.4 Project Schedule

6.4.1 Task Set

Task	**Description**
Task A	Domain study and literature survey
Task B	Identify problems and obstacles
Task C	Decide Scope
Task D	Decide deliverable and plan requirements
Task E	Create App Using Android Studio
Task F	Signal Switching System using Fog Computing
Task G	Data storage and maintenance
Task H	Testing

Table 6.3: Task Set

This will help us to share signal information present in path to specific fog server. This will be helpful at the time of Signal Switching.

CHAPTER 7

PROJECT IMPLEMENTATION

7.1 Overview of Project Modules

- Car App Module - This app will provide functionality such as help accident detection, communicate with fog server, inform relatives in post accident condition, etc. This act as starting phase of whole mechanism.
- Ambulance App Module - Receives location of the victim from the fog-server and shows ambulance the shortest path to the accident point. It continuously is in communication with fog-server to change the signal when the ambulance is nearer to the signal
- Signal Switching System Module - Switching the traffic light green for Ambulance using the location data of the vehicle.
- Database Module - The database include static database such as fog server information, signal information, User registration data, Ambulance driver registration and dynamic database may include Accident detection, Fog server selection, Ambulance allocation.

7.2 Tools and Technologies Used

- Arduino IDE
- Android Studio IDE
- Apache Tomcat Server
- Maps API
- MySQL Database
- Google Firebase
- HTTP/REST API

7.3 Algorithm Details

7.3.1 Algorithm 1

Accident detection and Discover Ambulance :

1. This phase is stimulated after accident occurrence. Here, accident is detected using accelerometer and gyroscope sensor.
2. Accident parameters and victim information is forwarded to relatives of victim. Further, communication is established with nearest static fog server with availability of ambulance in certain range.
3. Fog server is responsible to inform ambulance driver about accident parameters.

7.3.2 Algorithm 2

Shortest Path to Accident location and Nearest Hospital :

1. Android app provided to driver helps in finding nearest route to accident location with the help of Map API. It is also used to locate nearest hospital from accident location.
2. Fog server parameters are statically stored in Database. This can be used by android app to detect nearest fog server.
3. The ambulance will be considered as enclosed in range of nearest fog server.
4. This will help us to share signal information present in path to specific fog server. This will be helpful at the time of Signal Switching.

7.3.3 Algorithm 3

Signal Switching System :

1. Receive data from the local fog node about vehicle having route through that junction.
2. Identify the direct from which vehicle will arrive using real-time tracking of the vehicle using Maps API.
3. When the vehicle come in the range of the signal, switching the required signal to green and other signals to red.
4. Once the vehicle passes the traffic signal, switch the regular signal switching system.

CHAPTER 8

SOFTWARE TESTING

8.1 Type of Testing

- Type of Testing

8.2 Test cases & Test Results

- Test cases & Test Results

CHAPTER 9

RESULTS

9.1 Outcomes

1.

9.2 Screen Shots

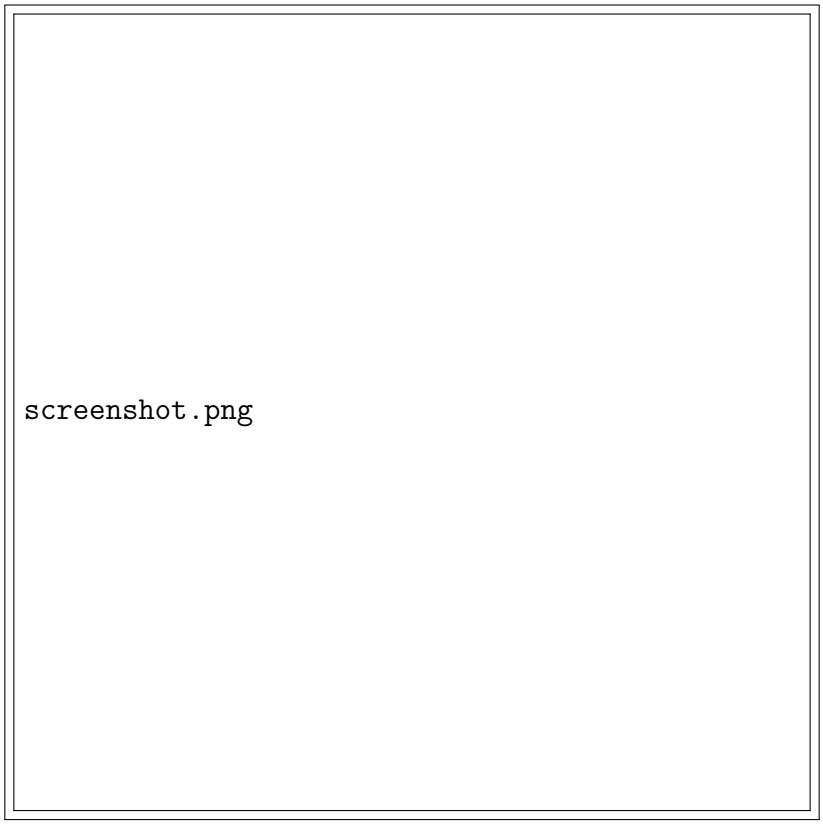


Figure 9.1: Screenshot

CHAPTER 10

CONCLUSION AND FUTURE SCOPE

10.1 Conclusion

Death rate due to accidents are increasing unabated and there are very less services immediately available. The existing system has latency due to centralised response system. To overcome the disadvantages of the existing systems, we are using fog nodes which plays an important role in time-sensitive systems. As, even with the growing number of data and computations, these scenarios require a quick response. We achieved this objective by processing data on the edge of the network.

10.2 Future Scope

Future plan is to do this in real-time, to check the real-time response of the system and to compare the response time of fog-based and cloud-based systems. Additionally, we will integrate the real time intelligent traffic signaling for the ambulance. We are also including the following minor future scopes.

- Connecting cars with sensors for detecting accidents accurately
- Removing app dependency in accident detection

ANNEXURE A

FEASIBILITY STUDY

A.1 Feasibility Study

This project is focused on developing a standard and cost-efficient approach for client and AR server communication by replacing the VPN tunnel that is used currently. Possible Solutions :

1. RESTful architecture - Each physical entity or abstract concept can be a resource. A representation is any useful information about the state of a resource. REST using HTTP standard can be one way for establishing communication between client and server[**?**].

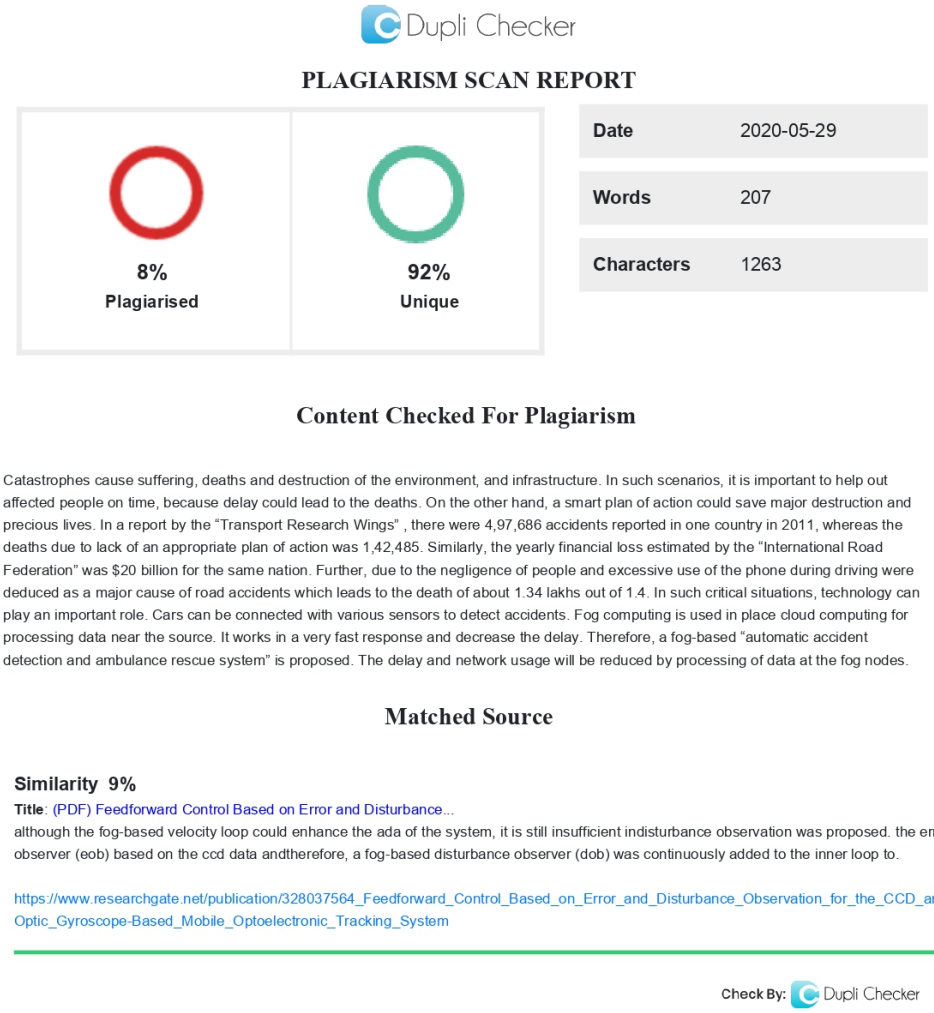
2. RPC over HTTP - RPC over HTTP allows remote clients to securely and efficiently connect across the Internet to RPC server programs and execute remote procedure calls without having to log into a virtual private network (VPN) first.

A.1.1 Evaluation

The APIs that are used currently support RPC implementation. RPC payloads are sent over the VPN tunnel. Using a REST architecture will require to transform the entire set of APIs into a consistent JSON / XML format for representation.
If the project was to be built from scratch, REST would be preferable since it is easier to build and extend. But as our work is on top of already built APIs that support RPC, RPC over HTTP would be a feasible option. Moreover, RESTful HTTP lacks tooling and interface definition languages. It is unsuitable for application-to-application integration, and it can't adequately support distributed transactions[**?**].

ANNEXURE B

PLAGIARISM REPORT



Dupli Checker

PLAGIARISM SCAN REPORT

Date	2020-05-29
Words	207
Characters	1263

8%
Plagiarised

92%
Unique

Content Checked For Plagiarism

Catastrophes cause suffering, deaths and destruction of the environment, and infrastructure. In such scenarios, it is important to help out affected people on time, because delay could lead to the deaths. On the other hand, a smart plan of action could save major destruction and precious lives. In a report by the "Transport Research Wings" , there were 4,97,686 accidents reported in one country in 2011, whereas the deaths due to lack of an appropriate plan of action was 1,42,485. Similarly, the yearly financial loss estimated by the "International Road Federation" was $20 billion for the same nation. Further, due to the negligence of people and excessive use of the phone during driving were deduced as a major cause of road accidents which leads to the death of about 1.34 lakhs out of 1.4. In such critical situations, technology can play an important role. Cars can be connected with various sensors to detect accidents. Fog computing is used in place cloud computing for processing data near the source. It works in a very fast response and decrease the delay. Therefore, a fog-based "automatic accident detection and ambulance rescue system" is proposed. The delay and network usage will be reduced by processing of data at the fog nodes.

Matched Source

Similarity 9%

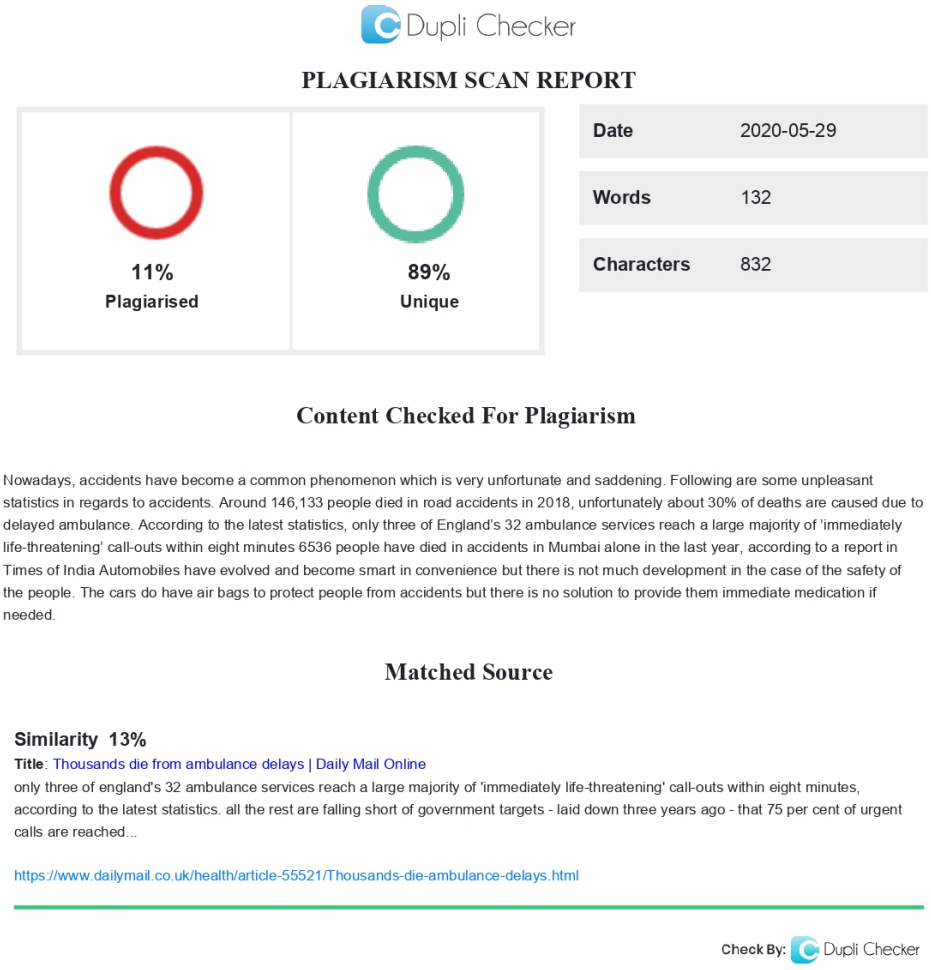
Title: (PDF) Feedforward Control Based on Error and Disturbance...

although the fog-based velocity loop could enhance the ada of the system, it is still insufficient indisturbance observation was proposed. the error observer (eob) based on the ccd data andtherefore, a fog-based disturbance observer (dob) was continuously added to the inner loop to.

https://www.researchgate.net/publication/328037564_Feedforward_Control_Based_on_Error_and_Disturbance_Observation_for_the_CCD_and_Fiber-Optic_Gyroscope-Based_Mobile_Optoelectronic_Tracking_System

Check By: Dupli Checker

Figure B.1: Plagiarism Report (Abstract)



Dupli Checker

PLAGIARISM SCAN REPORT

Date	2020-05-29
Words	132
Characters	832

11%
Plagiarised

89%
Unique

Content Checked For Plagiarism

Nowadays, accidents have become a common phenomenon which is very unfortunate and saddening. Following are some unpleasant statistics in regards to accidents. Around 146,133 people died in road accidents in 2018, unfortunately about 30% of deaths are caused due to delayed ambulance. According to the latest statistics, only three of England's 32 ambulance services reach a large majority of 'immediately life-threatening' call-outs within eight minutes 6536 people have died in accidents in Mumbai alone in the last year, according to a report in Times of India Automobiles have evolved and become smart in convenience but there is not much development in the case of the safety of the people. The cars do have air bags to protect people from accidents but there is no solution to provide them immediate medication if needed.

Matched Source

Similarity 13%

Title: Thousands die from ambulance delays | Daily Mail Online

only three of england's 32 ambulance services reach a large majority of 'immediately life-threatening' call-outs within eight minutes, according to the latest statistics. all the rest are falling short of government targets - laid down three years ago - that 75 per cent of urgent calls are reached...

https://www.dailymail.co.uk/health/article-55521/Thousands-die-ambulance-delays.html

Check By: Dupli Checker

Figure B.2: Plagiarism Report (Motivation)

CHAPTER 11

REFERENCES

[1] S. K. Bilal Khalid Dar, Munam Ali Shah, "Delay-aware accident detection and response system using fog computing," *IEEE Access-volume 7*, 2019.

[2] A. N. Bilal Khalid Dar, Huniya Shahid, "Fog computing based automated accident detection and emergency response system using android smartphone," *14th International Conference on Emerging Technologies (ICET)*, 2018.

[3] F. B. Arsalan Khan, "Accident detection and smart rescue system using android smartphone with real-time location tracking," *International Journal of Advanced Computer Science and Applications, Vol. 9, No. 6*, 2018.

[4] D. S. Tandrima Chowdhury, Smriti Singh, "A rescue system of an advanced ambulance using prioritized traffic switching," *IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication Systems (ICECS)*, 2015.

[5] M. K.Sangeetha, P.Archana and P.Ramya, "Automatic ambulance rescue with intelligent traffic light system," *IOSR Journal of Engineering (IOSRJEN) Vol. 04, Issue 02*, 2014.