ACCIDENT DETECTION USING VEHICULAR ADHOC NETWORK

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INTRODUCTION

- VANET, or Vehicular AdHoc Network, is an application of MANET (Mobile AdHoc Network)
- Vehicles in the network communicate during the event of an accident to any of their peers

PROBLEM STATEMENT

- *Chances of saving precious human lives during the course of an unfortunate accident are diminishing.*
- *The time taken for vital assistance to get notified about an accident can determine the chances of survival of the victims.*

PROPOSED SYSTEM

- Sensing of an accident using a combination of multiple sensors
- Transmission of data efficiently using VANET principle
- Processing of incoming data at the central hub
- Classification of accidents based on their severity using Machine Learning
- Informing concerned authorities and organisations, providing information such as shortest distance to accident spot

ARCHITECTURE

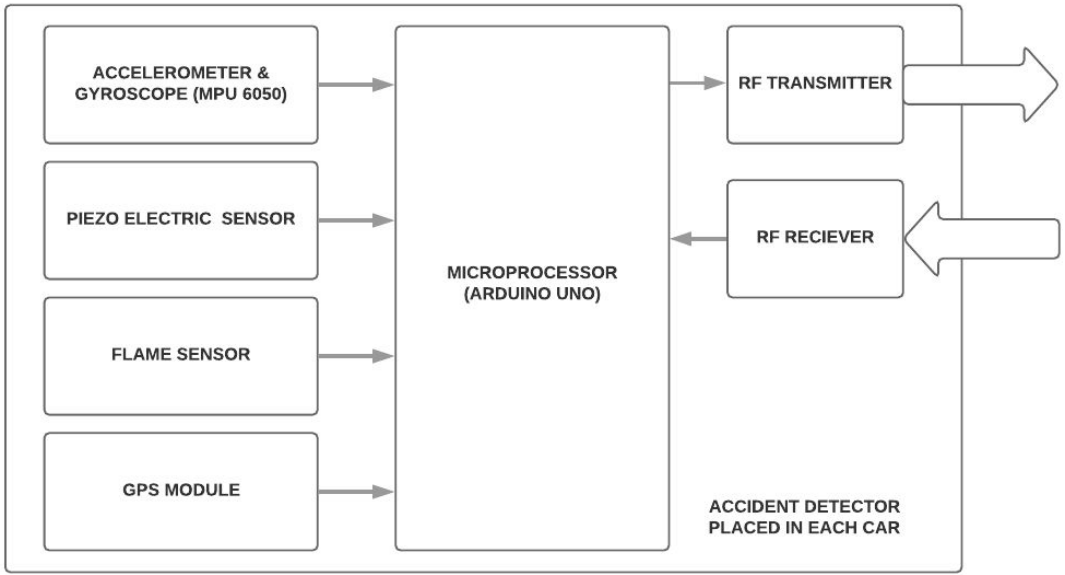

Figure : Accident Detection within the affected vehicle

ARCHITECTURE (cont'd)

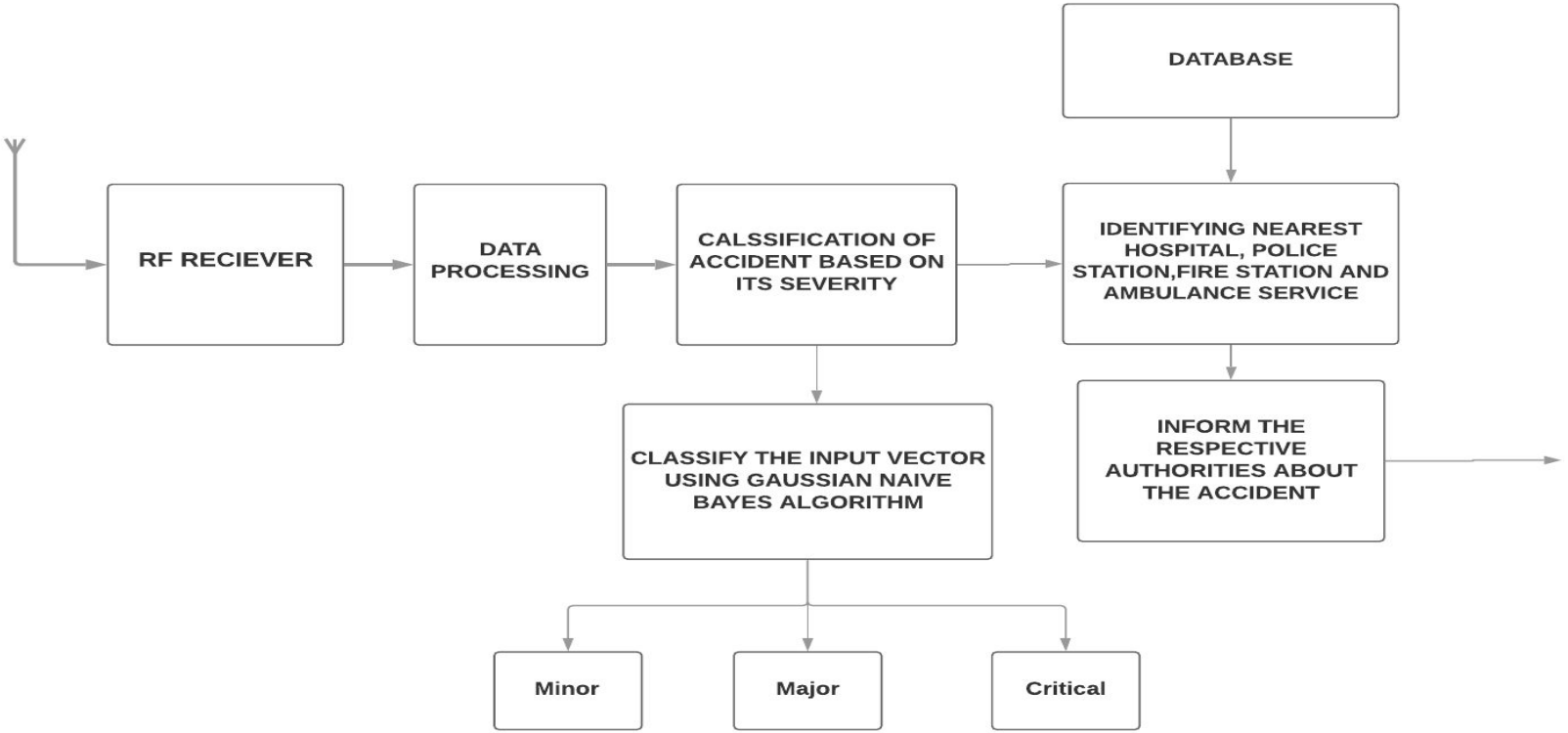

Figure : Intervehicular Communication (From site of accident to the central hub)

IMPLEMENTATION

Within The Vehicle :

- Microprocessor - Arduino UNO (inside each node, i.e, vehicle)
- Sensors -
  - Accelerometer & Gyroscope (MPU 6050)
  - IR Fire Sensor
  - Piezoelectric Sensor (Flexi-Force A301)
  - GPS module (NEO 6M GPS Module)
  - RF Transmitter and receiver (433 MHz)

IMPLEMENTATION

Outside the Vehicle :

- Central Hub
  - Classification of accidents based on severity.
    - Using the pre-trained Naive Bayes algorithm we classify accident based on the received data.
  - Finding nearest hospital, police station, fire station and ambulance service.
  - Informing the nearest medical centre to the accident spot, and other required personnel.

IMPLEMENTATION

How is the data classified ?

- The machine learning classification technique called ‘Gaussian Naive Bayes’
- It is implemented using SciKit library in Python, which classifies data in the online database made in Xampp
- The three class labels are : minor, major and critical

IMPLEMENTATION

Identifying nearest hospital, police station, etc :

- The '**Haversine formula**' is used to calculate distance between two coordinates on a sphere
- Using the formula the distances to all organisations stored in the database from the accident spot is calculated as follows :

$$d = 2r\sin^{-1}\left(\sqrt{\sin^2\left(\frac{\Phi_2-\Phi_1}{2}\right) + \cos(\Phi_1)\cos(\Phi_2)\sin^2\left(\frac{\lambda_2-\lambda_1}{2}\right)}\right)$$

OUTPUT

- Obtaining analog data from the various sensors placed at particular positions in the nodes
- Transmitting data including location and other parameters efficiently
- Classification of accidents into minor, major and critical
- SMS received at nearest hospital, police station and fire station (only in the event of a fire detected), informing about the severity of the accident and location
- Mail sent to nearest ambulance service specifying the shortest route to the accident spot.

OUTPUT

VehicleID	Roll	Pitch	Impact	Fire	Time Of Accident	Lat	Lon	Severity	Nearest Hospital	Nearest PoliceStation	Nearest FireStation	Nearest Ambulance	Current Status
KL65	-12.41	-1.19	56	1	2020-06-04 13:24:45	10.314961	76.35411	Critical	Apollo Adlux Kochi, Karukutty, Kochi	Edathala	Angamaly	Jeevan Raksha Vedi	MsgSent-Active
KL61	-10.64	0.28	83	0	2020-06-04 01:08:34	10.0603	76.6352	Major	Rajagiri Hospital, Choondy, Kochi	Kothamangalam		St. Thomas Ambulance Service Kothamangalam	MsgSent-Active

Find Severity | Find Nearest Hospital | Find Nearest PoliceStation | Find Nearest FireStation | Find Nearest Ambulance | Send Alert

Refresh Page

Figure : Database Values, after classification and identifying nearest authorities and organisations

OUTPUT

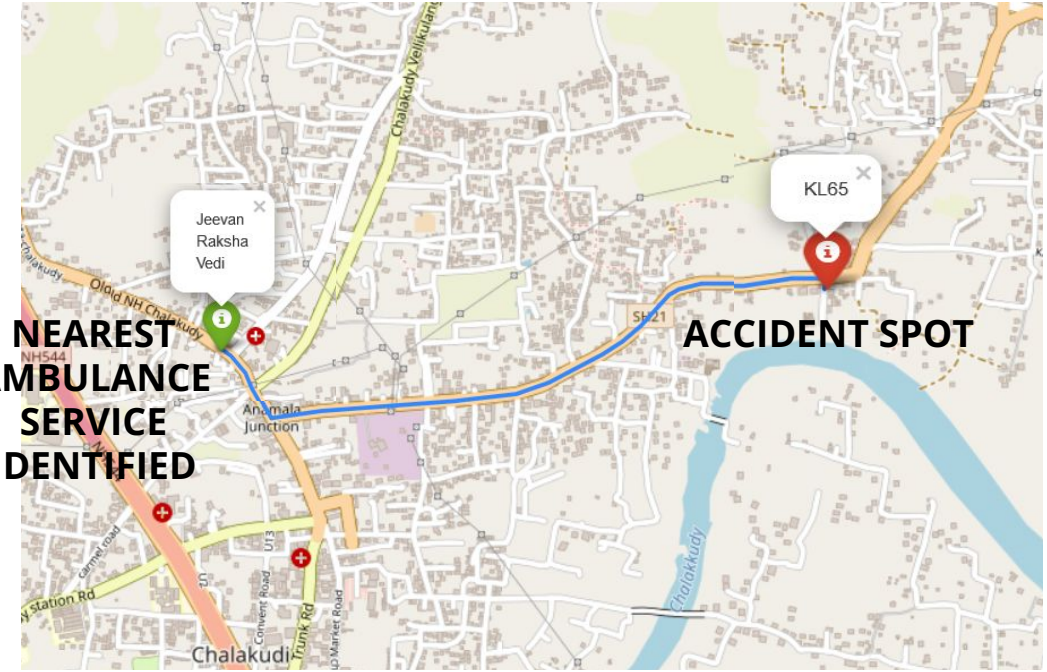

Figure : Map showing the shortest route to the accident spot, as mailed to the ambulance service

OUTPUT

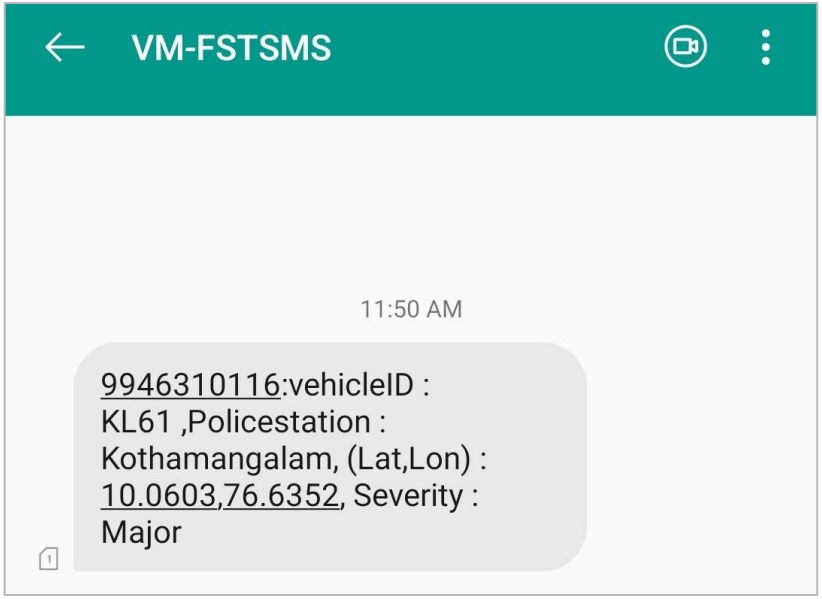

Figure : Message received at the nearest identified police station to the accident spot

DATASET

roll	pitch	force	fire	acc_severity
14.94	89.94	90	Yes	Critical
15.35	87.92	102	Yes	Critical
16.65	87.79	110	No	Critical
18.65	85.35	85	Yes	Critical
18.72	83.53	82	No	Critical
18.86	83.29	79	No	Critical
19.26	82.38	98	Yes	Critical
19.93	82.36	97	No	Critical
20.15	81.34	135	No	Critical
20.60	80.51	131	No	Critical
20.64	80.45	129	Yes	Critical
22.34	80.16	137	Yes	Critical
22.68	79.43	149	Yes	Critical
23.96	79.30	145	No	Critical
23.99	78.49	122	No	Major
24.16	77.50	125	No	Major
24.38	76.57	141	No	Major
24.94	75.56	131	No	Major
25.06	74.10	91	Yes	Critical
25.86	73.54	143	No	Major
25.86	73.16	141	Yes	Critical
26.41	72.83	132	No	Major
26.46	72.72	147	Yes	Critical

Figure: A portion of dataset used for training

RESULT

- An accurate system which detects accidents using many parameters being monitored continuously
- A system which accurately classifies accidents based on severity and finds nearest organisations such as hospital, ambulance service,etc
- A system which can efficiently reduce the chances of accidents not being spotted, and decrease the response time of important life-saving authorities

THANK YOU