

Identification of Accident-Prone Sites using Internet of Things (AD-HOC Networks and Raspberry Pi)

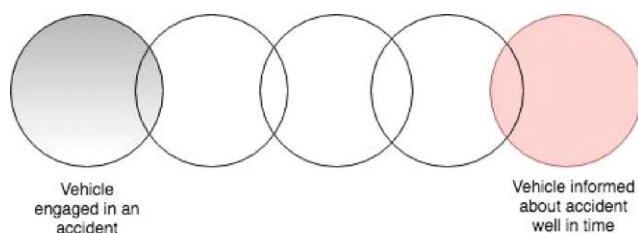
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Abstract— Altering the emergency centers like hospitals, police stations, ambulances, and fire stations also to the Traffic Light management system regarding the accident in a particular area and identification of accident-prone spots beforehand (alerting the drivers) and automatically broadcasting messages through AD-HOC wireless technology which uses beacons. By this system, we can decrease the chances of death due to accidents as this system signals to the nearby milestones and moving vehicles.

Keywords— AD-HOC, Raspberry Pi, Internet Of Things (IoT), Beacons, Mishappening

INTRODUCTION :

Road accidents have always been a major issue for India. In India, more than 150,000 people are killed each year in traffic accidents, the accident-related deaths in India in 2019 were 151,113 in number[1]. That's about 400 fatalities a day and far higher than developed auto markets like the US, which in 2019 logged about 37,595[2]. Identification of an accident-prone area is a major issue in India, so automatically broadcasting messages to nearby authorized people in case of accidents can prove a breakthrough for Traffic Shaping. This project aims to combat this prolonged case of unworthy accidents using IoT devices (Raspberry Pi) and AD-HOC networking. Internet of things, or IoT, is a system that involves the correlation of certain devices, parts of automobiles, different objects in living beings to transmit data excluding the interaction of human-to-human or human-to-machine. The thing in IoT can be anyone or anything which is integrated with a device that can send useful signals over a network. Also, it will help in monitoring and supervising rash driving cases. The Android App will have an easy and simple to use interface. In case of emergency, ambulances and fire trucks can broadcast emergency beacon messages to make way at the earliest.



AD-HOC:

AD-HOC is a wireless network that is a dynamic local area network wherein connections do not involve any central device (like routers in wired networks or access points in wireless networks). AD-HOC involves multi-hop radio replaying. Unlike cellular networks, all the components of the AD-HOC network are dynamic. Each node in the wireless ad hoc network serves as the sender as well as the receiver. Although this WANET is dynamic yet route is hosted. Each node in this network acts as a router and helps in forwarding data in a chain.

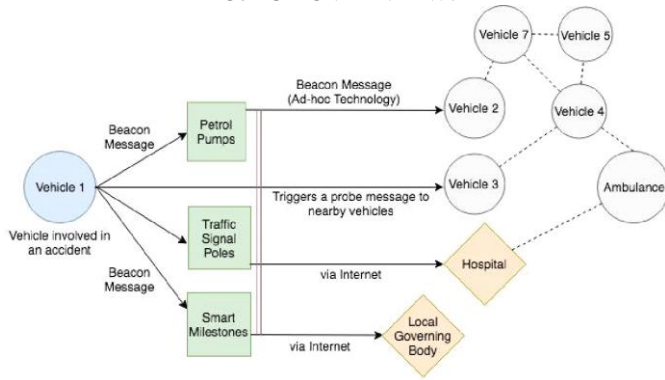
VANET is used to oversee the vehicles' movement. The onboard unit and application unit of VANET helps vehicle to vehicle communication. The aforementioned units are mounted on the vehicle itself. The roadside unit is used to extend the communication of the AD-HOC network. The roadside unit helps to alert the drivers in advance about an accident ahead, speed breaker, school ahead or hospital ahead, etc so that the driver can take preventive measures and act accordingly. These roadside units can be mounted on milestones, poles, towers, emergency centers, or on some roadside static component so that connectivity of vehicles is not lost.

RELATED WORKS:

There are some related works in the field. Some systems work to make emergencies facilities available as soon as possible. Automatic Vehicle Accident Detection and Messaging System Using GSM and GPS Modem [3] project involves a system wherein sensor fitted in the vehicle detects that vehicle has met the accident, and an alert message is sent to the rescue team. An IoT Based Car Accident Prevention and

Detection System with Smart Brake Control [4] project deals with precautions for an accident using ultrasonic sensors and a smart braking system. But Identification of accident-prone sites using Internet of Things (AD-HOC networks and Raspberry Pi) projects deals in identifying the accident-prone sites already and by user interface drivers can already know the spot and drive safely. It also deals with easy traffic management for emergencies and helps in maintaining discipline among drivers.

PROJECT OVERVIEW:



SIGNAL ON WHEELS

IDEA / SOLUTION:

The **problem** regarding various accident zones can be tackled if both the authorities and the drivers know about the situation of a zone. To do that, **we aim to alert the drivers and authorities** regarding the situation by providing them with the necessary equipment through which they can get alerts about any mishappening.

To make this successful, a system needs to be integrated into every vehicle, which will consist of Raspberry Pi and various sensors like vehicle speed sensor (VSS), Thermocouple(Heat Sensor), Collision sensor(impact sensor). This system will also use **GPS technology** which can also be used to detect if the vehicle has **crossed the speed limit at any time or cases of rash driving** like not slowing at turns and speed breakers and can be used to identify crossing of red lights, and in those cases, a **notification will be sent to authorities** for ticketing, after all, it is not only the issues at a region which causes an accident, it is also the rash driving which results in miss happenings.

Also, **the driver will be alerted** regarding the accident-prone zones by **sending a message** on the driver’s mobile so that they can manage their speed accordingly and call for help if necessary.

This is how the system works as a precaution for anticipated accidents.

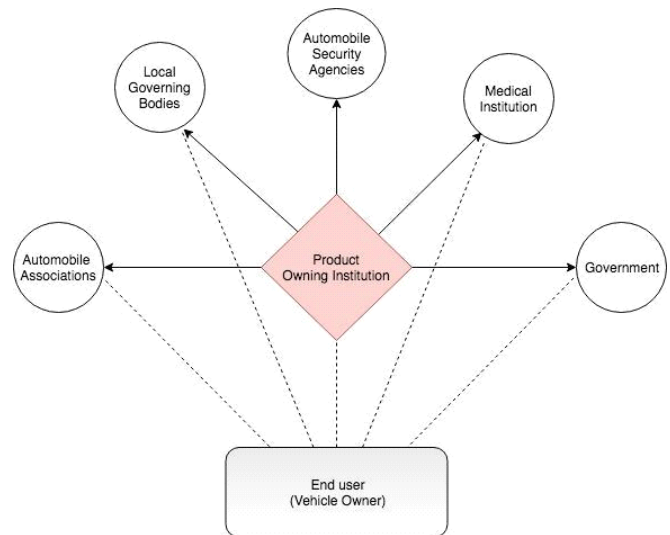
In **case of an accident**, the IoT system (which will be integrated with all the sensors and raspberry pi) will automatically **send a broadcast message** through **beacons** or **the internet** whichever is feasible to each **nearby emergency site** like a hospital, police station regarding that an accident has occurred in the nearby vicinity so that they can help them accordingly. We can use **AD-HOC devices** to reduce transmission charges and expand the application area like in remote regions. In AD- HOC networking the individual device embedded in vehicles, milestones, nearby poles, or emergency centers, are themselves senders as well as receivers. As there is no central server, the transmission of the signal will be fast.

The idea is **to prevent accidents and help someone who has gone through an accident** by making people aware of the issues in the region and keeping a check on the driver.

IoT systems can be installed in various **traffic signals** to allow all the emergency vehicles to cross easily without thinking about stopping at the traffic light when they are in a hurry. The driver while starting his drive will allocate the route through the user interface in the application and through GPS technology[5] the location of the vehicle in an emergency will be traced. This information will be transmitted to all the traffic signals on that route. Through this system, traffic signals will **turn green automatically** when there is an emergency vehicle crossing by. The nearby vehicles can then manage accordingly.

TECHNOLOGY USED:

The system will consist of various modules, sensors, and raspberry pi making an IOT based system/device that will be integrated with every vehicle and the milestones, traffic lights, poles. The cost to set this up is small in comparison to vehicles and is negligible in comparison to help with the safety of people.



USE CASE:

Every vehicle needs to have this system so that we can keep a check on everyone to follow the rules and be aware of the issues and concerns in the area. They will have a very simple interface to report the issue, when they see any and the authorities will mark it spam or not and the area will be flagged appropriately for others.

It will help maintain discipline among the drivers. As they know they are being watched at every second, they will have to follow the rules, and this will help in providing safety to all.

This project will greatly reduce the number of accidents in India which will save a lot of lives.

This project will help all the emergency vehicles to move freely in India since this system will handle the traffic signals.

TECHNICAL REQUIREMENT:

Hardware Requirements for Product-

1. Raspberry Pi
2. Motion Detection Sensor
3. Temperature Sensor
4. P-IR Sensor
5. Mobile AD-HOC module
6. Storage Media
7. Miscellaneous modules

Requirements for Development-

1. Desktop Computer with strong GPU
2. Hosting Services
3. Mongo DB Storage

PROPOSED METHODOLOGY:

We will use Raspberry Pi 3 and mobile GPS tracking for this project. In case of an accident, Pi will send a notification ping to all the nearby sites like hospitals and police stations regarding the accident. Sensors will be installed in traffic signals to detect the signals which vehicles emit to change the signal accordingly.

MATERIALS AND METHODS:

The system will consist of various modules and raspberry pi making an IOT based system that will be integrated with every vehicle. The cost to set this up is small in comparison to vehicles and is negligible in comparison to help with the safety of people.

OBSERVATIONS DETAILS:

A message notification will be sent to all drivers if they enter a red zone to slow down themselves and drive properly. In case of an accident, a message will be broadcasted to nearby emergency sites, and we will use AD-HOC technologies to reduce transmission charges and in areas like remote regions. IoT systems can be installed in traffic signals to allow emergency vehicles when they are in a hurry. Signals will turn green and others are turned red when the emergency vehicles are in an emergency.

DEPENDENCIES:

It will help maintain discipline among the drivers. As they know they are being watched at every time, they will have to follow the rules, and this will help in providing safety to all.

THE VERDICT:

With this system enabled in all vehicles, over 10% of all accidents and deaths on the road can be reduced. Road rage can be stopped by proper administration and easy device installation and implementation at the ground level.

The challenges we would be facing are somewhat related to the morals and ethics of people. But there is a dire need for this.

Table: Causes of Road Accident and persons killed on All Roads: 2015

S. No.	Causes of road accidents	Total number of Road Accidents	Total number of persons killed
1	Fault of Driver	386481	106021
2	Fault of Cyclist	3695	1384
3	Fault of Driver of other vehicles	24431	6961
4	Fault of Pedestrian	7509	2690
5	Defect in Condition of Motor Vehicle	11601	4127
6	Defect in Road Condition	7314	2733
7	Weather Condition	5781	2552
8	Fault of Passenger	6668	2657
9	Poor light	5456	2095
10	Falling of boulders	1087	505
11	Neglect of civic bodies	1076	416
12	Stray animals	1534	579
13	Other causes/ Causes not known	38790	13413
	Total	501423	146133

FUTURE SCOPE:

This project will greatly reduce the number of accidents in India which will save a lot of lives. This project will help all the emergency vehicles to move freely in India since this system will handle the traffic signals.

REFERENCES:

- [1] https://morth.nic.in/sites/default/files/RA_Uploading.pdf
- [2] <https://www.cdc.gov/nchs/fastats/accidental-injury.htm>
- [3] <https://www.irjet.net/archives/V5/i3/IRJET-V5I357.pdf>
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- [5] "What is GPS System and its working? "
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