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Estimation of Accident Severity and Automatic Notification to Emergency Service

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Abstract— In modern day communication technology has been developed a lot. With the help of communications technology in modern vehicles we estimate the people injured in an accident. By using artificial Intelligent system communication takes place between the vehicle to the emergency service and is also notified to the relatives of that person who met the accident .This paper proposes a method which is able to automatically detect road accident, notify them through vehicular network and estimate their severity based on the concept of data mining and knowledge inference. In this project we estimate the severity based upon the vehicle speed, the type of vehicle, status of airbags in the vehicle. It will estimate the severity of accident occurred using Knowledge Discovery Database (KDD) process. We develop a prototype of the vehicle based upon the crash test and previous reports. It totally reduces the time to alert the emergency service.

Keywords— Data Mining; Knowledge Discovery Database.

1. INTRODUCTION

During the last ten years, the number of vehicles in our roads has been increased remarkably. Similarly traffic accidents increased rapidly on the roads. It represents a serious problem in most of the countries.

Vehicular networks will play an increasing role in the intelligent transportation systems (ITS) areas to reduce the number of road accidents. It has a collection of data like road safety, fleet management and navigation. It exchanges the data between the vehicle and the road side infrastructure (V2I) or even directly between vehicle to vehicle (V2V)[1].Using peer to peer mobile communications, sensing capabilities may be integrated in on board of vehicle which leads to significant improvement for future safety in road accident.

The objective of this paper is to create a fast and efficient method to get out of a dangerous situation during the traffic accident. Its significance is to improve the probability of severity of the accidents and to reduce the injury severity and to improve the usage of communication system between vehicular networks. The intelligent system supports the infrastructure to analysis the severity of the accidents and automatically instructs the emergency service for the required action.

It collects valid information from the result of the previous road accidents, crash test reports and estimates the severity of accident. The data is already stored in a database. It uses KDD process to retrieve the information from the database and instructs about the accident.

2. OUR PROPOSAL

The process is to collect information when an accident occurred. The sensor which is fixed in the vehicle spreads the severity of the accident and captures the input. The information is captured by sensor which fixed in the vehicles. The packet consists of collected data and forward to the control unit using combination of V2V and V2I wireless communication. The system will estimate the severity of information by comparing the information from the sensor and previous information stored in the database. After estimating the information, a message is sent to the mobile number which is already registered in it.

3. OVERVIEW OF ARCHITECTURE

The proposed system consists of various components with different function. The major two components are On board unit and control unit. The On board unit function is to detect the impact of an accident, collect information from the sensor and finally communicate with the control unit using wireless interface like GPS, GSM. After sending notification to the control unit it will estimate the severity of accidents and send to the appropriate emergency service and a notification along with the location to the registered number [2]. The On Board Unit (OBU) is very important device in our system, it is practically easily can be used in vehicle and provide future software updates.

The information exchange between On-Board Unit and Control Unit is made through wireless interface to pass the message. The Control Unit will generate the message using details from the previous accident and alert the emergency services.

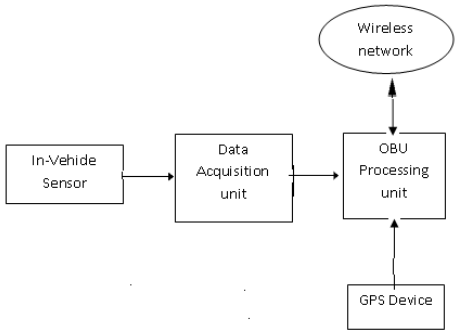


Fig-1 On-Board Unit Structure Diagram

1. On-Board Unit Structure:

The main role of On-Board Unit is to collect information from the sensor fixed in the vehicle and identifies the impact of an accident when a dangerous situation occurs. As shown in Fig 1, it then sends notification to the nearest control unit [3]. Interact with each other to detect the impact of an accident; the components are sensor, the data acquisition unit, the wireless interface and the processing unit.

A. In-Vehicle Sensor:

Using the On-Board Diagnostics standard interface it is possible in vehicle sensor to access the data. It provides information about cause of an accident. OBD serves as an entry point to the vehicle internal bus.

B. Data Acquisition Unit (DAU):

It collects information from the sensors available in the vehicle like airbags, speed. By collecting it converts into common format and provide collected data set to the On-Board Unit processing unit.

C. On-Board Unit Processing Unit:

These devices are responsible for collecting data from the DAV and determine the impact of an accident and the current status of the vehicle.

2. Control Unit Structure:

The process of control unit is responsible to get information from the notification of accident by receiving message from the On-Board Unit structure. As shown in Fig 2, it retrieves information based on details from On-Board Unit and estimate the impact of an accident. The severity of the accident is passed to the emergency service.

A. Receiver/Interpreting Module:

The control unit will receive the warning message from the On-Board Unit. This module will wait until the notification to retrieve the information.

B. Accident Severity Estimation Module:

When a notification receives it estimate how serious the collision was and the severity of the passenger injuries.

C. Resource Assignment Module:

After estimating the severity it allocates the resource according to the severity of an accident.

3. Database Update Module:

It will update the data to the existing database, to increase the knowledge about the accident [5].

Time
Location
Vehicle | Passenger
Features of
The passengers
Seat belt | Airbags
Speed |Acceleration
Impact of
Direction |Position

Warning Message

4. PROTOTYPE DEVELOPMENT:

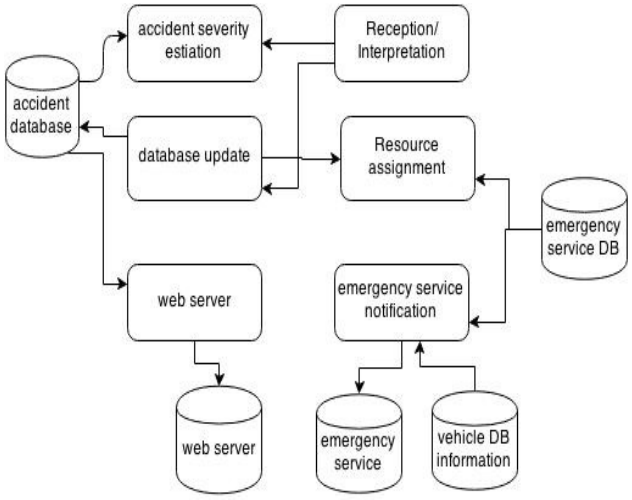


Fig-2 Control Unit Structure

A. Selection:

It determines the correct information from the existing database according to the current information.

B. *Preprocessing:*

The selected data will be cleaned and handled to the preprocessing phase.

C. Transformation:

According to the information it reduces and projects the data to find the related features to the process.

D. Data Mining:

To find patterns in data it selects mining algorithms and selection methods.

E. Interpretation/Evaluation:

The extracted patterns must be interpreted. This step may also include displaying the patterns and models or displaying the data taking into account such models.

In On-Board Unit structure the DAU module was constructed using the ARM microcontroller [4]. By programming the microcontroller it can collect information from the sensor. The sensor is used to detect the speed, the airbag condition that will determine the severity of the impact of an accident. The interaction between the processing unit and microcontroller takes place using UDD packets through an Ethernet interface. To reduce the damage possibilities on processing unit it is designed in solid-state.

5. DATA MINING AND INTERPRETATION/ EVALUATION PHASES

Bayesian Models for Accident Severity Estimation:

Here we tabulated the condition depends between variables used to estimate the severity of the accidents based on damage on the vehicles and the injuries of the passengers. In the Bayesian model, all the vehicles have at least one base value, the value of the class based on the damage on the vehicles and injuries of the passengers [6].

By referring the tables, we can find some important connection, present in almost all cases. The body type of vehicle presents strong connections with the present variables, since the vehicle may be a heavy truck.

The most important one parent variable is speed of the vehicle is the variable has more connection with other variables; speed limit, Rollover of the registered overturned vehicles occurred at speeds, light conditions. In touring cars seat belts and air bags are most often variables. Thus the airbag status and the restraint system usage are strongly related to the type of vehicle.

However, we find some of the probability generated are not so automatic,(the probability table associated to front rear end impact for passengers) estimation injuries show that ,under daylight condition ,the majority of the accidents is not very severe, while at dawn and dusk which increases up to 60% of the air bag status becomes the most determinant value for the severity in the passengers in front and side collision. When the airbag condition is not deployed, the impact is not usually dangerous for the passengers, whereas strong collisions where the airbags have to be deployed present a greater magnitude that could affect the passengers. To prove this observation, about 70% of the registered cases where the airbags was not deployed more than 60% passengers get affected.

6. EXPERIMENTAL RESULT

ATTRIBUTES	VEHICLE DAMAGE				PASSENGER INJURY			
	FULL SET	FRONT	SIDE	REAR	FULL SET	FRONT	SIDE	REAR
Body Type	✓		✓	✓	✓	✓	✓	✓
Light Condition	✓	✓		✓				✓
Model Year				✓				
Point of Impact	✓		✓		✓			
Road Align						✓		
Road Profile		✓				✓		
Roll Over	✓	✓	✓	✓	✓		✓	✓
Speed	✓	✓	✓	✓	✓	✓	✓	
Speed Limit	✓	✓	✓	✓	✓		✓	✓
Air Bag					✓	✓	✓	✓
Seat Position					✓	✓	✓	
Vehicle Role		✓	✓					

Weather			✓	✓				

Fig-5 SIDE VIEW

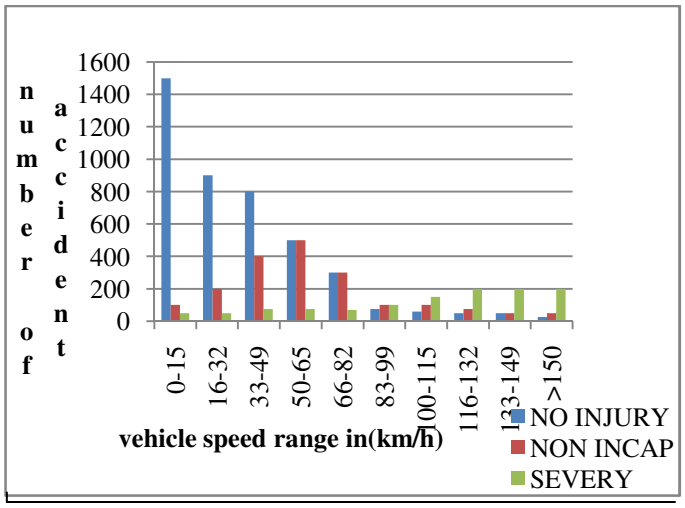


Fig-3 FRONT VIEW

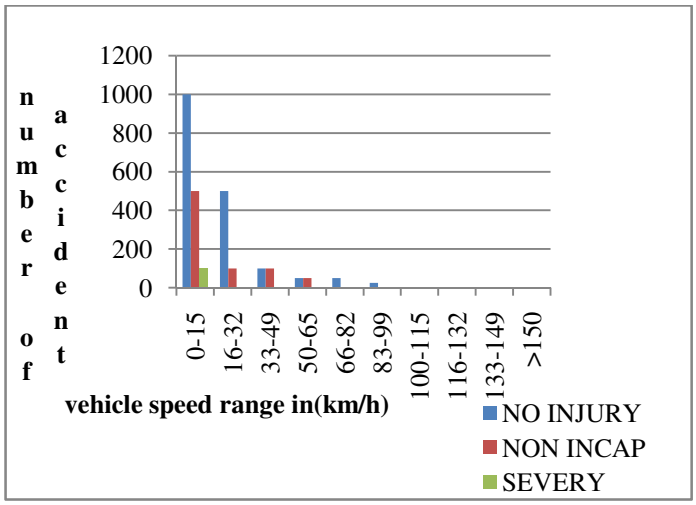
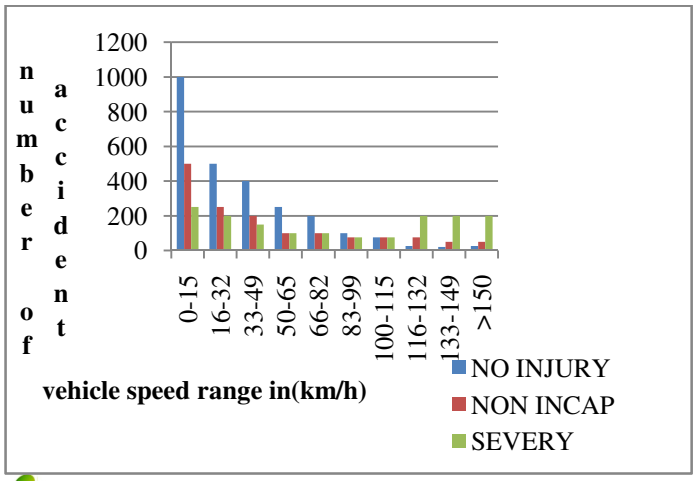


Fig-4 REAR VIEW



7. CONCLUSION

Recent Communication technologies are integrated into the automotive sector which offer an opportunity for better assistance to people that are injured in traffic accidents. It can also reduce the response time of emergency services and increase the information about the accidents for the rescue process [7]. In order to end this, we designed and implemented the process for automatic accident notification based on V2V and V2I communications. This technology can be improved with the support of intelligent systems, which can automate the decision making process. A preliminary assessment is needed and this can estimate by using a Knowledge Discovery in Database process.

The work is based on Data mining in traffic accidents which are based on datasets. It also showed the vehicle speed, where it is a crucial factor in front crashes. The type of vehicle involved and speed of their striking is important than speed itself. Here the status of the air bag also estimate to detect the no of persons injured.

It also demonstrates about the classification of accidents depending upon the impact. We can notify the increase in accuracy of the system, especially front crashes. In order to end this we develop a prototype that are used for the inter vehicle communications, that can make accessible information about the accidents involved. The positive results are also achieved on the test that is accidents detection and severity estimation algorithms.

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