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DESIGN OF VEHICLE CRASH CONFIRMATION AND MINIMIZATION SYSTEM

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Abstract

The dawn of know-how has surged the traffic menace. Paucity in emergency services cause huge loss of life and property.A significant indicator of survival rate after a smash up is the minutes between the mishap and the EMS personnel report to the incident. In order to counteract. The malfunction of sensor during catastrophe and to cut down the time delay for the arrival of EMS personnel. This project provides an advanced in-vehicle system which involuntarily transmits the location and severity of the crash to the EMS when the maximum probability of the collision has been revealed. The collision is notified to the EMS on or before a seconds ahead of calamity on affirmation of supreme prospect of crash. The notification reports all the possible information to the EMS such as vehicle tilt, temperature, location.In addition this it involves collision minimization technique, which aims at reducing the impact of the collision on confirmation before its occurrence.

Keywords: Vehicle crash , EMS etc.

I. INTRODUCTION

A Traffic collision occurs when a vehicle collides with the other vehicle. Vehicle collision may results in injury or death along with the vehicle damage.Generally road collision may occur at lane departure or at junction and may involve pedestrians or animals. Vehicle collision are of two types

- Head on collision
- Intersection collision
- Rear end collision

Head on collision often have serious outcomes because of speed involved when collision takes place. When one vehicle inadvertently interrupt into the path of other vehicle, it is referred o as Head on collision. Risk of Head on collision will be more on road with narrow lane, sharp cure and there is no separation of opposing traffic and also due to heavy traffic. In head on collision,the speed is directly proportional to the measured risk of death or injury (ie.,as speed increases consequence of the collision also increases).Median separation or median treatment is one of the countermeasure for head on collision which can reduce collision in order of 70%.

Prevention can be done by providing various barrier such as

- Rigid barrier
- Semi rigid barrier
- Flexible barrier

These barrier helps in impact minimization as well as to provide cost effective reconstruction after the collision.

Crashes at intersection may involve direct head on impact, when one vehicle crosses the opposite lane or the side impact, when vehicle turn atintersection.In urban area, the intersection collision may be high compared with the rural. At lane crossing the possibility of side impact may be more.Clear road marking and signing are low cost method of improving safety at intersection.

Rear end crashes are caused due to the sudden deceleration of the moving vehicle.

These are the major often occurring vehicle collisions which causes severe damage to life and property. The other types of vehicle collision are sideswipe, vehicle rollover, single car accidents and multivehicle collision. Vehicle rollover are not so often but are dangerous. Single car accident may be due to driver's fatigue. Multivehicle collision is of rare case. In this circumstance, emergency service need to be strengthened to prevent fatalities because Poor emergency services is one of the leading cause of the fatalities in road accidents. Delay in the alerting the emergency service can reduce the risk of human life. In addition, by detecting the severity of crash efficient first aid services can also be provided. Hence an automobile safety system was designed to reduce the severity of the accidents, which is known as collision avoidance system or collision mitigating system. In case of critical situation, these system either provide a warning signal or takes action autonomously. It uses small radar or sensors or cameras to detect the collision. There is also another possibility for minimizing the impact of the vehicle collision which is known as collision minimization system.

II. COLLISION DETECTION SYSTEM

Collision detection system in automobile aims at reducing or mitigating the severity of an accidents. These system provide a warning to the driver about the imminent collision in order to take immediate action to mitigate it.Crash avoidance system is the emerging feature after the collision detection.Advanced technology assists the driver with warning or automatic braking to help,avoid or mitigate a crash. Collision avoiding systems place small radar detectors up near the front of the car, which sends out quick bursts of radar waves with high frequency.

Six common new technology are forward collision warning,auto brake, lane departure prevention,and adaptive headlights and blind spot detection.

Collision detection system involves three major categories

- Collision warning/avoidance
- Collision Confirmation
- Collision Minimization

III. COLLISION WARNING/AVOIDANCE

Developing a collision warning/avoidance system that is capable of preventing accident regardless of unexpected condition is of major importance. By considering road safety as a major social issue, the automotive collision avoidance system focuses on crash warning/avoidance system, which monitors the environment of the vehicle to assist the driver in avoiding the collision.

The design of collision warning/avoidance system is based on three possible algorithm

- Forward collision algorithm
- Intersection collision algorithm
- Rear end collision algorithm

Collision warning /avoidance is assisted via communication system which incorporates the wireless transmission system for transferring the warning message.

Forward collision algorithm

I. Sensors are mounted on the bumper.
II. Depending on the range and coverage of the sensor, the TTC is estimated.
III. TTC is calculated from the distance and velocity of the colliding vehicle.
IV. With the value of TTC,forward collision is confirmed.

Generally forward collision algorithm accounts for the following scenario

- The vehicle in front is stand still-it uses the vision sensor which does not require the target to be moving. It has high closing velocity. A warning can be given up 3.0 seconds before a possible collision
- The vehicle in front is braking - detected by recognizing the target vehicle's brake lights. This is an acceleration scenario with a lower closing velocity by which warning can be given up to 7 seconds before a possible impact.
- When the driver is pressing the brake pedal – the warning can be given a little later as the drivers response time may be reduced as the brake pedal is already depressed and the time to avoid the collision can be shorter.

The system may use microcontroller based processing unit running RTOS and it also uses a camera to detect various crash scenarios. The major advantage of the system is the low cost and retrofit scheme.

The discussion on forward collision avoidance system aims at avoiding the host vehicle frontal collision which is done either by warning or braking or steering away. It focuses on method for calculating the risk is estimated [7].when the probability of collision is predicted brake is activated to mitigate collision. It uses various sensor in which time and space are handled in kalman filtering framework. The overall system reduces the impact speed in frontal collision.

Intersection collision algorithm

I. Base station have to be implemented at every four junction area.
II. By using the wireless sensor network the vehicle information is collected.
III. With respect to the distance of the intersecting vehicle at the collision zone, alert message is transmitted to the vehicle.

Intersection collision warning system can be implemented as a part of vehicle safety system. It incorporates vehicle data acquisition, transferring of data to the base station and the analysis of the collected data. Importance in accuracy and time prediction is achieved in intersection collision warning at the point of road intersection. This system provides warning when the high probability of collision is predicted.

Rear end collision algorithm

I. The sensors are placed at the rear end of the car.
II. In case of sudden deceleration, signals are transmitted to the following vehicle.

The analysis of the rear end collision warning/avoidance algorithm results in the estimation of tire road friction values. The rear end collision avoidance system is developed by considering the human factors which requires brake control warning algorithm. The proposed algorithm will be obtained by the braking and warning distance calculated. By the use of various wireless sensor for detection and controller for transmission the collision avoidance can be made. For (e.g.,) laser sensor which incorporates laser transmitter and receiver to detect laser rays. CAN controller is used for the information transmission[3]. Basically wireless transmission network uses various sensor to monitor physical and environmental condition. Collision avoidance system uses GPS and wireless local area network to improve safety features[4].

Collision avoidance system

Collision avoidance system assist the driver in avoiding collision. By considering the time to last second braking as threat assessment measure the evasive action is determined (i.e., braking).It provides more appropriate warning and more effective over riding at the last moment [5].The protocol have also been developed to provide emergency warning [6].The primary component of the protocol includes message differentiation, mechanism, congestion control policies, message dissemination so that vehicle to vehicle communication is achieved.

IV. COLLISION CONFIRMATION SYSTEM

Collision confirmation system provides collision confirmation warning message signal on or before few seconds at collision.

Confirmation algorithm is estimated by calculating the time to stop and stopping distance of the collision vehicle [8]. The last second decision for braking and steering input is the essential factors to be considered. The parameters to be considered are road surface, speed of the vehicle mass and brake callipers pressure. TTC is computed from size and position of the vehicle. Relative distance and velocity may also use for TTC calculation. It deals with the use of TTC measures as per the speed and braking instructions [10].crash confirmation uses various sensing technologies such as microwave radar, laser radar are improved to develop the colliding objects. Vehicle information were considered to improve the reliability of the prediction.CHAMELEON system is supposed to identify impending collision. By using various sensor configuration, different angled collision are tested under various test scenarios. Sensor placement place an important role.

Various trends in automotive active safety assist in pre detection, configuration and minimization of accident which include ABS, Traction control, Stability control, Adaptive cruise control, Forward collision mitigation, Primary warning, Secondary warning, Collision damage reduction, Lane detection and Blind spot warning. The above features are considered to detect the pre-crash and collision confirmation. [12]

Rear end collision in [13]. It is mostly due to driver distribution. It provides certain situation to avoid rear end collision collisions in low speed. Dynamic tests is done to measure the performance of the sensors, object discrimination test to distinguish between types of objects. These test result will be used to direct the design of a pre-crash sensing system integrating responses of differentsensors. [14]

In camera based forward collision confirmation systems the images are generated by the camera on detecting the collision to alert for confirmation. TTC estimation is used for assessing whether an imminent closing conflict FCA warning is merited. It provides the development and testing of sole forward collision alert sensing mechanism [15].

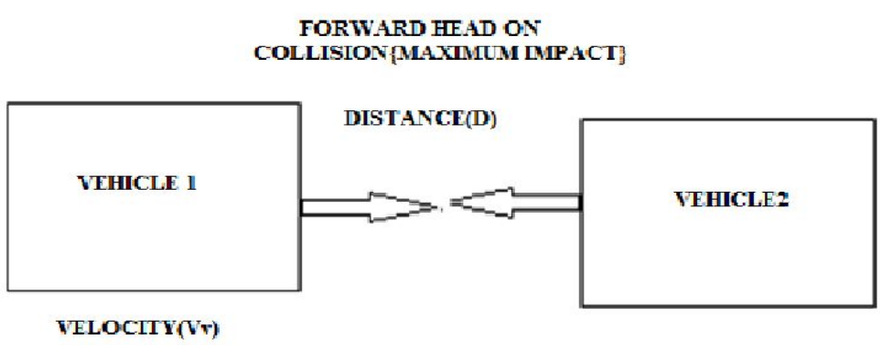
V. COLLISION MINIMIZATION SYSTEM

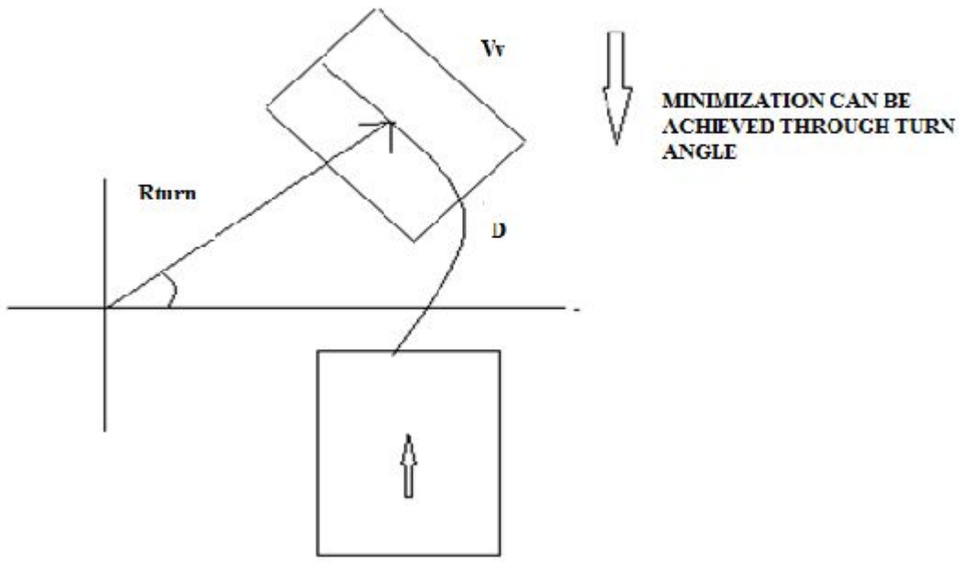
Collision minimization system aims at reducing the impact of the collision so that serious death constraints can be reduced. By considering Time to collision (TTC) as a risk indicator, the collision minimization can be achieved.

Depending upon the value of TTC, the driver is warned about the collision [16].The another minimization system is based on measuring the distance and velocity with respect to sensor limit which outperforms the common parameter of collision warning system in detecting the collision [17].

Cooperative collision warning system will be very effective in the curve environment [18]. In minimization system, the risk of collision is avoided by predicting the future collision point using velocity of each car (v) and the vector coordinate axis (x,y) so that the algorithm predicts the collision point in before[19].

Principle direction of force is used to determine the area of maximum impact in the vehicle [20],which estimates the collision minimization algorithm.





VI. COMPLETE COLLISION AVOIDANCE

The complete collision avoidance can be made by turning with the constant turn radius which is fixed at 90' and then $t_{turn}$and TTC, the distance and the lateral distance will be evaluated to avoid the collision completely[21]

VII. CONCLUSION

As per the early collision detection system it mainly focuses on accident prevention.Various crash detection algorithm have been discussed which shows the avoidance through automatic braking or by alerting the driver through message.Crash detection system can be made efficient by incorporating the minimization technique after detecting the maximum possible collision through which collision impact can be reduced.

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