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A Study on Advanced Safety Systems

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ABSTRACT: Safety is considered as important in life. For the past ten years the safety consideration in automobiles are made. The safety is classified as active safety and passive safety. Active safety systems are systems which avoid accidents and passive safety systems which reduce injuries caused during accidents. Providing safety includes sensing, restraining and proper positioning of the occupants. The vehicle sensing are systems that senses the effect of crash before and during crash also and provide necessary safety to the occupant and the vehicle. Restraints are systems to provide restraining effect to occupant before and during a crash. The restraint systems can be seatbelt, airbag and head restraints. Some systems such as steering which are made retractable during crash and adaptive seat geometry which provide anti – submarining effect during crash are not considered as restraining systems. In addition to these advanced and developed systems, there should be proper work focused on integrated safety which is effective not only for the occupant and the vehicle also.

KEYWORDS: Text Active safety, passive safety, Restraints

I. INTRODUCTION

Vehicle Sensing Systems

Vehicle sensing systems are those sensors that determine what the vehicle is about to do (Preimpact sensing), or is actually doing (impact sensing). Pre-impact sensing There are two main types of pre-impact sensing. The first recognises that the vehicle is in a dangerous manoeuvre and the driver is at risk of losing control, or has already lost control. There may not be an impact, but there is a significant risk of an impact of some type. The second type of sensing determines that an impact is imminent and unavoidable. Dangerous Manoeuvre A number of vehicles are now fitted with some form of anti-lock brakes and a stability control system. These systems already use various sensors, such as wheel speed sensors, yaw sensors etc, to determine the behaviour of a vehicle. These systems could alert a smart restraint system to be ready for a possible impact, and could deploy early countermeasures, such as true seat belt pretensioners., .

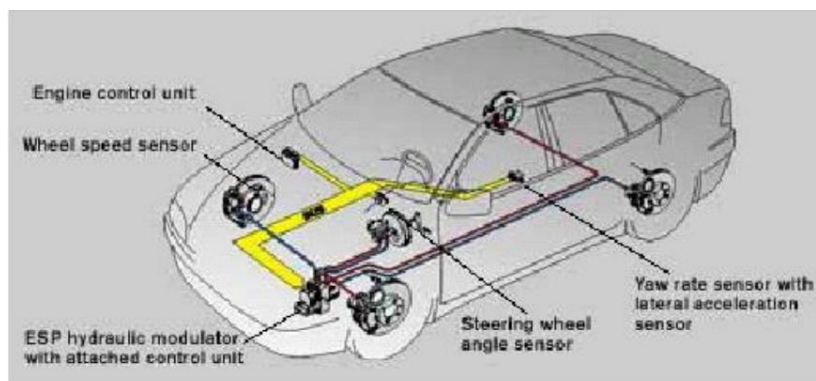


Fig-1

Impact Imminent A large range of scanning type sensors or sensor arrays have been developed and continue to be developed to detect when an impact is likely or imminent. However, such systems are expensive and do not yet have sufficiently high reliability in performance for vehicle manufacturers to rely on such devices alone at this time. An example of such a development system is the Delphi (Ref. 2) system shown below in Figure 2.

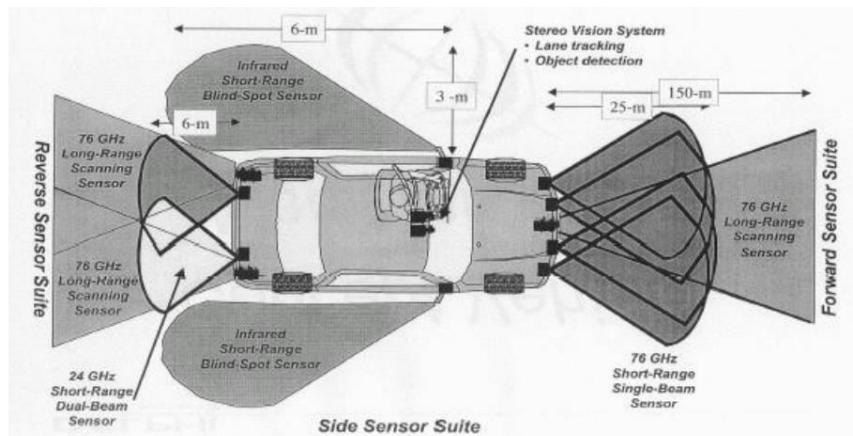


Fig-2

II. RELATED WORK

Impact sensing – central Virtually all restraint systems use a central impact sensor, which also behaves as a system Controller. These devices are almost always mounted on the vehicle centre line and are the primary sensor for frontal impacts. Additional “safing” functions are often included, to prevent spurious signals from causing unwanted deployments in non-impact (abuse) conditions. The central sensor may also house other features such as a rollover gyro, fuel pump cut switch, hazard warning light switch, door unlock override switch, battery cutoff etc. With most typical non-smart restraints, the central impact sensor also holds the back-up power supply to deploy airbags and pretensioners in the event that the main vehicle battery is disconnected or damaged early in the impact. This is typically a large capacitor which discharges after several seconds. (Ref. 3)

Impact sensing – satellite Satellite impact sensors are additional sensors that are fitted around the vehicle to provide additional information about an impact. Their location can give additional signal information to allow impact characterisation, but they can be more abuse sensitive in some circumstances. The combination of signals from satellite and central sensors usually gives the greatest and most reliable information. Satellite sensors are frequently found at the sides of the vehicle near the seat mounting, the sill or the B-pillar base. These provide the early information required to deploy a thorax type side airbag. A typical deployment time may be between 5 and 10ms after the initial impact. The signal level at the central sensor may still only be 5m/s/s, which may be seen during other non-impact handling manoeuvres, hence the requirement for the side satellite sensor. Satellite sensors are becoming popular at the front of vehicles to sense the impact types that are difficult to sense with only a central sensor. A pole impact inboard of the vehicle front longitudinal structure is a good example of this type. An “up-front” satellite sensor can detect such an impact very quickly and can ensure a timely deployment of seat belt pretensioners and airbags. (Ref. 4)

Other vehicle impact sensors Pressure sensors in door cavities Impact sensors are almost always accelerometer based, usually piezo-resistive or piezocapacitive technologies. However, Siemens have developed a pressure-based sensor for side impact detection. This sensor measures air pressure in the door cavity and can discriminate an impact by the pressure change as the door cavity collapses. Stress wave sensing When an object is impacted, a stress wave is propagated through that object at the speed of sound. The placing of devices that can measure stress (or the resulting strain) on the surface of the object can allow the stress wave and its original driving impact to be characterised. The timing between the stress wave and resulting echoes can be used to determine impact direction very accurately. This concept has great potential for impact characterisation, but is currently expensive due to the extremely fast signal processing required

Footwell airbags Footwell airbags are usually mounted underneath the carpet and are used to protect the feet and lower legs in two different ways. The first method is to provide initial impact energy absorption if the foot or feet are not in direct and flat contact with the floor or footrest. If a foot slides off a pedal or is “in space” then the initial impact can cause significant injuries in a high speed impact. The second method is to provide secondary cushioning and foot mobility during the quasistatic loading phase. If there is major intrusion and the ankle locks up, then serious



injuries can occur. The additional compliance of the airbag can limit the ankle lock-up load. Also in this circumstance, a degree of lateral mobility provided by the “lubricating” effect of the airbag may be beneficial. Collapsible pedals may be used to control initial foot impacts and to reduce the risk of a trap hazard as the pedal remains below the foot. However, the most likely position for the right foot in an impact is on the brake pedal. This pedal absolutely must not collapse under normal use or emergency braking use or control of the vehicle may be lost. The most challenging and important issue is how to make the brake pedal stiff and reliable in normal and emergency use, but to collapse safely and in a controlled manner in a crash. Few if any systems have been developed to meet all these requirements though a smart controller and a pyrotechnic device could achieve this behaviour at a cost. It is most important that foot trajectory is well controlled if implementing collapsible pedals. The heel position is variable and difficult to determine if the pedal is a “pendent” type which hangs down.

III. CONCLUSION

By now, security engineering is an accepted challenge in the development of most vehicular electronics. Nevertheless, vehicular security engineering is still a recent field of research and an emerging area of application. However, the ongoing demand for more advanced and comprehensive vehicular applications that more and more have direct impacts on crucial driving operations impose strong obligations on trustworthiness, reliability, dependability, and hence also on security. Unfortunately, there exist no ready-made standard solutions yet that can be simply added to vehicular applications to ensure necessary IT security. In fact, securing vehicular electronics usually requires very individual and well-adapted approaches that seldom can simply be derived from existing conventional IT protection measures. Vehicular security measures have to be considered already at the beginning of every development process and require both technical and organizational measures. However, in doing so, embedding IT security into vehicles

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