Full-Coverage Collision Warning: Human Factors Research Needs

Introduction

As part of the U.S. Department of Transportation's *Intelligent Vehicle Initiative* (IVI) program, the Federal Highway Administration (FHWA) investigated the human factors research needs for integrating in-vehicle safety and driver information technologies into usable systems that provide manageable information to the driver. This investigation included a workshop in December 1997 for IVI stakeholders (i.e., universities, automotive manufacturers, vendors, and contractors) and a preliminary assessment of infrastructure and in-vehicle requirements. This flyer summarizes the identified human factors research needs for a full 360-degree collision warning coverage, one of five configurations of in-vehicle safety and driver information systems. A complete review of the research needs for all five configurations can be found in the final report (FHWA-RD-98-178). These configurations were developed based on (1) identified safety and driver information systems and functions; (2) a thorough literature review of past research and research gaps related to these in-vehicle systems; and (3) combining logical groups of basic and advanced safety and driver information functions in passenger cars, commercial trucks, and transit vehicles such as buses. Each candidate configuration was meant to provide clear safety benefits to the driver as well as a solid technical foundation for the system configurations for the IVI. The goal of the configuration described below is to provide full collision warning coverage for the three vehicle types.

360-Degree Collision Warning Coverage Configuration

Basic Collision Warning Technologies: Adaptive Cruise Control, Rear-End Collision Avoidance, Obstacle/Pedestrian Detection (forward).

Advanced Collision Warning Technologies: Lane Change/Merge Collision Avoidance, Intersection Collision Avoidance, Vehicle Diagnostics, Obstacle/Pedestrian Detection (rear).

Basic Traveler Information Devices: Navigation/Routing, Real-Time Traffic and Traveler Information, Automatic Collision Notification.

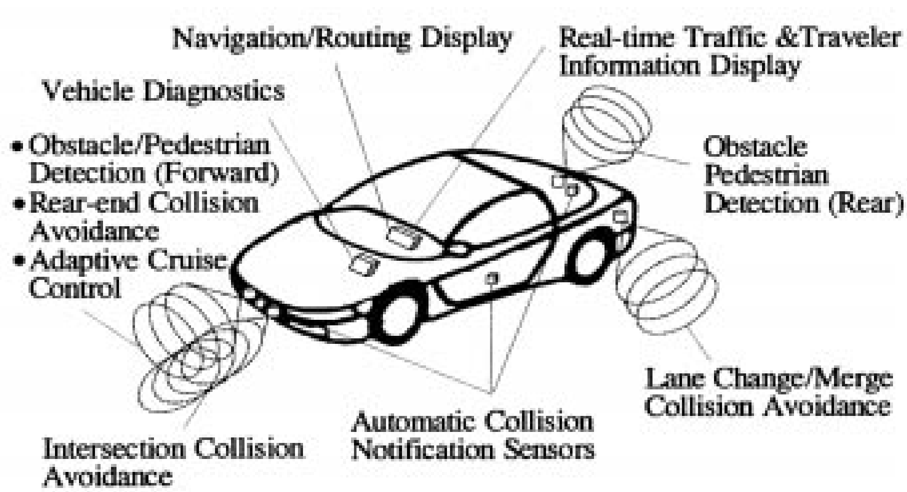
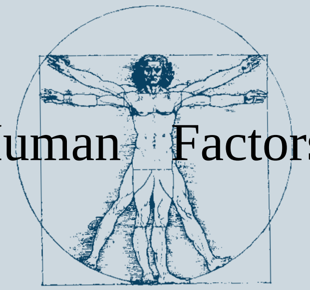


Figure 1. 360-Degree Collision Warning Configuration.

Summary Report



The Human Factors Research Program addresses human performance-related issues that affect highway system design. Current human factors research focuses on Highway Safety and Intelligent Transportation Systems (ITS).

FHWA is placing special emphasis on the trend of the United States to increase the numbers of older drivers and implications of this trend on highway safety and ITS design. Human factors research products include highway system design guidelines and handbooks based upon empirical human performance data collected in the laboratory and in controlled, on-the-road tests.

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Human Factors Research Needs

A primary research issue for this IVI configuration will be to assess the usefulness and human factors ***design implications associated with the integration of multiple collision avoidance system (CAS) devices.*** A number of research issues identified during the human factors IVI workshop addressed the issue of multiple CAS devices in the IVI. Although suggestions for the format and timing of individual CAS alerts have been presented, guidelines that address multiple CAS devices remain to be developed. Rather than providing distinct warnings across multiple displays, the IVI will need to integrate information from multiple sensors and provide useful, timely information to the driver regarding the nature, severity, and (perhaps) corrective action required for a potential collision situation. In particular, research is needed to identify requirements and guidelines for the standardization of CAS warnings. Key objectives of this research would be to (1) develop consistent and effective boundaries in space and time that divide hazardous from non-hazardous conditions; (2) determine warning characteristics (e.g., modalities, location, and timing) that lead to high levels of driver comprehension; and (3) identify long-term effects of CAS use (e.g., risk compensation and reductions in turn-signal use).

Another primary issue for this IVI configuration is the ***integration of CAS information with Advanced Traveler Information System (ATIS) devices.*** Key objectives of this research include (1) reviewing relevant efforts and lessons learned from comparable systems; (2) identifying workload demands associated with this configuration; (3) assessing priorities among presented information; (4) identifying appropriate information presentation methods; and (5) developing design guidelines that can support safe and effective design.

A secondary issue is ***driver tolerance for false alarms.*** The issue of false alarms must be addressed to ensure the successful design of collision warning devices. Since there are five distinct CAS devices that must be integrated in this IVI configuration, high false alarm rates may significantly decrease system use and effectiveness. Key objectives of this research would be to (1) assess the impact of false alarm rates on system use; (2) quantify the effects of false alarms on subsequent driver behavior; and (3) identify design guidelines for driver control of system parameters such as timing and modality.

Research Directions From Configuration #2

The following research directions were identified from this configuration:

- How to provide the driver with useful and timely warning information that leads to high levels of comprehension and compliance.
- Identify any long-term effects of CAS use on driver behaviors such as risk compensation and reduction in turn-signal use.
- How to integrate these warnings from multiple CAS devices while maintaining a manageable level of workload for the driver.
- Identify workload demands associated with this configuration, as well as proper information presentation methods and priorities.
- Impact of false alarm rates on driver behavior.

For More Information:

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