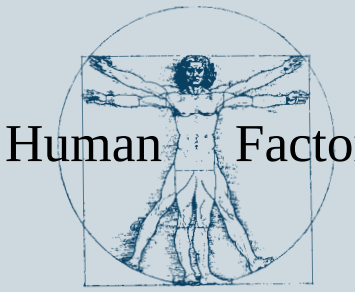
Summary Report



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 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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Basic Collision Warning and Driver Information Systems: Human Factors Research Needs

Introduction

As part of the U.S. Department of Transportation's Intelligent Vehicle Initiative (IVI) program, the Federal Highway Administration 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 basic safety and information systems, 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 basic collision warning and driver information capabilities to the three vehicle types.

Basic Safety and Driver Information Configuration

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

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

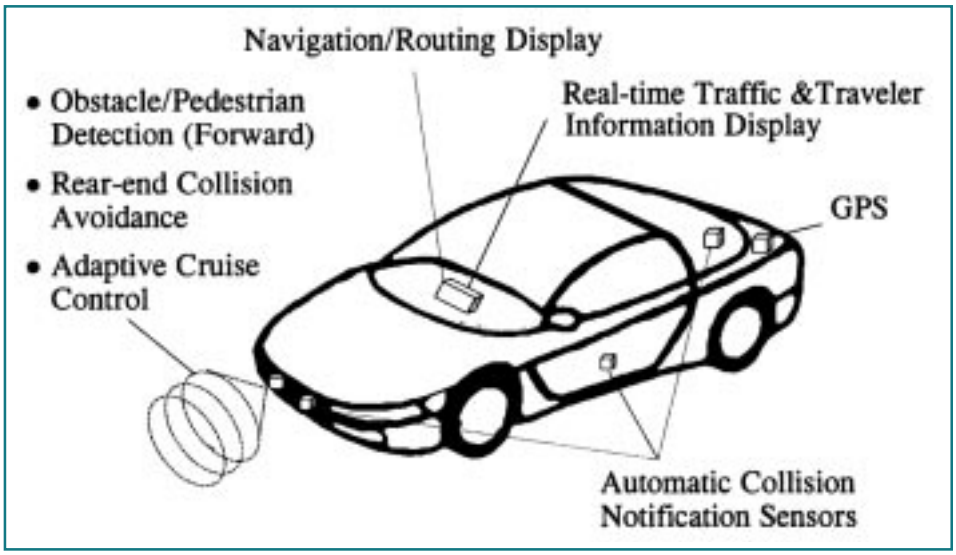

Figure 1. Basic Safety and Driver Information Systems Configuration

Human Factors Research Needs

A primary research issue for this IVI configuration will be the ***joint use of visual, auditory, and tactile information.*** Specifically, how can these different display modalities be used together to foster the discriminability, recognition, and interpretation of in-vehicle messages? What design guidelines/standards can be provided to IVI designers to ensure that messages are received and acted upon by the driver in an accurate and timely fashion? This issue is particularly important for this IVI candidate configuration in which collision warning information requiring immediate understanding and response are "competing" for the driver's information processing resources with less urgent messages associated with routing and other traveler information. Design approaches such as the Likelihood Alarm Display may use multiple modalities for warning drivers about potential crashes. Although design tools relating to information modality are available, these tools deal with Advanced Traveler Information System (ATIS) information only and do not address the use of tactile displays. Importantly, the results from this research must be in a form that IVI developers can quickly and easily apply to IVI design. Vague human factors procedures, heuristics, or principles should be avoided in favor of modality recommendations for specific IVI driver messages and general-purpose, modality-selection tools that designers can use themselves. Design standards should be able to address the complexity of the advanced automotive devices, including adaptive and integrated systems.

Secondary issues include ***driver performance, driver acceptance, and driver workload.*** Although user acceptance has been discussed as a key issue for Intelligent Transportation Systems (ITS), little human factors work has been done to examine user preferences for and reactions to integrated ITS devices. While these will be important issues for any IVI configuration, this one represents the smallest step forward, relative to existing vehicles. Thus, driver performance, driver acceptance, and workload data for this configuration will serve as an important benchmark and starting point for subsequent IVI development. Specific objectives include: (1) identifying how drivers react to an integrated, multi-function display that presents both collision and traveler information, (2) determining if a distributed display approach (i.e., multiple displays) is preferred by drivers, (3) determining how drivers react to concurrent presentation of collision avoidance systems and ATIS information, and (4) determining how IVI design can help drivers selectively focus on the most urgent information.

Research Directions From Configuration #1

The following research directions were identified from this configuration:

- How different display modalities, including visual, auditory, and tactile, can be used together to foster discriminability, recognition, and interpretation of in-vehicle messages.
- How to ensure that drivers receive and act upon high-priority safety messages in a timely fashion.
- Examine user preferences for integrated in-vehicle systems, as well as their reactions to such systems.
- How to deal with overlapping or concurrent information presentation effectively so that the driver is not overloaded.
- How to effectively present information from multiple systems to the driver, including distributed multiple displays versus single integrated displays.

For More Information

This research was conducted by the Battelle Human Factors Transportation Center, Seattle, WA. For more information, contact M. Joseph Moyer, Engineering Research Psychologist, HSR-30, (703) 285-2008.

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