Survey on In-vehicle Technology Use: Results and Findings

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ABSTRACT

The use of advanced technology in automobiles has increased dramatically in the past couple of years. Driver-assisting gadgets such as navigation systems, advanced cruise control, collision avoidance systems, and other safety systems have moved down the ladder from luxury to more basic vehicles. Concurrently, auto manufacturers are also designing and testing driving algorithms that can assist with basic driving tasks, many of which are being continuously scrutinized by traffic safety agencies to ensure that these systems do not pose a safety hazard. The research presented in this paper brings a third perspective to in-vehicle technology by conducting a two-stage survey to collect public opinion on advanced in-vehicle technology. Approximately 64 percent of the respondents used a smartphone application to assist with their travel. The top-used applications were navigation and real-time traffic information systems. Among those who used smartphones during their commutes, the top-used applications were navigation and entertainment.

Key words: Driver-assistance, In-vehicle technology, Public perception, Stated preference survey

1. INTRODUCTION

Use of technology in our daily life is increasing so rapidly that we see computers and computerized devices everywhere. As far as automobiles are concerned, where we once only had cruise control units, power windows, and remote lock/unlock devices in our vehicles, we now have navigation systems, voice-command operating systems, adaptive cruise control systems, and automated parking control systems. Researchers are also developing driverless vehicles, and transportation authorities in many countries are legislating inter-vehicular communications to enhance safety. For instance, the U.S. Department of Transportation started the Connected Vehicle research

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program, partnering with auto manufacturers and research universities to include more connectivity and technology in automobiles [1]. Auto manufacturers are equipping vehicle dashboards with more gadgets, while regulators such as the National Highway Traffic Safety Administration (NHTSA), citing safety reasons, are working towards new legislation that limits technology in vehicles [2].

For decades, researchers have been studying how to make driving more safe, fuel efficient, and comfortable. As a result, we now have vehicles that park themselves, cruise themselves, and even drive themselves. On the other hand, there are studies in which researchers analyze how effective or distractive these systems are. This has left a gap in research, namely, identifying what the end users want in their vehicles—more or less technology and the kind of assisting devices. An extensive background study suggested that most similar surveys reflect a non-scientific approach through publishing blog platforms or newspapers. All of these were consumer surveys that can be used as a comparison tool for different user interfaces and ease of use. The 2012 J.D. Power U.S. Initial Quality Study revealed that most of the complaints that new-car owners have relate to high-tech gadgets in their cars and how these gadgets interact with drivers [3].

Consequently, this paper is intended to fill the gap between the perceptions of end users and vehicle manufacturer implementations using statistics from a scientifically designed online survey implemented in two stages. These stated preference surveys were intended to solicit a sample population's opinions on the use of advanced technology in automobiles. The first stage of the survey, conducted in 2012, highlights the generalized implications on how typical drivers react to equipping their vehicles with different levels of automation. In particular, two types of advanced cruise control systems were analyzed in this survey, namely Adaptive Cruise Control (ACC) and Cooperative Adaptive Cruise Control (CACC). The second stage of the survey, conducted in 2013, focused on identifying public opinion about the benefits sought from these advanced technologies. This survey highlights and ranks the aspects of driving or riding that the public would like to be automated.

A review of the literature reveals that most researchers have focused their efforts on testing the performance of new technology (e.g., advanced cruise control systems) and have assumed that drivers will accept such technologies. For example, some of the studies developed dynamic optimal speed advising algorithms on the vehicle side and compared system performance to actuated traffic signal control [4, 5]. For connected vehicles, many researchers have studied the impact of advanced cruise control (ACC and/or CACC) systems using simulation/simulator experiments (e.g., [6] and [7]). In addition, a few attempts in the literature have been made to create simulators (or simulation software) for modeling fully automated/autonomous vehicles (e.g., Dresner and Stone [8–10]).

However, a very limited number of researchers have attempted to study the impact of new technologies on driver behavior and driver distraction. In a NHTSA study, test vehicles with multiple vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) safety applications were tested using a total of 688 drivers, ages 20 to 70. The study concluded that, following the driver clinic, over 90 percent of the participants expressed a desire to have V2V communication safety features in their personal vehicles [11].