Design and installation of a driving simulator in a hospital environment

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Abstract

SIREN, the Simulator for Interdisciplinary Research in Ergonomics and Neuroscience, was built to create an immersive real-time virtual environment for assessing at-risk drivers in a medical setting. All running gear of a 1994 GM Saturn was removed, the vehicle cut in half at the door-posts, and a steel frame and instrumentation installed. Each half was moved through our university hospital and a temporary 10-foot gap in our laboratory wall. SIREN comprises the reassembled car, embedded electronic sensors and pinhole video cameras for recording driver performance. SIREN also includes a sound system and surrounding screens (150º forward FOV, 50º rear FOV), four Epson 710c LCD projectors with image generators and an integrated host computer, and another computer for scenario design, control and data collection. SIREN is applied to study the driving performance safety errors of motorists with medical disorders that can impair cognitive abilities that are crucial to the driving task.

Introduction

Driving simulation offers several advantages over the use of road tests or driving records in research on driver fitness. Simulator studies provide the only means to replicate exactly the experimental road conditions under which driving comparisons are made, and simulations are safe and have none of the risk of the road or test track. Successful demonstrations include performance profiles in sleep apnoea, drowsiness, alcohol intoxication, old age, Parkinson's Disease, Alzheimer's Disease, traumatic brain injury, and the study of basic aspects of cognition in drivers with brain lesions (Dingus et al., 1987; McMillen & Wells-Parker, 1987; Brouwer et al., 1991; Haraldsson et al., 1990; Katz et al., 1990; Madeley et al., 1990; Guerrier et al., 1995; Rizzo et al., 1997, 2000).

To test driving abilities of patients with different medical diagnoses, SIREN (Figure 1) was built. SIREN is a four channel, 150 degree forward view, and 50 degree rear view, high performance driving simulator. The SIREN vehicle cab is comprised of a four-door 1994 GM Saturn SL2. The simulation software was supplied by Hyperion Technologies (Fort Collins, Colorado). Four 550 Megahertz Pentium III PC image generators generate the graphics for each of the four visual channels. A separate PC host computer controls the general operation of the simulator and