School of Computing, Engineering, and the Built Environment
Edinburgh Napier University

PHD STUDENT PROJECT

Funding and application details

Funding status: Self funded students only

Application instructions:
Detailed instructions are available at https://blogs.napier.ac.uk/scebe-research/available-phd-student-projects/

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:

- DIRECTOR OF STUDY: Adelaide Marzano (Email: A.Marzano@napier.ac.uk)
- 2ND SUPERVISOR: Gokula Vasantha

Subject Group: Engineering & mathematics

Research Areas: Mechanical Engineering, Human computer Interaction, Automotive engineering

Project Title: A Tool for designing in-vehicle technology and assess operators distractibility

Project description:

One of the key challenges in the vehicle manufacturing industry is to design and implement in-vehicle technology that do not cause cognitive overload on the vehicle operator. Determining the acceptable amount of in-vehicle technology related to automation (which may at times require direct intervention from the operator) and how the operator would intervene without disengaging with the main task of operating the vehicle are key elements of the design. This project will investigate distractibility of in-vehicle technology and interiors consoles layouts to assess what level of operator distractibility is acceptable and in which situations.

Project Motivation

The levels of automation in vehicles are increasing, relegating the operator to a supervisory role [1, 2]. In such environments the vehicle's operator takes control only during critically important tasks, for instance pilots switching to manual during the landing of an airplane. Understanding and managing distractibility (i.e. the "condition by which the attention of the mind is easily distracted by small and irrelevant stimuli" [3]) during these tasks is crucial [4], a failure to complete procedures during the tasks may lead to disastrous outcomes [1]. Although some stimuli may be detrimental to the operator attention, in some situations (such as those where operators experience high levels of passive fatigue [5]) such stimuli may have opposite effects and result to be beneficial to attention [1, 6], as such it is not yet clear what is the role of distractibility in vehicle operation safety [2].

Project Objectives and Deliverables

The objective of the project is to produce a Virtual Reality (VR) tool to help vehicles designer design in-vehicles technology and assess the degree of distractibility of their design and test, analyse and compare different configurations and designs.

The project expected deliverables will be:

- D1. An analysis of the current state of the art of tools used in the vehicle's design industry to assess console distractibility.
- D2. A quantification of distractibility in vehicles' console/dashboards.
- D3. A data driven design for a virtual reality tool for assessing distractibility in vehicle consoles.
- D4. A prototype of a virtual reality tool that will allow designers to analyse and test their consoles designs.

Distractibility is a key design driver in determining optimal console and interior layout design for vehicles across the transport sector. The project goal is to quantify distractibility and the broader human experience across the 17-80 age demographic within vehicular interiors using simulated environments around the user / vehicle interface.

To achieve this the project will consist of three parts as follows:

1. Benchmark current vehicle consoles: Understand current drivers for in-vehicle technology design and define exemplar(s) as the basis for digital equivalent(s)
2. Immersive VR tool: Build a VR tool that will allow designers to analyse aspects related to distractibility in-vehicles technology.
3. Human factor analysis: Design experiments to quantify human aspects of design in terms of distractibility taking into account ergonomics and cognitive load.

EEG will be used alongside behavioural measures within a simulated VR environments to quantify changes in attentional state over time. This data will be used to generate the design of the VR tool.

The researcher joining this project will develop and train in the appropriate technical areas. In addition, the researcher will be actively encouraged to present the work at leading international conferences and workshops. Therefore, the researcher should have an appetite for undertaking an enquiring and rigorous approach to research together with a keen intellect and disciplined work habits.

References:

[1] McFarlane, D. C., and Latorella, K. A. (2002). The Scope and Importance of Human Interruption in Human–Computer Interaction Design. Human-Computer Interaction, 17, pp. 1-61
[2] Matthews, G. Neubauer, C. Saxby, D. J., Wohleber, and R. W., Lin J. (2018). Dangerous intersections? A review of studies of fatigue and distraction in the automated vehicle. Accident Analysis and Prevention, In Press.
[3] Merriam-Webster (2005). Merriam-Webster's Medical dictionary. CENGAGE Delmar Learning; 3 edition.
[4] Gibson, Z., Butterfield, J., and Marzano, A. (2016). User-centered design criteria in next generation vehicle consoles
[5] Saxby, D. J., Matthews, G., Warm, J. S., Hitchcok, E. M., and Neubauer, C. (2013). Active and Passive Fatigue in Simulated Driving: Discriminating Styles of Workload Regulation and Their Safety Impacts. Journal of Experimental Psycology: Applied. 19(4), 287-300.
[6] Atchley, P., Chan, M., and Gregersen, S. (2014). A Strategically Timed Verbal Task Improves Performance and Neurophysiological Alertness During Fatiguing Drives. Human Factors, 56(3), pp.453-462.

Candidate characteristics

Education:

A first-class honours degree, or a distinction at master level, or equivalent achievements in Mechanical engineering, Product Design, Interaction Design, Human Psychology, Human factors in Engineering

Subject knowledge:

- CAD Design
- Virtual Reality technology
- programming language skills

Essential attributes:

- Experience of fundamental Vehicle console design and Ergonomics
- Competent in Programming and Experimental studies
- Knowledge of Virtual reality and Data analysis
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management