

# Wearable Devices for Assisting Visually Impaired People in Mobility

PhD proposal by Simon Perrault, SUTD, Singapore and Christophe Jouffrais, IRIT, Toulouse & IPAL, Singapore

## Context

Thanks to miniaturization in the last few decades, wearable devices (e.g. smart watches, smart rings) are getting more powerful and embed a lot of sensors. Such devices are usually always worn by their owner and are thus always available for interaction.

On the other hand, 441.5 million people have mild to severe vision impairment<sup>1</sup> and need assistance in their everyday life. While a lot of existing technologies can provide assistance, they are usually bulky or impractical to in mobile contexts (e.g. while walking or sitting on a bus).

## Thesis Project

The proposed project aims at designing new interaction techniques and devices to help visually impaired people in their everyday life. Potential tasks include, but are not limited to, indoor/outdoor navigation, finding specific objects in space, or rendering visual information in a non-visual way.

Here are the steps of the project:

- Identify common tasks from the existing literature
  - Advantages and limitations of existing solutions
  - Find out the potential interest of wearable devices
- Conduct interviews of visually impaired people to find out about some areas not covered by the literature
- Prototyping
  - Propose a few interaction techniques and/or devices
  - Iterate on these devices to identify the most promising ones
- Improve Prototypes
  - Implement hardware and/or software solutions
- Validate Prototypes in the Lab
  - Run lab studies with (visually impaired) users
- Ecological Validity
  - Run a field study to verify ecological validity of the solutions

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<sup>1</sup> <http://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment>

## Outcome

The first outcome of the thesis will be publications in first-tier venues. Acceptable conferences are the ACM SIGCHI (CHI) conference, UIST, CSCW. Excellent journals such as ToCHI (ACM), IJHCS (Elsevier) and HCI (T&F) can also be considered, as well as journals or conferences on assistive technologies (ASSETS).

The second outcome will be the hardware and software solutions developed. Software solutions could then be released as applications on relevant platforms, while hardware solutions could be improved and potentially transferred in a longer term.

## Supervision & Contact

The thesis will be co-supervised by Dr Simon Perrault and Pr Christophe Jouffrais.

The PhD student will spend most of his time in Singapore (SUTD & IPAL).

### Singapore University of Technology and Design, Singapore

Simon Perrault is a newly appointed Assistant Professor at the Singapore University of Technology and Design (SUTD). Dr Perrault's research focuses on wearable devices and how to make interaction smoother in mobile context. He has developed several prototypes of smart bands/watches, smart rings and designed indoor navigation techniques for smart glasses. While most research projects tend to stay in the lab, Dr Perrault's focus is to offer a rich experience in any context, which means validating prototype in situ. SUTD offers a great infrastructure for research in both hardware and software, including a state-of-the-art fabrication lab and space for tinkering and conducting research

### « Cherchons pour Voir » lab @IRIT, Toulouse, France

“Cherchons pour Voir” is a common research lab between IRIT (Toulouse Institute of Computer Science) and the Institute of Blind Youth in Toulouse. The laboratory focuses on research projects aimed at improving the autonomy and quality of life of people with visual impairments, but also at improving adapted tools for the practitioners (specialized teachers, trainers, etc.) The lab can bring together researchers, practitioners, and people with visual impairment around a research problem, whether fundamental or applied. The method is based on participatory design.

Christophe Jouffrais, DR CNRS, is the director of the CPV lab. He has a background in Cognitive Science, with a focus on visual impairment and its cognitive consequences. He will bring strong support on the topic of non- visual human perception and cognition, non-visual Human-Machine Interaction but also Assistive Technology.

### Application and Contact

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Students with a master or engineer diploma in Computer Science or Cognitive Science can apply. Send a complete CV with cover letter, academic transcripts of Bachelor and Master studies and two references. Any additional document is

appreciated, including Graduate Record Examinations (GRE), Test of English (TOEFL or IELTS) if your studies were not in English.