Multisensory Navigational Aid for Visual Prosthesis Users

Seminar Presentation

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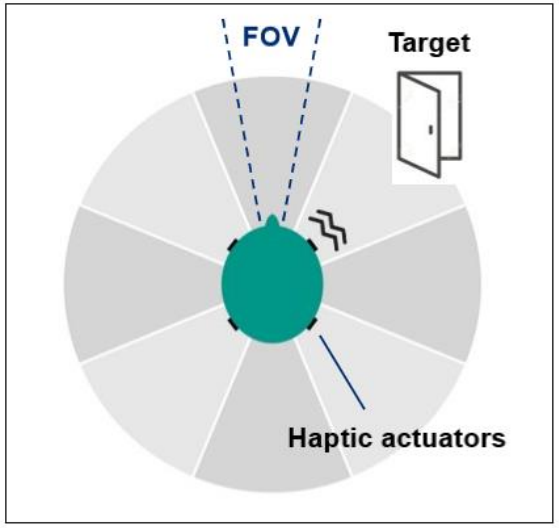
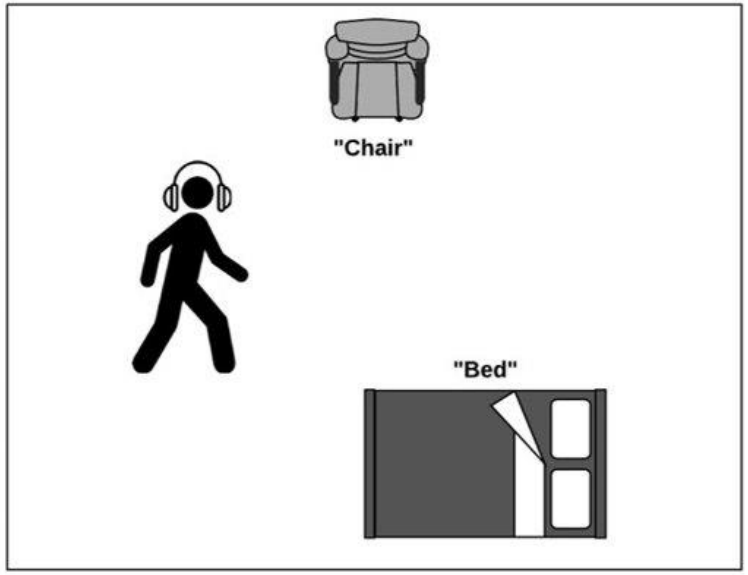
Project Summary

- Develop a haptic and auditory feedback system to supplement the Argus II retinal prosthesis system

- Haptic Feedback System



- Auditory Feedback System



Haptic Feedback System - Paper Selection

- “Around-the-Head Tactile System for Supporting Micro Navigation of People with Visual Impairments,” by Oliver Beren Kaul, Michael Rohs, Marc Mogalle, and Benjamin Simon

- Identified that visually impaired individuals cannot independently navigate a space

Objective and Background

- Use of a haptic feedback cap to provide micro navigation to visually impaired users
- HapticHead
  - Previous development for VR/AR applications

HapticHead

Approach

- Haptic pattern for commands
- Continuous guidance

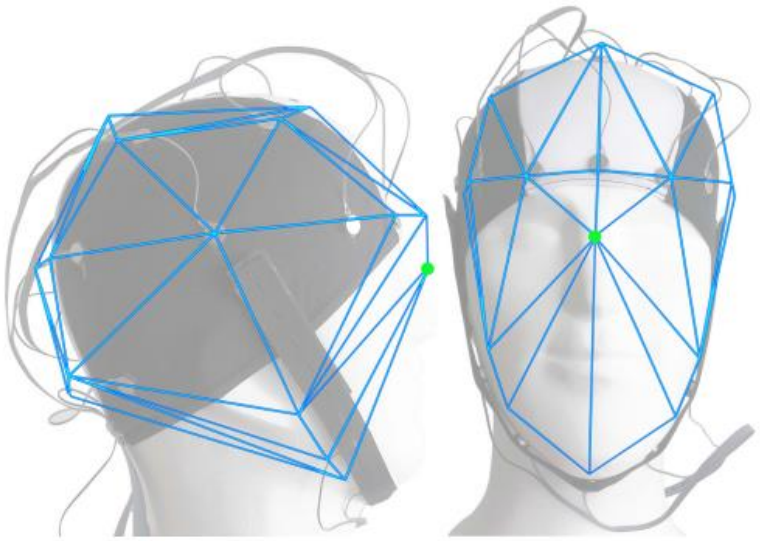
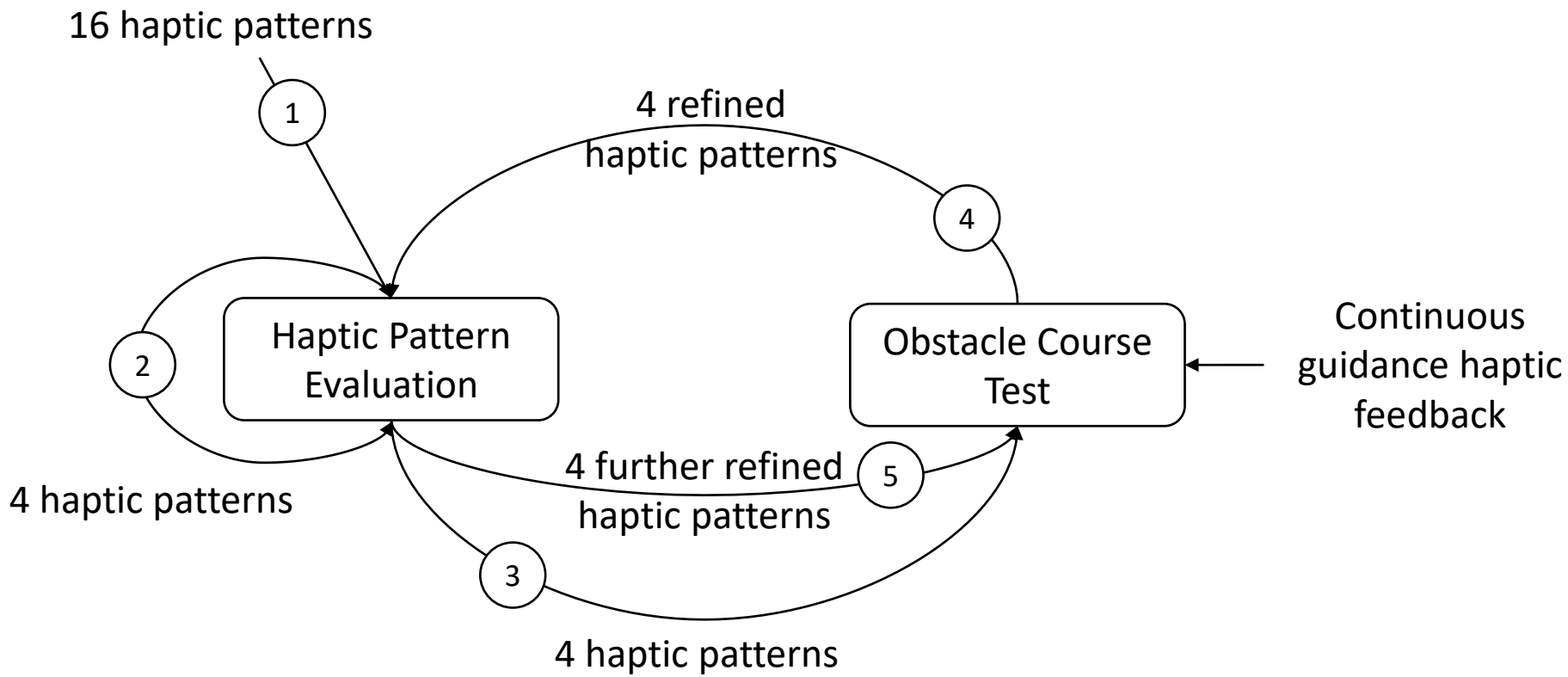


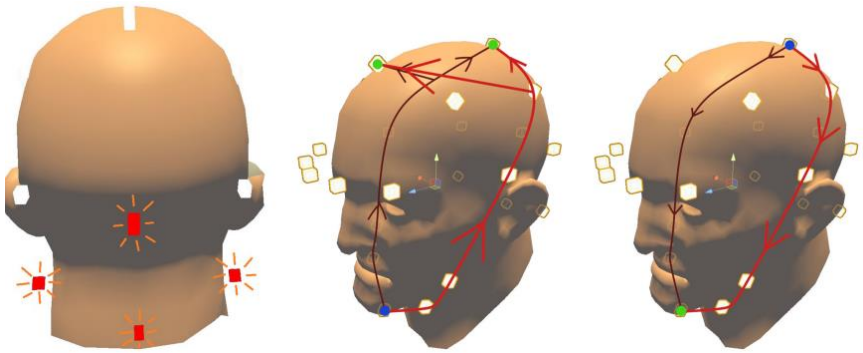
Illustration of continuous guidance method

Procedure


16 haptic patterns
1
4 refined
haptic patterns
4
Haptic Pattern
Evaluation
2
Obstacle Course
Test
Continuous
guidance haptic
feedback
4 haptic patterns
4 further refined
haptic patterns
5
3
4 haptic patterns

Results – Command Patterns

- Omitted ‘start’ command
- Added ‘attention’ command



Final haptic patterns

- Shorten the dynamic patterns to 575ms
- Static patterns were uncomfortable so used dynamic patterns
- Localising haptic actuators on top of head not precise and perceived strength is less

Results – Key Takeaways

- Use short dynamic patterns wherever possible
- Use side actuators in conjunction with top ones

Results – Obstacle Course Tests

Metric	First Obstacle Test	Second Obstacle Test
Max. Right Deviation* (cm)	~20	~15
Max. Left Deviation* (cm)	~18	~14.5
Num. users said intuitive/total	14/15	3/5
Num. users felt safe/total	12/15	4/5

*from optimal path

- In both obstacle course tests, time taken for each run decreased
- Is possible to effectively guide users using haptic feedback as standalone system

Assessment

- Good
  - Iterative approach for user-centric device
  - During pattern evaluation did not tell participants if they were correct or not
- Bad
  - Not enough participants
  - Paths through obstacle course predefined
  - Seeing participants

References

- Oliver Beren Kaul, Michael Rohs, Marc Mogalle, and Benjamin Simon. 2021. Around-the-Head Tactile System for Supporting Micro Navigation of People with Visual Impairments. ACM Trans. Comput.-Hum. Interact. 28, 4, Article 27 (August 2021), 35 pages. DOI:https://doi.org/10.1145/3458021