Navigation with Feetback

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Abstract*—We introduce an interface that implements vibration sensors into socks and provides orientation by haptic feedback. Feetback has the potential of several functionalities. We focus on navigation, disaster response in off grid scenarios. Moreover, the design of Feetback makes it possible to use the device to be a general prototyping interface.

Navigating with map applications makes it nessessary to hear or see the directions that help to go from point A to point B. In a new environment that can have a negative influence on our presence in the moment. Focusing on a screen or a voice that is giving directions makes it difficult to follow a conversation or be aware of the environment. To use feet as an interface for haptic feedback opens possibilities for several additional applications.

I. Related Work

Wearables with vibrating feedback technologies are a rising field [1].

In HCI wearables for feet with haptic feedback are used

for different purposes. But to the best of our knowledge no work has been done to use socks as a supportive interface for navigation [2].

To transform visual maps information into haptic signals was done for visual impaired people [3].

In disaster situations navigating into a save area can be crucial for surviving. We implement a system that interacts with changing electromagnetic fields. In case of an event that causes zero sight electromagnetic impulses can help to signalize the direction into a save space.

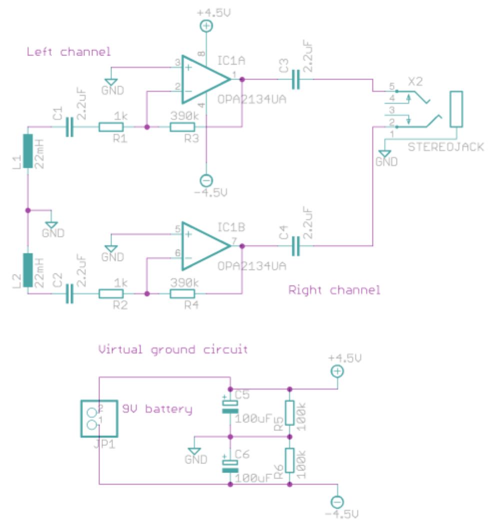

Figure 1 Circuit diagram Elektrosluch [4]

Figure 1 shows the circuit that works as a sensor for changing electromagnetic fields. It was developed by artist Jonáš Gruska. In the original version of the circuit electromagnetic noise is turned into sound [4]. We will turn the received noise into vibration patterns.

In order to provide a device that invites to attach further sensors or to exchange broken components we use audiojacks for intuitivly exchangable components.

II. Prototyping Feetback

Feetback is a sock with an attached vibration motors, battery, microcontroller, and a sensor with highpassfilter to receive electromagnetic noise from changing electromagnetic fields.

A. Overview of functionalities

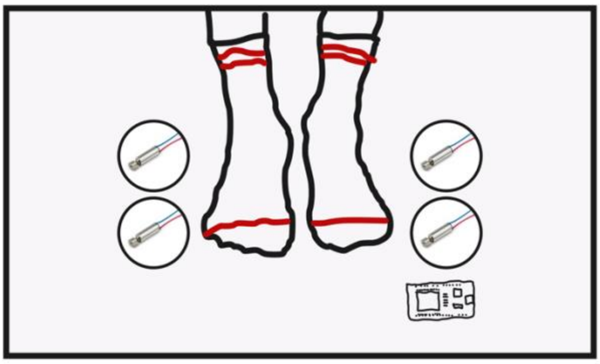

Figure 2: core components of Feetback.

Figure 2 shows the core components of the Feetback prototype. A microcontroller with WiFi or bluetooth functionality that receives control signals from a connected mobile phone. Every sock will have 4 vibration motors attached to the microcontroller.

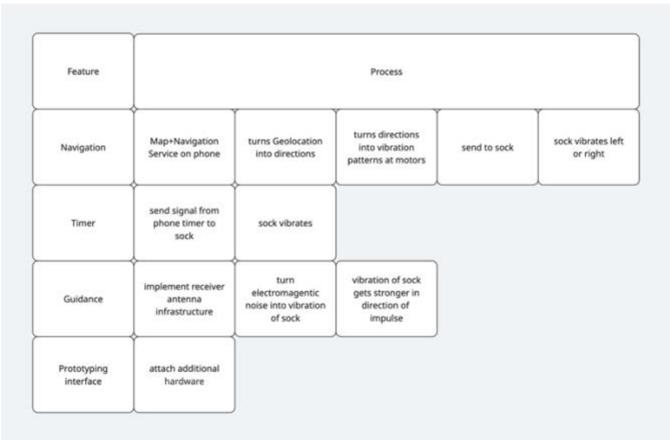

Figure 3: Planned features of Feetback

Figure 3 shows the planned features of Feetback: Navigation, Wake up timer, Guidance in disaster situations, inviting prototyping interface. Every functionality will require a flow of processes that are summarized in figure 3.

B. Methods

Task	Methodology	Evaluation/Testing
Attach vibration motors to socks	Experimenting with different vibration motors in different positions	User test with different motors
Connecting microcontroller and battery to sock using audio jack interface	Phsical computing, iterative design	Testing stability
Software development of Navigationsignals into haptic pattern logic	Coding of an application.	Simulation of different relevant situations
Connecting timer function to the sock for easy wake up application	Coding and physical computing	User test of wake up function
Implementing “Elektrosluch” with haptic feedback	Physical computing	Hardware testing of receiving haptic responses to changing electromagnetic fields
Building an app prototype to control Feetback	App-development	Testing the different features of the app
Iterating for production design	PCB- design	Testing the pcb

Table 1: Prototyping tasks of Feetback

Table 1 shows the tasks of prototyping Feetback. Every task requires different methodologies and evaluation and testing processes.

III. Responsible Innovation

Implications for society

1. We hope to contribute to the reduction of distraction in public space. A hidden feetinterface is less distractive than a display or a voice interface. This allows to connect to people and places in a more focused way.

2. Disaster situation with zero visibility and interrupted mobile connection need different technologies than common map applications. They need to be as independent as possible of digital infrastructure.

For example: In forest fires that are close to cities usually attract volunteers that dont have equipment like professional firefighters. The phones dont work and they get lost in the forest. An elektromagnetic impulse can help to give a roughly orientation.

In situation of power outage at night people could be directed out of the building.

Implications for environmental sustainability implications

We use repairable, widely available components and open hardware and software. The device can be produced in local makerspaces. All components can be easily replaced and connected to other socks.

IV. Author

I became an electrical engineer because I have been working for 5 years in a DIY shop (Bauhaus) in the electronics department and I loved to get involved in the projects of the customers. I used to run an open workshop space at cityLab Berlin before academia was calling me to do my phd. My focus is participatory prototyping.

I am a board member of the association of open workshops:

https://offene-werkstaetten.org/en

Recently I was founded for running a lab for prototyping for forests:

https://www.lifolab.de/

V. References

[1] Y. Huang, K. Yao, J. Li et al., "Recent advances in multi-mode haptic feedback technologies towards wearable interfaces" Materials Today Physics, vol. 22, p. 100602, 2022, doi: 10.1016/j.mtphys.2021.100602

[2] Keigo Ushiyama and Pedro Lopes. 2023. FeetThrough: Electrotactile Foot Interface that Preserves Real-World Sensations. In Proceedings of the 36th Annual ACM Symposium on User Interface Software and Technology (UIST '23). Association for Computing Machinery, New York, NY, USA, Article 10, 1–11. https://doi.org/10.1145/3586183.3606808

[3] Koji Yatani, Nikola Banovic, and Khai Truong. 2012. SpaceSense: representing geographical information to visually impaired people using spatial tactile feedback. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12). Association for Computing Machinery, New York, NY, USA, 415–424. https://doi.org/10.1145/2207676.2207734

[4] https://github.com/LOM-instruments/Elektrosluch-DIY