SHORT-PAPER

OpenWearables 2025: 2nd International Workshop on Open Wearable Computers

TOBIAS RÖDDIGER, Karlsruhe Institute of Technology, Karlsruhe, Baden-Wurttemberg, Germany

M BEIGL, Karlsruhe Institute of Technology, Karlsruhe, Baden-Wurttemberg, Germany

KRISTOF VAN LAERHOVEN, University of Siegen, Siegen, Nordrhein-Westfalen, Germany

KATIA CANEPA VEGA, University of California, Davis, Davis, CA, United States

YUNTAO WANG, Tsinghua University, Beijing, China

BO ZHOU, German Research Center for Artificial Intelligence (DFKI), Kaiserslautern, Rheinland-Pfalz, Germany

Open Access Support provided by:

Tsinghua University

German Research Center for Artificial Intelligence (DFKI)

Karlsruhe Institute of Technology

University of Siegen

University of California, Davis

Published: 12 October 2025

Citation in BibTeX format

UbiComp '25:The 2025 ACM International Joint Conference on Pervasive and Ubiquitous Computing / ISWC ACM International Symposium on Wearable Computers
October 12 - 16, 2025
Espoo, Finland

Conference Sponsors:
SIGMOBILE
SIGCHI

https://doi.org/10.1145/3714394.3750556
ISBN: 9798400714771

OpenWearables 2025: 2nd International Workshop on Open Wearable Computers

Tobias Röddiger
tobias.roeddiger@kit.edu
Karlsruhe Institute of Technology
Karlsruhe, Germany

Michael Beigl
michael.beigl@kit.edu
Karlsruhe Institute of Technology
Karlsruhe, Germany

Kristof Van Laerhoven
kvl@eti.uni-siegen.de
University of Siegen
Siegen, Germany

Katia Vega
kvega@ucdavis.edu
University of California, Davis
USA

Yuntao Wang
yuntaowang@tsinghua.edu.cn
Tsinghua University
Beijing, China

Bo Zhou
bo.zhou@dfki.de
DFKI
Kaiserslautern, Germany

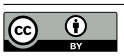
Figure 1: The 2nd International Workshop on Open Wearable Computers (OpenWearables 2025) aims to continue the research platform that was initially established in 2024 to increases the accessibility and utility of wearable technologies by focusing on the development and dissemination of open devices. (AI-generated teaser figure).

Abstract

Open hardware such as Arduino are an accelerator for research in ubiquitous and wearable computing. In recent years, an increasing number of open-source wearable devices is emerging. In this workshop, we seek to create a dedicated forum and venue for publication for topics around open wearable computers. The whole day workshop includes a keynote speech, paper presentations, demo sessions, hacking sessions, and networking opportunities. Through our activities, we hope to create a future where wearable technologies are accessible, interoperable and impactful across applications and industries.

CCS Concepts

• **Hardware → Emerging technologies**; • **Human-centered computing → Ubiquitous and mobile computing systems and tools**; **Ubiquitous and mobile devices**;



UbiComp Companion '25, Espoo, Finland

ACM ISBN 979-8-4007-1477-1/2025/10
https://doi.org/10.1145/3714394.3750556

Keywords

open wearables; open hardware; open-source; OSHW

ACM Reference Format:
Tobias Röddiger, Michael Beigl, Kristof Van Laerhoven, Katia Vega, Yuntao Wang, and Bo Zhou. 2025. OpenWearables 2025: 2nd International Workshop on Open Wearable Computers. In *Companion of the 2025 ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp Companion '25), October 12–16, 2025, Espoo, Finland.* ACM, New York, NY, USA, 4 pages. https://doi.org/10.1145/3714394.3750556

1 Introduction

In today's rapidly expanding wearable technology market, thousands of devices are available, from health trackers to augmented reality interfaces. However, a significant barrier to innovation and research in this field is the closed nature of many of these devices. They often come with proprietary systems that are difficult to interface with or retrieve data from. Furthermore, the few open devices that are available present a steep learning curve, preventing rapid, impactful research and application development in realistic environments.

As general-purpose platform, Arduino has found wide adoption in ubiquitous and wearable computing. Extending beyond this general platform, open-source wearable devices are beginning to be

more pervasive in research for example OpenBCI [2], EmotiBit [6], OpenEarable [8, 9], and Open ExG [4, 5].

After its initial success in 2024, the 2nd OpenWearables workshop aims to grow a research platform that increases the accessibility and utility of wearable technologies by focusing on the development and dissemination of open devices. In recent years, communities like the Open Source Hardware Association (OSHWA) have made significant strides in promoting open standards and guidelines for creating high quality, reproducible hardware [1]. The OSHWA and DIN SPEC 3105 [3] have already proposed general standards for open hardware, but there is a growing need to be more specific and practical when it comes to wearable technology. Similarly, the multi-company OWear initiative [7] seeks to build a community for the collection of open data for wearable computing. In contrast to these efforts, our workshop focuses on creating a practical exchange of wearable technology that meets the needs of researchers beyond processes and standards, and will not address open data for wearable computing.

The wearable systems should be designed for quick, easy and impactful use with a focus on:

- **Openness:** Enabling developers to create custom applications and services that communicate seamlessly with the devices.
- **Reproducibility:** Enabling anyone to build or modify the devices, ensuring that the knowledge and technology is freely available.
- **Extensibility:** Enabling easy physical integration (e.g. via hardware connectors) and software integration (e.g. via communication interfaces) with other devices and systems that encourage cross-use within the community.

2 Goal and Objectives

We seek to bring together people from different backgrounds that are passionate about open wearable computing. The OpenWearable workshop is driven by the following five key objectives:

(1) **Democratize wearable technology:** We aim to make advanced wearable technologies accessible to a wider audience, including hobbyists and educators, thereby democratizing innovation in the field.
(2) **Foster a community of open innovation:** We seek to create a forum to learn about each other's activities and create a vibrant ecosystem where developers, researchers and users can collaborate, share results and build on each other's work to advance the field.
(3) **Enable cross-disciplinary innovation:** By lowering the barrier to entry for the use and development of wearable technologies, we aim to enable researchers and innovators from diverse fields - from healthcare to education and beyond - to use these tools in their work.
(4) **Accelerate real-world applications:** By simplifying the development and integration process, we aim to shorten the time from concept to deployment of wearable technologies in real-world applications, making it easier to address immediate societal needs.
(5) **Make interoperability easier:** Establish useful, concrete interfaces that are needed by the wearable community to ensure interoperability and ease of use across devices and platforms.

Beyond these five core principles, the OpenWearables workshop is not only a meeting place for current technologies, but also a launch pad for future innovations. Through collaboration and open exchange of ideas, we aim to set new standards for wearable technologies to be compatible. This will result in lowering entry barriers and creating a community of passionate individuals and organizations that can work together towards common goals.

3 Background of the Organizers

Tobias Röddiger
Research Group Leader, Karlsruhe Institute of Technology, Germany
Tobias is a group leader for wearable systems at the Karlsruhe Institute of Technology in Germany. He is the developer of OpenEarable, an open-source Arduino platform for ear-based sensing applications. He regularly serves as reviewer for different journals and conferences (e.g. IMWUT, CHI) and has helped organize various events (e.g. Ubicomp, MuC).

Michael Beigl
Professor, Karlsruhe Institute of Technology, Germany
Michael Beigl is a researcher and practitioner in the field of Ubiquitous Computing and Wearable Computing. He has served as Program and General Co-Chair of Ubicomp and ISWC 2016, 2018, 2021, and co-organized several workshops on Ubicomp/ISWC.

Kristof Van Laerhoven
Professor, University of Siegen, Germany
Kristof is a professor for Ubiquitous Computing and interested in research into wearable and embedded sensing systems, as well as activity and affect recognition. He has co-chaired UbiComp 2023 and chaired till recently the ISWC Steering Committee, and currently is an Editor for the IMWUT journal.

Katia Vega
Associate Professor, University of California, Davis
Katia Vega is an Associate Professor at UC Davis, heading the Interactive Organisms Lab. Her research interests involve Beauty Technology, embedding electronics in cosmetics, Body Modification Technologies, integrating electrochemical and colorimetric biosensors into jewelry, tattoos and dental orthodontics for sensing biofluids, and Growable Interfaces, creating sustainable interfaces with bio-based materials. She has served as a program co-chair and co-chair of the Design Exhibition at ISWC.

Yuntao Wang
Associate Professor, Tsinghua University, China
Yuntao Wang is an Associate Professor in the Pervasive Interaction (PI) Lab at Tsinghua University. His research interests involve Human-Computer Interaction, Physiological Sensing, and Wearable Computing. He has served as an associate editor of the IMWUT journal and posters/demos chair of the Ubicomp/ISWC 2023.

Bo Zhou
Research Group Deputy Head, German Research Center for Artificial Intelligence (DFKI), Germany
Bo Zhou is a senior researcher and the deputy head of the Embedded Intelligence research group from DFKI. His research interests involve human activity recognition using smart wearables with embedded AI and smart textiles. He has served as the TPC co-chair for ISWC 2023/2024, and is currently the co-chair of the ISWC steering committee.

4 Expected Attendance

The OpenWearables workshop aims to engage a group of 20-40 in-person participants who embody the spirit of openness and diversity of expertise, ranging from hardware enthusiasts to software developers, designers, artists, and systems builders that can contribute to the field of Wearable Computing. The wide range of backgrounds will offer a basis for future collaboration.

We will recruit attendees from the community via the openwearables.org website that we will share on social media, via e-mail, and by personally approaching various researchers within our network. Furthermore, we are inviting anyone attending Ubicomp/ISWC to participate in all sessions.

5 Agenda

The full day workshop will be divided into four main parts: a keynote, paper presentations, demo sessions and a community hacking session.

5.1 Keynote

We will open the workshop with a keynote by a speaker that is relevant to the open wearables community. The goal of this talk will be to inspire the attendees for further research and showcase a success story of open wearable computing.

5.2 Papers

This session includes presentations based on accepted and invited papers. It will serve as a platform for sharing recent developments, findings and innovations in the field of open technology that can be or are used in the wearable computing domain. We invite papers including but not limited to the following topics:

- open-source designs of wearable devices
- applications and evaluation of open-source wearables
- software that supports designing, developing, or building open-source wearables
- frameworks simplify the interaction between open-source wearables

Submitted papers should be short, not exceeding 4 pages (excluding references and additional material). Papers should be concise and clear when presenting technical details (e.g., bullet lists, figures, etc.). We expect that most papers will present open hardware, software, or systems and their intended use and benefits. A significant part of the paper should be dedicated to the aspect of how to use, build and interface the presented approach. Complexity levels should indicate what skills and technical settings are required to use the system. At least one application example should demonstrate the use and impact. We expect that hard- and software presented at the workshop is open source. Papers that present a novel piece of hardware or software will have to include all relevant files as supplemental material in their submission.

5.2.1 Review Process. For paper review, we will set up a program committee. Each paper will be reviewed by two different members of the committee. Following the reviews, the organizers together with the PC members will discuss a meta review for the final selection. The meta review will summarize the reviews and give recommendations for the final submission. Supplemental material will be lightly reviewed.

5.2.2 Publication. We intend to have all papers published in the "ACM Digital Library and Adjunct Proceedings". All papers have to follow the requirements of ACM double-column format (UbiComp/ISWC 2025 Proceedings Formats).

5.3 Demo Sessions

Participants are encouraged to demonstrate or showcase their open source wearable projects. This hands-on session aims to showcase the practical applications of open wearables and encourage direct feedback and engagement from attendees. This session is open to all workshop participants: Bring your own device and/or software! Sessions will be limited in time (around 5 minutes) to give each participant the opportunity to showcase their work in progress and also to make connections between projects. Participants can opt-in to have their demo shared on open-wearables.org.

5.4 Hacking Sessions

The hacking sessions will function as a hackathon centered on open wearable technologies. Participants can use devices provided by the organizers or bring their own projects to work on. This session encourages creativity and collaboration, with participants forming teams to develop new applications, improve existing systems, or explore novel uses of open wearables. At the end of the session, teams will present their results, showcasing prototypes, ideas, or concepts they developed during the hackathon.

5.5 Networking

We intend to have a coffee and lunch break which create opportunities for participants to get to know each other better. They can discuss potential collaborations within the open wearable community and identify application partners for their open wearable devices. This will initiates the formation of an international open wearable community.

5.6 Awards

As part of the workshop we will award two prizes.

- **Best Paper:** The prize will be awarded to the best paper.
- **Best Demo:** The prize will be awarded to the best demo.

Both awards will serve as a testament to the outstanding work being done in the field of open wearables and should inspire future research and development in this area.

5.7 Preliminary Schedule

We plan to run a full day workshop with the following schedule:

Table 1: Preliminary schedule for OpenWearables 2025.

Time	Session Name
09:00 - 09:45	Introduction and Keynote
09:45 - 10:00	Coffee Break
10:00 - 12:00	Paper Presentations
12:00 - 13:00	Lunch Break
13:00 - 14:00	Demo Session
14:00 - 15:45	Hacking Sessions
15:45 - 16:00	Wrap-Up and Awards

References

[1] 2024. Open Source Hardware Association (OSHWA). https://www.oshwa.org/. Accessed: 2024-03-22.

[2] 2024. OpenBCI. https://openbci.com/. Accessed: 2024-03-22.

[3] Deutsche Industrienorm e.V. 2023. DIN SPEC 3105. https://gitlab.com/OSEGermany/OHS-3105.

[4] Michael Thomas Knierim, Daniel Puhl, Gabriel Ivucic, and Tobias Röddiger. 2023. OpenBCI+ 3D-Printed Headphones= Open ExG Headphones–An Open-Source Research Platform for Biopotential Earable Applications. In *Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems*. 1–7.

[5] Philipp Lepold, Tobias Röddiger, Tobias King, Kai Kunze, Christoph Maurer, and Michael Beigl. 2024. OpenEarable ExG: Open-Source Hardware for Ear-Based Biopotential Sensing Applications. In *Companion of the 2024 on ACM International Joint Conference on Pervasive and Ubiquitous Computing*. 916–920.

[6] Sean M Montgomery, Nitin Nair, Phoebe Chen, and Suzanne Dikker. 2023. Introducing EmotiBit, an open-source multi-modal sensor for measuring research-grade physiological signals. *Science Talks* 6 (2023), 100181.

[7] Open Wearables Initiative. 2024. OWeAR - Open Wearables Initiative. https://www.owear.org/. Accessed: 2024-03-20.

[8] Tobias Röddiger, Michael Küttner, Philipp Lepold, Tobias King, Dennis Moschina, Oliver Bagge, Joseph A Paradiso, Christopher Clarke, and Michael Beigl. 2025. Openearable 2.0: Open-source earphone platform for physiological ear sensing. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 9, 1 (2025), 1–33.

[9] Tobias Röddiger, Tobias King, Dylan Ray Roodt, Christopher Clarke, and Michael Beigl. 2023. OpenEarable: Open Hardware Earable Sensing Platform. In *Proceedings of the 1st International Workshop on Earable Computing* (Cambridge, United Kingdom) *(EarComp'22)*. Association for Computing Machinery, New York, NY, USA, 29–34. doi:10.1145/3544793.3563415

A Call for Papers: OpenWearables 2025 – 2nd International Workshop on Open Wearable Computers

The OpenWearables 2025 workshop aims to address the challenges and opportunities in the field of open source wearable technology. We invite submissions from researchers, developers and innovators on topics such as open source designs of wearable devices, applications and evaluations of open source wearables, software that supports the design and development of open wearables, and frameworks. Submissions should be concise, limited to a maximum of 4 pages excluding references, and demonstrate the use, build and interface processes of open hardware, software or systems. In addition, it is expected that authors submit "open-source materials" which are, for example, design files, 3D-printing files, schematics or any other materials that are required to reproduce the wearable device. Papers should use pictures, graphs and functional diagrams as often as possible in the explanation of the work. An essential requirement is that the projects presented adhere to open source principles. Papers will be selected based on adherence to these principles and the clarity of the paper. During the workshop, authors will be required to present their research paper and also provide a demonstration of their open wearable work to showcase the practical applications and potential impact of their research.

The workshop will feature a mix of keynote speeches, paper presentations, demo sessions, and group discussions, providing a platform for participants to showcase their work, share insights, and foster collaboration within the open wearables community. We particularly encourage demonstrations of open source wearable projects during the hands-on demo sessions, in addition to the paper.

Join us at OpenWearables 2025 to help democratise wearable technology, accelerate innovation and establish standards for open wearables. Together, we can create a future where wearable technologies are accessible, interoperable and impactful across applications and industries.