

Just-in-time adaptive interventions app

For OCD interventions in a Wizard-of-Oz style feasibility study.

Motivation: Part of OCD treatment: Interventions by Psychologists

Work:

- Creation of an app (Wear OS) to deliver different types of interventions, e.g. for hand washing.
E.g. “Stop” or an exercise (ERP micro task), with sounds, vibration, UI etc.
- Companion app on smartphone to control experiment and collect data
- Evaluation of app with users in simulated experiments (not “real” patients)
- Apps should be open-sourced, freely licensed

Your background:

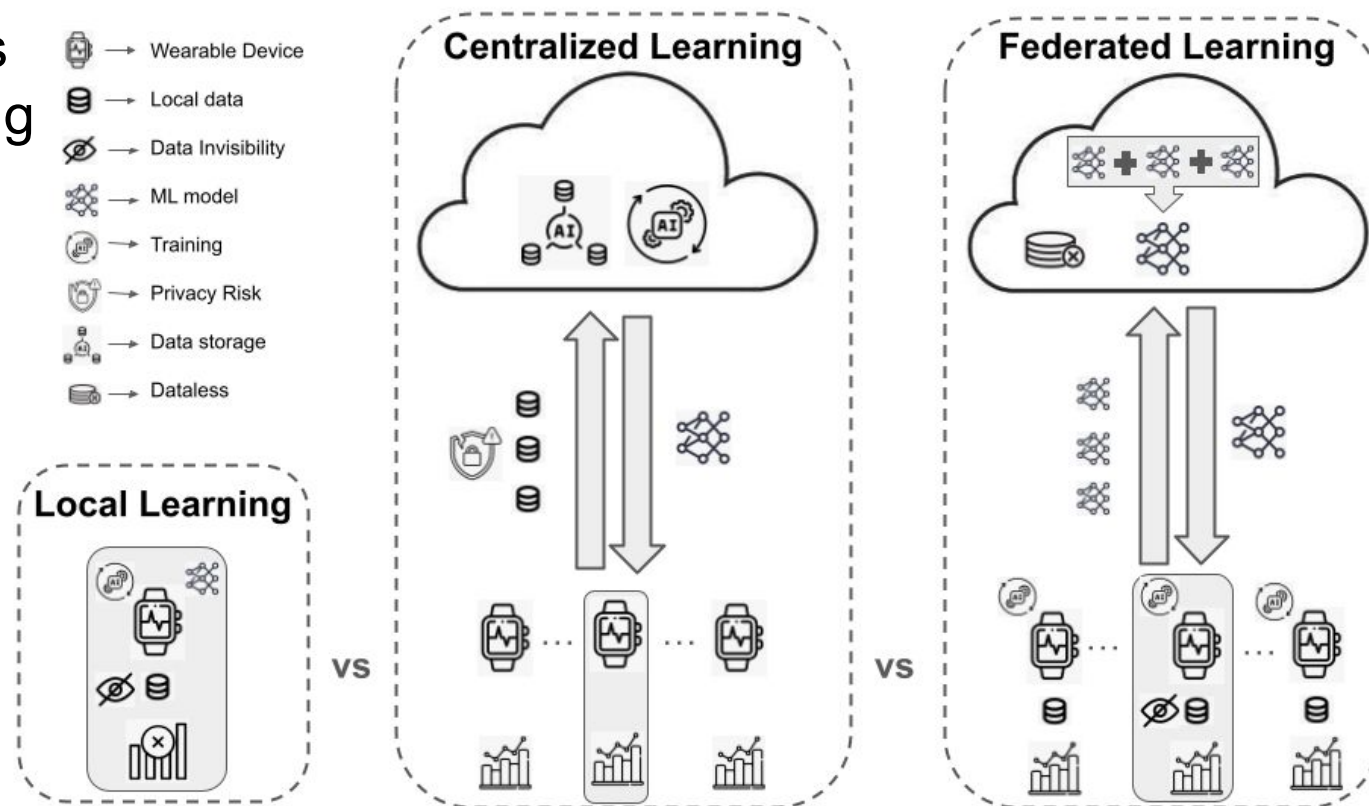
- Android programming experience is a plus (or willingness to learn needed!)
- Willingness to recruit and record participants
- Interest for mental health and psychology/ behavioral therapy

⇒ Optimal outcome: Submission of a workshop paper in July 2026



Enabling Trustworthy Collaborative Learning Systems for Human Activity Recognition

- Development of ML systems for the HAR domain by taking GDPR measures.
- Enhancing Federated Learning considering the characteristic of the target application.
- Evaluating metrics of designed system with existing learning systems using wearable device data.



ML-Optimized Dynamic Resource Allocation for LoRaWAN in Indoor IoT Networks

Description:

- Develop an ML-driven LoRaWAN resource management system that dynamically allocates resources such as bandwidth based on environmental conditions, human occupancy, and interference levels.
- The main aim is to improve network efficiency and reduce packet loss in dense IoT deployments.

Key Tasks:

- Using **an already available dataset**, design LoRaWAN network models (mainly ML) considering multi-wall penetration and environmental parameters.
- Validate performance of the models via simulations and/or streaming data.
- On device implementation of the optimal ML-based algorithm for dynamic channel selection & power adjustment.

Skills: Python data analysis and willingness to research and learn new methods.



[Image source](#)

Multi-Protocol IoT Network for Indoor Localization Using BLE, Thread, and LoRaWAN

Description:

- Develop a hybrid **BLE/Thread - LoRaWAN** network for **precise indoor localization** in smart buildings.
- **Application Examples:** asset tracking, personnel monitoring, and indoor navigation.
- The system will leverage **BLE's fine-grained positioning** with **LoRaWAN's long-range efficiency** to provide **real-time tracking** while optimizing power consumption.

Key Tasks:

- Develop a BLE/Thread-LoRaWAN hybrid localization system using the existing LoRaWAN setup.
- Implement and optimize ML-based RSSI fingerprinting with sensor fusion for improved accuracy.
- Design an adaptive transmission strategy to balance localization precision and power efficiency.

Skills: Understanding of BLE/Thread/LoRaWAN, basics in ML for HAR and localization, and proficiency in Python/C++ for IoT firmware development; Willingness to carry out research.

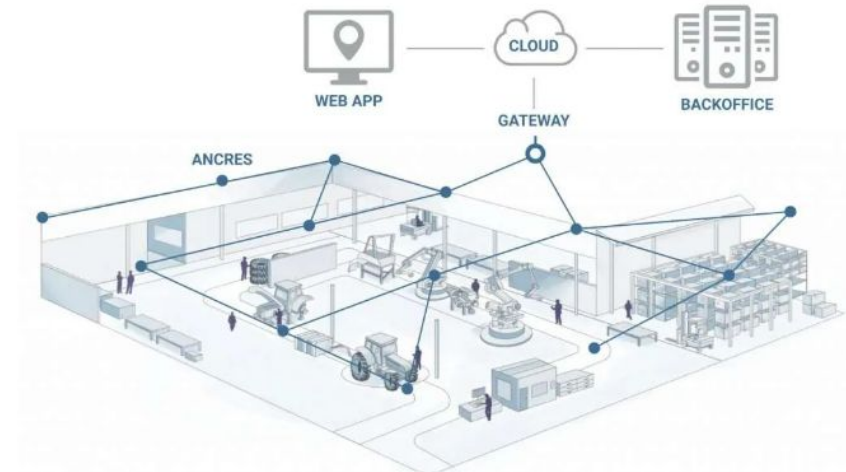


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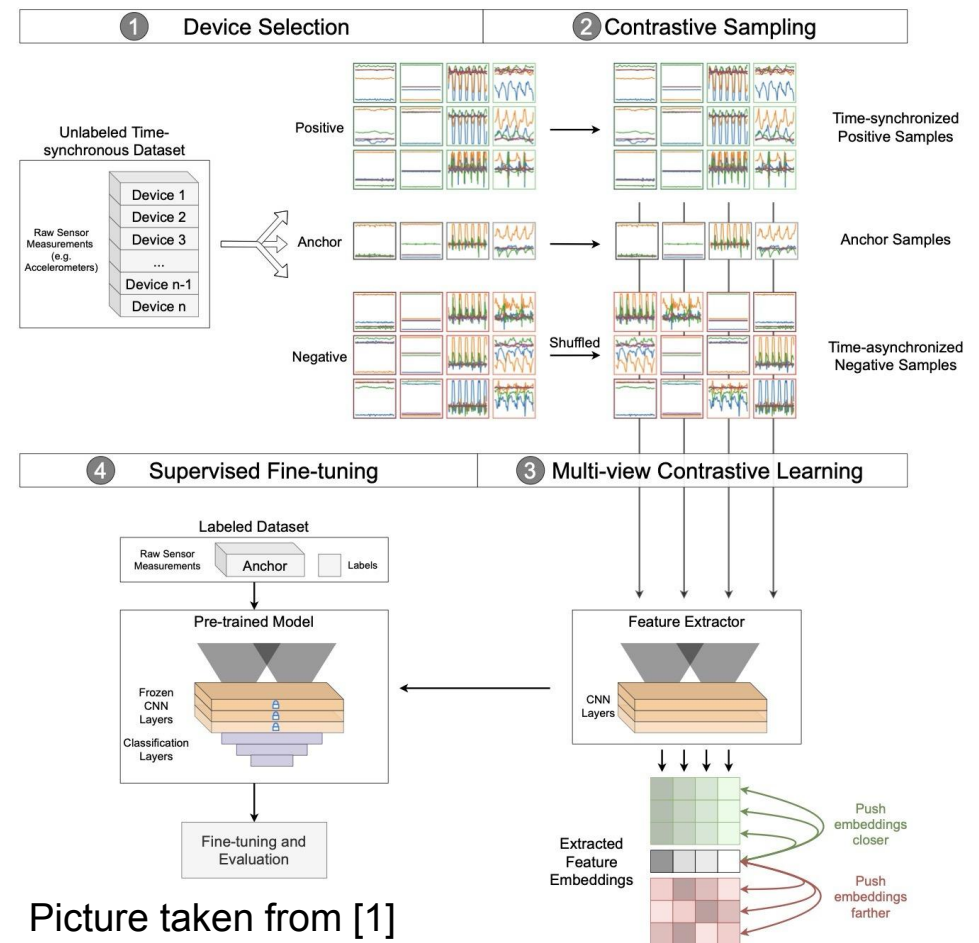


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Morphology-based Collaborative Self-Supervised Learning for Multi-Sensor Wearable Activity Recognition

- Collaborative capabilities of sensors in self-supervised wearable activity recognition have been shown [1]
- **Goal of Thesis:** extend existing framework in [1] using statistical and deep learning based similarity metrics to determine collaborating sensors

[1] <https://doi.org/10.1145/3517246>



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Towards A Medical-Grade Long-Term Activity Sensing Widget

- Develop an embedded Widget that fits in just a few kilobytes and operates in the Bangle open-source smartwatch ecosystem
- Design lossless compression & capture algorithms to acquire and save accurately-timed sensor data from motion and heart rate sensors
- Test your setup on a custom testbench

More information in
H-A8110 or: kvl@eti.uni-siegen.de

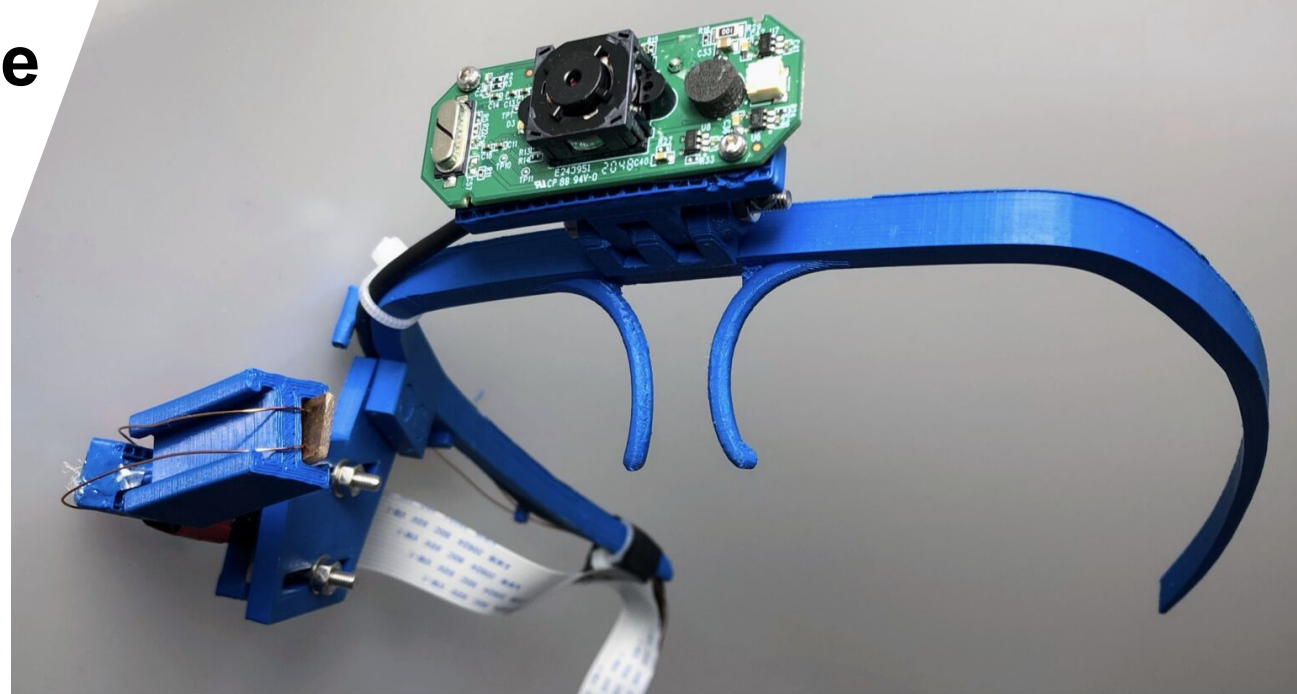


Thesis Topic

An Open-Source & Realtime Embedded Eye-Tracker

- Development of a Python and OpenCV-based wearable system on a Raspberry Pi
- Based on our existing pupil detection system
- Evaluation with two existing state- of-the-art eye tracking systems

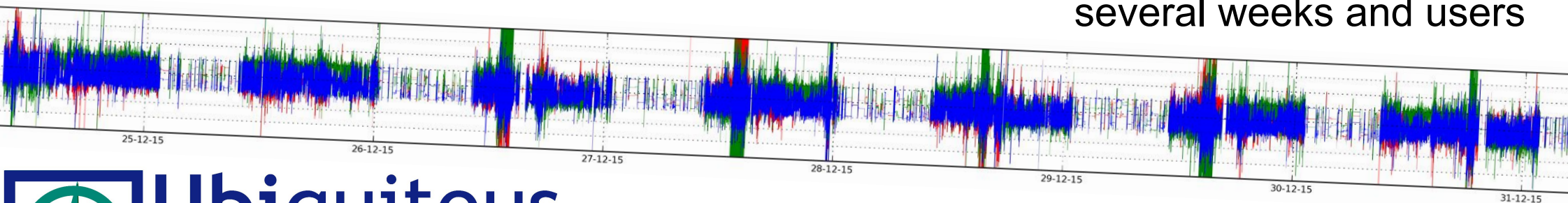
More information in **H-A8110**
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A Wearable Stairs vs. Elevator Detector

- Using the internal barometric pressure and inertial sensor data from the Bangle.js.v2 watch, to detect when the wearer uses the stairs or lift
- Development of an efficient embedded algorithm in the Espruino IDE, an embedded open-source ecosystem to enable long-term operation
- Goal should be to deploy and validate the algorithms in a longitudinal deployment study of several weeks and users



Updating the process to record entry's of the WEAR Dataset

- Implementing Bluetooth synchronisation
- Implementing approximation saving
- Creating a more user-friendly way to convert data
- Compare recording between old and new method

More information in **H-A 8115** or
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