

# Portable Sensor Unit for Environment Mapping

## Students



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**Introduction:** MedTech Lab at OST is continually developing assistive devices like exoskeletons. With their newest development, the "enhanced Hybrid", they aim to improve mobility by allowing the user to climb stairs. For this reason, they conducted work on how to detect stairs in the environment and built a prototype unit capable of doing so. The goal of this project is to improve that unit.

**Definition of Task:** The project consisted of several tasks that were grouped into the following categories:

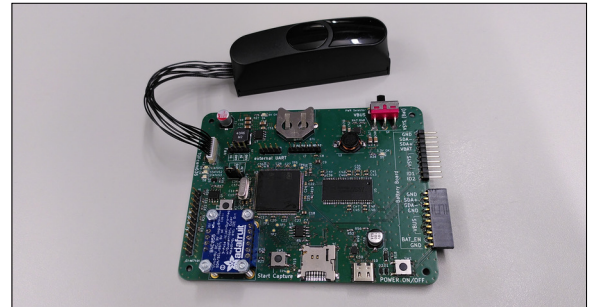
- Evaluation of the current prototype provided by MedTech Lab.
- Evaluation of different sensors in order to improve acquisition accuracy and consistency.
- Development of a portable, self-contained sensor unit.

The main function of this device is to deliver consistent sensor data that will be used to detect stairs in the user's environment.

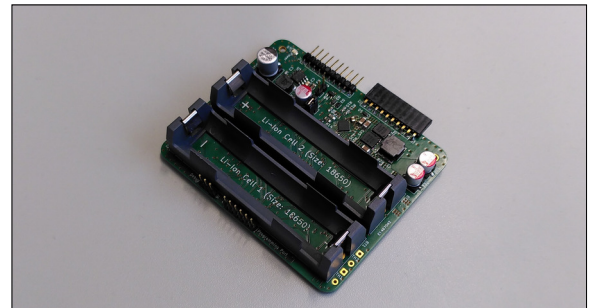
**Approach:** It was decided that the sensor unit shall use a Time of Flight (TOF) camera as well as a stereo camera. The stereo camera was interfaced using a Raspberry Pi while a microcontroller was used to communicate with the TOF camera. To achieve portability, the device contains its own rechargeable batteries. Additionally, the unit was built in a modular fashion to provide the most flexible solution in order to be used in other unrelated projects. Thus, the system was separated into several independent modules, two of which, the "Interface Board" and the "Battery Board", formed the main scope of this project. The function of the Interface Board is to acquire camera data, correlate it with the current position

provided by the on-board IMU and to store it on board or stream it directly to a different device like the Raspberry Pi. The Battery Board's responsibility lies in the battery management as well as providing the necessary power for operation.

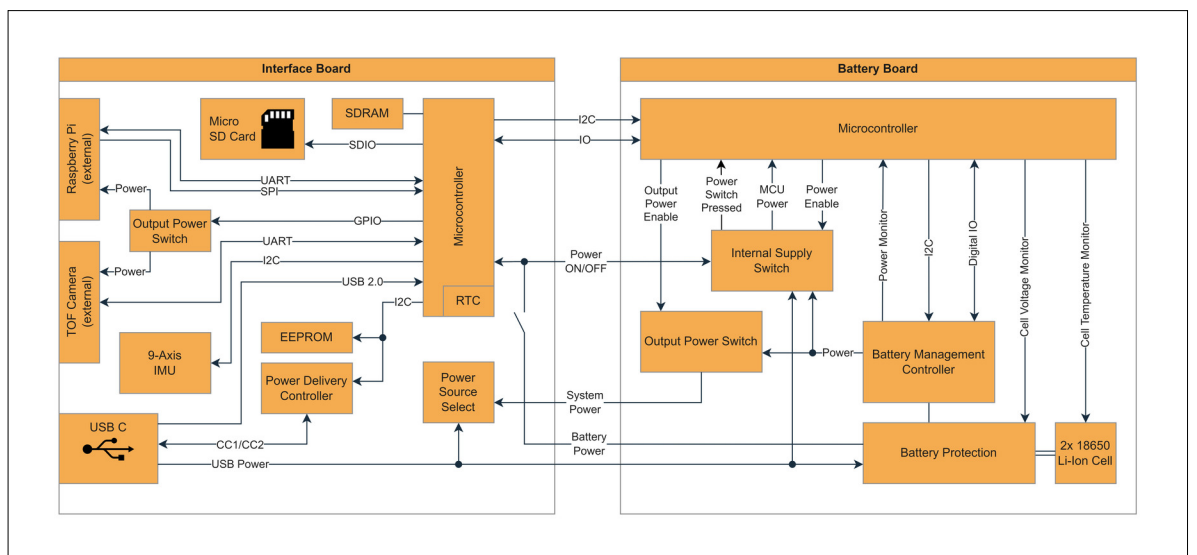
**Interface Board with the TOF camera connected**  
Own presentation



**Battery Board without the Li-ion cells inserted**  
Own presentation



**System diagram of the interconnected Interface Board and Battery Board**  
Own presentation



**Advisor**  
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**Subject Area**  
Embedded Systems

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