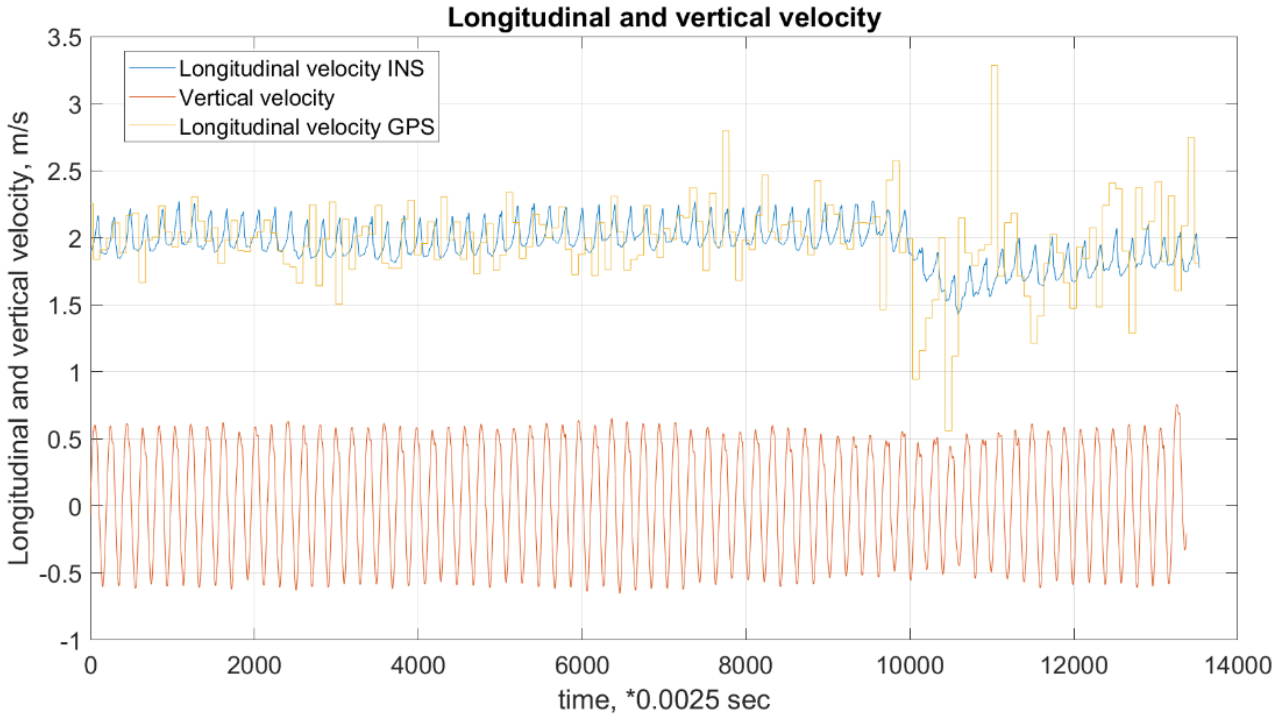
In 2015 we began a Finnish Academy funded project in collaboration with Tampere University of Technology (Dr. Pavel Davidson & Professor Robert Piche). The original goal of the project was to develop and test a wearable device that could be used to automatically identify important features of human gait. Over the course of the project we have prototyped different designs, and we now have a working device.

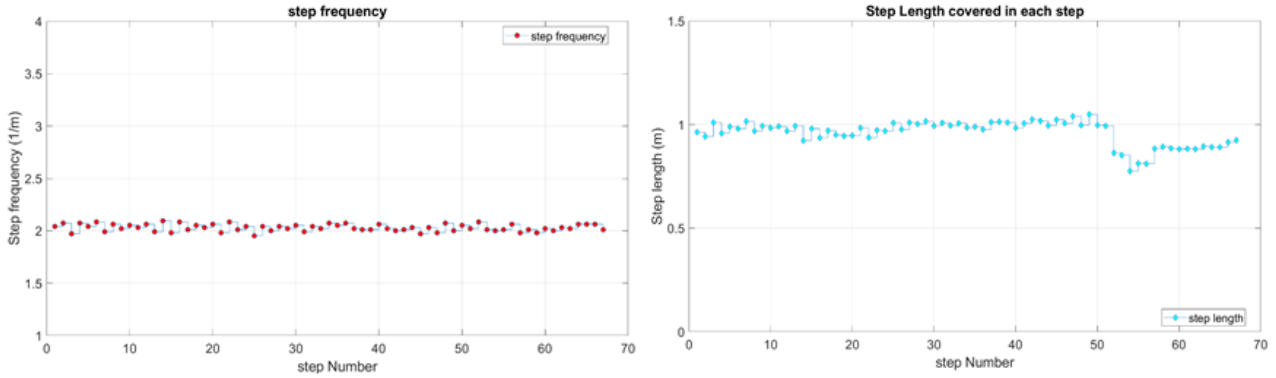
The device includes a range of on-board sensor technology, including GPS and IMUs. We recently completed an extensive testing period here in Jyväskylä, and we are now putting together several manuscripts on the basis of our results.

In the next stage of the project, we plan to use the device in several different ways. In one branch of this work, we are using Machine Learning/Deep Learning to predict important gait-related parameters, and also to try to simulate ground reaction forces during walking and running. In another project, we will use the device to monitor how older people move in different outdoor environments. These are just two ideas to get started with- there are potentially lots of ways that this kind of technology could be exploited.

Below are some examples of results obtained during pilot testing with this device. During walking and running, we see consistent traces over a large number of steps, and based on the algorithms we have developed so far, we are able to track a large number of parameters including step length/frequency, speed, acceleration etc.



At the moment the device is not optimised as a wearable, and is probably too large to be practical for most people. However, now that everything works (approximately) as it should, we can focus on developing further metrics of interest, as well as optimising the design of the device. For this we will likely use 3D printing, since it allows full customisation.



One of the most exciting aspects of this work is that it allows us to compute important metrics related to gait that would normally require an expensive laboratory setup that includes equipment such as 3D motion analysis and force plates. With the device that we have developed, we free ourselves from the need to perform all gait studies in a lab, and can instead begin to study human movement in more natural environments. We could investigate a wide range of human populations, ranging from different clinical groups right through to elite athletes.

This work represents an excellent use of novel technology combined with artificial intelligence methods. The future of human movement analysis is bright!