



Fraunhofer

PORTUGAL



Fig1. BestMotions applied to the manufacturing context.

BestMotions

MEASURING REPETITIVE TASKS USING INERTIAL SENSORS

Project

This project aims to develop a cost-effective solution to monitor repetitive tasks using inertial sensors applied to the large manufacturing industry context.

Motivation

Large manufacturing industries rely on a set of predefined motions in order to optimize the productive process. A library of predetermined motions for specific tasks are used on a daily basis in large manufacturing industries and they have been extensively studied by the industrial engineering field. This approach not only aims for a better standardization in the production process itself, but also contributes to a quick adaptation process from future employees.

The assessment and planning of the techniques designed to establish the time for a qualified worker to carry out a specific task at a define rate of working is known as 'Work Measurement (WM)'. In the past few years, solutions to accurately assess

WM had reached a stable plateau.

However they still rely on a high workload process. On the other hand, we are assisting on an everyday basis to an increasing expansion of mobile and wearable solutions that are able to track Human motion.

Combining the opportunities arising from the latest wearable solutions to the industrial engineering field, this project outcomes allows to perform a cost-effective accurate monitoring, applied to the WM context.

Approach

The BestMotions solution will allow monitoring Human activity on the manufacturing context using a wearable device previously developed by Fraunhofer AICOS that contains integrated Inertial and Environmental Units and transmits the data using Bluetooth 4.0 interface.

The employee will wear the device on the wrist and will automatically record data on an unobtrusive and ubiquitous philosophy.

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Features

- State-of-the-art wearable technology
- Unobtrusive monitoring architecture
- Cloud based interface with multiplatform integration

Advantages

- Innovative solution in the Work Measurement Field
- Ubiquitous and non-biased monitoring
- Automatically system that reduces the post processing workload

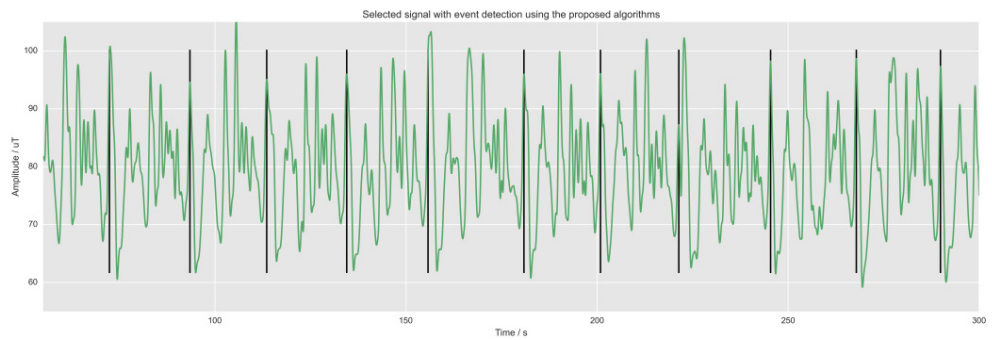


Fig2. Automatic task detection algorithm applied to manufacturing motion data.

The acquired data is pre-processed and is subject to algorithms that finds the optimal alignment between warped sequences. First, a reference sample is obtained from a high qualified worker in order to calculate the standard time for a specific task. Additionally, the reference sample is also considered the sample that supports both the productivity goals and ergonomics perspective from the employee. Secondly, the acquired data of the WM study is compared against the reference sample and the optimal signal alignment will allow to extract signal subsequences and consequently, compute measurements in time, speed, rhythm and similarity.

The result of the proposed solution is able to present temporal and distance measurements. Temporal measurements include the time and working rhythms extraction as per the requirements to conduct a valid work measurement study. Additionally, distance measurements can produce scores of how close the movement is being performed against the reference, leading to a fine characterization of the movements that composes a specific task.

The system output is based on a web application that integrates both the acquisition, processing and visualization blocks from the system architecture.

The manager is able to use the infrastructure and access real time individual and collective information about the productivity status of the manufacturing center.

Multiple applications

The system is centered on the industry context on a first phase, but the developed algorithms can be used in a wide variety of repetitive activities.

First tests were already conducted applying the core algorithms to gait cycle analysis, electrophysiological data and other activities that generate quasi-repetitive data and showed promising results to daily life activity monitoring and rehabilitation activities.

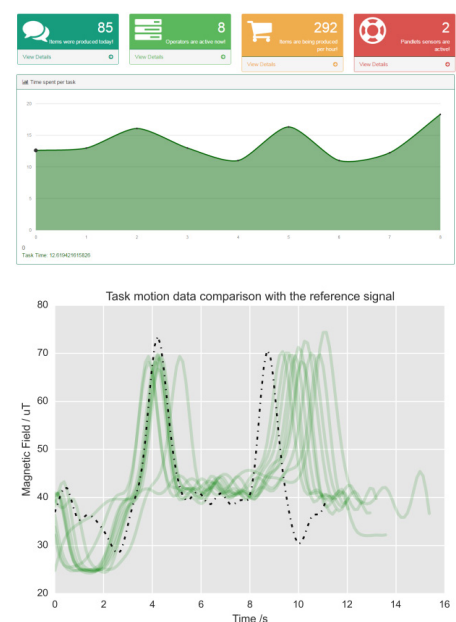


Fig3. BestMotions platform.