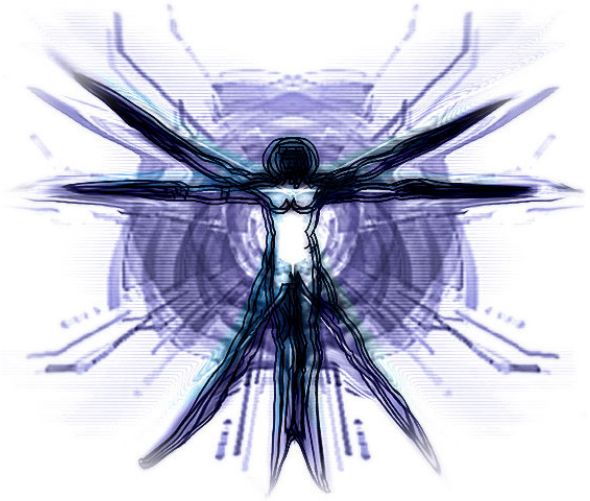

IS-ACTIVE

Inertial Sensing System for Advanced Chronic Condition Monitoring and Risk Prevention

WP3 – Platforms

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Table of contents

1. Overview

This document briefly overviews the features of the IS-ACTIVE hardware platform and software packages for wireless networking. The results are available as prototypes, used for experimentation and evaluation.

2. Hardware platform

The IS-ACTIVE hardware platform – ProMove – is a highly miniaturized inertial sensor node that captures and communicates wireless full 3-D motion and orientation information. It combines the latest advances in MEMS sensor design and low-power wireless communication. Featuring a suite of modern inertial and magnetic sensors, a dedicated microcontroller for application-specific software, and a separate System-on-Chip (SoC) solution for wireless networking, ProMove is a powerful, versatile platform for motion sensing applications.

Figure 1 - ProMove wireless sensor node

The sensor information provided by ProMove consists of: 3-D acceleration, 3-D turn rate (gyroscope) and 3-D magnetic field intensity (compass). ProMove features additionally an RF power amplifier for extended coverage and improved sensitivity, a mini-USB interface for retrieving sensor data to the computer, a Bluetooth expansion slot, and a rechargeable Li-Ion battery. Everything fits in a compact casing of 65x50x30 mm.

Summary of key hardware features:

- Full 3-D acceleration, turn rate and magnetic field intensity measurements
- All sensors in-plane mounting
- Dual CPU architecture, separation of resources for sensor data processing and wireless communication
- Selectable sensor measurement ranges and sampling rates
- IEEE 802.15.4 compatible RF transceiver in the 2.4 GHz license-free band
- On-board RF power amplifier for extended coverage and improved sensitivity
- On-board 128 Mbit Flash memory
- Integrated USB interface

- Bluetooth extension (optional, via additional chip)
- Internal rechargeable battery

3. Software packages for wireless networking

Multiple ProMove nodes can form a network and report the sensor data fully synchronized to a central node – the FastGateway, which connects through USB to a computer. The data is communicated using the 2.4 GHz wireless radio. The software packages for wireless networking include the following options:

- Low-power, low-data rate IEEE 802.15.4 compatible implementation, for long term sensing and monitoring, e.g. for activity level monitoring applications.
- High-data rate, real-time motion capture via the proprietary FastMAC networking protocol, for short term, detailed sensor data acquisition, e.g. for algorithm design and evaluation.

The sensor data can be visualized in the ProMove GUI software and is logged for post-analysis. The sampling rates achieved with the FastMAC protocol scale with the number of nodes in the network, e.g. 200 Hz for 5 nodes, 100 Hz for 10 nodes (sampling rate given for each node, each channel).

Alternatively, the ProMove nodes can store the sensor information in the on-board 128 Mbit Flash memory.

4. Technical specifications

The table below lists the relevant technical specifications of ProMove.

Accelerometer	
Range	±2 g / ±6 g
Resolution	1 mg @ ±2 g range
Sensitivity	1024 LSb/g @ ±2 g range
Non-linearity	±2 %FS
Cross-axis	±3.5 %
Gyroscope	
Range	Dual 440 °/s and 2000 °/s
Non-linearity	<1 %FS
Resolution	0.21 °/s @ 440 °/s range 0.98 °/s @ 2000 °/s range
Cross-axis	±1 %
Calibration	On-chip factory calibration
Compass	
Range	±4.5 Gauss
Resolution	7 mGauss
Cross-axis	±0.2 %FS/Gauss
Wireless communication	
Frequency band	2.4 GHz
Data rate	250 kbps
TX power	Selectable, max. 22 dBm

RX sensitivity	11 dB high-gain, 1 dB low-gain
Coverage	Typically 50m at max. TX power
Data collection	
Sampling rate	Scales with the number of nodes in the network 200 Hz for 5 nodes 100 Hz for 10 nodes
Synchronization	< 6µs
Wired interface	USB 2.0 full-speed compatible
Storage	128 Mbit Flash memory
Software and accessories	
Visualization software	ProMove GUI (runs on Windows 7/Vista/XP/2000, Ubuntu Linux)
Gateway	FastGateway, with USB interface
Electrical characteristics	
Power consumption in real-time streamming mode	55 mA - max. TX power, high-gain 52 mA - max. TX power, low-gain 42 mA - min. TX power, low-gain
Battery	3.7 V Li-Ion rechargeable 850 mAh capacity
Form factor	
Dimensions	65x50x30 mm
Weight	70g (with enclosure)

5. Conclusions

The first prototypes are available to the IS-ACTIVE consortium for design of algorithms, small-scale experiments and system performance evaluation. Milestone “M3 – Initial prototypes” has therefore been reached.