BlueSense2 - Wearable/IoT sensing platform and inertial measurement unit

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Purpose

BlueSense2 is a wearable/IoT platform designed to be functional out-of-the-box yet extensible. It's primary purpose is to be an inertial measurement unit for wearable applications. Yet it is extensible for IoT applications with a number of features making it appealing for this purpose

BlueSense2 as a wearable platform is a tiny device which can be used to capture body movement with a 9DoF motion sensor. The data can either be logged on an SDCard or streamed over bluetooth. This forms the core of a fitness tracker. Its extension ports allow to plug-in additional sensor modalities for research purposes (e.g. electric potential sensors). A display is being developed converting it into a smartwatch.

As an IoT device it's main appeal is a true *hardware off* which allows to put the device entirely to sleep (everything is powered down, including voltage regulators), yet wake up at programmed intervals thanks to a real-time clock wakeup. This allows to achieve very long battery life, as the device can wake up at desired times (once an hour, once a day, ...) to acquire and send sensor data. The extension ports allow to plug in custom sensor modalities which make this device highly versatile.

Specifications

- ATmega1284P core (128KB flash, 16KB RAM)
- 30x30mm
- USB interface for charging, device interaction
- Bluetooth interface for device interaction

- SD card (SDHC standard)
- Most accurate RTC (real-time clock) on the market: +/-5ppm
- 9DoF motion sensor (MPU9250) including software attitude and heading reference system at 100Hz (quaternion output). The system is capable of acquiring and storing raw motion data at 1KHz, which is useful for high frequency applications (sports, vibration analysis)
- Extension ports with analog inputs, digital I/O, I2C, SPI, timekeeping, etc.
- Coulomb counter allowing precise measurement of battery charge/discharge and characterisation of real-time current consumption by software

Publications

Roggen et al. *Electric field phase sensing for wearable orientation and localisation applications*, Proc. 2016 ACM International Symposium on Wearable Computers, 52-53, 2016

Pour Yazdan et al. *Wearable electric potential sensing: a new modality sensing hair touch and restless leg movement*, Proc. 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct, 846-850, 2016

History

Version	Release date	Changes
7	November 2016	More I/O on expansion port. First production version.
6	May 2016	Improved USB interface
5	Jan 2016	Improved motion sensor acquisition speed (1KHz)
1-4	2015	Initial prototypes
N/A	2012-2013	Initial concepts