Technische Universität Braunschweig

INGA - Open Source Sensor Node
Inexpensive Node for General Applications
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Configuration

- ATmega 1284P 8-bit RISC microcontroller up to 16 Mhz, JTAG, SPI, I²C, 128 kB Flash, 16 kB RAM, 4 kB EEPROM, 10-bit-A/D-Converter
- AT86RF321 2,4 GHz radio: IEEE 802.15.4, ZigBee, 6LoWPAN, hardware AES encryption support
- Program, debug and charge Li+-battery via USB
- 16 MBit onboard Flash and microSD-card slot
- Various sensors: online voltage and current monitoring, accelerometer, gyroscope, pressure sensor, temperture sensors, push button
- Easily expandable via buses, I/O-ports (2,54 mm (0.1 in) pin headers)
- Completely open source, cheap and hand solderable

Characteristics

With 39 x 50 x 7 mm INGA is comparably small and combines the advantages of other wireless sensor nodes. It is designed to be „lead-free" and for capacitors no „noble earths" (like tantalum) are needed. INGA consists of a two-layer PCB, with a printed antenna.

INGA can easily be programmed via USB and INGA's bootloader is ready for „over-the-air" flashing. The set of sensors is capable of monitoring movement, position and activity, which is very useful for medical applications. INGA runs Contiki and TinyOS „out of the box" and as an open source node, INGA's design can be adapted, changed, extended and enhanced.

Accelerometer

In previous evaluations we compared multiple types of accelerometers and for INGA the one with the lowest power consumption and the lowest bit noise was chosen. The Analog Devices ADXL345 MEMS-accelerometer can detect accelerations in 3 axis at variable bit rates and sensitivity. It can be used for fall detection or gait analysis when attached to a human body. As gravity is always detected the orientation towards the center of earth can be determined. The accelerometer is attached to INGA's MSPI bus and has an adjustable sampling rate of up to 3.2 kHz. Its dimensions are 3 x 5 x 1 mm.

Gyroscope

The ST-Microelectronics L3G4200 MEMS-gyroscope is able to meausre deviations of orientation and thus to determine the location more precisely. It is able to detect up to 2000 degrees per second in three axis (16 bit). The gyroscope has an interated temperature sensor (8 bit) and is attached to INGA's I²C bus. Its dimensions are 4 x 4 x 1 mm.
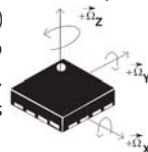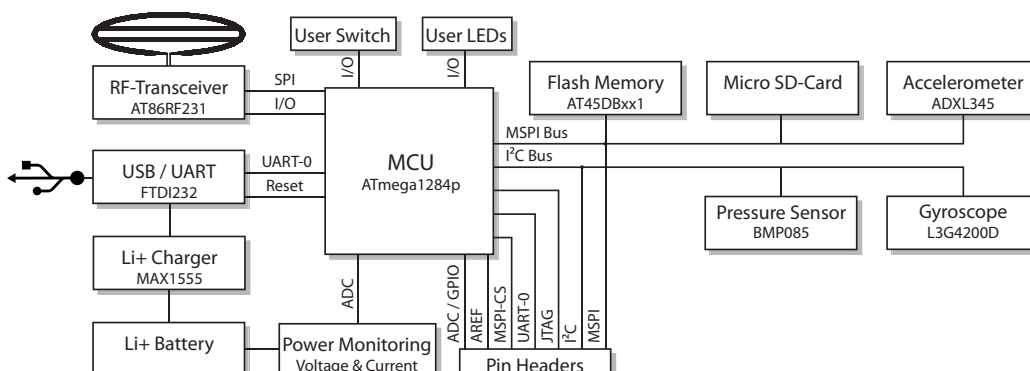
Pressure Sensor

The Bosch BMP085 pressure sensor can also be used for gait analysis as it is able to detect deviations in pressure in the area of 0,01 hPa. Such deviations result e.g. from a change in elevation in the magnitude of centimeters. Thus, it can be determinded whether a person is going up- or down-stairs. Its dimension are 5 x 5 x 1 mm. The pressure sensor has 16 to 19 bit resolution and is eqippend with an integrated temperature sensor for temperature compensation and by this way it is able to measure absolute pressure as well. It is attached to INGAs I²C bus .

Architecture

Resources

INGA is completely Open Source, check it out at:

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