MotionFit™ Wireless Developer Kit

The InvenSense MotionFit™ SDK is designed to enable rapid commercialization of wearable sensor solutions for fitness, health and sports applications. It delivers a sensor platform capable of tracking 10 degrees-of-freedom by combining MPU-9150 9-axis MotionTracking device (gyro, accel, compass), pressure sensor, microcontroller and Bluetooth radio module.
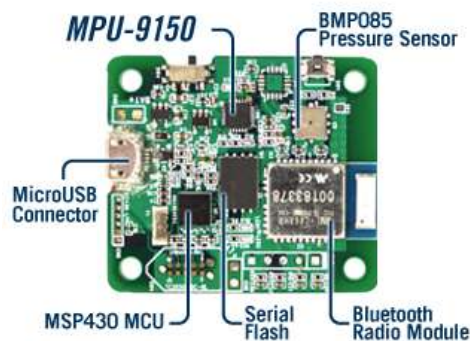
Product Overview

The MotionFit™ SDK provides a total solution encompassing hardware and software, with full 10 degrees-of-freedom from the MPU-9150 MotionTracking device. The sensors are interfaced via I^2C serial digital interface to a MSP430 MCU. A Bluetooth radio module that enables wireless connectivity is interfaced through the UART to the MCU. There is a serial flash that interfaces to the MCU using the SPI interface. Also included is a 110mAh rechargeable battery and charger circuitry that can provide up to 4 hours of wireless streaming. A micro-USB connector provides a wired interface to the SDK. The SDK is well suited for embedded applications such as activity detection for fitness, sports performance and medical applications such as rehab and outpatient monitoring.
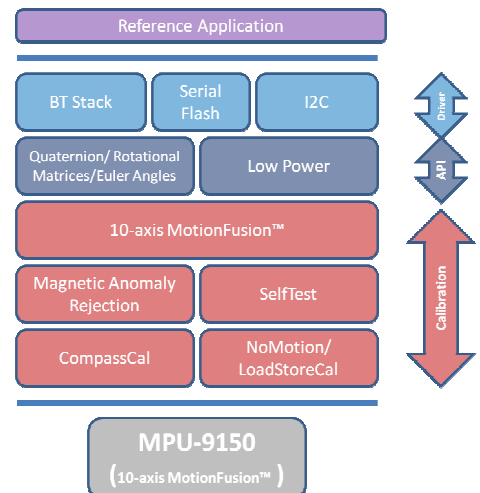
Hardware Description — The MotionFit™ wireless module includes InvenSense MPU-9150, a single-chip, digital-output, nine-axis MEMS gyroscope, accelerometer, compass and Digital Motion Processor (DMP) device optimized for wearable sensor applications. The MPU-9150 features two16-bit analog-to-digital converters (ADCs) for digitizing the gyroscope and accelerometer outputs, a user- selectable internal low-pass filter and a fast-mode I^2C interface. Also included in the SDK, is a pressure sensor, an MSP430 microcontroller, Bluetooth radio module, serial flash and a rechargeable Li-Ion battery.

Software Description — The SDK includes Embedded MotionApps™ Lite software, which performs 10-axis MotionFusion™ and calibration. Also included are drivers for the Bluetooth radio module, pressure sensor and serial interfaces.

APPLICATIONS

Activity Monitors

Fitness Tracking

Sports Kinetics

Remote health Monitoring

Clinical Applications

MotionFit™ SDK hardware diagram

MPU-9150
BMP085 Pressure Sensor
MicroUSB Connector
MSP430 MCU
Serial Flash
Bluetooth Radio Module

MotionFit™ SDK software stack

Reference Application

BT Stack | Serial Flash | I2C

Quaternion/ Rotational Matrices/Euler Angles | Low Power

10-axis MotionFusion™

Magnetic Anomaly Rejection | SelfTest

CompassCal | NoMotion/ LoadStoreCal

Driver
API
Calibration

MPU-9150
(10-axis MotionFusion™)

InvenSense
Innovation in MEMS™

LOCATIONS

InvenSense Headquarters

1197 Borregas Avenue
Sunnyvale, CA 94089, U.S.A.
+1.408.988.7339 Main
+1.408.988.8104 Fax

InvenSense Taiwan

1F, 9 Prosperity 1st Road
Hsinchu Science Park
30076, Taiwan
+886.3.6686999 Main
+866.3.6686777 Fax

InvenSense Japan G.K.

Nisso Building No. 16, 2F
3-8-8 Shin Yokohama
Kohoku-ku, Yokohama
222-0033, Japan
+81.045.308.9721 Main
+81.045.534.3005 Fax

InvenSense Korea

#601, Jungle Bldg. 206-17
Nonhyun-Dong, Gangnam-
Gu, Seoul 135-833, Korea
+82.2.541.2900 Main
+82.2.541.2955 Fax

InvenSense Dubai

InvenSense Int'l FZE
Office 206, C Wing
Dubai Silicon Oasis
P.O. Box 341166
Dubai, U.A.E.

InvenSense China

16F, No.20 Building, No.487,
Tianlin Road, Caohejing Hi-
Tech Park, Xuhui District,
Shanghai 200233

For sales inquiries, contact:
sales@invensense.com

SDK Hardware Components

MPU-9150 9-axis MotionTracking™ Device

- Single-chip, digital-output, nine-axis MEMS gyroscope, accelerometer and compass IC optimized for wearable sensor applications.
- Integrated Digital Motion Processor (DMP™) to perform 9-axis MotionFusion™ inside the MPU.
- I^{2}C interface. Temperature sensor that enables software temperature compensation for gyro bias.
- Embeds AK8975 compass sensor die that incorporates magnetic sensors for detecting terrestrial magnetism in the X-axis, Y-axis and Z-axis.

MSP430 Microcontroller

- MSP430 MCU from TI. Supports Code composer Studio (CCS) tool chain for software development.
- The device features a powerful 16-bit RISC CPU, 16-bit registers and constant generators that contribute to maximum code efficiency.

Pressure sensor

- BMP085 from Bosch, is based on piezo resistive technology for EMC robustness, high accuracy, linearity and long term stability.
- Low altitude noise of 0.25m at fast conversion time.
- I^{2}C interface.

Radio Module

- BT2.1 +EDR compliant.
- Up to 10m distance, and low power consumption modes (50mA active, 30uA deep sleep mode).

Serial Flash

- 256Mbit serial flash interfaces to MCU through SPI interface.

Rechargeable Battery

- 110 mAh rechargeable battery. Provides > 24 hours of activity logging. 4 hours of streaming time.

Micro USB connector

- For charging battery and wired connectivity.

SDK Software Components

Embedded MotionApps™ Lite

- Software provides 10-axis MotionFusion™ and calibration algorithms that run on the DMP (inside MPU) and MSP430.
- MotionFusion™ running on the DMP lowers the utilization on the microcontroller and provides headroom for the application. Calibration algorithms require no user intervention and provide a robust 10-axis motion interface solution.

Software Tool Chain support

Optimized for low cost CCS tool chain (from TI).

Drivers

SDK includes drivers for serial interfaces, Bluetooth module and serial flash.

About InvenSense

InvenSense (NYSE: INVN) is the leading provider of MotionTracking™ devices for the consumer electronics market. The company's patented and patent-pending MotionFusion™ technology and Nasiri-Fabrication™ platform address the emerging needs of many mass-market consumer applications including smart phones, tablets, gaming devices, optical image stabilization and remote controls for smart TVs, that require improved performance, enhanced features, and new and more intuitive motion and gesture-based motion-interface solutions. InvenSense is headquartered in Sunnyvale, California. More information can be found at http://www.invensense.com.

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