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Embedded MotionApps 5.1 (TI MSP430) Release Note

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1. Overview

This release note document explains all the relevant information regarding the Embedded MotionApps 5.1 software release.

2. Improved Configurability

Full Scale Range of the Gyroscope and Accelerometer: The FSR of these hardware components can now be configured to their maximum capability and are no longer locked to a default value. Please refer to the product specification for FSR values.

FIFO Output Rate: The default value has increased to 50Hz and can now be configured up to 200Hz.

3. References

- [1] Embedded MotionApps Functional Specification (EMA-AS-V5.1)
- [2] Application Note - Accel In-Use Calibration (AN-MAPPS-0.0.1)
- [3] Application Note - API Descriptions for MPU-6050 Self-Test and Calibration (AN-MPU-6000A-14)
- [4] Application Note - MPU-6000 / MPU-6050 Gyroscope & Accelerometer Hardware Self-Test: Relative Method (AN-MPU-6000A-12)
- [6] Application Note - Integration and Porting Guide for Embedded MotionApps
- [7] Application Note – 9-Axis MotionFusion and Calibration Algorithms



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4. Features

4.1 Architecture

MotionApps 5.1 has been designed with a new architecture as shown in the software architecture block diagram below. The new architecture provides customers with a much more modular MotionTracking solution that is easy-to-port and consumes much less applications processor resources, improving the overall power consumption.

There are three basic components in this architecture:

- embedded Hardware Adaption Layer (HAL):
 - a. This is the central point of communication between MPL, device drivers and the applications.
 - b. HAL provides function calls to initialize, enable, start, stop, and control all features in MPL. Please refer to [1] for further details.
- MotionProcessing Library (MPL):
 - a. MPL provides a plug-in framework for single function features (e.g. gyro bias calibration, 9-axis MotionFusion, etc.)
 - b. MPL provides a well-defined flow to register/unregister, initialization, start, stop, and generate features. Please refer to [1] for further details.
- Kernel driver:
 - a. Device drivers for all supported InvenSense devices are implemented in sysfs using the input subsystem. Please refer to [5] for further details.

4.2 Calibration and Self-test

Embedded MotionApps consists of the following key calibration and self-test features:

Calibration:

- Calibration for gyro bias
 - Fast no motion (<1 second convergence time)
 - Standard no motion (8 second convergence time)
 - SW temperature compensation
- InvenSense proprietary compass calibration
 - Standard fit
 - Vector
 - Small Motion using gyro
- Calibration for accelerometer using in-use calibration (Refer to [2] for further details)

Self-test:

- Integrated MotionTracking device based self-test for gyroscope (Refer to [3] and [4] for further details)
- Integrated MotionTracking device-based self-test for accelerometer (Refer to [3] and [4] for further details)
- Integrated MotionTracking device-based self-test for compass in MPU-9150 (Refer to [3] and [4] for further details)



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- Self-test for the respective devices is integrated into the respective device drivers

Please refer to [7] for a brief description of individual calibration algorithms and recommended settings.

In general, please refer to [6] on the description, usage and integration of each of the above features.

4.3 Ultra-Low Power Features (applicable to MPU-6050 and MPU-9150)

The ultra-low power features introduced in this release and listed below support fully autonomous operation, completely independent from the applications processor:

- DMP-based pedometer
- DMP-based gestures
 - Directional Tap
 - Orientation (including Flip)
 - Screen Orientation
- Low Power Quaternion
- Low Power 6-Axis Sensor Fusion

In general, please refer to [6] on the description, usage and integration of each of the above features.

5. Test Hardware Platform

- TI MSP430 Development platform
- Refer to section 6 for supported device configurations

6. Test SW Platform

Code Composer Studio (CCStudio) Integrated Development Environment (IDE) v5

7. InvenSense MotionTracking Device(s) Configurations Supported

As shown in the figure below, two InvenSense MotionTracking devices were tested in three combinations:

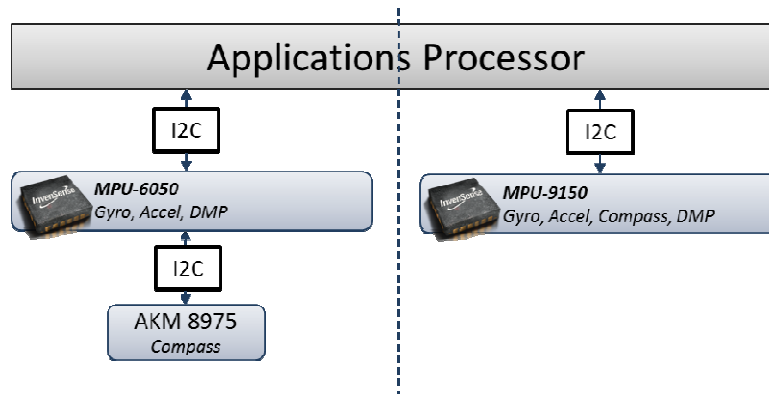


Figure 1 MotionTracking Device Configurations Supported

8. Sample applications Tested

- eMPL-client.py (A simple custom 3D UI application)

9. Bug Fixes (since 5.0)

- Improved sensor fusion.

10. Known Limitations and Design Constraints

- In-use accel calibration is not supported
- Slower performance when running 9-Axis at 100Hz.
- Minor yaw drift issues when running system at the default magnetometer output rate.