FreeMotion™ Sensor Fusion

- Supports accelerometer, magnetometer, gyroscope and barometer
- Continuous background calibration: no figure-8s required
- Automatically turns off the gyro based on lack of high speed rotational motions to save power
- Magnetic anomaly mitigation for accurate compass heading
- Efficient design taking 6 MIPS and up to 8kB of SRAM (benchmarked using Cortex M3)
- Complete suite of system integration utilities and validation tools

The Sensor Fusion module is the foundation of the FreeMotion Library. It can be implemented independently from the Context Awareness module. Sensor fusion works with two or more sensors common found in smartphones and tablets: accelerometers, magnetometers, gyroscopes (option), and barometer (optional). When these sensors record a common event, the sensor fusion algorithm combines their outputs so that the fused result better captures the event than any single constituent input. Additionally, it is responsible for keeping all the sensors in calibration and turning off the gyroscope and minimizing sensor power consumption without compromising the accuracy in motion tracking.

Sensor Power Management

Gyroscope, which is used to measure angular velocity, can draw ten times more power than accelerometer and magnetometer combined. However, angular velocity could also be derived by using just an accelerometer and a magnetometer when the rotational rate is below 500 degrees per second (dps). FreeMotion includes a *Resource Manager* that monitors user motion and automatically turns off the gyroscope and use the derived data whenever possible to increase battery life without compromising data accuracy.

Continuous Background Calibration

Sensors must be maintained in good calibration for their data to be useful. FreeMotion includes a low power background calibration process that leverages the users' natural motions instead of requiring users to move the device in figure-8 motions.

Magnetic Anomaly Mitigation

FreeMotion mitigates the effects magnetic interferences to its reported compass heading. In conjunction with sound magnetometer and accelerometer calibration, FreeMotion consistently limits compass heading errors to below 5 degrees.

Broad Processor Support

The FreeMotion Library uses efficient fixed point instructions that can be targeted to a wide array of processors. Its small footprint allows the same code base to be deployed in both the application processor and embedded in a sensor hub. This allows OEMs with broad mobile device offerings significant engineering efficiency by deploying and maintaining a single code base across all products and models.