CEVA MotionEngine

MotionEngine™ is a robust and feature-packed software system designed to solve the complex motion problems of today’s consumer applications. Its broad reaching capability has aided with hearables, handheld remote controls, fitness devices, medical devices, mobile computing, XR, robotics, livestock tracking, and more. If an application needs to track motion, MotionEngine can help.

Introduction

CEVA MotionEngine, which was developed and has been consistently improved over our 15+ years of sensor expertise, produces best-in-class sensor fusion. This claim is backed by customers who chose us for our distinct accuracy advantage. Additional features like calibration algorithms, contextual sensor fusion, and application specific features only add to that value. This sensor agnostic solution works with a variety of sensor types that enable a diverse set of applications.

Holistic Smart Sensing

Multiple Sensors
- Gyroscope
- Accelerometer
- Magnetometer
- Environmental
- Microphone
- Camera

MotionEngine
- Contextual Sensor Fusion
- Static and Dynamic Calibration
- Application-specific Algorithms

Diverse Applications
- Robots
- AR / VR
- Mobile PC
- Stylus Pen
- Hearable
- Remote Control
Comprehensive Sensor Fusion & Algorithms

Application-specific solutions are created by assembling packages of algorithms that are customized to the needs of each unique application in order to provide the right solution with the lowest memory footprint.

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Key Benefits of CEVA MotionEngine

- **Dynamic Calibration** that adjusts for accelerometer and gyroscope bias changes over factors like time and temperature.
- **Magnetic Interference Rejection** algorithms designed to ignore sudden changes in magnetic field.
- **Sensor, operating system and processor independent** drivers and sensor management written for a wide variety of inertial and environmental sensors for integration with:
  - Android®, Linux®, Windows®, macOS®, WebOS™
  - RISC-V, arm, CEVA DSP, other RISC-based processor architectures.
- **Specialized algorithms** to cover various applications:
  - **Cursor Control** with Single Pixel Accuracy - software designed for in-air pointing applications for using with motion remote controls.
  - **Gesture Recognition** - including flick, twist, flip, shake, in-air symbol recognition, virtual controls, tap, double tap, and in-ear detection.
- **AR/VR Stabilization and Predictive Head Tracking** - algorithms designed specifically to enhance and smooth AR/VR and 3D Audio user experiences.
- **Device Operation Mode Identification** - quickly determines the current orientation of a mobile computing device.
- **Personal Activity Tracking** - step counter and context detection, including walking, running, standing, in-vehicle, and on-bike.
- **Robust Motion Outputs** - including orientation, heading, and tilt.
- **Orientation Compensation** - algorithms designed to ignore changes in orientation with respect to the movement of a cursor on a display.
- **Interactive Calibration** - boosts performance of low-cost sensors in terrestrial robotic applications.
- **Robotic Dead Reckoning** - Dead reckoning algorithm that offers a cost-reduced alternative to VSLAM or LIDAR solutions.
Distinct Software Packages
To better accommodate our customers, we have developed specialized software packages for the markets that we serve:

MotionEngine Hear
In-ear and over-ear electronics like TWS, audio headsets, hearing aids, and AR glasses all have one thing in common: they can benefit from a gesture interface. But existing products have failures that frustrate users. MotionEngine Hear’s tap gestures and in-ear detection make taking control of that audio easier and more fluid. On top of that, built-in activity classifiers and VAD add to a dynamic list of features that informs intelligent automated decision making, and our 3D head tracking enables immersive spatial audio.

MotionEngine Air
Handheld controllers deserve more than antiquated button-based interfaces. Cursor and gesture controls can be easily added to enhance interactivity. MotionEngine Air enables similar cursor capability as our SmartTV package, but also enables unique gestures (like twist, flip, pick-up) to help streamline workflows whether you’re presenting, creating, or controlling.

MotionEngine Mobile
As our desires for more “smart” devices has increased, so has their power consumption. MotionEngine Mobile delivers high performance, low power, sensor independent motion processing for mobile devices. This can be used to power motion applications, provide context awareness, activity tracking, and even pedestrian navigation. This software is versatile enough for smartphones, tablets, wearables, and IoT devices.

MotionEngine SmartTV
Did you ever wish you could more easily interact with your TV? The SmartTV package enables this by utilizing instinctual hand motion and translating it intuitively on the screen. Movement (both physical and digital) feels natural with features like cursor control, orientation compensation, button motion suppression, and virtual controls.

MotionEngine Robotics
Automated robots need to move intelligently through their spaces, and our algorithms ensure they can. After all, a robot’s convenience is based on its autonomy. Our algorithms achieve precise heading with minimal drift. And with our interactive and dynamic calibration algorithms, robots can achieve great performance both right out of the box, and over time and changing temperature.

Hardware Product Line
Our best-in-class MotionEngine sensor fusion is available in a variety of hardware products seen below. Development kits are available for the BNO080, BNO086, and FSP200.
The FSP200 is a standard Cortex-M based microcontroller programmed with CEVA’s MotionEngine software.

- **The FSP200 line delivers**
  - High quality heading and orientation outputs based on sensor fusion from both 6- and 9-axis sensing
  - Activity Classification for Stability, Tap, Steps, Walk, Run, Still, Significant Motion, Shake
- **The FSP200 line** is applicable to robotics, XR headsets and peripherals, 3D audio headsets, wearables, motion controllers, medical devices, fixed assets (antennas, lighting, etc), livestock tracking, and more
  - If motion is involved, the FSP200 is likely able to help, especially if it requires a magnetometer and/or precise real-time tracking
  - The FSP200 is applicable to terrestrial robots, XR and 3D audio headsets, motion controllers, medical devices, and any other application that requires precise 6-axis heading and orientation measurements
  - I2C, SPI, and UART interface

The FSP200 is applicable to terrestrial robots, XR and 3D audio headsets, motion controllers, medical devices, and any other application that requires precise 6-axis heading and orientation measurements.

- **The FSM300/305** is applicable to the fast development of robotics, XR headsets and peripherals, 3D audio headsets, wearables, motion controllers, medical devices, fixed assets (antennas, lighting, etc), livestock tracking, and more
  - The FSM300/305 is well suited for customers in the prototyping, early development, or low volume production when you need a calibrated unit.
  - Customers are advised to switch to the FSM300/305 in their next iteration
  - I2C, SPI, and UART interface

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