

xsens DOT
PRECISION MOTION TRACKING



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CONNECTING THE DOTS IN HUMAN MOTION

How Xsens DOT can help
make your ideas move

Introduction

The Xsens DOT is a high quality, robust and affordable wearable sensor development platform, built by innovators for innovators. It uses a state-of-the-art signal processing and sensor fusion framework which has been optimized for human movement applications. This provides entrepreneurs, developers and inventors with a set of tools to measure human motion while providing ecological validity from being in the user's natural environment. The Xsens DOT utilizes BLE 5.0 and contains a software development kit (SDK) to use with both Android and iOS devices. With the ability to capture and deliver precise results, the Xsens DOT can help make your ideas move.



In recent decades, wearable technology has undergone great progress. As a society, we have officially embarked upon the 4th industrial revolution, or Industry 4.0 as you will see throughout the literature. This latest revolution has undertaken tremendous adoption of sensor-based technologies, with the internet of things (IoT) driving this revolution. As a result, the boundaries between physical, biological and technological worlds are being merged like never before. A direct application of this latest state of the art, is the use of human motion tracking technology to achieve important analyses across fields of medicine, exercise and health; pushing the boundaries of human digital interaction. Importantly, these capabilities are now at your fingertips with the introduction of the Xsens DOT, a sensor development platform to help you make any human movement idea a reality. Over 20 years of motion tracking experience is able to be integrated into your applications, eliminating many of the technical hurdles, so you can focus on an immediate entry into the market.

Motion sensor



Let's take a moment to first get an understanding of what a motion sensor is and how Xsens enables accurate and reliable data. As the name suggests a motion sensor measures movement and is an example of a Micro-Electrical-Mechanical-System (MEMS). Specifically, the Xsens DOT is an inertial measurement unit (IMU) and consists of an accelerometer to measure acceleration; a gyroscope to measure rotational speed or rate of turn; and a magnetometer to measure the magnetic field, much like a compass needle that points North. Each of these individual components collect their own data that can be used for analysis, but together they can be combined to calculate orientation by a process called sensor fusion. Xsens patented technology is centered around world leading sensor fusion algorithms that guarantee performance in your orientation measurements. Factors such as sensor accuracy, sensor component integration, performance and timing, along with hardware design and manufacturing are all ensured. With all of these potential sources of technical problems accounted for, entrepreneurs, developers and inventors no longer need to reinvent the wheel, thereby putting focus into the development of solutions for the market.

Several key components have come together over the years with respect to wearables. One such thing is the miniaturization of sensors, MEMS are now able to be incorporated into many small devices giving a seamless nature to them, with the ability to be integrated within textiles and ensuring comfortability. Complementing this is the communication with handheld devices, such as mobile smart phones. Recent advances in Bluetooth low energy (BLE) technology provide a wireless network communication protocol which uses significantly lower power consumption. As a result of this, an energy efficient method of providing real time motion data has the ability to be streamed to software or mobile phone-based applications. The Xsens DOT is a development platform utilizing BLE 5.0, that contains a software development kit (SDK) to use with both Android and iOS devices. This SDK has been designed in such a way to ensure smooth and rapid development of your application, with over-the-air firmware update functions providing ease of use to developers and more importantly, your customers.

IP68 standard

The Xsens DOT is a dependable sensor that can meet your goals in any condition, even in water-based activities. Motion capture in water-based activities has traditionally been a problem in the past. However, this is no longer an issue with Xsens DOT sensors. The sensors are water proof to an IP68 standard, with the previously mentioned sensor fusion possible through onboard recording. This is an extremely important feature, as water can affect Bluetooth communication. With the ability to store sensor fusion data for up to 88 mins onboard each synchronised device, this provides an option for you to measure and store orientation calculations in water based activities, with no loss of data from transmission issues. The DOT is a rugged sensor that won't let you down under any conditions.



Accuracy

Motion sensors require very specific calibrations in order to successfully measure human body motion. The Xsens DOT was designed by innovators for innovators. It is supported by offline Magnetic Field Mapping libraries making it more accurate, repeatable and robust. Moreover, multiple sensor fusion profiles ensure you can track dynamic movements. Xsens DOT onboard software makes use of a unique method called strap-down integration (SDI), in which internal sensing elements collect data at a higher sampling rate performing highly accurate numerical computation of the integrated quantities of angular velocity and acceleration to maintain accuracy under dynamic movements. The SDI then processes this at a lower sample rate prior to sensor fusion, maintaining the accuracy while reducing the transmission load, as well as the computational load on the hosting device. Collectively, this state-of-the-art signal processing and sensor fusion framework has been optimized for human movement applications.



Validity

An IMU provides an accurate method to undertake motion capture for the purpose of human movement analysis. Such analyses provide applications that span many different markets including the health and clinical community; sports and exercise populations; ergonomics and occupational settings; as well as the animation and visual effects industry. Historically, these applications have been performed using optical methods, including stereo-photogrammetry with passive or active light sources. Whilst these methods have a high degree of precision and accuracy, they require laboratory environments, which lack ecological validity and are therefore unable to be used in many user-cases. Furthermore, it is unable to be integrated into our everyday lives. The Xsens DOT addresses these shortcomings, by enabling an accurate method of measuring motion and providing ecological validity from being in the user's natural environment. The light weight form factor, also enables you to use it anywhere and anytime.

Synchronous

The ability to use multiple wireless motion trackers in a synchronous manner becomes of paramount importance in human movement applications. In many applications, users may be interested in knowing specific joint angles and not just the motion of a single segment. This requires very precise and accurate inter-tracker time synchronization, as timing errors of just a few milliseconds can potentially lead to unacceptable errors in joint angle measurements. In the past, time synchronization has been a challenge in multiple wireless sensor networks, however Xsens has overcome many of these challenges contributing to the reliability and robustness of its performance.

Human movement

The ability to measure joint angles of the body becomes very important in human movement analysis. This is a strength of the Xsens DOT compared to many other wearables that contain only a single motion tracker. Analysis of how different segments of the body move with respect to one another enables movement to be analyzed numerically based on measurements. This provides an objective and accurate representation of movement, allowing users to quantify movements that might not be possible to analyze with the naked eye. From this, critical variables of interest relevant to a task or skill can be identified, allowing users to assess strengths or weaknesses, and where appropriate apply specific interventions. Think of the Xsens DOT as your very own movement laboratory that you can depend on anywhere you go.



Connect the DOTs

With the capability to capture and deliver precise results, the Xsens DOT can help turn your innovative ideas into reality, in the fastest way possible. Xsens prides itself on its passionate, professional and precision-focused team, all with world leading expertise. The team can not only help you with all of the necessary technical support, but also collaborate and work with you to help make your ideas move. Connecting the dots in human motion has never been easier.

Tell us your application ideas

Send us your ideas for the Xsens DOT and one of our experts will get in touch to see how we can support you.