MVN BIOMECH

AMBULATORY MEASUREMENT OF HUMAN MOTION

xsens

MVN BIOMECH is a camera-less 3D human motion measurement system. It is based on state-of-the-art MEMS inertial sensors, biomechanical models and sensor fusion algorithms. MVN BIOMECH is ambulatory, can be used indoors and outdoors regardless of lighting conditions. The results of MVN BIOMECH trials require minimal post-processing as there is no occlusion or lost markers. Results can easily be exported to other software applications. MVN BIOMECH is created by Xsens, a leading expert in inertial sensor technology.

PRODUCT OVERVIEW

MVN BIOMECH Hardware

- 17 MTx inertial motion trackers
- Extra backup/prop MTx
- Wireless transmission (subject to PC)
- Full-body elasticated Velcro straps
- Comfortable lycra suit with embedded cabling (optional)

MVN BIOMECH Software

- Intuitive user interface
- Quick and easy set up
- Real-time visualization of:
  - 3D digital character (multi-plane view and user-adjustable)
  - 3D kinematic graphs
  - Video
- Record 3D motion data with ease
- Output data of 23 segments and 22 joints
- Access to direct inertial sensor data
- Export kinematic data

APPLICATIONS

- Biomechanics
  - Research
  - Rehabilitation
  - Gait analysis
  - Sports science
  - Sports coaching
  - Ergonomics
- 3D character animation (game, film, TV, advertising)
- Training and simulation, live events

FEATURES

Freedom of movement

- Portable suitcase for easy transportation
- Wireless subject-PC connection: up to 150m (492ft) measurement range
- No occlusion or line-of-sight restrictions
- Use anywhere: outside, in the office, no lab or simulated environment required
- Use under any lighting condition

Ease of use

- Very short setup time (≤15 minutes)
- Short, pre-defined sensor-to-segment calibration
- No marker labeling required
- C3D for analysis applications
- FBX, BVH for animation applications

Subject comfort

- Minimal subject time needed
- Easy calibration
- Straps can be worn over normal clothing
- Suit can be worn under normal clothing

Accurate data

- Highly sensitive MEMS inertial sensors capture subtle movements
- Sensor fusion algorithms ensures highly accurate output
- Sensors securely fastened to straps/suit
- Minimal skin motion artifact
- No sensitivity to EM-fields

MVN BIOMECH TECHNICAL SPECIFICATIONS

Motion trackers
Configuration

- Full-body 17 MTx
- Lower body 7MTx
- Upper body 10MTx
- Extra prop/backup sensor 1MTx

On-body cabling

For data communication and power
Only 1 cable needed on each limb
Trackers daisy-chained

Full-body straps

- Strong elasticated straps, fastened using Velcro
- 12TPS Dryflex sensor holders
- Clips provided to streamline cables
- One size fits all

Full-body suit

- Light weight revolutionary stretch fabric with cable guides
- 2 fabric sensor pockets
- 10 TPE Dryflex tracker holders
- Sizes: S, M, L (standard), XL, XXL

Accessories (included)

- Gloves with tracker pockets
- 1 head band with Dryflex holder and pocket
- 2 foot mounts

On-body cabling

For data communication and power
Only 1 cable needed on each arm/leg.
Trackers daisy-chained

Power supply

2 Xbus Masters (XM) synchronize data from and supply power to all connected MTx's.

- Power/data control unit: 2 Xbus Masters (XM)
- Power (each XM)
  - Battery (incl.) 4 AA NiMH rechargeables (plus 4 spare)
  - Power adapter (incl.) EU/US/UK power adapter 110-240VAC/12VDC 1A
  - Input voltage range 4 - 14V
- Operating time (typical) 3 hours
- Battery charger (incl.) for 8 AA NiMH batteries

Motion trackers
Performance Specifications[1]

- 3D orientation accuracy[2] <0.5 deg
- Resolution 0.05 deg
- Accelerometer range ± 180 m/s2 (18 g)
- Gyroscope range 1200 deg/s

Communication

- Interface
  - Wireless or high-speed RS-232/USB
- Wireless range radius (up to)
  - Outdoor 150 meters (492 ft.)
  - Indoor open space 150 meters (492 ft.)
  - Indoor office 50 meters (164 ft.)

Wireless receiver units

- All configurations 2 Wireless Receivers (incl.)
- RF technology Bluetooth 2.0 (optimized, class 1)
- Interface USB 1.1or 2.0

Dimensions

- MTx inertial tracker 38 x 53 x 21 mm (1.5" x 2.1" x 0.8")
- Xbus Master 100 x 150 x 40 mm (3.9" x 5.9" x 1.6")
- MVN BIOMECH suitcase 559 x 351 x 229 mm (22" x 13" x 9")

Weight

- MTx inertial tracker 30 g (1 oz.)
- Xbus Master 200 g (0.4 lbs)
- MVN BIOMECH straps (excl. trackers) 360 g (0.80 lbs)
- MVN BIOMECH Suit (excl. trackers) 360 g (0.80 lbs)
- Total on-body system (with batteries and cables) 1930 g (4.2 lbs)
- Shipping weight (incl. suitcase) 11 kg (24 lbs)

Operation environment

- -20... +55 deg Celsius
- Avoid wet and humid conditions as condensation can damage the internal circuitry

Entire system conveniently packed and shipped in a suitcase:

Strong, durable & waterproof
With wheels & extendable handle
Suitable as hand-luggage

[1] Please refer to MTx leaflet for detailed specifications
[2] Static accuracy in homogenous magnetic field

MVN FUSION ENGINE

MVN BIOMECH human models
- MVN BIOMECH uses a 23 segment biomechanical model with 22 joints
- Each joint is specified by statistical parameters for 6DOF joint laxity
- An advanced spine and shoulder model is used to compute the kinematics of the spine and shoulder blades
- Anthropometric scaling or user-specified segment dimensions

Sensor to segment calibration
Easy calibration, with animated instructions. Feedback of expected accuracy provided and advice for improvement (when necessary). Using preset delay, calibration can be carried out without assistance.

- Basic calibration
  - 10 seconds
  - Basic calibration needs only subject and foot length [cm]
- Advanced calibration
  - 10 - 30 seconds per additional step
  - Advanced subject-specific calibration determines tracker alignment and/or subject specific dimensions
  - Calibration procedures for subjects with limited range of motion are possible.

MVN Studio BIOMECH interface
- Real time preview of:
  - 3D motion representation, user defined or multi-plane view
  - Synchronized video data
  - Joint angle vs time
  - Joint angle vs joint angle (phase plots)
- Simultaneous recording/viewing
- Data replay: Video, digital character and graphical kinematics

Update rate
- Internal update rates 120, 100, 60 Hz
- Export frame rates 120, 100, 60, 50, 40, 30, 25, 24 Hz

3D translation
- Double integration of body segment accelerations allows for jumping/running (permanent floor contact is not needed)
- ~2% error in traveled distance
- Advanced external contact model detects body world contacts to enable crawling, sitting, cartwheels etc.
- Full control over external contact points

Prop/ object tracking
Supports up to three extra “prop sensors”, for detecting movement of assistive devices e.g., walking aids, sports equipment.

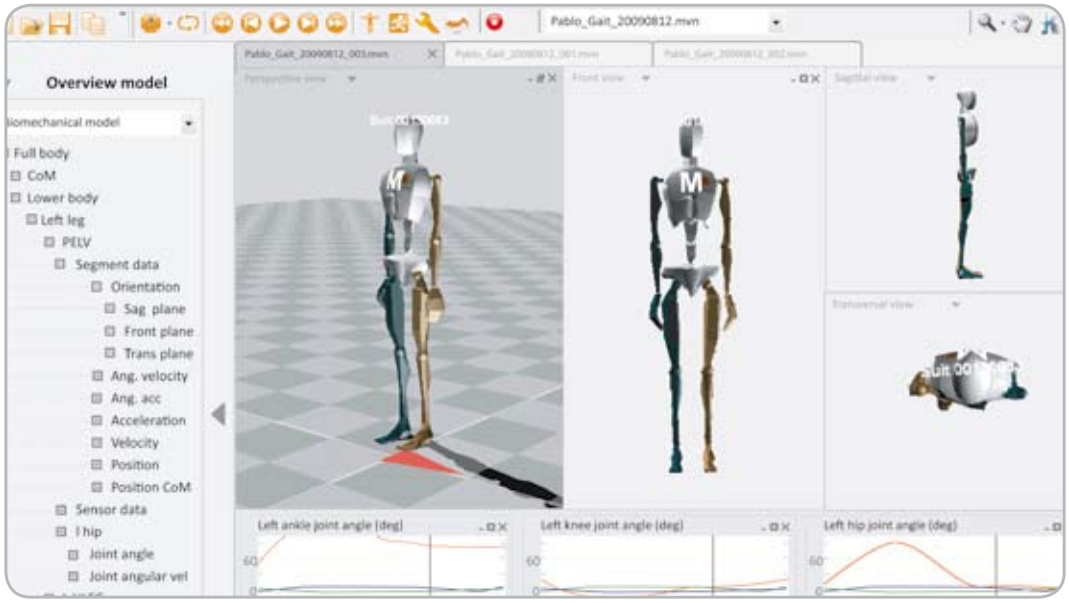
Magnetic environment
- Full immunity to temporary magnetic disturbances (~30 seconds)
- Visual warning of magnetically disturbed environment

Local, permanent magnetic disturbances
The degree of immunity and performance will depend on motion and magnetic environment

Soft tissue artifacts
- Minimized to ~2 degrees RMS using redundancy in measurement and biomechanical constraints

Multiple person capture
Up to four systems simultaneously on one PC

Warranty 2 year
Support & software updates 1 year



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Output
- 3D MVN BIOMECH character
- Video data
- 3D joint angles
- 3D Segment orientation and position (optionally: 3D segment acceleration, velocity, angular rate and angular acceleration)
- Body centre of mass
- Contact points for event detection
- Segment position
- 3D sensor
  - Angular rate
  - Acceleration
  - Orientation

Supported export formats
- .C3D (Coordinate 3D)
- .MVNX (MVN Open XML format)
- .BVH (Biovision Hierarchical Data)
- .FBX (FiLMBOX)
- .MPG, .AVI and .MOV (movie export)

Streaming motion data
- Streaming motion data on local area network (UDP)
- MotionBuilder 2009 -2010 compatible client plug-in available
- Client network monitor support in MVN Studio BIOMECH

EXTRAS/OPTIONAL

MVN BIOMECH Software Development Kit
- Easy integration with custom application software
- Provides real-time joint angle and orientation and position data of body segments using dynamic link library (C interface)
- Provides interfaces to calibration routines and character definition routines
- Handles pre-recorded MVN files for post-processing
- MVN BIOMECH Fusion Engine handles 3D position aiding input, in real-time

Time code and remote control plug-in
- Time code stored in MVN, MVNX (optional), C3D and FBX
- Remote control of recordings in MVN Studio BIOMECH

Data rate
39 MB/min @ 60 Hz
66 MB/min @ 100 Hz
79 MB/min @ 120 Hz

RECOMMENDED COMPUTER SYSTEM

Operating system:	Windows XP (SP2) Windows Vista
Processor:	Dual core e.g. Core2 or AMD X2 (minimal Pentium 4 - 2.6 GHz)
Graphics card:	Any graphics card with DirectX 9 hardware acceleration
USB Ports:	2x USB or hub per system

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ABOUT XSENS TECHNOLOGIES

Xsens is a leading supplier of 3D motion tracking products based upon miniature MEMS inertial sensor technology. Since its inception in 2000, several thousands of motion sensors and motion capture solutions have successfully been deployed in areas such as 3D character animation, rehabilitation and sports science, and robot and camera stabilization. Xsens' customers include Universities of Twente, Amsterdam, Rhode Island and Magdeburg. Research institutes Roessingh Research and Development, AZTI, INAIL and TNO. Companies Össur, Daimler, Sony Pictures Imageworks, Double Negative, Industrial Light & Magic, Electronic Arts, Sony Computer Entertainment, Gearbox Software, THQ, 2K, The Third Floor, Syndicate, CG Sweden and many other companies and institutes around the world.

Xsens' research department has built a unique portfolio of technologies and know-how in the field of multi-sensor data fusion algorithms, combining inertial sensors with aiding technologies such as GPS and RF positioning and biomechanical modeling. The company and its products have received several awards, amongst which 3 consecutive ratings in Deloitte's ranking of fastest growing technology companies in Europe.

Xsens is headquartered in Enschede, The Netherlands and has an office in Los Angeles, CA, US.

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