



3D Motion Capture Buyer's Guide

The 3D motion capture system market is exploding, with more than 20 new product launches in the last three years alone. Developers are constantly looking for new ways to offer high-quality motion capture in a way that's more accurate, portable, and affordable. This level of innovation has caused a wide range of options for hardware, software and accessories, which can be difficult to navigate. We're creating a buyer's guide to help ease the process. As we continue to gather information, we will update the table below. We have used our own research and the 3D Motion Capture System Market global forecast from MarketsandMarkets to create this first version.

Overall, users of 3D motion capture systems are looking for high-quality and accurate data for applications such as games, films, biomechanical analysis, robotics, education, engineering, and more. Both optical and non-optical systems provide the capture of human motion, but their usage for each application depends on desired time, cost, and quality. For example, animators who are looking to capture advanced motion movement and understand there will be extensive post-processing would invest in active optical systems. Physical therapists who are looking for quick running analysis and have dedicated studio space may find markerless systems are a good fit. Researchers looking for high accuracy, ease of use, and the freedom from a controlled environment would invest in Moire Phase Tracking (MPT) systems. Filmmakers capturing pre-defined movements may prefer inertial systems.

| Motion Capture System | Description | Major Brands | Major Components | Advantages | Disadvantages |
|-------------------------|---|--|---|--|---|
| OPTICAL | Infrared cameras emit beams of light that are used to track the motion of reflective markers or pulse LEDs. One or two cameras can be used for facial motion capture, but between eight and 16 cameras are needed for full body motion capture. | Vicon Motion Systems Ltd. Qualisys AB Motion Analysis Corporation Northern Digital Inc. Phoenix Technologies Inc. OptiTrack Codamotion | <ul style="list-style-type: none"> • High-quality cameras • Sensors • Markers • Calibration wand • Software | <ul style="list-style-type: none"> • Extremely accurate in most cases • Large application segment • Performers not constrained by cables • Larger performance area • High capture frequency | <ul style="list-style-type: none"> • Extensive post-processing • Comparatively high cost of ownership • Markers can be blocked by body parts or clothes • Expensive hardware • Capture needs to be in a controlled environment |
| OPTICAL - ACTIVE | An actor wears a motion capture suit comprised of LED markers connected by wires, and carries a portable power source such as battery or charger pack. The LED markers emit light rather than reflecting it back, thereby increasing the volume of captured data. | Northern Digital Inc. Phoenix Technologies Inc. Steinbichler Codamotion | <ul style="list-style-type: none"> • High-quality cameras • Motion capture suit • Portable power source • Markers • Calibration wand • Software | <ul style="list-style-type: none"> • High measurement resolution • Very low marker jitter | <ul style="list-style-type: none"> • Markers can be blocked by body parts or clothes • Capture needs to be in a controlled environment |



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|---------------------------------|---|--|---|---|--|
| <p>OPTICAL – PASSIVE</p> | <p>Infrared cameras track retro reflective markers. User wears hundreds of rubber balls attached with reflective tape.</p> <p>Additional technologies include:</p> <ul style="list-style-type: none"> • 3D depth sensing, where a 3D camera emits infrared light and measures the time it takes to travel from the camera, to the object, and back again. • Time-of-flight, where a camera resolves distance based on the known speed of light, measuring the time of flight of a light signal between the camera and the subject for each point of the image. • Structured light, which is used to measure the 3D shape of an object using projected light patterns and camera systems. | <p>Vicon Motion Systems Ltd. Qualisys AB Motion Analysis Corporation</p> | <ul style="list-style-type: none"> • High-quality cameras • Rubber balls • Reflective tape • Calibration wand • Software | <ul style="list-style-type: none"> • Do not require the user to wear wires or electronic equipment. • High volume data • High-quality output • Improved accuracy over traditional optical systems • High frequency • Multiple performance capture | <ul style="list-style-type: none"> • Markers can be blocked by body parts or clothes • Capture needs to be in a controlled environment |



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|---|--|---|---|--|---|
| OPTICAL – MOIRE PHASE TRACKING (MPT) | <p>A single camera system measures movement by tracking the position and orientation of highly-engineered wire-free markers. The MPT motion-tracking markers generate intricate optical patterns that change in appearance with even the slightest marker rotation. The markers have unique identification numbers, so they can be tracked individually and reliably, without hand-correction of the data.</p> | <p>Metria Innovation</p> | <ul style="list-style-type: none"> • Single high-quality camera • Markers • Software | <ul style="list-style-type: none"> • Extremely portable and compact • Factory-calibrated for ease of use, can be taken out and set up moments before data is captured • 30 times better accuracy than comparable multi-camera systems • Wire-free markers • No hand-correction of data • Can measure motion in ways previously not feasible • No need for a studio or controlled environment • Reduced marker occlusion compared to multi-camera systems | <ul style="list-style-type: none"> • Comparatively high cost of ownership • Lower capture volume • Markers can be blocked by body parts or clothes |
| OPTICAL - MARKERLESS | <p>Cameras and computers are used to accurately see, understand and quantify human motion.</p> <p>Data processing is done through special computer-based algorithms that analyze multiple streams of optical input, identify human form, and break them up into constituent parts from tracking.</p> | <p>Organic Motion Simi KinaTrax</p> | <ul style="list-style-type: none"> • High-quality cameras • Computers • Software | <ul style="list-style-type: none"> • Faster and easier to operate than active and passive systems • Comparatively low cost of ownership • Automatic processing • Absence of interference due to markers movement on skin or clothes • Zero disturbance | <ul style="list-style-type: none"> • Capture needs to be in a controlled environment |



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|-------------------------------|--|--|---|--|--|
| NON-OPTICAL | <p>Performers use a cable connection to track motion.</p> <p>Technologies include inertial and electromagnetic systems.</p> | <p>Xsens Technologies B.V.</p> <p>Synertial</p> <p>Polhemus, Inc.</p> <p>Inertial Labs</p> | <ul style="list-style-type: none"> • Sensors • Cable connection • Software | <ul style="list-style-type: none"> • Real-time data output by providing immediate feedback • Data availability with respect to position and orientation without post-processing • Less expensive than optical • Sensors do not occlude • Multiple performance capture | <ul style="list-style-type: none"> • Restricted movement • Pre-defined marker configurations • Tracker's sensitivity to metal can result in irregular output • Low sampling rate • Smaller capture area compared to optical |
| NON-OPTICAL – INERTIAL | <p>Based on miniature inertial sensors, sensor fusion algorithm, and biomechanical models. Use gyroscopes and accelerometers to capture data which is then transmitted to the computer. The rotational rates are measured using a gyroscope and then translated into skeleton in the software.</p> | <p>Xsens Technologies</p> <p>Synertial</p> <p>Inertial Labs</p> <p>Perception Neuron</p> | <ul style="list-style-type: none"> • Sensors • Gyroscopes • Accelerometers • Software | <ul style="list-style-type: none"> • Sensors • Gyroscopes • Accelerometers • Software | <ul style="list-style-type: none"> • Restricted movement • Pre-defined marker configurations • Tracker's sensitivity to metal can result in irregular output • Low sampling rate • Smaller capture area compared to optical |

