

MOTION CAPTURE AND ITS FUTURE IN VIRTUAL REALITY

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Annotation. Technologies of motion capture and their use in movie industry are discussed in this thesis. The mechanisms used in such technologies are also presented in the paper as well as the future possibilities of motion capture development and their use in virtual reality.

Keywords. Motion capture, mocap, movie, virtual reality, rotoscoping, recording, movement, markers, computer generated imagery, suit.

The movie industry has gone a long way since the 1900s. The newest advancements in technology allow filmmakers to create photorealistic digital models, using special motion capture systems or mocap for short.

The history of mocap runs deep, its predecessor is rotoscoping, a technique that includes creating a basic silhouette of an object for each frame to use it in animation [3]. With the development of modern computer technology, rotoscoping has evolved into mocap. The usage of computers eliminated the need to draw every single frame. There are different ways how a motion capture system might work. It is not hard to find videos of actors in full-body suits covered with small balls. This is optical motion capture. The balls on the suit are actually reflective markers. The surrounding infrared cameras record the actor's movements. Then a special piece of software is used to map the movement of the balls on the suit and align the marker positions with those on a digital skeleton as shown in Figure 1 [2]. The markers can also be replaced with LED lights recognizable by cameras for recording outdoors [4].

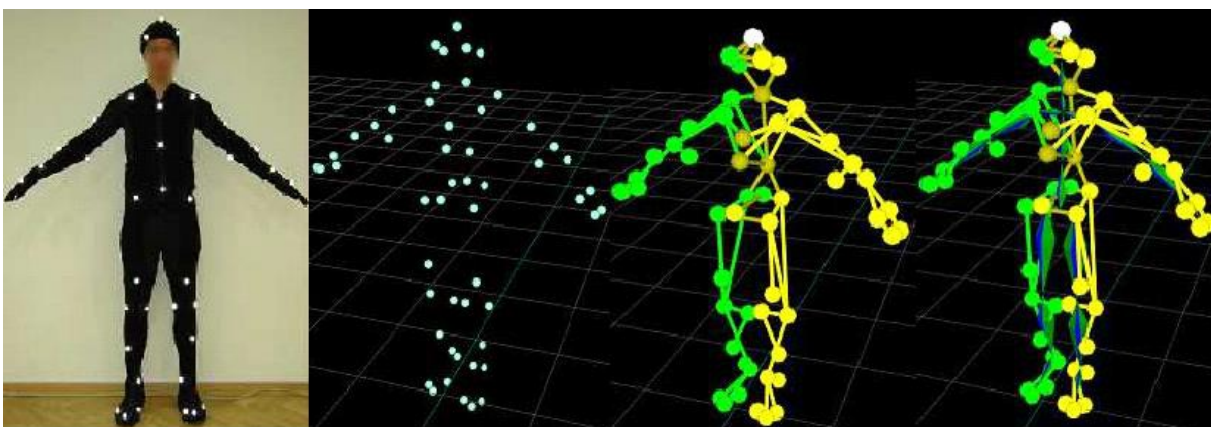


Figure 1 - A digital skeleton made of markers

As advanced as this sounds, these techniques are not even the latest development. Meet the markerless motion capture. Like the regular mocap, markerless mocap suits are also equipped with sensors, although they do not require cameras unlike the previous ones. The sensors used are called IMUs, that means inertial measurement units. They consist of several components such as gyroscopes, accelerometers and magnetometers [1]. These components are installed in the parts of the suit that correspond to joints and limbs which are used most of all during movements. The joint tracking data, recorded by the sensors, is then transferred to the software component that determines the current limb position using physical calculations.

So where exactly would people use motion capture and why? The answer is fairly simple: every more or less popular modern movie uses mocap. This is mainly because most movies nowadays use CGI. This acronym stands for computer generated imagery. CGI is used to create and animate any sort of scene that

would be impossible to recreate in real life. In our case, we are talking about computer generated characters. For example, the most recent installment of Avengers series features the use of mocap to animate Hulk. Especially important in movie-making is facial recognition which is also a form of mocap.

Motion capture is currently the best way to create CGI, but it also has its drawbacks. The first and the most obvious one is the price. Mocap suits are pretty difficult to find, especially if you are not in charge of a movie set. Price tags range from 500\$ up to 10,000\$ and are usually high enough to make 2,000\$ look like a bargain. However the value of the opportunities provided by the suit most likely outweighs the cost. There are also disadvantages involving the amount of space available for the user to maneuver. The amount of space is restricted by the distance at which the cameras can recognize suit markers.

The spatial disadvantages of mocap suits gave motion capture a new meaning in everyday life. With a limited amount of space it would be logical to use such systems at home. That is why motion capture today is expanding from movies into videogames and even fitness and sports. For now mocap is still rarely used in virtual reality. However, as VR is still a fairly new addition to the videogame industry, it is being rapidly developed nowadays. As the control systems get more and more sophisticated, the expected level of realism of the in-game mechanics rises. The use of motion capture suits will allow to recreate fluid and natural looking movements in virtual reality. The introduction of full-body character control will open new horizons for game development.

In conclusion, it is necessary to note that motion capture technologies were used back when rotoscoping was first introduced in the first half of the 20th century and since then have developed into a sophisticated system that is used by movie producers all over the world. However, the future of mocap lies in virtual reality. Due to some of its limitations, motion capture was introduced to virtual reality game development where it can be used to enhance the immersive experiences provided by VR.

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