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A Review Paper on Motion Capturing Technology for Gaming

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Abstract:

In this article we will provide the reader the over view of motion capturing technology and what types of motion capturing techniques are being used in the industry. We will also be discussing how motion capturing technology is been used for gaming industry and the process taken by these companies to generate good games with the help MO-CAP technology.



Image courtesy Grand Theft Auto Motion Capture (Google image)

Motion – The act of physically changing location.

Capture – Take into possession, to seize, to acquire.

Motion Capturing: (Acquisition of movements)

Introduction

Motion capturing is a technique of capturing /recording the movements of objects or people. It is also referred to MO-CAP .It is the method of recording digital data in which the performance of the actor/character is recorded and translate into the action of the computer generated 3D or 2D character on the screen. It records the live motion events by tracking a number of key points on the character / human in a three dimensional (3D) with the help of sensor cameras.

Earlier Rotoscoping technique was used to animate the character or object on the screen. It was done through masking a character and animate each and every key frames and used to take lot of time. Motion capturing technique came with the boom which helps the animators to animate some realistic movements in short period of time. Rotoscoping was designed for traditional hand drawn cartoons and are still used by some descendant traditional animated studios but motion capturing is a new birth to 3D animation industry. [1]

Motion Capturing Process Classified

1. **Outside-in**
2. **Inside-out**
3. **Inside in system**

Outside In – In this system external sensors are placed on the body to collect the data from the source/ character. This system has camera based tracking device where camera- sensor, markers- source.[2]

Inside out system – In this system the sensors are placed on the body that collect external sources. For example – Electro Magnetic system where sensors are moved in an externally generated electromagnetic field.[2]

Inside In – In this system both sensors and sources are placed on the body. Example – Electromechanical suits where sensors are potentiometer, accelerometer, gyroscopes and sources are actual joints inside the body.[2]

Today motion capturing technologies uses optical, electromagnetic and inertial human tracking system.

1. Optical Motion capturing system

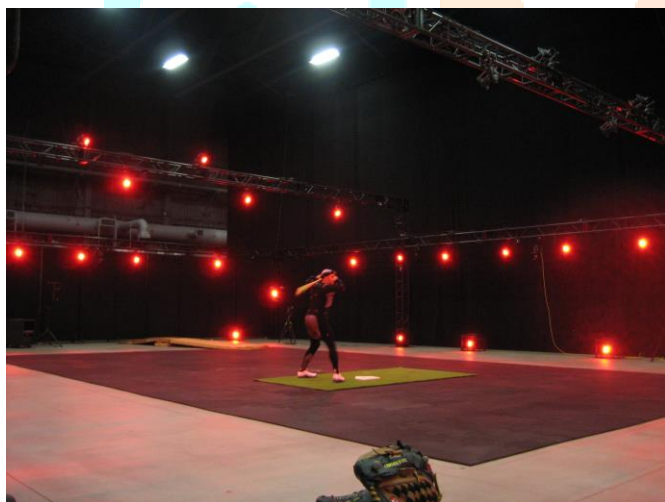


Image courtesy Optical Motion Capture | bestperformancegroup.com

OMC uses number of multiple cameras to utilize data capture from image sensors to triangulate the 3D position of subject between two or more cameras projected to provide over lapping projections. In this system special markers are attached to body of character. The cameras sense the action of the body movements to accomplice the data capture animation. [2]

Optical motion capturing types.

1. **Passive Markers** – In this system the markers on the body of a character is coated with retro reflective material to reflect light that is generated near the cameras lenses. The camera senses the marker with light reflection and captures the data.[2]



2. **Active Markers** – In this system the markers on the body of a character consist of LED light illumination where the markers themselves are powered to emit their own light. The cameras sense the light coming from LED markers and capture the data.[2]



3. **Mark less Motion Capture** – In this system optical motion tracking is used to keep track on character/ objects. Special Computer algorithms (AI) are designed to allow the system to analyse the character movements with the help of near infrared light to perceive depth of the character. Camera generates its own body markers made of light. [2]



2. Electro Magnetic Trackers



Image courtesy Image- itcw3.naist.jp Google Image

In this system electromagnetic sensors are placed on the joints of moving character / objects which measures the orientation and position of sensor relative to electromagnetic field generated by transmitter. The exoskeleton has several magnet receivers. These receivers capture and record the actor's movements and save them to computer. [2]

3. Electro Mechanical Motion Capture



Image courtesy Motion Capture of Human for Interaction with Service Robot

In this system motion capture is done by inside in system where the structure is linked by potentiometers, gyroscopes or angular measurement devices located at human joint locations. It is the process in which the character wears a skeleton structure also called exoskeleton helps in capturing and tracking human joints and angle movements. The sensors are placed on each joints of skeleton for full body motion capture. At least 15 sensors are needed to capture body movement. Each sensor measures 3D orientation.[2]

4. Facial Motion Capture System



Image courtesy of epic games, 3lateral and tencent

For capturing the facial expression of the face like crying laughing smiling and angry face several mechanical and optical devices are used. Real time optical face tracker is used popularly which consist of a camera that is placed in a structure attached to the performer head so that it can move with the character. The character face is placed with small markers; the sensors of the camera inside the structure capture the markers movements (Facial Expression) and send it to the computer software. [2]

How Mocap (Motion capturing helping in games)



Image Courtesy :F2 Freestylers-ultimate Soccer Skills Channel

Mocap technology is a boom for gaming industry as it has ability to create realistic character movements and environment for video games. It allows for the fastest animation pipeline in the industry. By this technology animators can animate large amount of animation as compare to the traditional key frame animation. It reduces the production time and reduces the overall cost.[6]

While making a game motion capture uses the motion tracking sensors cameras to capture the movement of an actor by using different motion capturing process. It capture and creates a virtual skeleton that moves with the character in real time.[6]

Past few years many gaming companies are working on mocap technology and creating certain types of good games. This

technology is useful for 3D games where tones of character animation are used.[6]

Process to motion Capture in Games

1. Planning

Capture games is quite different from planning a shoot for a film because for gaming you need to have more than 100 individual movements of the character that should perfectly connect with one another according to the sequence of the gameplay.[4]

2. Flow Chart of the movement of a character.

Flow chart is important as it decides the animation of the character in hierarchy form .It includes all the Special movements and animation of a character for example: [5]

If the character of the game is "Iron Man".

We need to define all the possible moves and animation which is required for the game play like

- Stand
- Walk
- Jump
- Fly move
- Run Defend
- Punch forward/right/left etc
- Run Forward/backward
- Special Stunts

Each character has its own flowchart according to the gameplay.[4]

3. Getting Ready for Shoot

All the selected shot listed animation moves from the flowchart which has been approved is shot in motion capturing studios where actor performs different action and moves to give realistic look the gameplay. Casting your actor should be talented enough to give the best shots of movements of a character in gameplay.[4]

4. Scheduling/Shooting

Schedule your session properly to avoid wastage of time and resources for example: Where to shoot/size of capture space to set up/logical progression of your moves/defining motion capturing technique to be used (Optical,electromagnetical or mechanical)/Mocap Settings / motion capturing suits of the actors and environment for the studio.[4]

5. Calibration at the day of shoot

Calibrate your cameras in 3D view port of your software all the cameras should aligned an accurate focused on character. No other light source then reflective markers on the actor's suit. [5]

6. Calibration of character

Have to set the movement's limit of the actor as he or she walk/move in studio setup called range of motion so that markers on the body of the actor can be detectable by the sensor cameras.[5]

7. Make a good rig digital skeleton

3D rigged skeleton is linked to the actor's marker suit as the actor moves in range of motion the rigged skeleton in software collects the animation data in real time and animation moves are recorded.[5]

8. Selection of good moves

Collect your notes, video tape to review select the best animation takes for your character for a good game play.[4]

9. Character is ready for game play

The recorded character animation is sent to 3D software like blender, unreal engine, unity engine etc. To connect are recorded animation to our game character by importing it. The skeleton recorded animation is copied to the 3D software character to give life to our character.[5]

Conclusion

MoCap technology is rising to its best to give more realistic life to our game character. Optical mocap system has evolved much more than its brethren system. Many gaming companies all over the world has their own mocap studio setup to enhance the video and animation quality of their game play as it reduces the time of production also. This technology has already proved a boom in film industry but now from past few years it's been a fruitful technology to gaming companies also where the gamers can experience more realistic moves of the character. Here are some of the games which has been made with the help of motion capturing technology.

Motion capturing Games

- Call of duty : world of war
- Call of duty 4 :modern war fare
- The crow : City of angles
- Grand theft auto V
- NBA court side
- Uncharted golden abys.
- The last of us
- Max Payne 3
- Red Dead Redemption
- Resident Evil 7: Biohazard
- Silent Hill 3
- Spider-Man: The City that Never Sleeps
- Star Wars: The Force Unleashed [7]

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