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Survey of Animation of 3D Human Model by Using Motion Capture

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ABSTRACT: Motion Capture is the recording human movement through specialised cameras and mapping them onto a character model and Motion capture involves sensing, digitizing and recording that object in motion. This paper presents a survey on motion and the skeleton tracking techniques which are developed or are under improvement. In this method to transform the motion of a performer to a 3D human character, the 3D human character performs similar movements as that of a performer in real time. Marker means sense the information of skeleton joints and also it is an object used to indicate a position, place, or route. There are two ways for motion capture, marker based motion capture and markerless motion capture. Marker-based motion capture method means add visual markers on body. In the Marker based motion capture, the performer is to wear a suit which consists of sensor or markers on it and the process consist of handling multiple cameras placed in a room. In markerless motion capture the performer doesn't have to wear a suit, but still markerless motion capture is a challenging task. Marker-less motion capture methods assume that a subject is observed by a single or multiple video cameras that the acquired images are processed in order to estimate the subject’s pose at every observation time

KEYWORDS: Animation; Markerless motion capture; Rigging; Rotation matrix

I. INTRODUCTION

Markerless motion capture is an active study in 3D virtualization. Human character performs related movements as that of a performer in real time. 3D human model is formed using open source software (MakeHuman).The markerless motion capture is not an simple task to perform as it requires more effort, so sufficient good results cannot be obtained using a single normal camera the process still requires a set of multiples cameras located all over the room, which also increases cost on the whole system. The 3D human model is created using open source software of MakeHuman and student version of Autodesk Maya. This paper gives a review on various existing techniques related to motion capture. All these techniques propose to build up an automated body motion capture technique which helps to make a digital animation in 3D, which can ease the task of animators.

This paper presents a discussion on depth camera and libraries that can be applied for skeleton tracking. In this paper markerless motion capture method for 3Dhuman character animation which can be useful for any HCI application similar to gaming, film industry, motion analysis in sports and many more. Motion capture and computer animation techniques have made major progress in game and film industry. Detecting movements of people in 3D and displaying it in a 3D virtual scene is a study problem. There are two customs for motion capture. First is marker based motion capture and second is markerless motion capture. The Marker based motion capture has lots of drawbacks, the major drawback is that the performer has to put on a suit which is sensor or markers on it and the process consist of control multiple cameras placed in a room, therefore markerless motion capture has happen to major area of research. In markerless motion capture the performer doesn't have to be dressed in a suit, but still markerless motion capture is a challenging task. Marker-less motion capture methods suppose that a subject is observed by a single or by multiple video cameras and that the acquired images are processed in order to estimate the subject’s pose at every observation

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time. We apply kinect with Microsoft kinect SDK for better act, for creating a human model open source software of Make Human [29] is used and the rigging is performed using algorithm mentioned in [22].

II. RELATED WORK

The researchers have surveyed different approaches for body motion and skeleton tracking for various applications. The body action and skeleton tracking techniques using an ordinary camera are not easy and require extensive time in developing. There are two survey. First survey is motion capture and motion capture for animation using kinect is presented . And the second survey is body and skeleton tracking techniques are presented by the technique used along with advantages, disadvantages.

Aitpayev, K.; Gaber, J. [1] described the method is "Collision Avatar (CA): Adding collision objects used human body in the augmented reality using Kinect". This method is used for Adding collision object for human body in augmented reality using kinect. This system is easy to implement but System is not accurate sufficient and trouble with measurement of bones. Xiaolong Tong; Pin Xu; Xing Yan [2] described the method "Research on Skeleton Animation action Data Based on Kinect. This scheme is used for formation of standard action data files in actual time but it reduces funding of implementation. Jitter present in data achieved for foot and Lack in Optimization of motion data.

Ming Zeng, Zhengcun Liu, Qinghao Meng, Zhengbiao Bai, Haiyan Jia [3] described the method "Motion capture and reconstruction based on depth information using Kinect”. In this technique it is fairly accurate results obtained for real time 3D human body movements also good fidelity and low latency of system. That’s why no support for occlusion handling. Mian Ma; Feng Xu; Yebin Liu [4] described the method "Animation of 3D characters from single depth camera". This system is used for Animation of 3D characters from single depth camera. In this system noise and errors with joints position are removed And due to removal of noise good results are obtained. The deformation models pose is not that similar to the captured character and Skinning is not done properly.

Colvin, C.E., Babcock, J.H., Forrest, J.H., Stuart, C.M., Tonnemacher, M.J., Wen-Shin Wang [5] described the method “Multiple user motion capture and systems engineering”. This system is used for multiple user motion capture and system engineering. The multiple user motion capture groups specific objective is to implement a method of capturing and mapping hand gestures from a Marine Trainee to their analogous avatar in the virtual training environment. This system does not support Arm gestures. Lucía Vera, Jesús Gimeno, Inmaculada Coma, and Marcos Fernández [6] described the method “Augmented mirror: interactive augmented reality system based on kinect.” This system is used Augmented Mirror for Interactive augmented reality system based on kinect. This system can handle Head orientation, lip movements, facial expressions and automatic gestures and occlusion is handled. This system not support Finger tracking and Use of too many devices makes system difficult to implement. Fern'ndez-Baena, Adso, Antonio Susin and Xavier Lligadas [7] described the method "Biomechanical validation of upper-body and lower-body joint movements of kinect motion capture data for rehabilitation treatments." In this system Optical Motion Capture technique is used. It Reduces funding of implementation. Comparison of Kinect motion capture with optical motion capture and fairly good results are obtained. Lack of precision in system and also approximation of joints and bones not done properly. J. Shotton, A. Fitzgibbon, M. Cook, T. Sharp, M. Finocchio, R. Moore, A. Kipman, and A. Blake [8] described the method “Real-time human pose recognition in parts from single depth images”. In this system randomized decision forests technique is used. This system can quickly and accurately predicts 3D positions of body joints from single depth image, using no temporal information and ability to run the classifier in parallel on each pixel on a GPU to increase speed. In this using large and highly varied training dataset to estimate body parts invariant to pose, body shape and clothing. Qu Wei, and Dan Schonfeld [9] described the method "Real-time decentralized articulated motion analysis and object tracking from videos". Decentralized articulated object tracking (DAOT), hierarchical articulated object tracking (HAOT) technique is used. This system is fast and easy to implement. In these results not shown in case of self-occlusion due to the fact that it cannot manage pose relation between two adjacent parts. del Rincón, Jesús Martínez, et al [10] described the method "Tracking human position and lower body parts using Kalman and particle filters constrained by human biomechanics".Position Tracking Based on a Kalman Filter,

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multiple-Particle-Filter Tracking Based on Two-Dimensional Articulaed Model technique is used. In this system Bipedal motion is handled without any constraints and occlusion is seen case of pivot joints.

Raskin, Leonid, Michael Rudzsky, and Ehud Rivlin [11] described the method "Dimensionality reduction using a Gaussian Process Annealed Particle Filter for tracking and classification of articulated body motions."In this Gaussian Process Annealed Particle Filter method is used. Robust than hierarchical annealed particle filter and Less errors .In this system hugging motion classification fails and cross validation is needed to classify ambiguous types of motion. Bernier, Olivier, Pascal Cheung-Mon-Chan, and Arnaud Bouguet [12] described the method "Fast nonparametric belief propagation for real-time stereo articulated body tracking." Recursive Bayesian Tracking for Articulated Objects techniques is used. In this system good results shown on arm movements to various human tracking positions and slow processing rate.

Zhu, Rong, and Zhaoying Zhou [13] described the method "A real-time articulated human motion tracking using tri-axis inertial/magnetic sensors package." Kalman-based fusion algorithm is used. This algorithm was applied to obtain dynamic orientation and further positions of segments of the subject body. The arm motion experiment was established using the developed system and algorithm. System sensor were build using tri-axis microelectomechanical accelerometers, rate gyros and magnetometers. Lee, Mun Wai, and Ramakant Nevatia [14] described the method "Human pose tracking in monocular sequence using multilevel structured models."In this system grid-based belief propagation algorithm, data-driven Markov chain Monte Carlo technique is used.In this system realistic scenes due to background clutter, variation in human appearance, and self occlusion. Solution to this system is addresses various issues including automatic initialization ,data association ,self and interocclusion. this system has Less position error due to full pose inference and Longer processing time for rendering hence it is not suitable for real time application. Peursum, Patrick, Svetha Venkatesh, and Geoff West [15] described the method "A study on smoothing for particle-filtered 3d human body tracking." Annealed Particle Filter, Particle Filter, factored-state hierarchical hidden Markov model techniques are used. In this system smoothed-inference techniques are implemented Occlusion and poor segmentation is handled by hierarchical hidden markov model and tracking results are not so accurate. This system smoothing does not improve body tracking accuracy and processing time is increased due to smoothing

Tong, Jing, et al [17] described the method “Scanning 3d full human bodies using kinects”. Research on skeleton tracking focus on image processing in conjunctions with a video camera constrained by bones and joint movement detection limits.3D skeleton tracking technique using depth camera known as a kinect sensor with the ability to approximate human poses to be capture reconstructed and displayed 3D skeleton in the virtual view using OPENNI, NITE primesense. Chanjira Sinthanayothin, Nonlapas Wongwaen, Wisarut Bholsithi [18] describe the method “Skeleton Tracking using Kinect Sensor & Displaying in 3D Virtual Scene”. In this the depth data capture by kinect over a certain distance is of extreme low quality. Solution of this system is capturing 3D human body models by using multiple kinects to avoid the interference phenomena, this two kinects capture the upper part and lower part of a human body without overlapping region.

Karina Hadad de Souza, Rosilane Ribeiro da Mota [19] described the method “Motion Capture by kinect”. In this system kinect has built in algorithm for identification of skeleton of human body, but there is gap when the joints are competing for the same area of sensor view. Thus solution has each kinect contributes to capture for position that are unreachable by other, making graphical representation of body and movement done. In this multiple kinect support for motion capture and increase in precision of system. Occlusion handled with use of multiple kinect and not enough good performance. Zhang, Quanshi, et al [20] described the method "Unsupervised skeleton extraction and motion capture from 3D deformable matching". In this extract skeletons of difficult articulated objects from 3D point cloud sequences collected by the Kinect. Solution is to reduce the large computational cost of the non-rigid matching; a coarse-to-fine procedure is proposed. This Approach is more robust than the traditional video-based and stereo-based approaches. Good performance is obtained but no support for occlusion in case when if a person folds his hands together.

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Shum, Hubert, and Edmond SL Ho [21] described the method "Real-time physical modelling of character movements with Microsoft kinect". In this system kinematics and dynamics approaches perform sub-optimally when the captured motion is noisy or even incomplete. Solution of this system is unified framework to control physically simulated characters with live captured motion from Kinect. Our framework can synthesize any posture in a physical environment using external forces and torques computed by a PD controller. In this system proposed algorithm is computationally efficient and can be applied to a wide variety of interactive virtual reality applications. This system not support for occlusions and noises handling.

III. COMPARATIVE STUDY

In the existing system there are some limitations. There are two ways for motion capture. First is marker based motion capture and second is markerless motion capture. The Marker based motion capture has many drawbacks; the most important drawback is that the performer has to be dressed in a suit which consists of sensor or markers on it. In This process handling multiple cameras placed in a room. The markerless motion capture is not an easy task to perform as it requires extra effort, so sufficient good results cannot be obtained using a single normal camera, the process still requires a set of multiples cameras located all over the room, which also increases cost of the on the entire system.
Some system is easy to implement but system is not accurate sufficient and trouble with measurement of bones. Before some system it is fairly accurate results obtained for real time 3D human body movements also good fidelity and low latency of system and system noise and errors with joints position are removed and due to removal of noise good results are obtained. Some techniques are used such as Gaussian Process Annealed Particle Filter, Recursive Bayesian Tracking for Articulated Objects, etc. Previous system has Less position error due to full pose inference and Longer processing time for image hence not appropriate for real time application.

IV. CONCLUSION

Different motion capture and skeleton tracking techniques, there is lot of scope for the development for the system. After conducting a survey on various motion capture and skeleton tracking technique, it is found that there is lot of scope for the development of such system this technique can widely be applied for gaming and film industry.

We have also done survey on different depth cameras presented and different NUI libraries available for development with these cameras. Hence, we conclude that using markerless motion capture for 3D human character animation using kinect camera, which takes relatively less development and processing time.

REFERENCES

[1] Aitpayev, K.; Gaber, J., "Collision Avatar (CA): Adding collision objects for human body in augmented reality using Kinect," Application of Information and Communication Technologies (AICT), 2012 6th International Conference on, vol., no., pp.1,4, 17-19 Oct. 2012.
[2] Xiaolong Tong; Pin Xu; Xing Yan, "Research on Skeleton Animation Motion Data Based on Kinect," Computational Intelligence and Design (ISCID), 2012 Fifth International Symposium on , vol.2, no., pp.347,350, 28-29 Oct. 2012.
[3] Ming Zeng; Zhengcun Liu; Qinghao Meng; Zhengbiao Bai; Haiyan Jia, "Motion capture and reconstruction based on depth information using Kinect," Image and Signal Processing (CISP), 2012 5th International Congress on , vol., no., pp.1381,1385, 16-18 Oct. 2012.
[4] Mian Ma; Feng Xu; Yebin Liu, "Animation of 3D characters from single depth camera," 3D Imaging (IC3D), 2011 International Conference on, vol., no., pp.1,4, 7-8 Dec. 2011.
[5] Colvin, C.E.; Babcock, J.H.; Forrest, J.H.; Stuart, C.M.; Tonnemacher, M.J.; Wen-Shin Wang, "Multiple user motion capture and systems engineering," Systems and Information Engineering Design Symposium (SIEDS), 2011 IEEE , vol., no., pp.137,140, 29-29 April 2011.
[6] Lucía Vera, Jesús Gimeno, Inmaculada Coma, and Marcos Fernández "Augmented mirror: interactive augmented reality system based on kinect." Human-Computer Interaction–INTERACT 2011. Springer Berlin Heidelberg, 483-486. 2011.
[7] Fern'ndez-Baena, Adso, Antonio Susin, and Xavier Lligadas. "Biomechanical validation of upper-body and lower-body joint movements of kinect motion capture data for rehabilitation treatments." Intelligent Networking and Collaborative Systems (INCoS), 2012 4th International Conference on. IEEE, 2012.
[8] J. Shotton, A. Fitzgibbon, M. Cook, T. Sharp, M. Finocchio, R. Moore, A. Kipman, and A. Blake. Real-time human pose recognition in parts from single depth images. In Computer Vision and Pattern Recognition (CVPR), 2011 IEEE Conference on, pages 1297 –1304, june 2011.
[9] Qu, Wei, and Dan Schonfeld. "Real-time decentralized articulated motion analysis and object tracking from videos." Image Processing, IEEE Transactions on 16.8 (2007): 2129-2138.

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[10] del Rincón, Jesús Martínez, et al. "Tracking human position and lower body parts using Kalman and particle filters constrained by human biomechanics." Systems, Man, and Cybernetics, Part B: Cybernetics, IEEE Transactions on 41.1 (2011): 26-37. International Journal of Computer Graphics & Animation (IJCGA) Vol.4, No.1, January 2014 39

[11] Raskin, Leonid, Michael Rudzsky, and Ehud Rivlin. "Dimensionality reduction using a Gaussian Process Annealed Particle Filter for tracking and classification of articulated body motions." Computer Vision and Image Understanding 115.4 (2011): 503-519.

[12] Bernier, Olivier, Pascal Cheung-Mon-Chan, and Arnaud Bouguet. "Fast nonparametric belief propagation for real-time stereo articulated body tracking." Computer Vision and Image Understanding 113.1 (2009): 29-47.

[13] Zhu, Rong, and Zhaoying Zhou. "A real-time articulated human motion tracking using tri-axis inertial/magnetic sensors package." Neural Systems and Rehabilitation Engineering, IEEE Transactions on 12.2 (2004): 295-302.

[14] Lee, Mun Wai, and Ramakant Nevatia. "Human pose tracking in monocular sequence using multilevel structured models." Pattern Analysis and Machine Intelligence, IEEE Transactions on 31.1 (2009): 27-38.

[15] Peursum, Patrick, Svetha Venkatesh, and Geoff West. "A study on smoothing for particle-filtered 3d human body tracking." International Journal of Computer Vision 87.1-2 (2010): 53-74.

[16] Caillette, Fabrice, Aphrodite Galata, and Toby Howard. "Real-time 3-D human body tracking using learnt models of behaviour." Computer Vision and Image Understanding 109.2 (2008): 112-125.

[17] Tong, Jing, et al. "Scanning 3d full human bodies using kinects." Visualization and Computer Graphics, IEEE Transactions on 18.4 (2012): 643-650.

[18] Chanjira Sinthanayothin, Nonlapas Wongwaen, Wisarut Bholsithi. Skeleton Tracking using Kinect Sensor & Displaying in 3D Virtual Scene. International Journal of Advancements in Computing Technology. IJACT: International Journal of Advancements in Computing Technology, Vol. 4, No. 11, pp. 213 - 223, 2012.

[19] Karina Hadad de Souza, Rosilane Ribeiro da Mota. Motion Capture by kinect. SBC - roceedings of SB ames, X SB ames – Bras lia – DF – Brazil, November 2nd - 4th, 2012.

[20] Zhang, Quanshi, et al. "Unsupervised skeleton extraction and motion capture from 3D deformable matching." Neurocomputing 100 (2013): 170-182.

[21] Shum, Hubert, and Edmond SL Ho. "Real-time physical modelling of character movements with microsoft kinect." Proceedings of the 18th ACM symposium on Virtual reality software and technology. ACM, 2012.

[22] Ilya Baran and Jovan Popovi´c. Automatic rigging and animation of 3d characters. In ACM S RA H 2007 papers, S RA H ’07, New York, NY, USA, 2007. ACM.

[23] PrimeSense Ltd., Willow Garage, Side-Kick Ltd., ASUS Inc., AppSide Ltd. OpenNITM: Introducing OpenNI, http://www.openni.org/, 2010.

[24] Microsoft Inc. Kinect for Windows: Develop What's Next, http://www.microsoft.com/enus/kinectforwindows/develop/, 2012.

[25] The OpenKinect Community. OpenKinect (libfreenect), http://openkinect.org/wiki/Main_Page, 2011.

[26] Code Laboratories Inc. CL NUI Platform - Kinect Preview, http://codelaboratories.com/nui/, 2010.

[27] WIN&I Team; Evoluce AG., INCREON GmbH. Evoluce SDK, http://www.evoluce.com/_win-and-i/en/software/overview/index.php?we_objectID=55, 2011.

[28] Delicode Ltd., NI Mate. http://www.ni-mate.com/ni-mate-v1-18-released/, 2013.

[29] MakeHuman. http://www.makehuman.org/