"Animation of 3D Human Model using Markerless Motion Capture"

Miss. Shere Sonali[1] Miss. Bansode Priyanka[2] Miss. Raut Smita[3] Miss. Kokare Supriya[4]
Prof.J.N.Ekatpure[5]
[5]Assistant Professor
[1,2,3,4,5]Department of Computer Engineering
[1,2,3,4,5]S B Patil College of Engineering, IndapurDist - Pune. SavitaribaiPhule Pune University

Abstract— Motion Capture is the recording human movement through specialised camera's and mapping them onto a character model and Motion capture involves sensing, digitizing and recording that object in motion. This paper presents a design 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.

Key words: Human Model, Markerless Motion Capture

I. INTRODUCTION

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 described the design of our system.

This paper present a design of our project .In this paper markerless motion capture method for 3D human character animation which can be useful for any HCI application similar to gaming, film industry, and many more. Motion capture and computer animation techniques have made major progress in game and film industry. 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 time. It described the UML(Unified Modelling Language)Diagram.

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.

Xiaolong Tong; Pin Xu; Xing Yan [1] described the method "Research on Skeleton Animation action Data Based on Kinect".This scehme 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.

Mian Ma; Feng Xu; Yebin Liu [2] 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 [3] 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 mehod 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.

Chanjira Sinthanayothin, Nonlapas Wongwaen, Wisarut Bholsithi [4] 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 interfence 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 [5]described the method "Motion Capture by kinect". In this system kinect has built in algorithm for identification of skeleton of human body,but their are 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. Shum, Hubert, and Edmond SL Ho [6]described the method "Real-time physical modelling of character movements with Microsoft kinect". In this systemkinematics 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. PROPOSED SYSTEM

In our proposed system, Markerless motion capture is an active study in 3D virtualization. 3D human model is formed using open source software (Makehuman). In this system markerless motion capture method for 3D human character animation which can be useful for any HCI application similar to gaming, film industry, motion analysis and many more. In markerless motion capture the performer doesn't have to be dressed in a suit, but still markerless motion capture is used. 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 time.

IV. BLOCK DIAGRAM OF PROPOSED SYSTEM

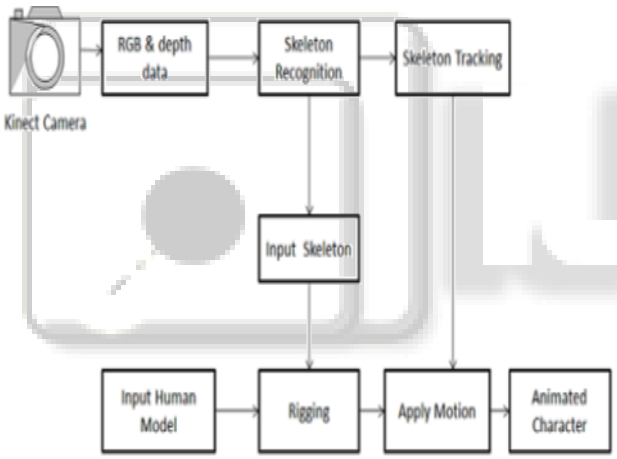

Fig. 1: System Architecture

The Figure shows the proposed methodology of our system, the system consist of the following major phases in implementation:

A. Kinect Camera:

Kinect camera allows us to produce depth, texture, user and skeleton information. Kinect camera captures the real time videos and gives output as a skeleton.

B. RGB and Depth Data:

The Kinect camera gives depth skeleton of human body. The depth information is obtained from IR cameras on kinect. The texture information is the RGB color map of the scene which can be obtained through the RGB camera on the kinect.

C. Skeleton Recognition And Tracking:

The process of extracting skeleton of the body from the input data is termed as skeleton recognition and capturing the movements of each joint position frame by frame is termed as skeleton tracking.

D. 3d Human Model Creation:

The 3D human model is created using open source software of MakeHuman and student version of Autodesk Maya. The process consists of following phases:

- Mesh model is created
- Texture is applied on the mesh
- Clothing is applied on the human model

E. Rigging:

Rigging is the process of attaching skeleton to a human model; the human model is prepared using open source software of Make Human. The joints of the skeleton need to be placed at corresponding positions on the created human model in order to map rig character skeleton with captured kinect skeleton.

F. Application of Motion Data To Rig:

Once the rigging process is completed we need to apply the motion data that we get from skeleton tracking phase to rig character to perform animation. The data obtained from skeleton tracking phase is relevant only to the position of joints

V. UML DIAGRAM

A. Data Flow Diagram:

The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system. The data flow diagram (DFD) is one of the most important modeling tools. It issued model the system components. These components klare the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output. DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction.

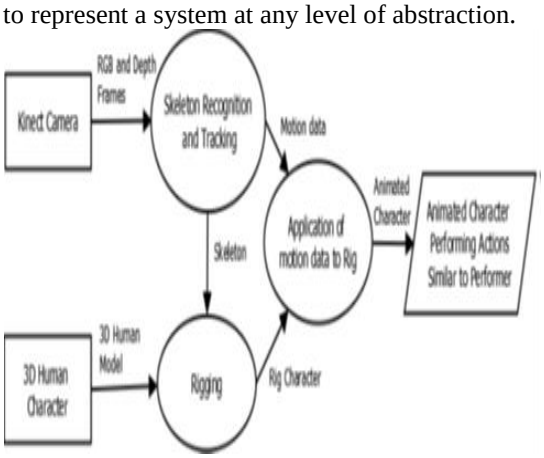

Fig. 2: Data Flow Diagram

B. Use Case Diagram:

A Use case diagram capture use-cases and actors interaction. It describes the functional requirement of the system the manner that outside interact at the system boundary and the response of the system. Provide an overview of all or part of the usage requirements for a system or organization in the

form of an essential model or business model communicate the scope of a development project.

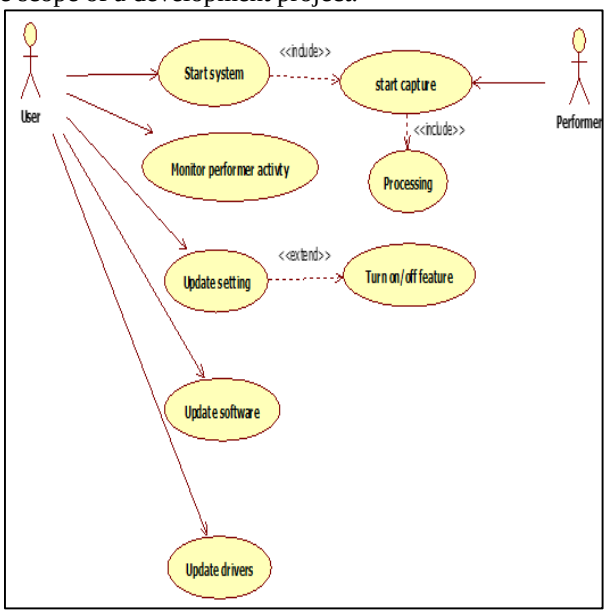

Fig. 3: Use Case Diagram

C. Activity Diagram:

An activity diagram is used for modelling dynamic feature of the system an activity diagram consist of flowchart, which shows the flow of control from of ow chart from one activity to another acitivity. In a computational process, sequential or the concurrent steps are present ,to model these sequential or the concurrent process we use activity diagram. Activity diagram done can the entire task specified by UML i.e visualize, specify, construct and document the dynamic aspect of an object. Notation:

1) Action state
2) Activity state
3) Transition
4) Branching

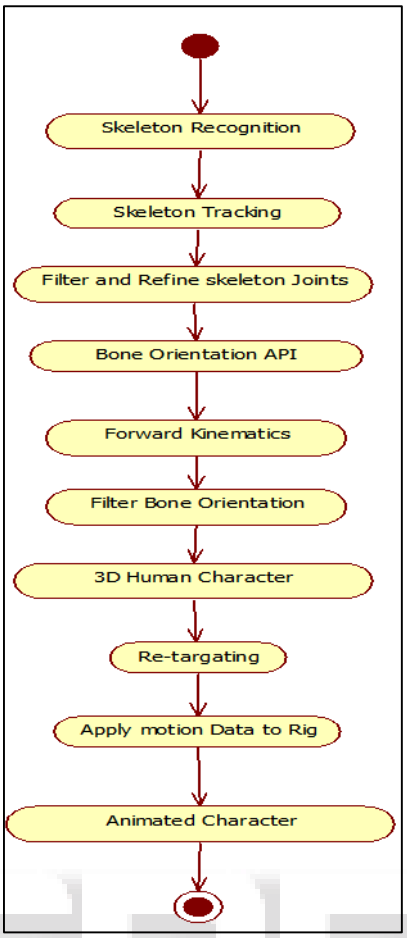

Fig. 4: Activity Diagram

D. Class Diagram:

Class diagram show a set of classes interfaces and collaboration and their relationship .Class diagram are important not only for visualizing, specifying and document structural model, but also for constructing executable system through forward and reverse engineering contents.

1) Class or object.
2) Interfaces.
3) collaborations.
4) The relationship like dependency, generalization and association.

The structure of a system by showing the systems classes, there attribute operations and the relationship among the classes.

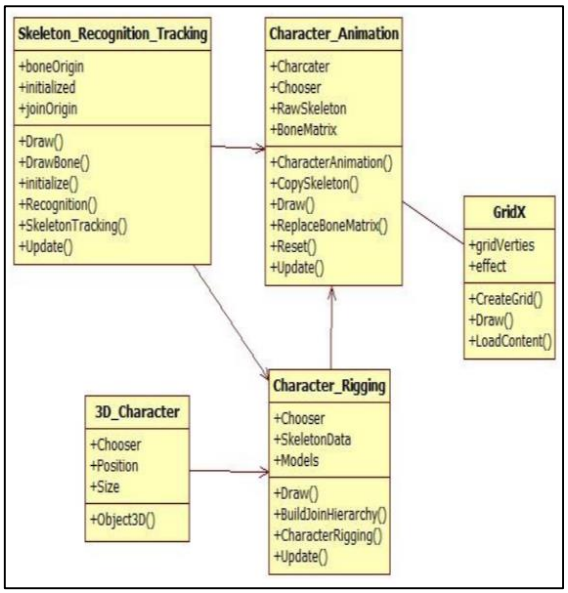

Fig. 5: Class Diagram

VI. MODULES

1) Skeleten Recogition and Tracking.
2) 3D Human Model Creation.
3) Character Rigging.
4) Application of Data to Rig.

A. Skeleton Recognition and Tracking:

In Skeleton Recognition and Tracking module, the purpose for getting human skeleton and set of tracked joints. This module performs skeleton recognition, then perform skeleton tracking with the help of MS Kinect SDK. This module contents set of 20 joints. Recognized skeleton is given to the rigging phase and tracked skeleton data is given to application of motion data to rig phase.

B. 3d Human Model Creation:

In 3D Human Model Creation module, the purpose for module will be used to display the animated character. This module contains creation of 3D Human Model. This module contents 3D Human Model. Created3D human model is given to the rigging phase.

C. Character Rigging:

In Character Rigging module, the purpose to map the recognized skeleton to the skeleton of the created 3D human character. This module contains creation rig character. This module contents 3D human mode, recognized skeleton. Created 3D human model is mapped with the recognized skeleton with proposed algorithm.

D. Application of Data to Rig:

In Application of data to Rig, the purpose of to apply motion to rig character. This module applies motion for skeleton tracking phase to rig character. This Module Contents Rig character, tracked skeleton data. Perform motion data transformation using rotation matrix to get final results.

VII. 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.

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