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# Animation of 3D Human Model Using Markerless Motion Capture

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***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 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. 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*— Computer graphics, Animation, Image processing, depth information, Rigging.**

## 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 present 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 whichis 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. 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. We apply kinect with Microsoft kinect SDK for better act, for creating a human model open source software of Make Human [7] is used.

## II. PROPOSED SYSTEM

### *A. Problem statement*

Nowadays, geometric models of a lot of real world objects are being used in games, movies, etc.To make these models look realistic, they should have natural looking movements. The movements can only look realistic only if the motion captured is natural. Solution to above problem ismaking a system which captures natural movements and applies it to a 3D character to look it realistic. So, the problem statement is to develop"Markerless motion capture for 3D character animation system transforming motion of a performer to a 3D human character, such that the 3D human model performs similar action as that of performer".

### *B. Proposed System as a solution for existing 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 paper gives a review on various existing techniques related to motion capture. In this system 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. 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.

## III. BLOCK DIAGRAM OF PROPOSED SYSTEM

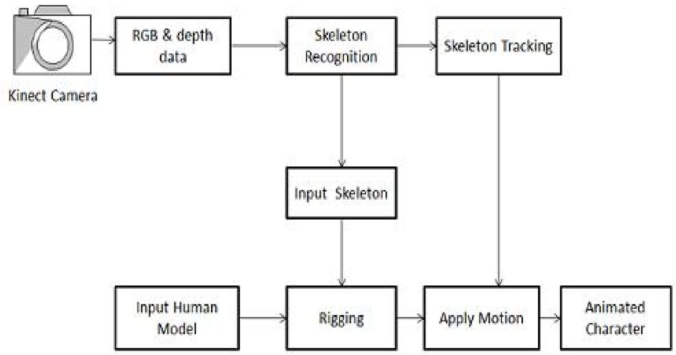


Fig: System Block diagram.

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:

*1)* Mesh model is created
*2)* Texture is applied on the mesh
*3)* 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

## IV. MODULES EXPLAINATION

### 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.

## V. EXPERIMENTAL SETUP

### A. System Requirement

1) *Hardware Requirement*
   a) Computer with Intel i5-3337U CPU @ 1.80GHz with 4 GB RAM
   b) 2 GB Nvidia Ge-Force 740M GPU 3)Xbox 360 Kinect Camera
   c) 2 GB HDD space for applications installation and execution.

2) *Software Requirement*
   a) Windows 7
   b) Microsoft Visual Studio 2010
   c) MS Kinect SDK 1.7
   d) XNA Game Studio 4.0

## VI. FLOW OF PROJECT

The Inputs are taken from kinect camera passed to skeleton recognition phase. In rigging phase skeleton is given as input from which the raw skeleton joint positions are filtered, than raw skeleton joint positions are passed to bone orientation API, next we calculate bone orientation using forward kinematics. The bone orientaion are contained and filtered, next the bone oreintaion are re targeted to the bones in the 3D model mesh for animation. The output of rigging phase is rig character which is given as input to the application of motion data to rig phase, in which motion data is taken from the skeleton tracking phase and applied on the rig character to perform animation.

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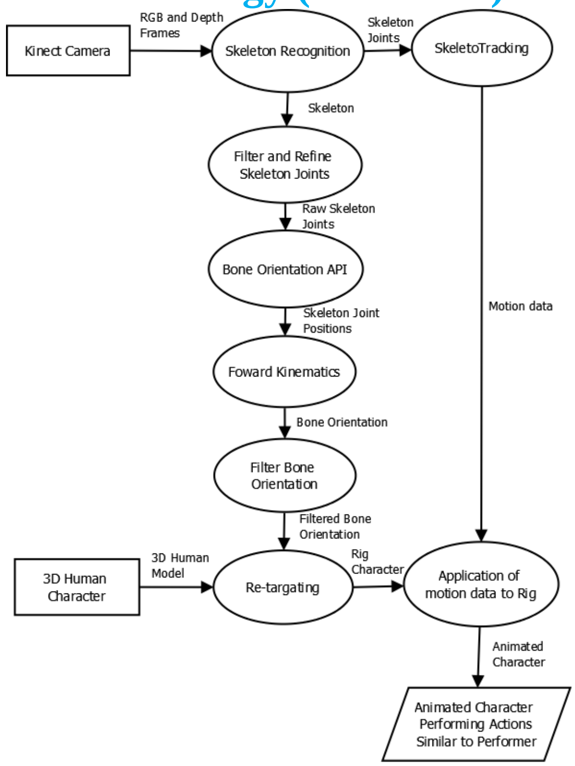


Fig. Flow of Project

## VII. MATEMATICAL MODEL

Let S be the system that describes method to perform human character animation.

$$S= \{I, O, F, Su, Fa / \phi_S\}$$

where

*A.* Let Ibe the input to the system.

*B.* O is output of the system.

*C.* F is set of functions.

*D.* Su is success of system.

*E.* Fa is failure of system.

### *F. Input*

1) I is the input set such that

– $I = \{R, D\}$.

– $R = \{r_1, r_2, r_3 \ldots. r_n\}$, set of RGB image frames.

– $D = \{d_1, d_2, d_3 \ldots. d_n\}$, set of depth image frames.

### *G. Output*

1) O– Animated character which performs same action as that of the performer.

### *H. Functions*

*1)* F is a set of functions where.

– $F = \{ST, RI, AM\}$

*2)* ST is skeleton recognition and tracking function.

– $ST = \{j_1, j_2, j_3 \ldots.. j_{20}\}$, set of tracked skeleton joints.

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3) RI is rigging function.
4) AM is Application of motion data to rig character function.

–Let Y be the Transformed matrix such that

Y = AX

Where Y, X are the transformed and original vertices respectively and A is the rotation matrix.

$$R(j) = \prod_{i=1}^{n} M(v, \theta)$$

*I. Success*

1) Character performs similar action as that of the performer.

*J. Failure*

1) Character does not perform any action.
2) Character performs dissimilar action.

## VIII. RESULT AND SCREENSHOTS

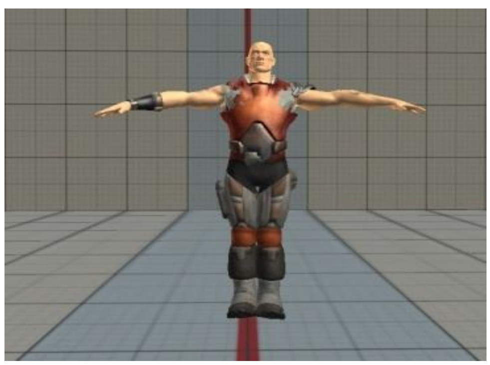

Fig: User Interface

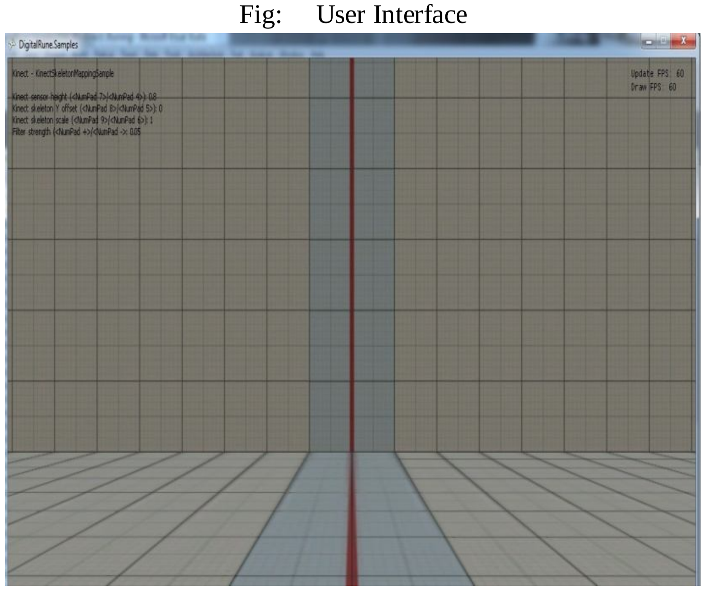

Fig : Skeleton mapping to 3D human model created using Autodesk Maya

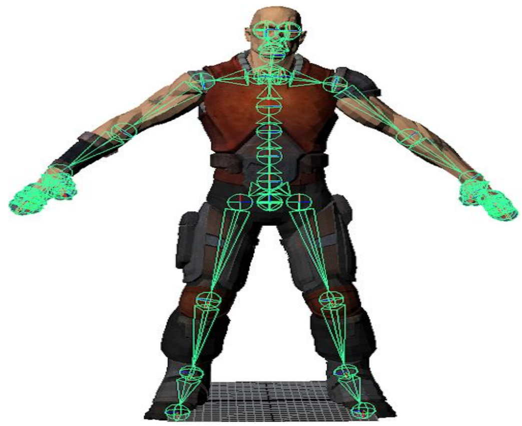

Fig: Human skeleton joints model obtained from Kinect SDK

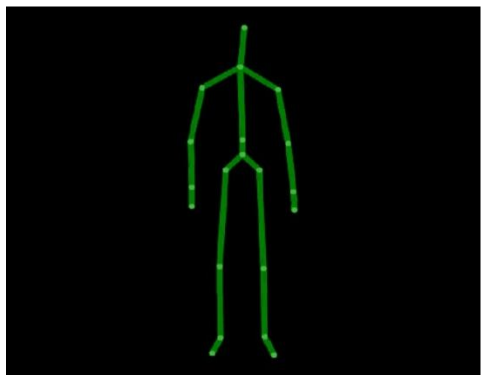

Fig: Human skeleton joints model obtained from Kinect SDK

Throwing

One hand wave

Jumping

Kicking

## IX. CONCLUSION

Different motion capture and skeleton tracking techniques ,there is lot of scope for the development for the system. The 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 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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