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Research paper

Implementing Robots in Defence Through Motion Capture with Mixed Reality

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Abstract

Our soldiers are fighting for us, risking their lives and people working in mines spoiling their health. In this paper we will see how we will implement the technology of mixed reality and motion capture will give solutions for replacing humans with robots. We can save a lot of lot of human lives and it will be more cost efficient. As on today we are implementing motion capture in analyzing the responses of military soldiers to test their capabilities and doing animations in movies. So let us extend the existing features to implement a remote robot control system that allows us to replace humans with robots.

Keywords: *Motion capture suit, Accelerometer, Robots, Motion Capture, Virtual Reality, Augmented Reality.*

1. Introduction

We can observe the world changing so rapidly. The technology is evolving day by day. Today's world is creating our own ideas and going inside them and design our own world [1]. The technology that is allowing us to bridge the gap between the virtual world and the real world is virtual reality. By scanning the real world data and performing actions as per the scanned data is called augmented reality [2]. Here is a small example of a augmented reality application, We will give a image to the computer and we will program the computer on what to do when it scans the application, from then whenever the computer see that image with that camera it will perform those calculations[3]. Virtual reality is used for architectural visualization, as a gaming platform, Education [4]. Augmented reality is today being used for teaching complex lessons with visual 3d models and animations.

The motion capture technology will send our skeletons data (i.e. the orientation of our skeleton, i.e. the location, rotation).A simple application of motion capture application is the animated movies and video games that we play [5]. In the next phase of this paper we will see how further this motion can capture technology can used [6]. Robotics is the word we hear every day as an engineer. This is a field where we will be implementing robots instead of a human for doing repetitive jobs [7]. Sensors are the physical devices that we will use to determine a physical entity [8]. Well there are several ways we can implement the motion capture technology in several ways [9].

The proposed method is to design human controlled intelligent devices which will work like soldiers during war time. The research work is carried out to save humanitarians by Substituting human beings with Robots. The Robot will act exactly person who is controlling it, Regardless of the place of that person i.e. Soldier can do control from a remote location and all the fighting will be done by the robot. We will combine the concepts of remote controlled robot arm with motion capture and will generate a wireless motion controlled robots.

2. Literature Survey

Remote controlled robots are being implemented in various fields like medicine, automobile industries. Mastura binti Muhammed et.al (2006) was introduced MR-999-E wireless robotic arm. It has modified a remote OS (Operating System) for a robotic arm by means of infrared sensors to remote monitoring [10]. It has a constraint where the infrared can only communicate in a small range. Stevens J et. al (2015) was particularly focuses on provide work for the optimal visual basic in virtual and mixed reality simulations [11]. Amorim et al (2013) this paper is worked on training to guarantee order and law at the same time, get ready soldiers and officers for interventions even in urban areas[12][13]. To allow such training, this service counts with physical built sites to allow soldiers to train how to get inside houses, how to shoot at short ranges ,how to move and shelter while going up in a hill with many houses and corridors on the way. Joaquin Ortiz et. al. (2005) focused on a robotic arm that can differentiate a colour for a golf ball using LabVIEW as a program to control the robot [14]. On the other hand, LabVIEW becomes inefficient when designing complex control algorithm and this will affect the results of the system [15]. Liarokapis et al (2015) this paper worked on the angles for a 3D representation of the human arm. The angles thus obtained are sent using a serial communication port to the Arduino microcontroller, which in turn generates signals which are sent to the servo motors [16]. The servo motors rotate based on the angles given as input. The combined motion of the servos results in a complete Robotic arm movement which is a mimic of the human arm movement. Megalingam et al (2013) in this structure observes the motion of the user's arm using a Kinect [17]. The skeletal image of the arm obtained using the “Kinect Skeletal Image” project of Kinect SDK, consists of three joints and links connecting them. In this system there are some components which directly interacts with users such as sensors, actuators etc plays a major role [18]. Users manipulate data through these components [18].

We can implement it using a smart suit or we can implement it using real time depth sensors such as Kinect sensor or readily available smart suits. Now we will start discussing about the applications that can be used. We will first start with the data flow sequence.

3. Implementation

Methodology: The data from motion capture suit will be received into unreal engine-4. By using the unreal engine 4 we will store the data of the skeleton such as position and rotation of bones into a cloud database, Data will be uploaded. This cloud database will be accessed by the robot and the robot will check the orientation of its skeleton. It will have a delta function which will calculate the difference in orientation of the bones with the data it receives. Then as per the result of information from the delta function the robot will know the calculations that it need to perform in order to exactly replicate the human skeleton data that it will receive.

In figure 1 shows data flow sequence of the proposed work. The robot will have a 360 degree camera. The 360 degree camera will stream the data to the mixed reality device .The robot will send the video data into cloud .Now, the application on the user system will access the cloud database and takes the video and display it via the mixed reality device.

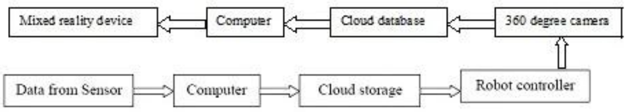

Figure 1: Data flow sequence

The position, rotation and movement of the robots will be tracked by using gyroscope

Algorithm for synchronizing robots skeleton data with human skeletal data

Step1: get into an infinite loop.
Step2: get the skeletal data through motion capture.
Step3: Send it to cloud storage.
Step4: Robot controller should access the cloud storage
Step5: Calculate the difference between the orientation of the robot and the skeletal data of the robot.
Step6: Change the orientation of the robot skeleton such that it matches the orientation of the human skeleton.
The orientation of the algorithm is shown in figure 2.

4. Experimental Results

LEFT LEG ORIENTATION 1:
Translation: X=-747.948; Y=358.812; Z=198.658;
Rotation: P=74.975349; Y=-6.116202; R=85.905746
Scale: X=1.000; Y=1.000; Z=1.000
LEFT LEG ORIENTATION 2:
Translation: X=-754.910 Y=357.337 Z=190.549
Rotation: P=19.244488 Y=-3.306334 R=85.766190
Scale: X=1.000; Y=1.000; Z=1.000
LEFT LEG ORIENTATION 3:
Translation: X=-808.125 Y=361.939 Z=189.649
Rotation: P=13.699016 Y=-2.800477 R=87.720711
Scale: X=1.000; Y=1.000; Z=1.000
RIGHT LEG ORIENTATION 1:
Translation: X=-752.058; Y=378.326; Z=192.364;
Rotation: P=-85.344604 Y=-158.969406 R=-107.629066;
Scale: X=1.000; Y=1.000; Z=1.000
RIGHT LEG ORIENTATION 2:
Translation: X=-755.751; Y=380.589; Z=185.959;
Rotation: P=-28.117653; Y=-177.042282; R=-93.128624;
Scale: X=1.000; Y=1.000; Z=1.000
RIGHT LEG ORIENTATION 3:
Translation: X=-808.405 ;Y=376.774; Z=184.261;
Rotation: P=-44.200928 Y=179.734100 R=-84.927734;
Scale X=1.000 Y=1.000 Z=1.000
NECK ORIENTATION 1:
Translation: X=-749.172; Y=368.652 ;Z=281.361;
Rotation: P=79.874191; Y=20.284521; R=113.799759
Scale X=1.000 Y=1.000 Z=1.000
NECK ORIENTATION 2:
Translation: X=-745.790; Y=368.021; Z=277.561
Rotation: P=81.947327; Y=19.093269; R=111.823235
Scale X=1.000 Y=1.000 Z=1.000
NECK ORIENTATION 3:
Translation: X=-746.839; Y=373.060; Z=282.840
Rotation: P=81.757683; Y=-5.845208; R=85.839424
Scale X=1.000 Y=1.000 Z=1.000
NAMING CONVENTION:
X,Y and Z are translation and scale values of coordinate.
X- X coordinates
Y- Y coordinates
Z- Z coordinate
P, Y and R are rotation along with X, Y and Z axis.
P-rotation along X axis
Y-rotation along Y axis
R-rotation along Z axis

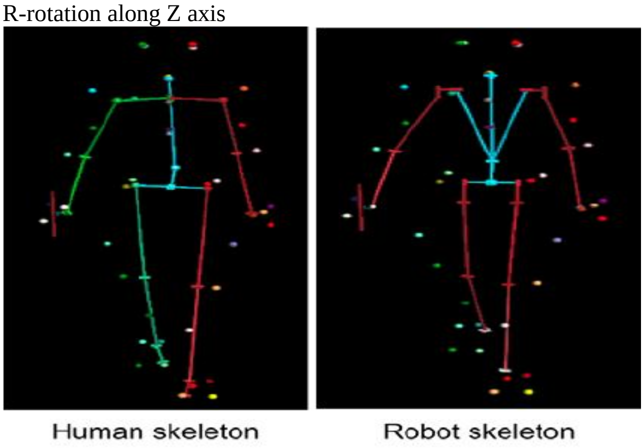

Figure 1: synchronizing human skeleton data with robot skeleton data

5. Applications

Our proposed algorithm is also applicable to the real life application such as

5.1. Substitute Humans via Robots

In this part of application we will take the data from motion capture devices and we will store the data from motion capture in cloud. Generally data is the data from the depth sensor, which includes the skeleton offset, bones rotation etc. This data will be received on the other side by accessing the common cloud storage. The data from the common storage will be sent into the control system of the robot. The control system will calculate the difference between the present position and orientation of the robot and the data from the cloud. Then it will do the necessary movement operation to get the desired orientation of skeleton of the robot. With the above application we can send robots for construction works. This application will be used in meetings. Rather than travelling large distances for attending a meeting one can use this application.

By using the above concepts we can implement robots in military where people will fight from a very place which is at a far away distance from the battlefield. Since motion capture is limited to a limited place joysticks can be used for performing movements. If soldiers are trained in operating such kinds of robots then there will be no need for a human being to be in a war field.

5.2. Real time Military training via battle field simulation

Soldiers by using above technologies will be sent into virtual battlefield and can be tested on their behaviour in a battle. The experience from mixed reality will be close to our real world. Like the multiplayer games we play soldiers can be divided into two groups and they will fight with each other. In countries like Brazil military simulations are already in implementation. At present they are giving some static data and are device do calculations on data and produce several results like illusion of an enemy being present etc. By implementing networking and motion capture to create a multiplayer environment we can generate a real time war situation where a soldier will fight against another soldier.

5.3. Using Mixed reality in Education

Mixed reality with motion capture can be used to simulate operations. Showing students practically in 3d about what they read. This will help them to visualize what they learn and enhance their understanding capabilities.

6. Conclusion

This paper is mainly works on the effective utilization of mixed reality and motion capture. In this paper Robot will operate accurately human who is controlling it, in spite of the place of that human i.e. Soldier can do control from a remote location and all the fighting will be done by the robot. It is combination of remote controlled robot arm with motion capture and will create a wireless motion controlled robots. We can make robots to perform dangerous tasks like fighting a battle, working in coal mines, working in constructions through manual control. This paper is also used for architectural visualization, as a gaming platform, Education (for teaching complex lessons with visual 3d models and animations) and film industry.

References

[1] Jacky C.P. Chan, Howard Leung, Jeff K.T. Tang, and Taku Komura," A Virtual Reality Dance Training System Using Motion Capture Technology", IEEE TRANSACTIONS ON LEARNING TECHNOLOGIES, VOL. 4, NO. 2, APRIL-JUNE 2011.

[2] Chris Bregler," Motion Capture Technology for Entertainment", IEEE SIGNAL PROCESSING MAGAZINE NOVEMBER 2007.

[3] D. Vlasic, R. Adelsberger, G. Vannucci, J.Barnwell, M. Gross, W. Matusik, and J. Popovic´,"Practical motion capture in everyday surroundings,"in *Proc. SIGGRAPH 2007, ACM*, San Diego,CA, 2007.

[4] S. Yabukami, H. Kikuchi, M. Yamaguchi, K. I. Arai, K. Takahashi, A. Itagaki, N. Wako. "Motion capture system of magnetic markers using three-axial magnetic field sensor". IEEE Transactions on Magnetics, Vol: 36, Issue: 5, pp: 3646-3648. 2000.

[5] C. Chu, O. C. Jenkins, M. J. Matarie. "Markerless Kinematic Model and Motion Capture from Volume Sequences". Proceedings of IEEE Computer Vision and Pattern Recognition, Vol: 2, pp: 475-482. 2003.

[6] B. Rosenhahn, T. Brox, H. Seidel. "Scaled Motion Dynamics for MarkerlessMotion Capture". IEEE Conference on Computer Vision and PatternRecognition". 2007.

[7] Ascencion Technology. "MotionStar (Tethered Model)". 2011.

[8] J. Shotton, A. Fitzgibbon, M. Cook, T. Sharp, M. Finocchio. "Real-Time HumanPose Recognition in Parts from Single Depth Images". Computer Vision andPatter Recognition. 2011.

[9] Michael Gleicher," Animation From Observation: Motion Capture and Motion Editing", Computer Graphics 33(4), p51-54. Special Issue on Applications of Computer Vision to Computer Graphics.

[10] Muhammed, Mastura, Mohd Muji, Siti Zarina, Siti Rozaini Zakaria, and Mohd Zarar Mohd Jenu. "MR999-E wireless robotic arm." (2006).

[11] Stevens, J., Kincaid, P., & Sottilare, R. (2015). Visual modality research in virtual and mixed reality simulation. The Journal of Defense Modeling and Simulation, 12(4), 519-537.

[12] Insinna, V. Defense simulation firms turn to commercial sector for inspiration. National Defense, February2014, pp. 20–21.

[13] Amorim, J. A., Matos, C., Cuperschmid, A. R., Gustavsson, P. M., & Pozzer, C. T. (2013). Augmented reality and mixed reality technologies: Enhancing training and mission preparation with simulations. In NATO Modelling and Simulation Group (MSG) Annual Conference 2013 (MSG-111), 2013.

[14] Joaquin Ortiz, Ivan Godinez, Rosa I. Peña and Immanuel Edinbarough.(2005). Robotic Arm Vision System. Texas, United State

[15] Cyberbotics Ltd. Webots™: Professional Mobile Robot Simulation Olivier Michel

[16] Liarokapis, M.V., Artemiadis, P.K., Kyriakopoulos, K.J. Mapping human to robot motion with functional anthropomorphism for teleoperation and telemanipulation with robot arm hand systems

[17] Megalingam, Rajesh Kannan, Nihil Saboo, Nitin Ajithkumar, Sreeram Unny, and Deepansh Menon. "Kinect based gesture controlled Robotic arm: A research work at HuT Labs." In Innovation and Technology in Education (MITE), 2013 IEEE International Conference in MOOC, pp. 294-299. IEEE, 2013.

[18] Pachipala yellamma,v saranya manasa,a ramya,g.v Kalyani,challa Narasimham," controling and monitoring home Appliances through cloud using IoT",PONTE International Journal of Sciences and Research, Vol. 74 | No. 2 | Feb 2018 DOI: 10.21506/j.ponte.2018.2.8