Artificial Intelligence and Biomechanics Method for Designing Robosoldier

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Abstract: ***In this paper the principle of biomechanics and artificial Intelligence are used in the design of robo soldier. The whole the structure is designed in such a way humans can use the structure with ease. Any artificial system should be designed in similar to the human anatomy. This paper gives the complete details of the design of robosoldier.***

Keywords: Robosoldier, FEM & AI.

I. INTRODUCTION

For many years numerous types of robo were designs were created for many application. Today the robo is applied in the field of Medicine, Military applications, Space research and in almost all the field. In medicine the robot is used surgery, particularly heart surgery, knee alignment, brain surgery[1]-[2]. The human hand can do excellent surgery, when it comes to brain, even a small movement will result in a wrong surgery and it may affect the vital organs of the human body. Placing the heart valve is one of the important aspects of the surgery[3]-[4]. The robots can do precision surgery and this helps the success of the surgery. In nuclear field the robots are used to replace nuclear fuels in the nuclear plant. In military the robot can penetrate the enemy territory without life loss of the soldier[5]-[6]. There is a very high difficult in the design of the robot. Most of the designs are failures because the Biomechanics principles and Artificial Intelligence techniques are not used in the design of the robot[7]-[8].

II. MATERIALS AND METHODS

The robot soldier is designed keeping in view the principles of biomechanics. The robot is designed for 24 degrees of freedom. Special motors are designed for the movement of the arms, fingers and legs of the robot. The human bone and muscle movements are measured using instruments and their reach is measured and workspaces are measured. This knowledge is used in the biomechanical design of the robot. The dynamic movement and static load of the robot are calculated[9]. The gait analysis of the robot is carried out similar to the human gait. Experiments are carried out with humans, the gait of the humans are traced. This gait is transferred to the robot.

In this paper the robosoldier is designed, the requirements of the robosoldier are analyzed and specifications are identified. The payload carried by the robot and actions to be carried during war and combat are identified specified. The material used for the manufacture of the robot should be strong at the same time strength to weight ratio should be maintained. In order to make the robot think similar to the human's artificial intelligence is used in the design of the robot. Speech recognition is one of the important parameters in the warfare using robosoldier. The robosoldier should work with the human soldiers in the battle field. So the human soldiers and robosoldiers should communicate.

III. FABRICATION OF ROBOSOLDIER

Fig. 1.Robosoldier .

The fabricated robosoldier is shown in the figure1. It consists of 24 degrees of freedom. A camera is fixed in the head of the robot. This gives the eyes to the robot. A receiver is placed in the robot. This is used as the ear of the robot. The specialized motor is used for various movements of the robot similar to the human gait movement.

The flow chart in figure 2 shows the robo soldier commands, these commands are programmed and stored in the microprocessor of the robot. In the first step initialization of the robo soldier is carried out. Next collection of warzone data and the environment data are collected. In the next step the data are collected and stored are input to the artificial intelligence system. Next the biomechanics simulation data stored in the library of the robo soldier memory. Speech recognition and image

Revised Manuscript Received on December 16, 2019.

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processing of the environmental data are carried out.

The commands within the group and the commands given by the head command also execution is also shown in the flow chart.

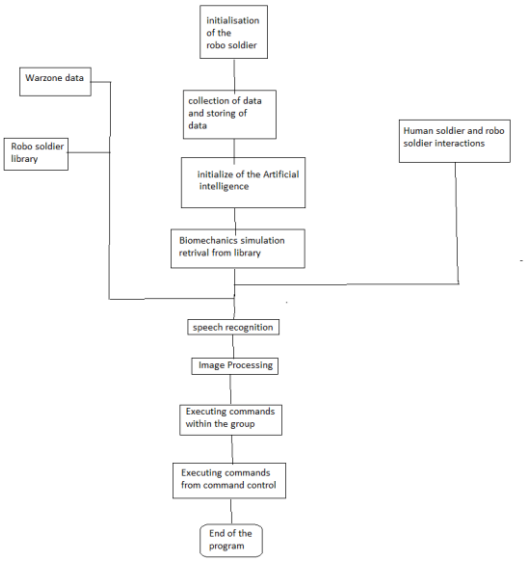

Fig. 2.Flow chart robo soldier commands .

The applications of AI "input" to an AI algorithm gather war zone information in hourly basis and search for enemy formation and tanks and artillery weapons patterns and general changes in war zone. Algorithms (data mining) search data for patterns based on mathematical theories of learning. The robot soldier communicates with the human soldier with biometric identification. Speech recognition with the group. Learning algorithms are used to analyze the surroundings and store the data in the library. Learning algorithms can learn the matching process by analyzing a large library database off-line, it can improve the performance of the Artificial Intelligence.

IV. RESULTS AND ANALYSIS OF THE PERFORMANCE OF ROBOSOLDIER

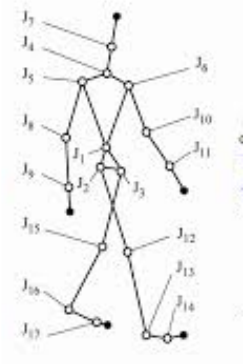

Fig. 3.Experiments using pointers to capture the gait.

The figure 3 shows the markers fixed on the human and he is made to walk with the marker. The markers information is stored in the computer. A simulation study is carried out on the gait and it is transformed to the robosoldier. The joints are identified on the skeletal system of the human. Markers are placed on the joints, using high definition cameras, the joints movements are captured. These stored movements are stored in the microprocessor of the robosoldier. These movements are fed to the joints of the robo soldier.

Specialized motor used for joint movements are controlled by the microprocessor. The movements of the robosoldier and captured videos from human movements are compared; any deviation between the human and robo-soldier are corrected using a feedback system connected to a microprocessor. The robosoldier is trained till the perfect movement is achieved.

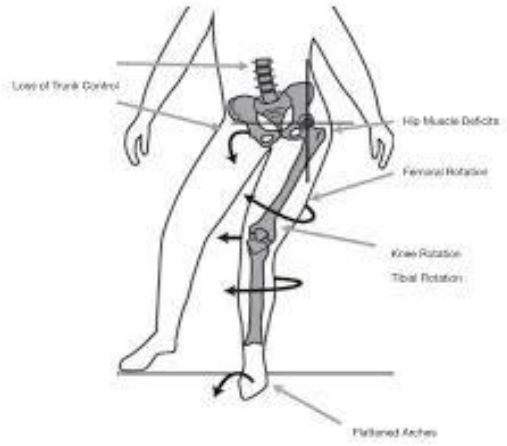

Fig. 4.Load falling on the lower part of the body.

The figure 4 shows the load falling on the tibia and femur of the human during movement. This information will be useful in the design of the robo soldier.

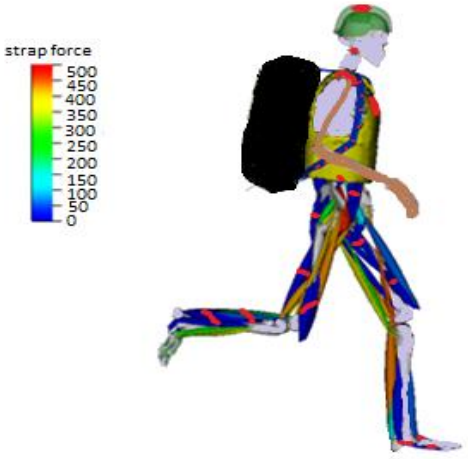

Fig. 5. FEM Analysis of Back bag carried by the Robosoldier.

The figure 5 shows the finite element design of the load carried by the soldier during walking, that is the dynamic

movement of the soldier. The load carried by the soldier can range from 0 to 200 kg. Figure 5 shows the results of finite element analysis using ANSYS WorkBench 15 of the robosoldier reveals the various stresses acting on the robosoldier. The red color on the robosoldier indicates maximum stress acting at that point on the soldier. The stresses are maximum at the center of the head where the helmet is placed. The tibia, femur of the robosoldier shows red marks which indicates high stress at that point of the robosoldier. The neck, toe and shoulder of the robosoldier indicate red color, where high stress levels occur.

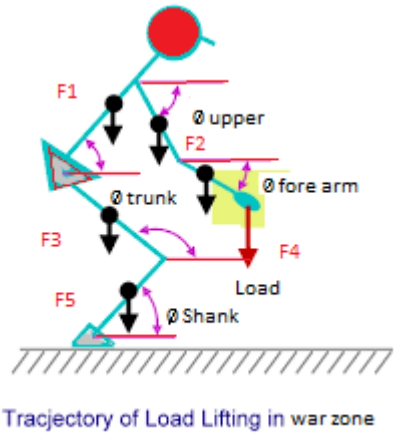

Fig. 6.Trajectory of load lifting in war zone.

The figure 6 shows upper arm load, the trunk load, fore arm and shank movement. The various loads acting on the robosoldier during squatting. The trajectory of the robosoldier during sqatting is shown in the figure:6. Based on the above load diagram, a simulation study is carried out on the robo movement during weight lifting.

V. CONCLUSION

It is concluded that the robosoldier can be designed as per biomechanics and artificial intelligence approach. These robots designed to mimic the human soldier and to help the human soldier in the warzone.

REFERENCES

1. M. Vukobratović ,B. Borovac " Zero-moment point—thirty five years of its life", *International journal of humanoid robotics*,*Mar*.2004 , Vol.1,No.01,pp.157-73.
2. T. McGeer, " Passive dynamic walking",*I. J. Robotic Res*,Vol.9.No.2,Apr.1990,pp-62-82.
3. S. Collins ,A. Ruina ,R. Tedrake ,M. Wisse," Efficient bipedal robots based on passive-dynamic walkers", *Science*, Vol.307,No.5712, feb.2005, pp.1082-5.
4. R. Playter,M. Buehler ,M. Raibert ," BigDog", *International Society for Optics and Photonics*,Vol.6230,May.2006,pp.62302O.
5. J. Rebula , F. Canas ,J. Pratt ,A. Goswami ," Learning capture points for humanoid push recovery", *IEEE-RAS International Conference on Humanoid Robots*, Nov. 2007 ,pp. 65-72.
6. B. Verrelst ,R. Van Ham ,B. Vanderborght,F. Daerden ,D. Lefeber , J. Vermeulen , "The pneumatic biped "Lucy" actuated with pleated pneumatic artificial muscles", *Autonomous Robots*, ,Vol.18,No.2, Mar.2005, pp.201-13.
7. T. Minato, Y. Yoshikawa, T. Noda, S. Ikemoto, H. Ishiguro, and M. Asada, "CB2: A child robot with biomimetic body for cognitive developmental robotics", *IEEE-RAS International Conference on Humanoid Robots* , Nov.2007,pp. 557-562.
8. S. Nishio ,H. Ishiguro ,N. Hagita ," Geminoid: Teleoperated android of an existing person", *InHumanoid robots: New developments*,Jun. 2007
9. P.Sathish kumar, R. Ramadoss,"INVESTIGATION OF MECHANICAL PROPERTIES AND TRIBOLOGICAL BEHAVIOUR OF BAGASSE FIBER REINFORCED POLYMER COMPOSITE", *International Journal of MC Square Scientific Research*, Vol.9, No.2, 2017,pp.86-96.

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