Glimpse of Humanoid Robot Assembly

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Abstract- **Humanoid robots are those looking like their movement and working like individuals having capacities of doing everyday exercises like man and supplant him every which way. these exercises fluctuate from day by day exercises for example strolling standing and bowing to staircase climbing running and stooping. the ebb and flow look into incorporates numerous advancements and strategies inside a framework for example 3d printing inverse kinematic programming power gadgets control framework learning calculations mechanical design human-pc cooperation programming apparatuses for collective undertakings. a definite mechanical plan methodology has been completed in cad alongside its auxiliary investigation in fea. pursued by kinematic and dynamic examination of the framework considering reasonable physical properties in v-rep.**

Index Terms- **Servo Motors, 3D printing, Inverse Kinematics, Electronics, FEA analysis, DC battery, Arduino controller**

I. INTRODUCTION

Humanoid robot is another class of mobile robots which resembles human behavior in appearance and also in motion. Lately robots

have been designed which are replica of human face and show expressions similar to human beings, whereas some are designed for user friendly interactions or use to perform delicate tasks impossible to carry out by man. If these robots resemble in terms of material texture or physical appearance then these may be called as Android robots. Currently the robots developed are costly very costly and undergo a sophisticated process for manufacturing. For example robots like Honda Asimov & Fujitsu HOAP fall under the category of expensive designed by well-funded companies and research labs. Due to advancement in material science, cheap manufacturing of motors & batteries, small sensor systems and increase in processing

capabilities of embedded systems led to a new era of tiny affordable robots such as Hansa Ram, Manus, Tao-Pie-Pie and many more are being developed by hobbyists all across the world.

Goals have been set for the future that in 2050, a team of humanoid robots will compete with the winner of the football in Soccer. Darpa also is planning to create contest related to humanoid robots which can perform tasks as complicated as humans can do. Many innovations and technological advancement can been seen developed by research labs and universities

Considering the situation, it should be our duty to develop an effective and advanced robot that can easily be built and get acquinted in to our lives. Still development of complete humanoid alone is a challenging task but nothing is impossible. But the major challenge is control of walking motors and stabilizing the robot on its own.

Biped robots are a part of humanoid robots where the focus is primarily given on the walking motion analysis of the robot. Many several such attempts have been made since 1993 to develop a smooth uniform walking characteristic replicating human way of walking. [2-5] J. Yamaguchi, A. Takanishi and I. Kato presented their research on Biped motion in which three axis moment was compensated in IEEE in Japan.

A well-known humanoid robot till now is ASIMO Honda which has been developed by the company Honda and was released in 2000. But Honda has developed various prototypes before the ASIMO robot and many of them failures. It took them a decade to actually develop this wonderful robot which has unimaginable specifications. In 1996they revealed their robot which had the self-regulating feature and was known for first of its kind. Consecutive improvement and development made ASIMO the best of all the robots and the humanoid

robots. This robot can perform tasks like running, climbing and a lot more.

CONFIGURATION DETAILS

17 DOF Humanoid Robot from Robokits comes with 17 degrees of freedom joints. Its ac 17 Metal Gear Standard Servo (or) Servo Economy. This Humanoid Robot is controlled by ARDUINO UNO R3 BASED USB 18 SERVO CONTROLLER (Optionally available with Bluetooth). It can also be controlled by PC using USB 18 Servo Controller Software. The software helps to develop the complex sequences in real time on the hardware. It also generates Arduino based code for the developed sequence which can be deployed on the controller on board thereby making the robot autonomous.

The power requirement for this robot is 5 to 6V DC 10 Amp power supply. It could be either battery or a AC power supply rated at 5-6VDC. You can also use a modified computer SMPS supply, it is available for sale on Robokits website. The detailed features of the Servo Controller are:

- Control 18 hobby servos from PC and Microcontroller
- USB interface
- Comes Pre-loaded Arduino Uno bootloader
- Software exports servo sequences to Arduino Uno for running servo sequences
- Independent range setting for each servo
- Independent offset, Maximum, Minimum and Direction setting for each servo
- 0.5-microsecond resolution
- 50 Hz update rate
- Small size of 80 X 47 mm
- Plug and Play, Auto detection of hardware
- Easy to use software
- Servo sequencer with speed, delay, goto and many other features

1. M4 x 12 Screw - M4 Screw
2. M4 x 12 Screw Nut - M4 Nut
3. 3 x 6 Servo Screw - Servo Screw
4. Miniature Ball Radial Bearing - Bearing
5. 3 mm Nylock Nut - Lock nut
6. 3 mm Nut - Nut
7. 3 x 6 Button Head Screw - Small Button Screw
8. 3 x 10 Button Head Screw - Big Button Screw

9. 3 x 6 CSK Screw - CSK Screw
10. M3 x 8 Screw - M3 Mid Screw
11. Metal Horn for Servo 25T - Servo Horn
12. Metal Gear Standard Servo (or) Servo Economy - Servo Motor
13. Multipurpose Aluminium Standard Servo Bracket - Multipurpose Bracket
14. Short U Shape Aluminium Servo Bracket - Short U Bracket
15. Long U Aluminium Servo Bracket - Long U Bracket
16. Oblique U Shape Aluminium Servo Bracket - Oblique U Bracket
17. Interconnect Aluminium Servo Bracket - Interconnect Bracket
18. L Shaped Interconnect Servo Bracket - L Shaped Bracket
19. Large U Beam Aluminium Servo Bracket - Large U Bracket
20. Robot feet Aluminium Servo Bracket - Robot Feet

Step 1: Take 2 x Robot Feets, 2 x Multipurpose Brackets, 8 x Lock Nuts and 8 x CSK Screws. Fix the Multipurpose Brackets on the Robot Feets with the help of CSK Screws and Lock Nuts.

Step 2: Now take 2 x Short U Brackets, 2 x Servo Horns, 8 x Servo Fix the Servo Horns with the help of Servo Screws.

Step 3: Fix the Short U Brackets on the Multipurpose Brackets as shown in following image by using 2 x M3 Mid Screws, 2 x Lock Nuts, and 2 x Bearings shown in the Black Boxes.

Step 4: Now take 2 x Servo Motors, 8 x M4 Screws and 8 x M4 Nuts. Fix the Servo Motors in the assembly with the help of M4 Mid Screws and M4 Nuts. Now the Black Box shows the Servo Screw which is to be fixed to Servo Motor Shaft after Neutralizing the Servo Motor. To Neutralize connect the Servo Motor to Servo Controller. Power up Servo Controller with 5 to 6 VDC power supply and connect to PC software with USB or Bluetooth connection. Neutralize the servo (Put the servo to center position) using software. After that tight the Servo Screw (Shown in Black Box) to the Shaft of the Servo Motor

Step 5: Now take 2 x Multipurpose Brackets, 8 x Big Button Screws, and 8 x Lock Nuts.   Fix the

Multipurpose Brackets with Big Button Screws and Lock Nuts.

Step 6: Now take 2 x Oblique U Brackets, 2 x Short U Brackets, 8 x Big Button Screws and 8 x Lock Nuts. Fix the Oblique U Bracket with Short U Bracket with Big Button Screws and Lock Nuts.

Step 7: Now take both the structures assembled 2 x Servo Horns, 8 x Servo Screws, 2 x M3 Mid Screws, 2 x Lock Nuts and 2 x Bearings.

Step 8: Now take 2 x Servo Motors, 8 x M4 Screws, 8 x M4 Nuts and the structure assembled in previous step. This Servos are to be fixed on the Multipurpose Brackets .Fix the Servo Motor on the Multipurpose Brackets as seen in the below image. Neutralize the Motor and then tight the Servo Screw on the Motor Shaft. The Servo Screws are shown in the Black Boxes.

Step 9: Now take 4 x Multipurpose Brackets, 2 x Interconnect Brackets, 16 x Small Button Screws and 16 x Nuts

Step 10: The two structures that we have assembled. To connect both of them we need 2 x M3 Mid Screws, 2 x Lock Nuts (image shows nuts but you can use Lock Nuts), 2 x Bearings. Also we need 8 x Servo Screws and 2 x Servo Horns for further assembly.

Fix the both the structures with the help of M3 Mid Screws, Nuts and Bearings. Also fix the Servo Horns.

Step 11: Now take 2 x Long U Brackets, 2 x Servo Horns, 8 x Servo Screws, 2 x M3 Mid Screws, 2 x Lock Nuts and 2 x Bearings along with the assembled structure

Fix the Long U Brackets to the Structure with the help of M3 Mid Screws and Lock Nuts. Also fix the Servo Horns.

Step 12: Now take 4 x Servo Motors, 16 x M4 Screws, 16 x M4 Nuts, 4 x Servo Screws. Fix the Servo Motors at Place 1, 2, 3 and 4. Tight the Servo Screws to the shaft of each Servo Motor after neutralizing each Servo Motor. The following image shows the Servo Motors already fixed.

The M4 Screws, M4 Nuts and the Servo Motor is shown below in the Big Black Box while the Servo Screw is in the small Black Box.

Step 13: Take 2 x Short U Brackets, 8 x Big Button Screws and 8 x Lock Nuts. Fix the Short U Brackets on the top of Long U Brackets with the help of Big Button Screws and Lock Nuts. The structure after fixing the Short U Brackets is shown in the main

image below. The Short U Brackets, Big Button Screws and Lock Nuts is shown in the Black Box.

Step 14: Now take 2 x Multipurpose Brackets, 2 x L Shaped Brackets, 1 x Long U Bracket, 1 x Large U Bracket, 20 x Big Button Screws and 20 x Lock

Step 15: Now we will connect the two structures that we have already assembled in previous steps. To connect them take 2 x M3 Mid Screws, 2 x Lock Nuts and 2 x Bearings. Also take 2 x Servo Horns and 8 x Servo Screws for fixing the Servo Motors

Step 16: Now take 2 x Servo Motors, 8 x M4 Screws, 8 x M4 Nuts and 2 x Servo Screws. The Servo Motors are to be fixed at place 1 and 2.

The Servo Screws is to be fixed at the shaft of both Servo Motors after neutralizing the Servo Motors.

Step 17: Now take 2 x Multipurpose Brackets, 8 x Big Button Screws and 8 x Lock Nuts which are the Black Box

These Multipurpose Brackets are to be fixed at the places 1 and 2 with the help of Screws and Nuts taken

Step 18: Now take 2 x Servo Motors, 8 x M4 Screws and 8 x M4 Nuts and fix them at place 1 and 2.

Step 19: Now remove the Long U Bracket from the top of the structure shown in the below image and fix the Servo Horn on the top of Long U Bracket with the help of Servo Screws. Below image shows the already fixed Servo Horn. Now before fixing the Long U Bracket on the same place from where it was removed, fix the Servo Motor on the Servo Horn and tight the Servo Screw on the Servo Motor Shaft.

Step 20: Now let's assemble both the hands of Humanoid Robot. Take 2 x Oblique U Brackets, 2 x Multipurpose Brackets, 2 x Servo Horns, 8 x Servo Screws, 2 x M3 Mid Screws, 2 x Lock Nuts and 2 x Bearings. Below sequence of images shows the assembly.

Step 21: Now take the two structures assembled in previous step along with 2 x L Shaped Brackets, 2 x Servo Horns, 8 x Servo Screws, 8 Small Button Screws, and 8 Nuts

Step 22: Now take 2 x Long U Brackets, 8 x Small Button Screws, 8 x Nuts along with already assembled structures.

Step 23: Now take 2 x Multipurpose Brackets, 2 x Interconnect Brackets, 8 x Small Button Screws, 8 x Nuts, 2 x M3 Mid Screws, 2 x Lock Nuts and 2 x Bearings.

Step 24: Now we will fix the Servo Motor in the two hands. Take 4 x Servo Motors, 16 x M4 Screws and 16 x M4 Nuts.

Step 25: Now take 2 x Servo Horns and 8 x Servo Screws to fix the Servo Horns for the last two Servo Motors.

Step 26: Now we have both the Hands ready as shown in the below Image and also the Middle Structure. Now we will fix both the hands with the Middle Structure to complete the Assembly. For fixing we take 2 x Servo

Screws which are in the Black Box. Now Neutralize both the Servo Motors and tight the Servo Screws on the Shaft of both the Motors.
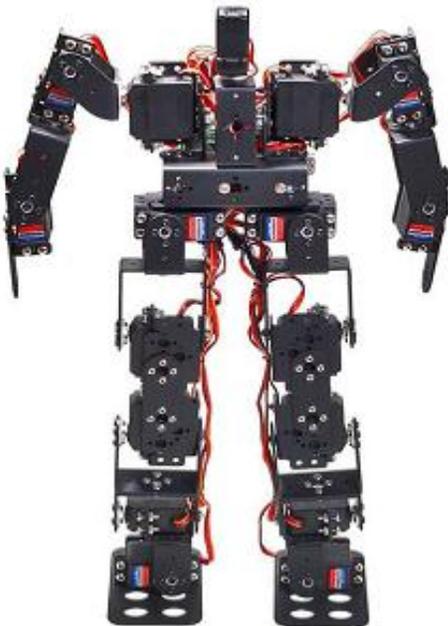
Following all the above steps assembly of the Humanoid Robot will complete and Humanoid Robot will look as below:

APPLICATIONS

1. Security Applications: It can be used for surveillance and also to pick up harmful objects like bombs and diffuse them safely.
2. Manufacturing Applications: These robots are used in manufacturing, to pick up the required parts and place it in correct position to complete the machinery fixture. It can be also used to place objects on the conveyer belt as well as pick up defective products from the conveyer belt.
3. Therapeutic Applications: These robots can be used in various surgical operations like in joint replacement operations, orthopedic and internal surgery operations. It performs the operations with more precision and accuracy
4. Flight Simulators
5. Automobile Simulators
6. In Work Processes
7. Photonics / Optical Fiber Alignment[4]
8. In high speed, high-accuracy positioning with limited workspace, such as in assembly of pcbs
9. As micro manipulators mounted on the end effector of larger but slower serial manipulators
10. As high speed/high-precision milling machines.

CONCLUSION

We have first read the assembly of Robot Manual manually. And study it. After that we read out the robot's configuration and checked the difference part of the robot. After that, checking the different part of the robot and checking his servo motor and different parts. After that we attached the manual to the According of his manual and joined his part.

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