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THE INTELLIGENT HUMANOID ROBOT

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Abstract - Robotics is an emerging field of science during which robots are fabricated and programmed to try to varied tasks. In those robots, Humanoid robots are the well-sophisticated robots that perform tasks almost like humans and interact with them. The critical introduces the event of Humanoid robots is to style it effectively. The project deals with designing the humanoid robot then fabricating it using rubbish parts. The planning replicates that of the citizenry. I decided to form this project because it was very challenging. A user can control the robot using an Android interface and every part of the robot is often moved independently around during a remote location. Providing motor position change during a sys-tem and automatic controlling of the info from the measuring system reduces process time and reduce the loss of labour. Arduino Uno R3 based USB 18 Servo Controller is right for creating Autonomous and PC based systems that control and run Servo motors. The software helps to develop the complex sequences in real-time on the hard-ware like robotic arms, walkers, bipeds and the other servo-controlled system. It also generates Arduino based code for the developed sequence which may be deployed on the controller board thereby making the robot autonomous. Further development within the Humanoid robot is often carried on by attaching various sensors to the Humanoid robot to extend its degree of automaticity. Further one can integrate the artificially intelligent brain so that it can make decisions on its own.

Keywords: Humanoid Robot, future of humanoid.

1. INTRODUCTION

1.1 OVERVIEW

Robotics is the branch of technology that deals with the planning, construction, operation, and application of robots also as computer systems for his or her control, sensory feedback and knowledge processing. These technologies affect automated machines which will take the place of humans in dangerous environments or manufacturing processes or resemble humans in appearance, behaviour, and/or cognition. Many of today's robots are inspired naturally, contributing to the sector of bio-inspired robotics. There are many sorts of robots but all of them have three aspects in common. They need a mechanical construction, a form or shape; Electrical, within the sort of wires, sensors, and a few levels of programming. The mechanical structure of a robot must be controlled to perform tasks. The control of a robot involves three distinct phases perception, processing, and action. Even the control of a robot can occur in various levels of automation namely, Complete human control, Operator-mode, and completely autonomous. Human-robot interaction is often effective as long as the robot has efficient speech recognition, voice, gestures, facial expressions, artificial emotions, and personality. The study of motion in robots is often divided into kinematics and dynamics. Direct kinematics refers to the calculation of end effector position, orientation, velocity, and acceleration when the corresponding joint values are known. Inverse kinematics refers to the other case during which required joint values are calculated for given end effector values, as wiped out path planning. Similarly, direct dynamics refers to the calculation of accelerations within the robot once the applied forces are known. This is often utilized in computer simulations of the robot. Inverse dynamics refers to the calculation of the actuator forces necessary to make a prescribed end-effector acceleration. Generally, humanoid robots have a torso, a head, two arms, and two legs. Some humanoid robots can also have heads designed to duplicate human countenance like eyes and mouths. A humanoid design could be for functional purposes, like interacting with human tools and environments, for experimental purposes, like the study of bipedal locomotion, or other purposes. Arduino Uno Ultrasonic Sensor Web Camera Servo motor 1 Arduino Uno R3 Servo-Controller, 5V Power Supply Servo Signal, Raspberry Pi, Servo motor 16, Image Activity Tracking, Distance Monitor, Voice Assistant Virtual Assistant, Head Eye 1 DOF Neck 1 DOF Arm Shoulder 2 DOF x 2 = 4 DOF Elbow 1 DOF Leg Hip 2 DOF x 1 = 2 DOF Knee 2 DOF x 2= 4 DOF Ankle 2 DOF x 1 = 2 DOF Total 16 DOF Dimensions (mm) Height 1,200 Length of the upper leg 290 Width (Shoulder to shoulder) 420 Length of lower leg 280 Depth (Chest to back) 213 Length between hip joints 142 Length of upper arm 184 Width of sole 140 Length of lower arm 185.5 Length of sole 233 d Mechanical Design of Humanoid Robot Platform 16 DOF may be a humanoid which may walk on the living-floor with human-like appearance and movement. it's 16 degrees of freedom, of about 125cm height, and 55Kg weight. The objective of this project is to develop a reliable and nice-looking humanoid platform which allows the implementation of varied theories and algorithms like dynamic walking, human interaction, AI (Artificial Intelligence), visual & image recognition, and navigation. They allocated the huge part in the torso to make its center

of gravity(COG) at a certain height. The humanoid robot's mechanical stiffness of links and gearing capacity of joints are modified and improved to satisfy the planning criteria. Degree of Freedom It has 8 DOF in legs and a couple of DOF in arms. There are 2 DOF for every eye camera pan and tilt, 2 DOF for every hand - 2 DOF for the wrist and a total 16 DOF has been used. The Main Servo controller (PC), battery and servo controllers/drivers for the upper body are located in the torso. The entire mass except actuators is targeting the torso. Actuator (RC Servo Motor) RC Servo motors are used for the main joints like leg and arm joints. Brushed 5V RC Servo motors are used. Design of Compact Humanoids & Development of Biped Control Strategies Aspects to be considered while designing Limited Torque of the motors, the rigidity of Hardware, impulsive landing, interface among links and weight. For walk control one must consider stability, starting, stopping and making turns, high-energy efficiency and flexibility of selecting landing position. The material used should be highly rigid and light-weight.

1.2 OBJECTIVE

The main objective of this project is as follows:

Even though there are many varied sorts of humanoid robots built around the globe, there is always how through which better design and fabrication of the humanoid robots are often made possible. Thereby, there's a scope for us to extend the efficiency to approach, a touch bit towards the right mechanical design of a humanoid robot. Moreover, designing a humanoid is the crucial step within the development of humanoid robotics and it's like without proper foundation even a skyscraper isn't worthy enough to measure in. The main problem within the humanoid robots we observed is that the improper mechanical design or less priority for mechanical hardware to regulate led to several aspects just like the instabilities, demand for rigorous dynamic calculations for control strategies development,

need of more reduction ratios, energy inefficiency, etc. Considering the majority of them under consideration we would like to rectify the essential problem in all the humanoid robots.

2. LITERATURE SURVEY

16 DOF is a humanoid that can walk on the living-floor with human-like appearance and movement. It has 16 degrees of freedom, of about 125cm height, and 55Kg weight. The objective of this project is to develop a reliable and nice looking humanoid platform which allows the implementation of various theories and algorithms such as dynamic walking, human interaction, AI (Artificial Intelligence), visual & image recognition, and navigation. They allocated the massive part in torso to make its center of gravity (COG) at the certain height. The humanoid robot's mechanical stiffness of links and reduction gear capacity of joints have been modified and improved to meet the design criteria.

2.1 DEGREE OF FREEDOM

It has 8 DOF in legs and 2 DOF in arms. There are 2 DOF for each eye – camera pan and tilt, 2 DOF for each hand - 2 DOF for the wrist and a total 16 DOF has been used.

2.2 DEGREE OF FREEDOM

The Main Servo controller (PC), battery and servo controllers/drivers for upper body are located in the torso. The total mass except actuators is concentrated on torso.

2.3 ACTUATORS (RC SERVO MOTORS)

RC Servo motors are used for the major joints such as leg and arm joints.16 Brushed RC Servo motors are used.

Head	Eye	1 DOF		
	Neck	1 DOF		
Arm	Shoulder	2 DOF x 2 = 4 DOF		
	Elbow	1 DOF		
Leg	Hip	2 DOF x 1 = 2 DOF		
	Knee	2 DOF x 2= 4 DOF		
	Ankle	2 DOF x 1 = 2 DOF		
Total		16 DOF		
Dimensions (mm)	Height	500	width	500

Table-1.1

3. OBJECTIVE

3.1 PROBLEM STATEMENT

Even though there are many varieties of humanoid robots built around the globe, there is always a way through which better design and fabrication of the humanoid robots can be made possible. Thereby, there is a scope for us to increase the efficiency to approach, a little bit towards the perfect mechanical design of a humanoid robot Moreover, designing a humanoid is the crucial step in the development of humanoid robotics. The main problem in the humanoid

robots we observed is the improper mechanical design or less priority for mechanical hardware to control, led to many aspects like the instabilities, demand for rigorous dynamic calculations for control strategies development, the need for more reduction ratios, energy inefficiency, etc. Of course, this is not in the case of all the humanoid robots built so far. Considering the majority of them into account we want to rectify the basic problem in all the humanoid robots. Even though there are many varied varieties of humanoid robots built around the globe, there is always a way through which better design and fabrication of the humanoid robots can be made possible. Thereby, there is a scope for us to increase the efficiency to approach, a little bit towards the perfect mechanical design of a humanoid robot.

The main problem in the humanoid robots we observed is the improper mechanical design or less priority for mechanical hardware to control, led to many aspects like the instabilities, demand for rigorous dynamic calculations for control strategies development, need of more reduction ratios, energy inefficiency, etc. Of course, this is not in the case of all the humanoid robots built so far. Considering the majority of them into account we want to rectify the basic problem in all the humanoid robots.

3.2 PLATFORM

Intelligent humanoid robots are considered one of the core technologies. All current humanoids are capable of stable dynamic walking but few are able to walk or even run-at speeds comparable to humans. Moreover, flexible motion generation in realistic environments still remains challenging. Aiming at fast and autonomous bipedal locomotion, the development of the humanoid walking robot wishes to make an important step towards this goal.

4. METHODOLOGY

4.1 SKELETAL EXAMINATION

Design Parts and their Measurements

Number of Servo motors used:

S1 = Eye

S2 = Neck

S3 = Left arm hand

S4 = Left arm elbow

S5 = Left arm shoulder

S6 = Left leg foot

S7 = Left leg ankle

S8 = Left leg knee

S9 = Left Hip

S10 = Right Hip

S11 = Right arm shoulder

S12 = Right arm elbow

S13 = Right arm-hand

S14 = Right leg knee

S15 = Right leg ankle

S16 = Right leg foot

4.2 MODELLING

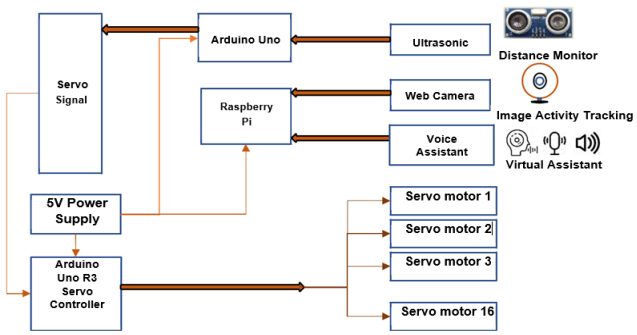
HARDWARE REQUIREMENTS

- Arduino Uno R3 Servo Controller.
- Aluminium Alloy Sheets.
- Connecting Wires.
- Raspberry pi 3.
- RC Servo Motors
- Screws.
- Ultrasonic Sensor.
- Web Camera.

SOFTWARE REQUIREMENTS

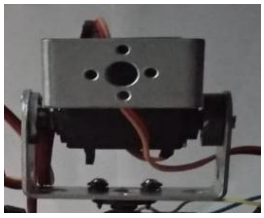
- Operating System: Windows, Raspbian OS.
- Coding Language: Embedded C Programming, Servo Controller Software.

ARCHITECTURAL DIAGRAM



PARTS OF HUMANOID ROBOT

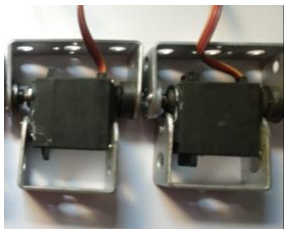
HEAD



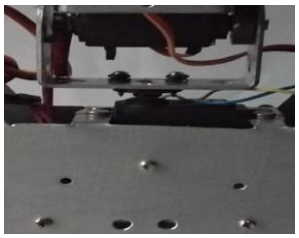
RIGHT LOWER ARM

LEFT LOWER ARM

UPPER ARM



TORSO



UPPER LEG

LOWER LEG

FOOT

HUMANOID ROBOT

4.3 FABRICATION

Based on the analysis, the fabrication part is divided into mechanical aspects, electrical and electronic aspects and computer programming.

Mechanical aspects

Basically, the material used for fabricating the humanoid is an Aluminum alloy sheet of thickness around 1.5 mm because Aluminum alloy is a metal with properties like low density, easy machinability, etc. However, Aluminum being ductile easily deforms under medium loads. The compactness of the humanoid robot can cope up with this disadvantage by using an Aluminium alloy instead of pure Aluminium or a bit more thickened sheet at the sites prone to deformation. Fabrication of the humanoid system is done by first cutting the Aluminium alloy sheet according to the desired dimension with the help of a hacksaw. The holes are drilled through the frames for bolts to fit in with the help of a manual hand drill. These frames are fastened with nuts and bolts with the help of a screwdriver and a cutting plier. The servo motors are attached to the mechanically fastened frames with the help of U-clamps, nuts and bolts. The mechanical framework is successfully actuated by selecting appropriate actuators based on the torque estimated in the analysis. The tools used for the fabrication namely screwdriver, hacksaw, files, cutting plier, manual hand drill and drill bits; the sequence in which the mechanical framework is built is as shown below

COMPONENTS USED

i. **Arduino R3 Servo Controller**

ii. **Raspberry pi 3**

iii. **Web Camera**

iv. **MG995 Servo motor**

5. CONCLUSION & FUTURE ENHANCEMENT

5.1 CONCLUSION

Humanoid robots are a new and promising application area for robotics. The Intelligent humanoid robots are considered one of the core technologies. All current humanoids are capable of stable dynamic walking but few are able to walk or even run-at speeds comparable to humans. Moreover, flexible motion generation in realistic environments still remains challenging. Aiming at fast and autonomous bipedal locomotion, the development of the humanoid walking robot wishes to make an important step towards this goal.

5.2 FUTURE ENHANCEMENT

This thesis deals with the design and realization of the robot's mechatronic system. The issues include the mechatronic design concept, electrical drive systems, design and analysis of the mechanical structure, sensor technology, and contributions to the computer and electronics architecture.

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