MODELING AND ANALYSIS OF WORKING PATTERN OF A HUMANOID ROBOT

Prashantsingh P. Rajput[1], Dhaval J. Yadav [2], Mahirkumar P. Joshi [3], and Priteshkumar K. Patel [4], Prof. Sanket T. Gandhi [5]

1, 2, 3, 4, Student, Department of Mechanical Engineering, SMET Himmatnagar, Gujarat, India.
5, Assistant Professor, Department of Mechanical Engineering, SMET Himmatnagar, Gujarat, India.

ABSTRACT

This is the design and development for an autonomous humanoid robot using moving and walking combination of controllers. With addition of wireless controller. The work presents here moving pattern, system control, actuators controls, and servo control. With the use of 17 degree of freedom .we are trying to make a walking humanoid robot, with body movement and walking pattern. In order to walk stably in various environments, such as on rough terrain, up and down slopes, or in regions containing obstacles. So this the aim for this topic. In future we can work for development and implement new sensors and cameras for the features for humanoid robot.

Key words: *servo arm, sensors, aluminum body, servo controller*.

1. INTRODUCTION

A **humanoid robot** is a machine with its body shape built to resemble the human body. The design may be for functional purposes, such as interacting with human tools and environments, for experimental purposes, such as the study of al locomotion, or for other purposes. In general, humanoid robots have a torso, a head, two arms, and two legs,

Modeling and analysis of working pattern of a humanoid robot is a project which is depend on AI (artificial intelligent). In this project we are going to learn about how a humanoid robot works and perform its working. In the previous semester we design components and parts of our humanoid robot. In current semester we are going to analysis and make a movement pattern of a humanoid robot. In this project there we use many different components like servos, controller (3 different type of controllers), aluminum alloy parts, screws & nuts, battery, sensors, and etc components. In this project we take guidance for from different made parts and components. In the project we are program the controller, design parts, create codes, and sequence the parts, assembly, centering, and analysis.

Making part with different processes and tools. In this project we use aluminum alloy 3003 h-14.

1.1 Material for making

Aluminum alloy:- Aluminum is reusable material. Which is reused up to 95% . Good conductor of electricity. High weight to strength ratio. High Strength at low temperature. Non-toxic and odorless. Shrinkage allowance for aluminum is 13 mm/m. aluminum is used as a deoxidizer in steels. It is most effective in the inhibiting grain growth. Aluminum have excellent thermal conductivity (053 cal/cm/°C), low mass density (2.791 cm^3). Aluminum have low melting point (658°C). Aluminum is non-toxic

2. PART MANUFACTURE

In the work shop of our collage SMET we manufacture some parts like body parts servo bracket u-shape bracket, foot bracket plate. And some part we design from different industry for cutting and sand blasting processes

Figure 2.1. Part manufacture in work shop (aluminum) bracket

2.1. Design:

We design some part with using solid work, inventor, AutoCAD. We referred some design parts from past research.

2.1.1. Design of leg bracket:

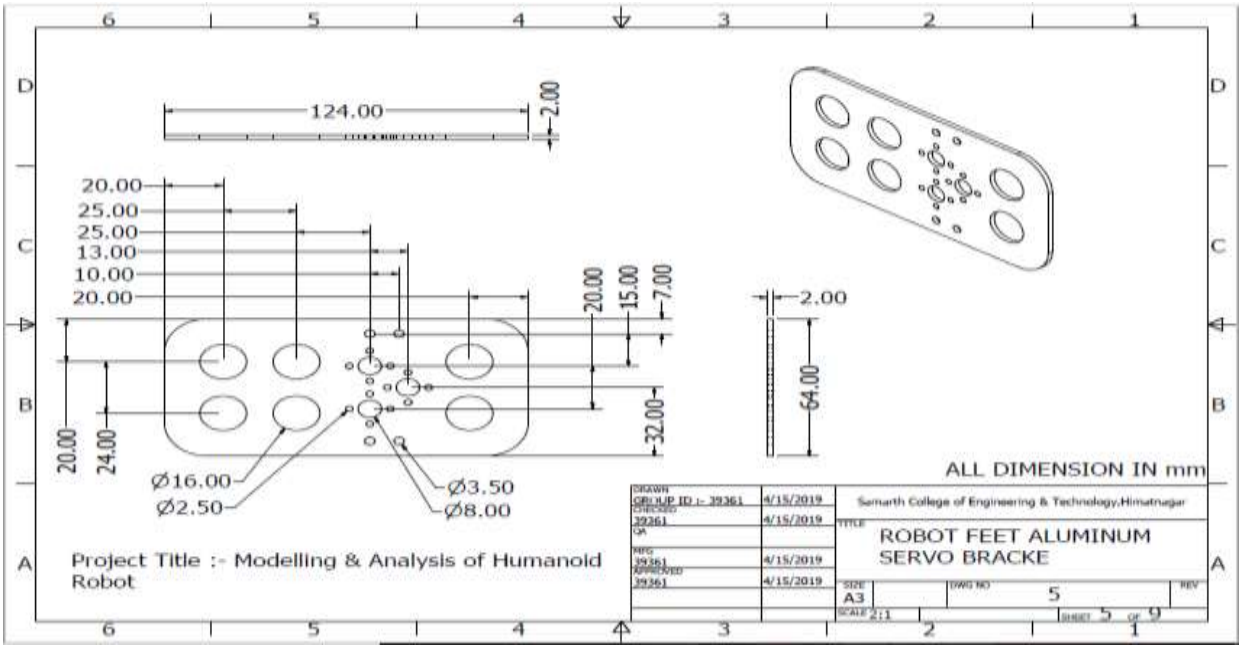

Fig 2.2. Robot feet (aluminum) bracket

2.1.2. Design of servo bracket:

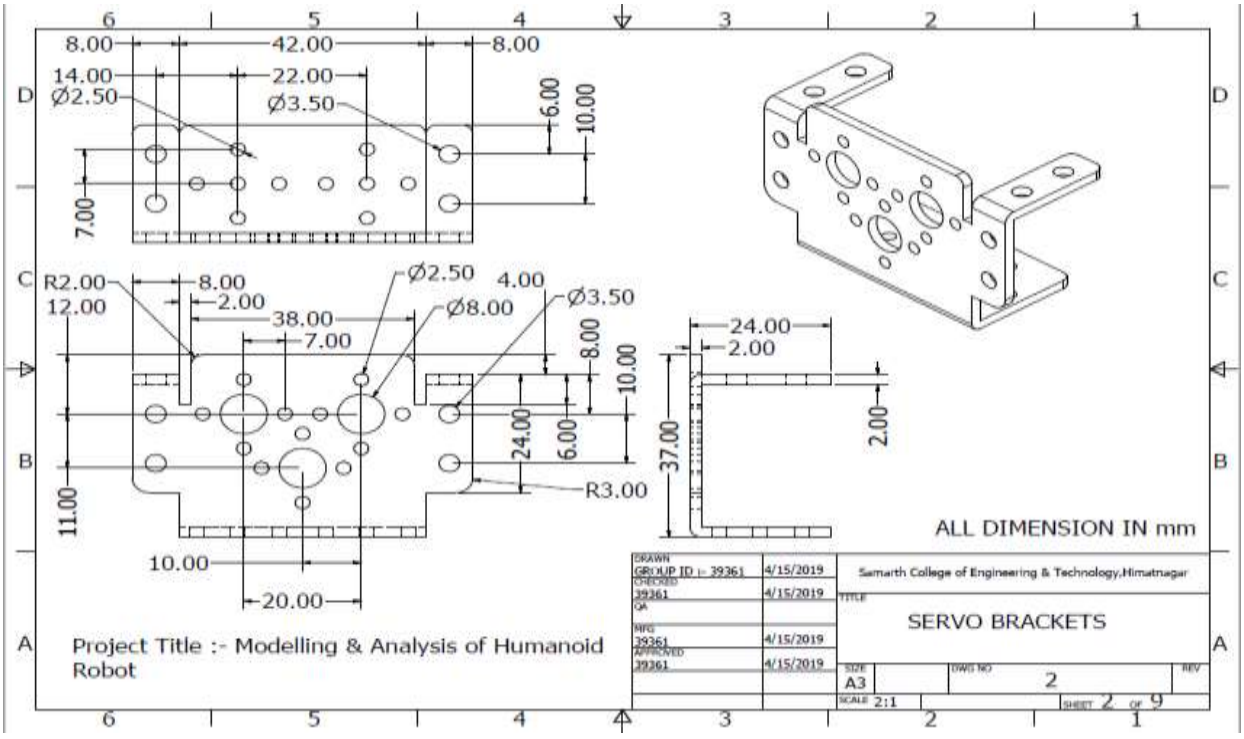

Fig 2.3. Servo (aluminum) bracket

3. EXPERIMENTAL SETUP

Modeling and analysis of working pattern of a humanoid robot is a project in humanoid robot which work like a humanoid robot and in this project we design some parts by using some perimeters.

We design, change some parts, assemble, material change.

H- 424.83mm

W- 81.44mm

L- 226.65mm

THK- 3mm (THK- Thickness sheet metal)

Weight- 7 to 8 kg (approximate)

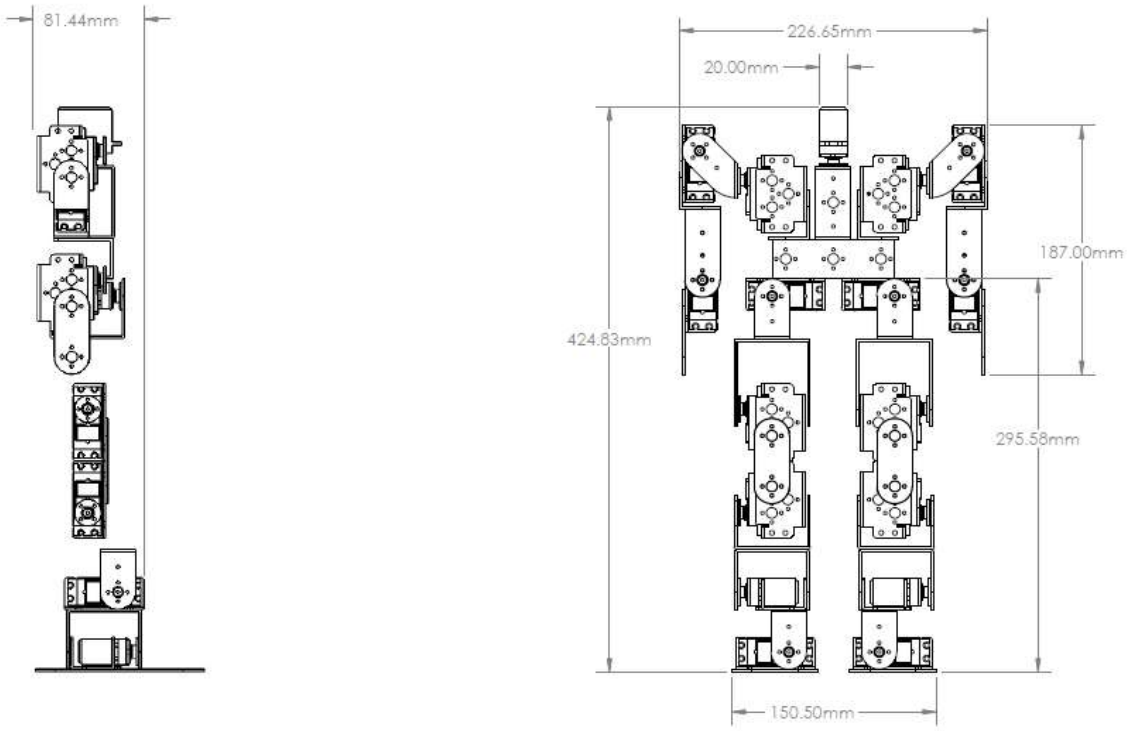

Figure 3.1 shows the software design of the experimental setup (assembled robot)

4. THEORETICAL ANALYSIS

4.1 Stress & strain Analysis

The theoretical model employed for the study of the humanoid robot body which contain stress & strain analysis on the working body of our experimental setup model.

Stress and strain are both responses to applied loads on a structure.

Straight- forward equation

Strain = change in length form applied force/ original length

$$\varepsilon = \Delta I / I \text{ (unit less)} \qquad \textbf{- 1}$$

Straight- Forward Equation

Stress = force/ area (unit of pressure)

$$\sigma = F/A \text{ (Units of Pressure)} \qquad \textbf{- 2}$$

4.2 Design Parts for Stress & Strain Analysis

Design part of our model that indicate the stress & strain force in the part with graph indicating image

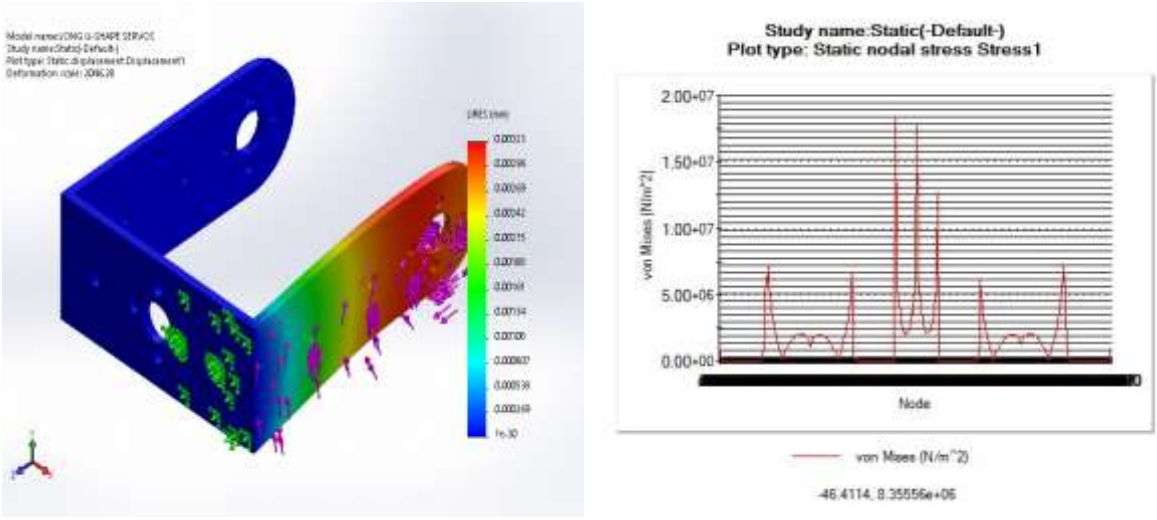

Figure 4.1 shows the stress analysis in a part of robot body with node graph

5. RESULTS AND DISCUSSIONS

Different parts contain different strength and design. As per our part analysis we design and make node and force indicating graph.
Which indicate different force in different node. (Node is a point which contains force in a particular area).

The total parts and components in this model are 42. Total weight of components is around 4 to 5 kg. The parts made of aluminum alloy (3003-h14 grade). It also contains high torque standard servo motors with metal gears. Provides 11kg-cm at 4.8v, 13.5kg-cm at 6v 16kg-cm at 7.2v (dimension 1.6'' × 0.8'' ×1.4'' (41×20×36mm), weight 56gm).

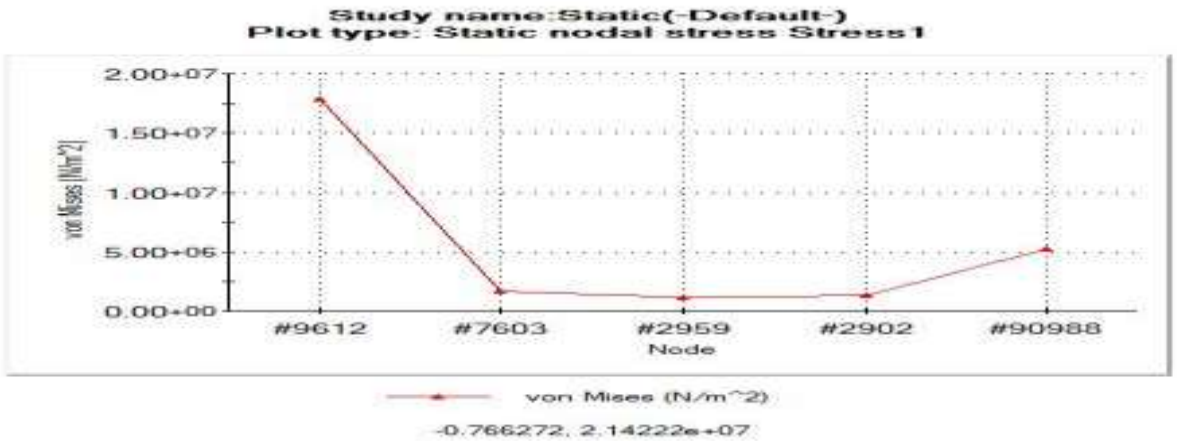

Figure 5.1 long u shape servo bracket stress analysis.

In this graph stress analysis was completed by using node point and stress taking area. The graph indicates that in which node how much Newton force is applying.

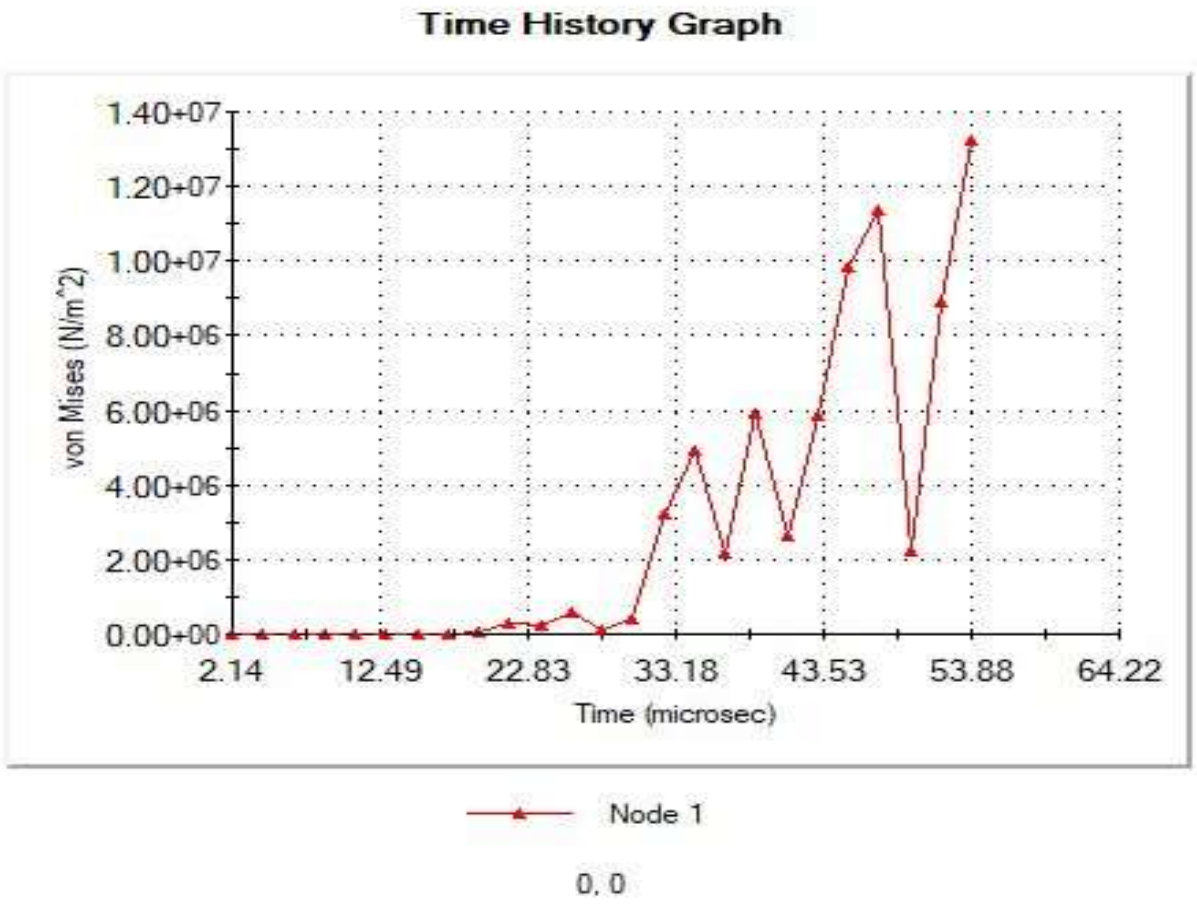

Figure 5.2 long u shape servo bracket drop test graph.

6. CONCLUSION

In our project we are going to install suction cups that help the robot to climb up on 45˚ to 90˚of angle. The robot is used in space research tool the can help humans to learn more about new planets and resource that can helpful.

We can use it for forming places for research the help for finding some new source. We are going to make a walking pattern for the robot and install some new sensors, gadgets that help them to survive at any place.

A humanoid robot having a new field of robotic. It can contain much different challenge to us for human life. It contain many different components and parts to belt a robot, it is so costly for a common people.

It is a help full in future, for, working, house work, security, and many different works

REFERENCES

[1] Andre senior, and Sabri Tosunoglu, designs of a biped robot Florida international university, department of mechanical engineering, Miami, Florida 33174, pp; 1-6, 2006.

[2] (1).dr. B.s.n. murthy, (2) k. Adarsh Kumar, (3)p. Tejendra reddy, design and fabrication of humanoid robot with 21 dof, international journal of mechanical and production journal of mechanical and production engineering research and development, volume:- 1,issue:-1,pp;17-30, 2011.

[3] (1), Hun-ok lim, (2), Atsuo Takanishi, a biped humanoid robot for human-robot coexistence, kanagawa institute of technology Shimoogino, Atugi, kanagawa, Japan waseda university okubo, Shinjuku, Tokyo, Japan, pp:- 1-13, 2016, 2017

[4] Aditya Guptadr. Abhishek Shamra, modeling and analysis of walking pattern for a biped robot, the lnm institute of information and technology, pp:-1-9, 2006.

[5] (1).Mesut Acar, (2).Alper Gercek, (3).Burak Tasasiz, (4). Z.Yagız Bayraktaroglu, (5). Hikmet Kocabas, design of a 12-dof biped robot, international conference on recent achievements in Mechatronics, automation, computer science and robotics, pp: -1-11, 2010.

[6] Dr:-Ingenieur, of design and control aspects humanoid walking robots, Lehrstuhl fur Steuerungs- und Regelungstechnik Technische Universit, at m, unchain, pp:- 11-103, 2006