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Modelling and Control Design of Shadowbot in Real Time Basis

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Abstract- *In the era of rapid industrialization and automation the demand for humanoid robot is increasing day by day due to some restrictions of the tasks which is difficult to perform by humans. So, development of humanoid robot in advanced world is blessing for humans. We are developing a humanoid robot which will exactly imitates the human actions. As the name suggests 'Shadowbot' it will exactly mimic the human action in real time basis as the shadow does. The project is divided into 2 Categories which is Modelling and Controlling of shadowbot. In controlling, with the help of Microsoft Kinect XBOX Oneshadowbot will imitates human actions in real time basis. Kinect sensor is a posture recognition device which will capture the movements of operator and calculate the local coordinates of postures. With the help of calculated local coordinates, it will make a 2D animations.*

With the help of V-REP software which is a simulation software and Kinect we will be achieving real time. With the help of Teensy 3.2 microcontroller controller will give command to motor driver and ultimately the actuators will operate and we will get motions. For operating shadowbot robot remotely from certain distance we will be using HC12 or LORA. To operate robot in real time basis we will be buying and implementing some ready to modify advanced gaming technologies in order to complete our project in less time.

Keywords– Gesture Imitate, Humanoid Robot, Kinect Sensor, V-REP Software, Shadowbot, Human Arm, Humanoid

I. INTRODUCTION

In today's world with increase in demand for efficiency and quality of work, the field of robotics has become the integral part in many fields. This field growing tremendously and will evolved more in future too. Development of robot ensures us to put less effort and will saves time too contributing towards the production rate of any industries. In this project, we are m1aking a humanoid robot which will work on a virtual reality. Till today, we have seen the use of Kinect sensor in most of games where you play it and feel as if you are present there. So, by fusing the robotics and gaming technology we will operate the humanoid robot which will actually imitates the direction and actions of the, operator in real time basis. This project will serve the nation at borders by helping our soldiers to stay safe at still fight efficiently with enemies.

II. PROBLEM DEFINITION

Modelling & control design of humanoid robot to reduce delay time by using Microsoft Kinect XBOX One and V-Rep software for determining global co-ordinates of the postures using shadow features on real time basis. Design model can able to imitate human actions as per given inputs.

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2.2 Objective

1. To design and develop a Standalone type robot.
2. To lift load with minimum human efforts.
3. To visualize and work from distance.
4. To develop a robot who is statically and dynamically stable.

III. MATERIAL AND METHOD

3.1 Proposed methododology

Approach of Methodology:

1. Robotics is a very huge field and studying it in a month is not possible so we started our research specifically on bipedal robots, controllers and mechanism.
2. The very first step was to search and download research papers of IEEE transactions and study them.
3. After that we've got rough idea about mechanisms and controllers so we started sketching our idea first. We sketched it and tried to justify the same by developing the robot model in Solidworks.
4. Simultaneously we have done market survey in order to collect some data regarding controllers and materials.
5. We have been developing and changing our model day by day, making it better and better.
6. After that we will try to simulate the same using softwares.

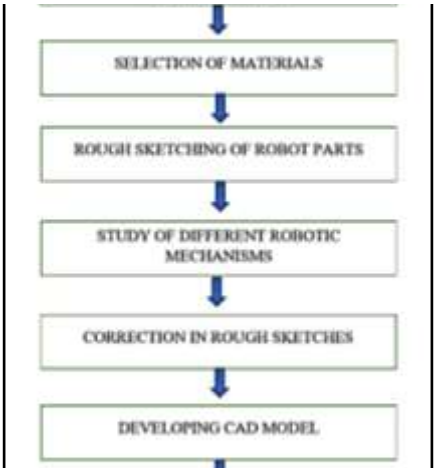

FIGURE 1:Flow chart of proposed methodology

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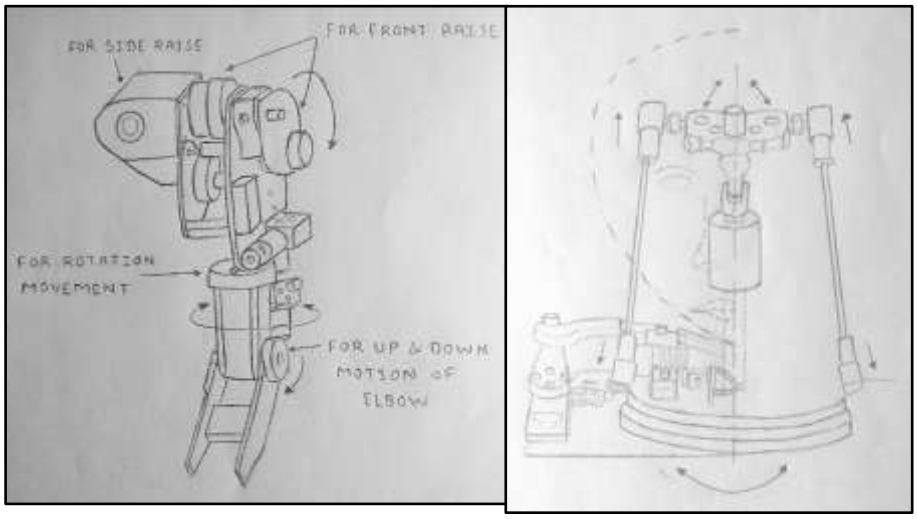

FIGURE 2:Sketches of proposed robot on paper

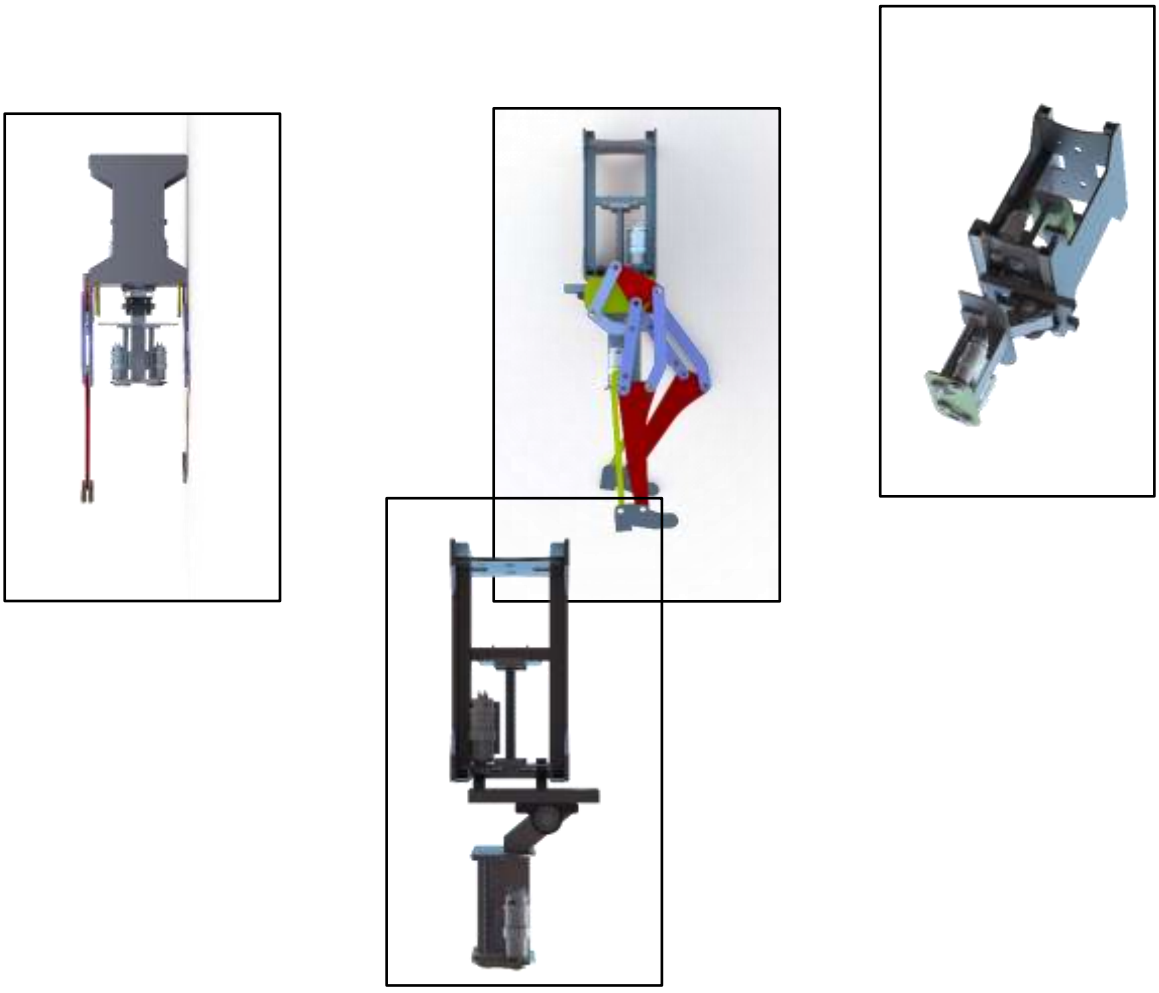

FIGURE 3:Modelling of proposed robot in Solidworks software

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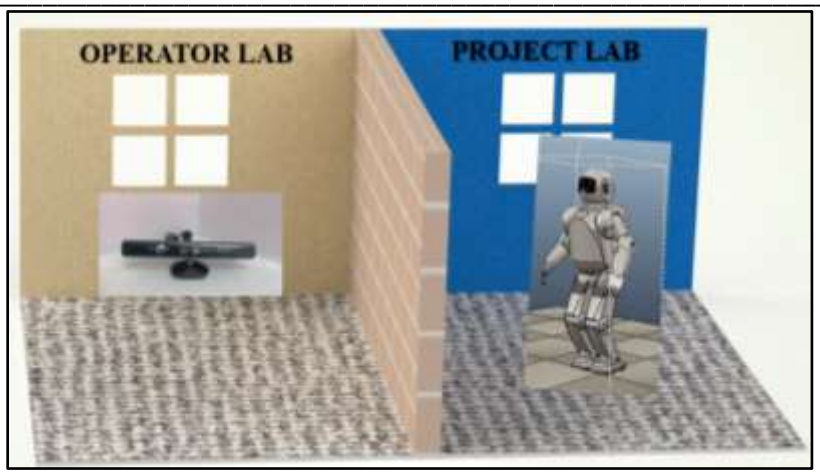

FIGURE 4:Example of representation of project execution

3.2 MATERIAL SELECTION

We have shortlisted raw material on the basis of their physical as well as chemical properties. We will be using various materials at various joints and parts. We will be using following materials,

Sr. No.	Part	Material
1	Shouder/Waist Joint Casing	EN8 Round Bar
2	Paneling	3 mm Polycarbonate Sheet
3	Upper and Lower Limbs	3-8 mm Acrylic Sheet
4	Support Members	Aluminium Plate and Bar
5	Brackets	3 mm EN8 sheet

TABLE 1: Material Selection

Sr. No.	Part	Properties
1	EN 8	Tensile Strength : 500-800 N/mm^2
2	Polycarbonate	Tensile Strength : 63-70 Mpa
3	Aluminium	Tensile Strength : 124 – 290 Mpa
4	Acrylic	Tensile Strength : 69 Mpa

TABLE 2: Material Properties

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Sr. No.	Electronic Part	Properties
1	Primary sensor (flex , accelerometer)	Operating voltage of FLEX SENSOR: 0-5V Power rating : 0.5Watt (continuous), 1 Watt (peak), Life: 1 million
2	Controlling Board (Netduino Plus 2).	Speed: 168MHz, Code Storage: 384 KB RAM: 100+ KB 10 mbps Ethernet
3	F.P.V. Goggles & Headphones with built in Mirophone.	Screen Resolution: 480x272 Frequency Channel: built-in 40CH 5.8GHz A/V automatic search receiver
4	Microcontroller (Quantity : Multiple. For example: Arduino mega, Teensy 3.2).	Voltage range: 1.71 to 3.6 V Flash write voltage range: 1.71 to 3.6 V Temperature range (ambient): -40 to 105°C

TABLE 3:Electronic Components

3.3 Construction & Working

Construction is divided into two major areas.

1. OPERATING LAB (Source)
   a. Operator Electronic
   b. Setup
2. PROJECT LAB (Destination)

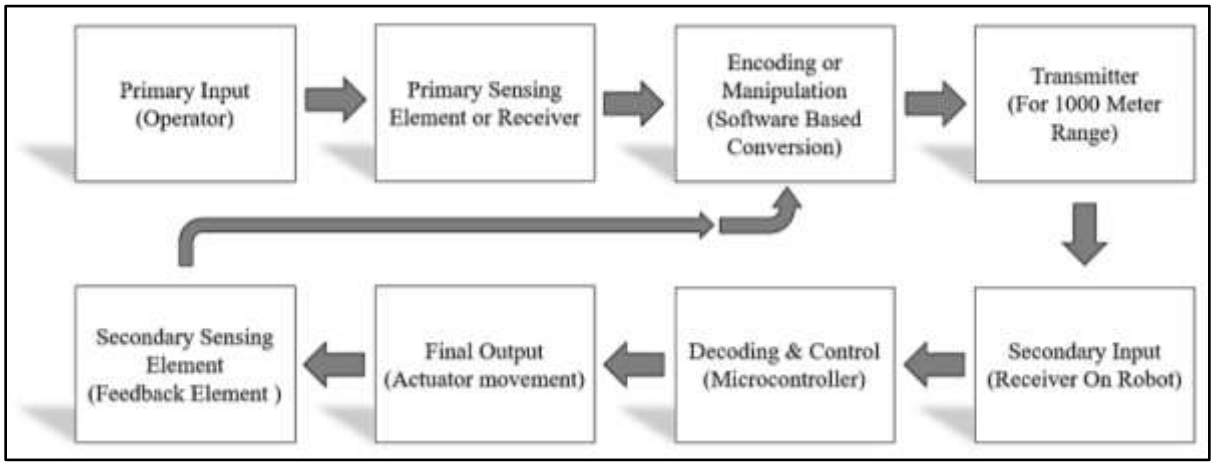

FIGURE 5:Project flow chart

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Operator : In Operating Lab, Operator will be standing next to Microsoft XBOX One Kinect 3D Camera Sensor.Operator will be wearing FPV Goggles, Headphones with built in Microphone and few sensors (Flex, Accelerometer etc) on the body.The Operator will be standing on a 360° Treadmill.

Electronic Setup : Electronic setup will consist of the Primary Sensing/Receiving, Manipulating and Transmitting element (For example : Microsoft XBOX One Kinect Camera Sensor, HC 12 etc).

PROJECT LAB : In project lab, there will be a Robot standing with inbuilt shadow feature and receivers/transmitters (For example : HC 12, Microphone, Speakers) mounted on the body of the robot.In Project Lab, the ShadowBot will replicate operator's movements in real time basis with amplified strength.

IV. CONCLUSION

As per our sketches and design we have developed a 3D CAD model in Solidworks software and have checked its movements and motions. We have also tried to develop and test the circuit of our robot digitally on softwares using Arduino and Vrep. Also, during designing we had experienced that there is not enough vacant space available near waist so, we have restricted 1 Degree of freedom near waist and we will be having 42 degree of freedom. We had researched on various controllers and software to obtain our desired aim i.e. to achieve bot operating in real time basis. We will be using Kinect Sensor, Flex Sensor and Accelerometer sensors for determining various movements of robots. From researching various journals, we have also reached to this conclusion that controllers will be playing vital role in our project. We will be using PID controller, teensy 3.2 Microcontroller and IMU to achieve our desired aim.

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