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HUMANOID ROBOT ACT AS GYMTRAINER

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ABSTRACT

Humanoid robots with artificial intelligence is very captivating field for people, since the robots are introduced. For humanoid robots we can introduce new ideas without any limitations and constraints but in reality there are limitations to implement them. In this paper we are discussing different humanoid robots with their practical applications. Based on their implementation structure detailed comparison of their characteristics is performed and on this bases some limitations and future work has been discussed. This paper explores the concept of utilizing humanoid robots as gym trainers in fitness centers, focusing on scenarios where real-time feedback is not available. Traditional gym trainers offer guidance, correction, and motivation during workouts, but such interactions require real-time assessment and feedback. However, humanoid robots can still play a valuable role in guiding users through exercise routines even without immediate feedback capabilities. The proposed humanoid robot gym trainer operates based on pre-programmed exercise routines, offering verbal instructions, demonstrations, and counting repetitions. Utilizing sensors, it can monitor basic movements and track progress over time. By providing structured workouts and encouraging verbal cues, the robot fosters engagement and adherence to exercise programs.

I. INTRODUCTION

Humanoid robots are expected to exist and work in a close relationship with human beings in the everyday world and to erve the needs of physically handicapped people.

These robots must be able to cope with the wide variety of tasks and objects encountered in dynamic unstructured environments. Humanoid robots for personal use for elderly and disabled people must be safe and easy to use. Therefore, humanoid robots need a lightweight body,high flexibility,many kinds of sensors and high intelligence.

The successful introduction of these robots into human environments will rely on the development of human friendly components. The ideal end-effector for an artificial arm or a humanoid would be able to use the tools and objects that a person uses when working in the same environment. The modeling of a sophisticated hand is one of the challenges in the design of humanoid robots and artificial arms.

A lot of research activities have been carried out to develop artificial robot hands with capabilities similar to the human hand.

The hands require many actuators to be dexterously moved. However, the control system of the humanoid robot becomes more complicated if more actuators are additionally used for the hand design. This is a key aspect for the artificial arm because a handicapped person might not be able to control a complex hand mechanism with many actuators. For this reason, we propose to develop a lightweight hand driven by a single actuator. To this end we adopted a new mechanism for the cooperative movement of finger and palm joints

II. RESEARCH

Our survey aimed to understand gym-goers' needs and preferences for a robotic fitness assistant. Demographic analysis revealed a diverse participant pool, with varying gym visit frequencies and reasons for attendance. Key insights include the importance of exercise guidance, form correction, and motivation during gym sessions. Participants expressed interest in using a robotic assistant, particularly for features like real-time feedback and personalized recommendations. These findings underscore the demand for tailored fitness solutions. Recommendations include prioritizing these features in the development of the robotic fitness assistant to enhance user experience and engagement.

III. PROPOSED SYSTEM

Creating a humanoid robot to act as a gym trainer could involve designing a system where the robot assists users with exercises, provides feedback on form, tracks progress, and adjusts routines based on individual goals and Capabilities. The robot could utilize sensors, AI, and natural language processing to interact with users effectively, offering personalized workout plans and motivation. Additionally, integrating features like gesture recognition andvirtual reality could enhance the user experience and engagement.

Developing a Robotic Fitness Assistant

IV. METHODOLOGY

Our research methodology for developing the robotic fitness assistant involves several key steps. We begin by identifying the specific needs of gym-goers, including exercise guidance, form correction, motivation, and progress tracking. Considering factors like anthropometry and human interaction capabilities, we design the robot's appearance to be engaging and approachable. We then develop the necessary hardware and software systems to enable the robot to perform various tasks effectively. Additionally, we compile a comprehensive database of exercises covering different muscle groups, fitness goals, and difficulty levels. Finally, we implement machine learning algorithms to enable the robot to adapt to users' preferences, fitness levels, and progress over time. This methodology ensures that our robotic fitness assistant meets the diverse needs of gym-goers while providing personalized and effective support.

V. SYSTEM IMPLEMENTATION

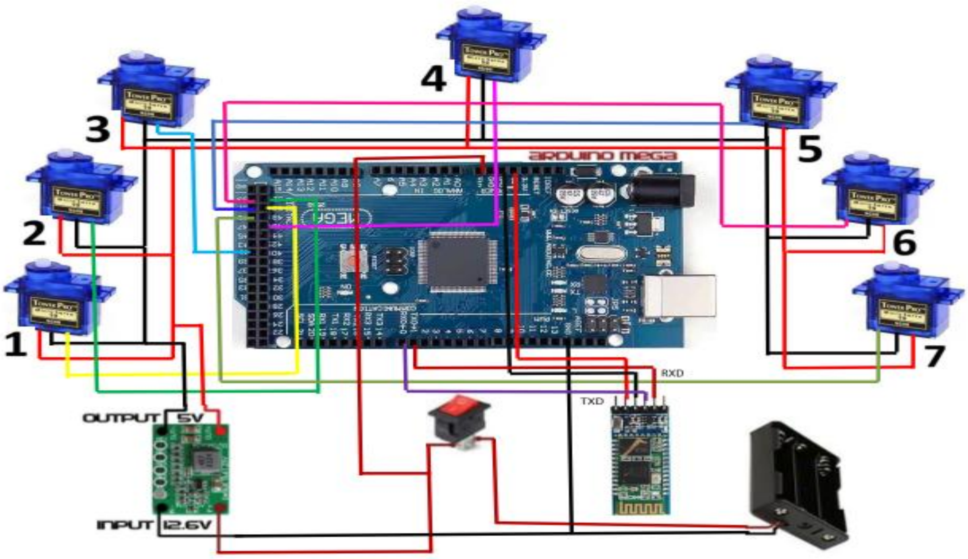

Figure 1: Circuit Building

1. **Arduino Mega 2560** : Arduino is a micro-controller. This small computer is used as the brain of the robot. It can be programmed to control the way buttons, motors, switches, lights, and other electronic parts work together
2. **Servo Motor :** The movement of humanoid robots is very precise, so DC motors are usually used. These motors have variable Speed and Torque characteristics and can be controlled by built-in programs
3. **Bluetooth :** Bluetooth RC car app is used to send the signals and to receive signals in between Smartphone and Arduino hardware. This module works on 3.3V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator Here Arduino acts as main controller of the device which receives signal or commands and sends these commands to motors and motor drivers to perform a particular task. The data transfer rate of HC-05 module can vary up to 1Mbps is in the range of 10 meters.
4. **Buck Converter :** Buck converter are the energy conversion device used inside a robot. The major function of buck converter is to convert energy into movement. Electric motors (DC/AC) - Motors are electromechanical component used for converting electrical energy into its equivalent mechanical energy.

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5. **Bluetooth Terminal**: Download Serial Bluetooth Terminal Application in Mobile Turn on the Bluetooth device in the mobile and then HC-05 has red LED which indicates connection status, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds.. When the device is connecting to the HC - 05 module it asks for a password then enter the password 1234 . Once it's connected go into the Serial Bluetooth Terminal app and Select device then connect to HC - 05 and then give the Commands (i.e A,B,C,D)

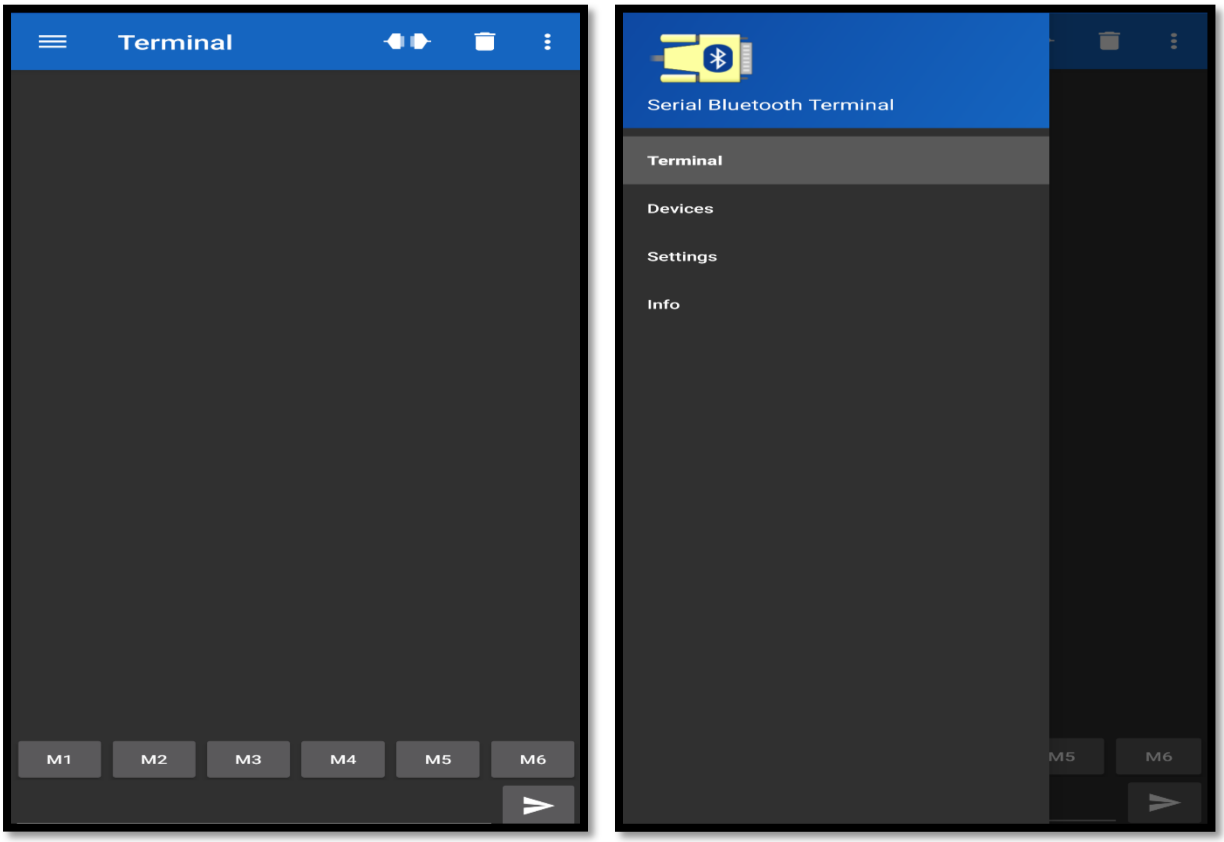

Figure 2: Bluetooth Terminal Application

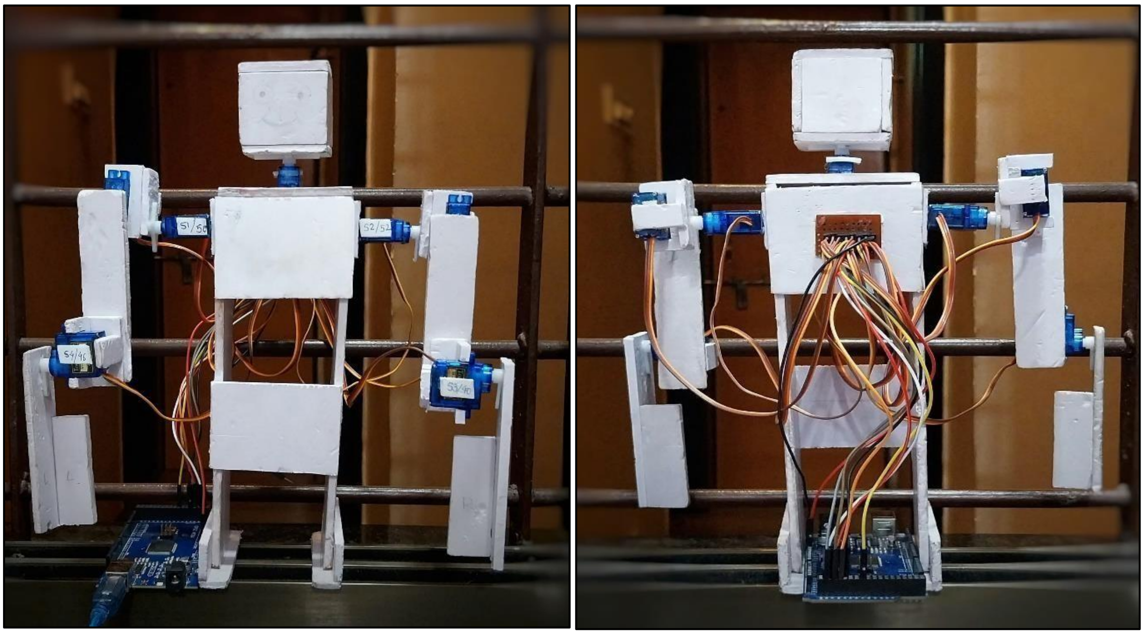

Figure 3: Humanoid Robot.

VI. MODELING

1. **Exercise1 (Dumbbell Exercise)** : Flexion is a movement that causes the angle between two bones of a joint to decrease, such as when a person bends their elbow joint. Extension is a movement that causes the angle between two bones of joint to increase, such as when a person straightens their elbow joint.
2. **Exercise 2 (Flexion and Extension) :** This means that when you bring your palm towards your forearm, you're bending forwards, or anteriorly, defining this direction as flexion. Similarly, when you move the back of your hand towards your forearm, you're bending backwards and increasing the anterior angle, creating extension.
3. **Exercise 3 (Bicep curls) :** This exercise focuses on the biceps, the muscles in the front of your upper arms. Hold a dumbbell in each hand with your palms facing up, then slowly curl the weights towards your shoulders while keeping your elbows.
4. **Exercise 4 (Dumbbell Spider Curls) :** (Muscles worked: Biceps, triceps). How: Lie on an incline bench and hold a dumbbell in each hand, letting them hang underneath your shoulders. Use your biceps to curl the dumbbells towards your shoulders. Slowly return to starting position and repeat.

VII. CONCLUSION

Humanoid robots in gyms offer personalized guidance, real-time feedback, and tailored workout plans, revolutionizing fitness experiences. Their interactive nature enhances motivation and engagement, potentially leading to more effective and enjoyable workouts. While still in early stages, integrating humanoid robots presents exciting opportunities for improving fitness outcomes and creating futuristic gym environments.

VIII. FUTURE SCOPE

Even without real-time feedback, humanoid robots acting as gym trainers still hold significant potential. They could provide pre-programmed workout routines tailored to individual needs, demonstrate proper exercise techniques, monitor progress over time, and offer motivational encouragement. This would streamline gym sessions, make fitness instruction more accessible, and potentially reduce the need for human trainers in certain contexts.

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