Modeling and Control of an upper Humanoid Robot as a Basketball Player

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***Abstract*—This project aims to design a system that can pick up and shoot a basketball with two robotic arms. It also focuses on creating interactive experiences for elderly individuals and children by engaging in playful activities with a softball. The project combines robotics, control systems, and entertainment to enhance well-being, social interaction, and physical activity for different age groups. Success will be measured by the system's ability to accurately pick up and shoot the basketball.**

***Keywords*-Robotics, Basketball, Control Systems.**

I. Introduction

The integration of robotics and sports has marked a groundbreaking advancement in the field of technology, offering us the opportunity to explore new dimensions of human-machine interaction. In this context, our research delves into the fascinating realm of humanoid robotics, aiming to develop a Poppy humanoid arm system capable of playing basketball. This innovative project merges the intricacies of mechanical design, control algorithms, and real-time sensing, presenting a significant step forward in the pursuit of enhancing both robotic capabilities and human-robot cooperation in dynamic and demanding environments.

The primary objective of this paper is to detail the design, modeling, and control strategies employed in the creation of a Poppy upper humanoid arm specifically optimized for playing basketball. The project seeks to bridge the gap between theoretical robotic design and real-world application in sports, with the ultimate goal of demonstrating how advanced robotics can be integrated into recreational activities, education, or even therapy for individuals with physical disabilities.Figure 1.

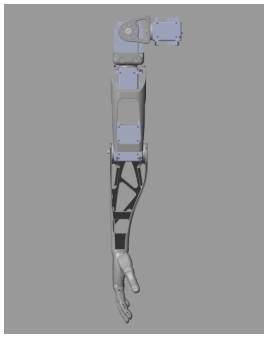

Figure 1: Poppy Right Arm

Table I: Hardware Components Table

Name of component	Location of purchasing	No. of items	Price
3D printed arm	Make It Real	1	500
Servo motor 10kg.cm	Future electronics	3	550
Servo motor 15kg.cm	Future electronics	1	750
Arduino Uno	Future electronics	1	410
Battery 3.7v	Ram electronics	3	65
Wires, Jumpers	Future electronics	Some	50

You should also state the contribution of this report in a paragraph stating what you are going to present.

In section II, the robot's hardware design and implementation is going to be presented. section III presents the simulation results.

II. Hardware Design and Implementation

In order to build the hardware of the system, certain components are required as well as the circuit diagram of the system is built.

A. Hardware Components

The poppy upper humanoid open source is used and 3D printed for hardware testing. For the motors, three double axes motors holding 10 kg.cm torque max and one motor holding 15 kg.cm for the shoulder to hold the whole system. Arduino Uno is used to control the four motors.

B. Circuit Diagram

As shown in Figure 2, the circuit consists of 4 motors, each have three connections for the voltage, the ground and the signal which is the output of the arduino. A breadboard to connect the wires at common nodes.

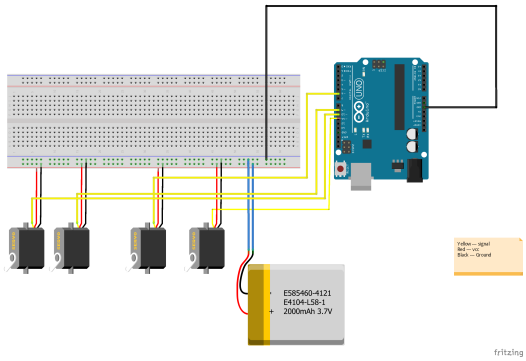

Figure 2: Circuit Diagram

III. Simulation Results

The robot arm is exported from Solidworks, and then imported to Simscape and tested with different inputs, constants, sine waves, signal editor and lastly, a slider. the following figures show the block diagram.

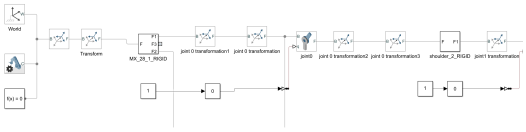

Figure 3: Block diagram part 1

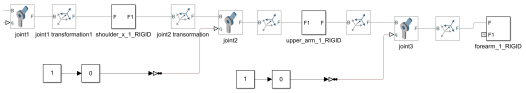

Figure 4: Block diagram part 2

References