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Helping Hand for Paralyzed Persons Using Robotic Arm

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ABSTRACT

The main objective of this project is to assist a 2 degrees of freedom (2DoF) robot arm based on inverse kinematics using Arduino. The proposed system is designed to provide precise control of the robot arm's movement for the application which helps partially paralyzed persons including pick and place tasks. Because of the system's use of inverse kinematics, which translates relevant joint angles into desired end-effector positions, users may intuitively control the movements of the robotic arm. People who are partially paralyzed can easily engage with the robotic arm and carry out everyday duties more independently and effectively. Results from the system's implementation and testing in a real-world setting demonstrate its excellent accuracy and efficiency in performing precise movements. The 2DoF robot arm has several uses not only for the partially paralyzed persons but in various industries, including manufacturing, health, and robotics research, to automate complicated operations and boost efficiency. All things considered, this project shows that it is possible to use Arduino to precisely and accurately program a 2DoF robotic arm based on inverse kinematics.

Keywords: **Inverse Kinematics,2 Degree of Freedom**

1. INTRODUCTION

This project is fascinating because it uses Arduino to assist a 2 Degree of Freedom (2DoF) robot arm based on inverse kinematics. This allows you to control the position and orientation of a robot arm using software. We will investigate the idea of inverse kinematics in this project, which entails figuring out the joint angles necessary to get the desired end effector position. The Arduino platform's adaptability, user-friendliness, and strong community support make it the perfect setting for carrying out this project. We can use Arduino to develop code that reads sensor data, controls the robot arm's movements, and interfaces with a variety of input devices. An important idea in robotics is inverse kinematics, which allows for precise control of robot arms. Inverse kinematics enables us to ascertain the joint angles necessary to attain a desired position, in contrast to forward kinematics, which determines the end effector's position based on the joint angles. We may program the robot arm to move precisely and correctly to a certain place inside its workspace by utilizing inverse kinematics. We will connect the Arduino microcontroller platform to the 2DoF robot arm in order to carry out this project. Two servo motors will drive each of the robot arm's two joints. To precisely regulate the joint angles, we will interface the servo motors with the Arduino. We will create code for Arduino that accepts input parameters like the intended orientation and position of the end effector. After that, the code will use inverse kinematics equations to determine the required joint angles. The servo motors will receive these joint angles and adjust the robot arm's position accordingly.

We will investigate a number of ideas in this project, including motor control, trigonometry, and coordinate transformations. Additionally, we'll concentrate on enhancing the coding to ensure the robot arm moves smoothly and efficiently. You will have a solid understanding of inverse kinematics, Arduino programming, and software control of a 2DoF robot arm by the end of this project. This project can be expanded to include grippers, sensors, and possibly remote control of the robot arm, among other things.

2. PROPOSED SYSTEM

The keyboard serves as the primary controlling device, deciding which way to move the robot arms. Given that the robotic arm has two degrees of freedom, the two servo motors are helpful in moving the arm forward and backward. The Arduino board is mounted on the kit, and the keyboard is first connected to it by inserting the Arduino code into it. The Arduino board is connected to the gripper and the two servo motors. The code that is included on the Arduino board and is entered via the keyboard controls the movement of the gripper and the servo motors

The figure 1.1 is block diagram of our project it explains how Arduino UNO serves as the project's main hub and connects to the gripper through the servo motor, according to the block diagram. Real-time control is provided by the KeyPad which has the keys that send commands to the Arduino, which converts them into motor movements for the robot.

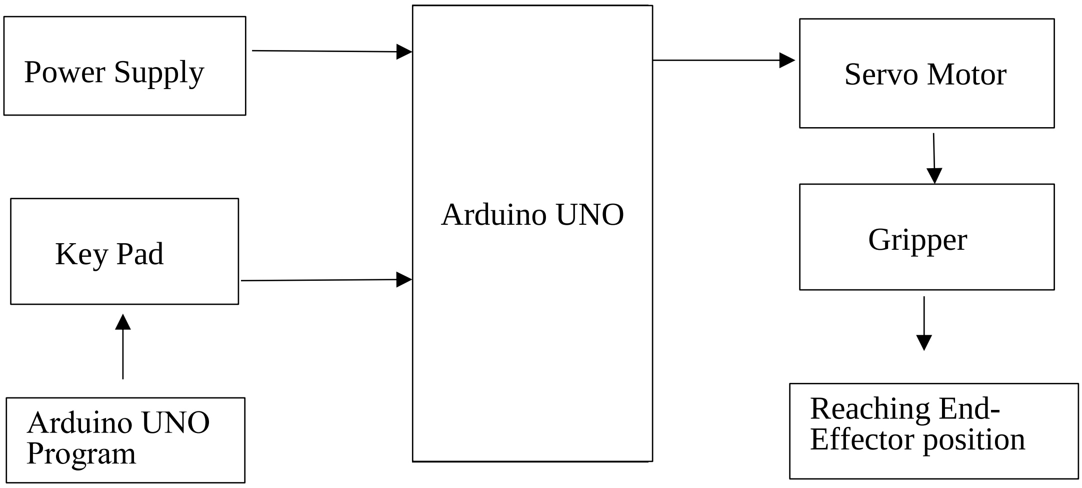

Fig. 1.1. Block Diagram of the Proposed System

To ascertain whether the robot arm is selecting and moving the objects from the starting location to the intended position, the implemented system has been put to the test. The following outcomes were noted. Output 1: Robotic arm and gripper movement during object picking The arm will select the item based on the keypad input and taking the delay into account. Output 2: Robotic arm and gripper movement during object placement Based on the keypad's input, the robotic arm will move to the required position while accounting for any delays. The keypad serves as a tangible or digital interface that allows human operators to interact with the robotic system. The keypad makes it easier to enter the numerous settings and instructions that control the robot's motions, ability to manipulate objects, and general demeanor during the pick-and-place procedure.

Output 1: Movement of robotic arm and gripper while picking the object

Based upon the given input from the keypad and by considering the delay, the arm will pick the object as shown in Fig. 3.1

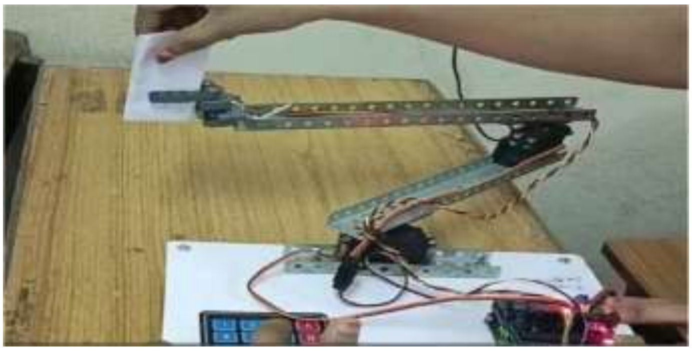

Fig. 3.1 Picking the object by gripper

Output 2- Movement of robotic arm and gripper while placing the object

Based upon the given input from the keypad to reach to desired position and by considering the delay, the robotic arm will place the object as shown Fig. 3.2

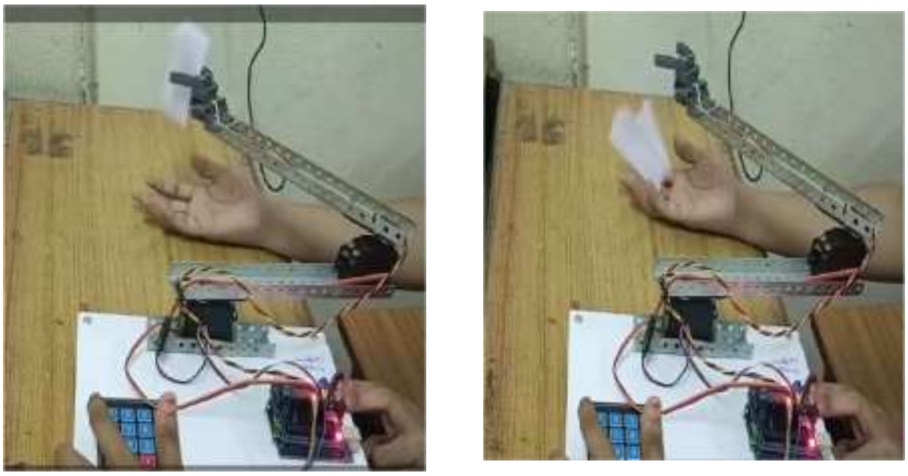

Fig. 3.2 Placing the object by gripper

3. CONCLUSION

It is difficult for paralyzed people to move around throughout daily tasks. This project suggests using a gripper and robot arms to move from an initial position to the end-effector position. According to the delay time specified in the code, the gripper opens for a certain amount of time. In the meantime, the gripper is filled with the necessary object. The gripper then closes and moves to the desired location in accordance with the instructions provided to it.

Our project assists in lessening the difficulties paralyzed individuals have picking up objects since they are unable to move. Our system aids in the handling of little items like medications.

4. REFERENCES

[1] Peter Corke: A prominent writer in the robotics and automation fields is Peter Corke. Among the many topics he addresses in his book "Robotics, Vision and Control: Fundamental Algorithms in MATLAB" is robotic arm programming. It offers a thorough overview of robotic systems and contains MATLAB code and real-world examples.

[2] John J. Craig and J. M. Cameron collaborated on the book "Introduction to Robotics: Mechanics and Control." The principles of robotics, including kinematics, dynamics, control, and programming, are covered in this extensively used textbook. It offers a strong basis for comprehending the ideas underlying robotic arm programming for pick and place tasks.

[3] Benjamin J. Stephens, Kenneth A. Waldron, and Jonathan W. Hurst: Together, these writers authored "Robot Manipulator Control: Theory and Practice." The book covers a wide range of subjects, including kinematics, dynamics, and trajectory planning—all crucial for programming robotic arms—even though its main focus is control theory.

[4] Oussama Khatib and Bruno Siciliano: Renowned robotics researchers and writers are Bruno Siciliano and Oussama Khatib. The "Springer Handbook of Robotics," which they co-wrote, is an extensive resource on a variety of robotics topics, including programming robotic arms. It offers insightful information on pick and place applications by covering kinematics, dynamics, control, and grasping.