Dow Cox

Jacob West

***Abstract* – Through the use of automation, the potential for scaling up production of supply of goods is nearly limitless. This project is a marriage of hardware and software that represents an interdisciplinary approach to manufacturing needs. This controllable robotic arm can move in three axis and use a claw to move objects.**

1. Introduction

The purpose of this project is to build and program a robotic arm that will be controlled with a joystick. We wanted to be able to build a robotic arm to gain experience in the automation and programing industries. As companies trend toward automation, robotics experience will become increasingly in demand. Our team is composed of Dow Cox, a Computer Engineering major, and Jacob West, an Electrical Engineering major with a concentration in mechatronics.

1. Background

We relied on sources from thingiverse for the arm as well as the resources provided to us in class for the coding. Coding was completed with the help of Copilot. Our citation acknowledges these resources, and they are cited in the section citation section.

Project description and formulation

Materials:

1. Chassis: Serves as the framework for the robotic arm and houses the motors
2. Motors: These allow the arm to move
3. Raspberry pi pico: This is the central processing unit. Responsible for all data processing.
4. Glue: Used to reinforce the chassis.
5. Zip Ties: Used to reinforce the chassis.
6. Joystick: Allows the user to interact with the arm and control its movements.

The total cost of the project was four dollars. The kits were provided at no cost and the 3d printing was done in the imaker space. A hot glue gun was purchased to repair the chassis after a failed 3d print.

Diagram:

The diagram depicts a modified representation of our project. Because of the limitations of parts in tinkercad, an Arduino was used to represent the processing unit. For the same reason, a push button is used to represent the analog input of the joystick. Finally, the diagram depicts a single servo motor as the output. Our project makes use of three identical motors.

Blue plastic parts on a grid

Description automatically generated A circuit board with wires and a cable

Description automatically generated

Functionality:

The system works by collecting analog values from the user through the joystick. When the joystick is activated, the raspberry pi pico collects the user inputs, and then the code changes these values to a usable range. The values are then used to power the outputs which in this case are servo motors in the arm.

The chassis of the arm consists of interconnecting plastic pieces that house a servo motor inside them. The motors are powered by the raspberry pi pico and allow the arm to move. The pieces of the chassis are designed to fit together with friction. Some hot glue was added to the chassis to reinforce the connections between the pieces as well as to repair cracks from the print.

1. Discussion and results

The program and motors functioned as expected. The motors can be controlled by the joystick properly. However, due to an issue with the 3d print, the robot arm was not able to be assembled without using glue. After the repairs were made the arm can move in 3 dimensions as expected.

A circuit board with wires

Description automatically generated

We wanted to do this project because we wanted the chance to work with the raspberry pi pico and to gain experience with robotics. This project is perfect for us because it gives us the ability to work on something that is directly related to what we would be doing in the field after graduation. Dow is majoring in computer engineering and was responsible for developing the python code. Jacob is majoring in electrical engineering with a concentration on mechatronics and was responsible for researching and 3d printing of the chassis.

1. Conclusion

This project represents proof of concept that could be carried over to almost any industry. Automation already has and will continue to revolutionize the way that business is done in many fields. Building a robotic arm that is controlled by a human is an excellent resume’ builder for any engineering discipline. Using the same principles, this project could be easily scaled up in size, and by using more robust materials would allow the arm greater functionality in almost any industrial setting. By using a robotic arm to do work instead of humans, industries can increase production while also making work safer for those involved. Through automation, our robotic arm project represents a concept that promotes industrial innovation, worker safety, increased productivity, and lower bottom lines for countless industries.

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Description automatically generatedA blue object on a grid surface

Description automatically generatedA blue plastic object on a grid surface

Description automatically generatedBlue machine on a tile floor

Description automatically generatedA blue gear on a grid

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Description automatically generated

References:

[bentommye](https://www.thingiverse.com/bentommye) (November 18, 2012) Micro Robot arm (9g Micro Servo) <https://www.thingiverse.com/thing:34829>

Microsoft (2024). Copilot [Large Language Model]. https://copilot.microsoft.com/