ROO-Bot: An Interactive Tour Robot

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Dr. Lucas Craig, Mechatronics Technology, Capstone 2023

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Introduction

With SUNY Canton being a Technology school, we thought that a unique special touch to our program would intrigue potential students. The ROO-Bot is an interactive tour robot that is controlled remotely by and individual that can verbally and physically interact with the students and their families. By using 3D printers, programming receivers and a raspberry pie we were able to create Canton's own robot.

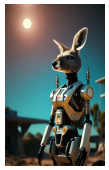


Figure 1: Projected ROO-Bot ideas.

Design Requirements

Needs	Wants	Like-to-haves
Be at least 50" tall	Able to stay connected up to 100 meters away	Cosmetically pleasing
Under 40lbs and easy to maneuver	Moveable arm and claw like hand	Presentation of arduinos and other boards and wiring
Intereactive with perspective students using camera and microphone	Easy to control using a separate display	Able to carry a backpack to assist people unable to carry items
Wireless motion control	Strong wireless connection	

Background

Through research of general robotic design as well as a 3D printed EZ bot arm project, the Roo-bot was designed to be a functional touring assistant prototype while showing off the facets of the mechatronics engineering discipline. These details and choices made ultimately made it apparent to control the motion wireless and accurately distribute power accordingly, while maintaining a specific aesthetic.

Capstone Objectives

- Research, design, and fabricate a ROO-Bot
- Implement 3D modeling using Autodesk Inventor.
- Utilize our 3D printing skills to fabricate parts.
- Implement programming using Arduino with various sensors: actuators, servos, …..<finish>.
- Use a raspberry pie to connect our speakers and microphones remotely for communication.

Preliminary Design

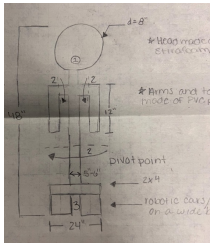


Figure 2: Preliminary design 1

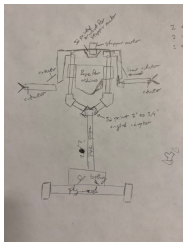


Figure 3: Preliminary design 2

For the initial design we wanted to have a good center of gravity for the frame. Our vision was to use a remote controller RC car to allow the robot to move smoothly. The body will be made of PVC to create a lightweight frame, which will take stress of the shocks of the RC car. We will be printing all the joints to allow for movement and interaction.

Budget

Cost Analysis				
Part Description	Website	Price	Quantity	Subtotal
Arduino uno	Amazon	$28.50	6	$171
Soldering shields (5 Pack)	Amazon	$10.88	2	$21.76
Servo Motors	AmainHobbies	$39.99	2	$79.98
PLA	Hatchbox	$25.99	4	$103.96
Linear actuator 3"	Amazon	$28.50	1	$28.50
Redcat TC8 Marksman 1/8 4WD Rock Crawler	AmainHobbies	$439.00	1	$439.00
NRF24L01+ (4 Pack)	Amazon	$7.89	1	$7.89
NRF24L01+PA+LNA (2 Pack)	Amazon	$8.49	1	$8.49
1/2-in x 24-in x 4-ft Medium-density MDF	Lowes	$14.54	1	$14.54
INTSUN Mini Portable Speaker	Amazon	$14.69	1	$14.69
1080P Webcam	Amazon	$19.99	1	$19.99
3.5mm Male to Female Stereo Audio Extension Adapter	Amazon	$7.39	1	$7.39
Redcat 2x10mm Wheel Hex Pin (10 Pack)	Ebay	$2.98	1	$2.98
4xAA Battery Holder to DC Barrel Jack Connector (2 Pack)	Amazon	$5.19	1	$5.19
3S LiPo Battery (2 Pack)	Amazon	$34.99	1	$34.99
2S Lipo Battery Pack	Amazon	$32.47	1	$32.47
BTS7960 43A High Power Motor Driver Module	Amazon	$7.39	1	$7.39

Figure 4: Cost Analysis

Materials

Figure 4: Batteries

Figure 5: Servo Motor

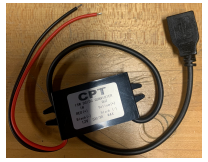


Figure 6: DC power converter

Figure 7: Raspberry Pie Screen

Final Design

Figure 8: RC Car and base

Figure 9: RC Car and base

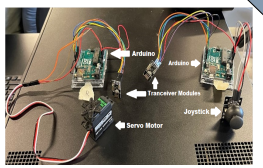


Figure 10: Raspberry Pie and Arduino setup.

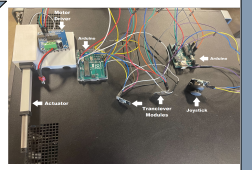
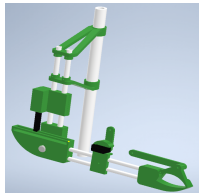


Figure 11: Raspberry Pie and Arduino setup.



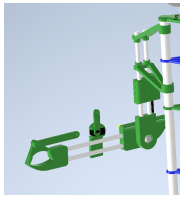
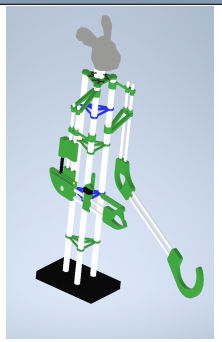


Figure 12: 3D Render of our ROO-Bot.



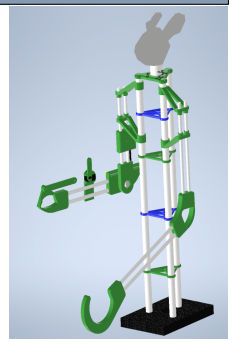


Figure 13: 3D Render of our ROO-Bot.

Contributions

Tyler Shorette	Michael Osterhaudt	Matthew Passaretti	Laura Clements
designed arm, shoulder, and claw	Designed and printed struts for pvc pipes and top plate	Designed holes for base plate	Made weekly checklists
Made prototype of arm	disassembled and re assembled RC car, swapping out motor, and finding good	Filled in blanks and worked on poster and report	Cut out baseplate, got hole drilled, and painted
Printed and assembled robot arms.	Designed and printed plugs for shocks	Figured out transmitter and coding	Cut pvc for arms and body
	designed and tested preliminary clamp design, along with tester	Put together budget	Created poster design doc, poster rough draft, report outline, report document
	tested assembly and fit of rc car + kangaroo base, along with clamp pieces.	Mapped out arduino connection for all controlled movement	Created 3D model of robot
		Researched audio and video connection (Rasberry Pi)	
		Created order forms and facilitated order processing	

Complications

- Substantial printing time
- Power Conversion/distribution
- Reevaluation of design
- Time constraints
- Wireless motion control