Teleoperated Cobot Arm for Human Augmenta

Jan. 1

Brainstorming - "choose a topic for my Science Fair Project "Teleoperated Cobot Arm for Human Augmentatio

The project idea is: robotic arm that is cont remotely using potentiometers and a simple joysti with a program.

Jan. 3

- Researched about teleoperation systems.
- Learned about master-servant robotic systems.
- Decided to use Arduino Uno.

Jan. 5

- Made a blueprint for master & slave robotic arm.
- Planned to mount potentiometers directly on mast arm joints.

Jan. 7

- Gathered all the materials I needed:

- Master:

- Potentiometers
- Wood
- Jumper Wires
- Super Glue
- Breadboard
- Arduino Uno
- Joystick

- Servant:

- Wood
- Microservos
- Super Glue
- Camera
- Breadboard
- Arduino Uno
- Nuts & Bolts
- Jumper Wires
- AC/DC adaptor
- Extension Cord

Jan. 12

- Bought 5v external supply (AC/DC adaptor).

- Tested all servos independently with simple code.

- Checked if all microservos rotated 0-180° successfully.

Date

Jan. 15

- Checked dimensions
- Started building master & servant robotic arm.
- Installed first servo (base)
- Tested if mechanical rotation from 0-180° was successful.

Jan. 17

- Found out torque : F = mass of object in kg x g

$T(kg\cdot cm) = mass\,(kg) \times distance\,(cm)$

$mass\,(kg) = \frac{T(kg\cdot cm)}{r(cm)}$

$mass = \frac{2}{10} = 0.2\,kg\ (200g)$

$T_{joint} = \sum_i m_i \cdot g \cdot l_i$

$F = \frac{T}{r} = \frac{2}{r} = kg$

Torque $T = 2\,kg\cdot cm$

Arm Length = 10cm

Date

Jan. 18

- Built Master robotic arm frame
- Tested if servos move when connected to potentiometers.
- Ensured if potentiometers work & rotate with arm joint

Jan. 20

- Worked on building the servant robotic arm.
- Wired potentiometers to Arduino analog pins (A0, A1, A2)
- Checked if claw opened & closed with help of joystick.

Jan. 22

- Added changes to initial Arduino code.
- Used serial monitor to function and convert servos from 0-1023 to 0-180°
- Uploaded code
- First successful movement test.

Date

Jan. 25

- Noticed servo jittering
- Problem: insufficient power from Arduino.
- Solution: used external power supply for servos.

Jan. 28

- Delay observed (~150ms)
- Checked wiring
- Reduced delay by simplifying code.

Jan. 30

- Tested all 3 joints moving at the same time.
- Observed slight lag when moving quickly.
- Estimated delay (~140ms)
- Movement still synchronized accurately.

Jan. 31

- Tested lifting different weights
- 50g → stable
- 100g → stable
- 150g → barely shaking
- Added a small dead-zone in code to prevent unwanted movement.

Feb. 3

- Secured connections with electrical tape.
- Movement became more stable

Feb. 6

- Tested lifting different weights again:
- 50g → stable
- 100g → stable

Date

- 150g → stable
- 200g → slightly shaking

Feb. 8

- Measured voltage from potentiometers.
- Range confirmed from 0 → 5v
- Analog readings stable between 0 → 1023

Feb. 8

- Re-measured voltage from potentiometers.
- Range confirmed: 0-5v
- Analog readings stable between 0-1023

Feb. 12

- Conducted 5 trial accuracy tests
- Recorded master angle vs slave angle

Date

• Trial results :

• 30° → 29°

• 60° → 60°

• 90° → 89°

• 120° → 121°

• 150° → 149°

• Average error ≈ 1°.

Feb. 15

• Calculated average response delay.

• Trials : 118ms, 125ms, 130ms, 120ms.

• Average delay ≈ 123ms

• Considered acceptable for teleoperation prototype.

Date

Feb. 18

- Reviewed wiring connections
- Ensured all wires were not loose
- Glued all loose servos.
- Stability improved

Feb. 22

- Evaluated possible improvements

Feb. 24

- Final performance testing
- Moved all joints simultaneously.

Feb. 26

- Reviewed all data.
- Confirmed
- Average error ≈ 1°