Feedback with Robotic Appendages

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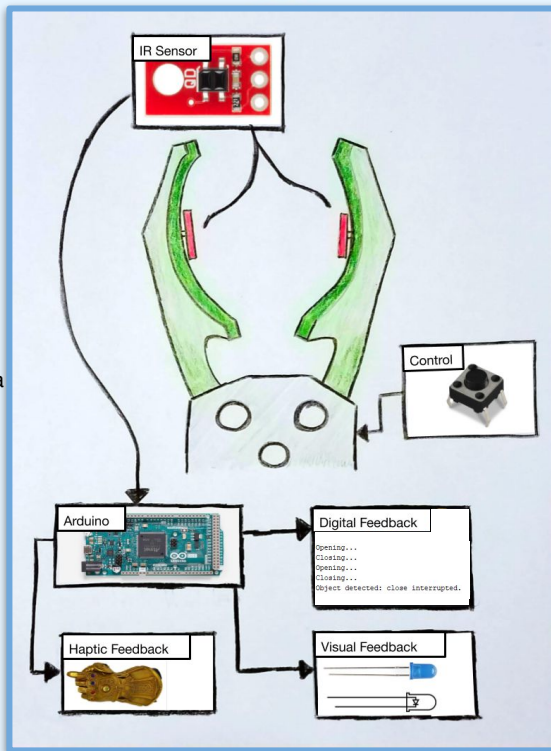
Introduction

- Certain robotic arm technologies could be improved with haptic or optical feedback to the user.
- Some of the areas where improvement can be made:
  - Toxic waste management
  - Prosthetics
  - Remote Surgery
- The goal is to figure out the best way of providing feedback to the user.

Development

- Distance Sensing
  - This IR sensor uses a phototransistor output, emitting a larger value when there is less light.
  - We can use this to sense when the robot is getting close or touching.
- Robotic Claw
  - Used Arduino code with a Vex Robotics Motor to programmatically open and close a claw.
  - Controlled commands with input from computer.

Acknowledgements

Research Findings

- Distance is not an easy thing to measure
  - Capacitive sensor versus IR sensor.
- Visual comparison

	Simple	Inexpensive	Natural Response	Easily Modifyable
Visual	x	x		x
Digital	x	x		x
Haptic			x	

Results

- Where we are now.
  - Claw that can open and close around objects using computer controls.
  - Sensor that can sense touch and close proximity.
- Where We Want to Go?
  - Haptic gauntlet with motion controls to simulate real arm movements and touch.
  - Testing with different shaped objects.
  - Full wireless control.

References

1. Okamura A. M. (2009). Haptic feedback in robot-assisted minimally invasive surgery. Current opinion in urology, 19(1), 102–107. https://doi.org/10.1097/MOU.0b013e32831a478c
2. Bimbo, Joao & Pacchierotti, Claudio & Aggravi, Marco & Tsagarakis, Nikos & Prattichizzo, Domenico. (2017). Teleoperation in cluttered environments using wearable haptic feedback. 3401-3408. 10.1109/IROS.2017.8206180.