# Project H.A.N.D.: Handy Appendage for Nonlocal Distances

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## ABSTRACT

A robotic hand wirelessly controlled by a glove worn by a user has many applications in the medical, industrial, and luxury industries:

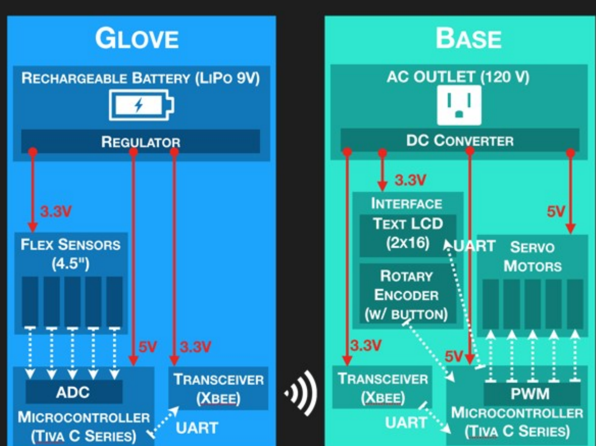
- Medical: It can be used as an enhancement to those with weak arms, so the user could grasp things that he would not otherwise be able to grasp.
- Industrial: Workers can control arms that can carry far more weight than a human, and with more dexterity than a crane or lift.
- Luxury: It can be used to change the channel of the television without requiring a couch potato to leave his seat.

## OBJECTIVES

The goal of this project is to create a robotic hand that is wirelessly controlled by a glove.

We planned for three different modes:

- **Real Time Mimicry:** Mimic user's finger movements in real time.
- **Rock-Paper-Scissors:** Gloved user plays against the robotic hand.
- **Delayed Mimicry:** Stores several positions provided by user, then executes sequentially in a loop.




## THE USER'S GLOVE

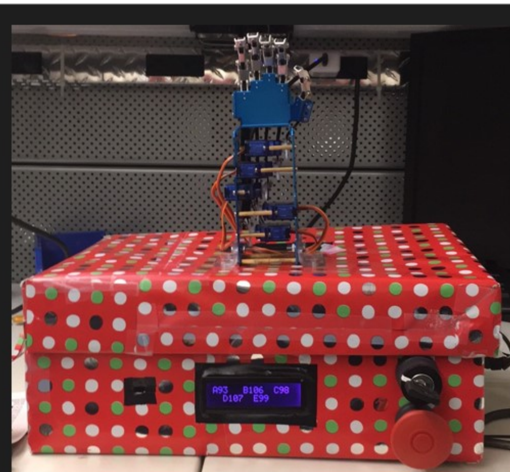
Each finger on the glove has a flex sensor going along it. These sensors change resistance depending on their flex. To acquire the data, each flex sensor is put into a voltage dividing circuit, whose value is read by the ADC of a Tiva Launchpad TM4C microcontroller. The 5 raw readings are then packed into a frame and sent off to a XBee Series 1 RF transceiver. The data is wirelessly transmitted to a XBee in the robotic hand's circuitry.

New frames were constantly broadcasted from the glove, irrespective of the mode that the robotic hand was on. This simplified our system design because we only needed to work on the robotic hand to implement the various modes.

## THE ROBOTIC HAND

Each robotic finger is controlled by a servo motor pulling a "tendon" in the finger. The servos are controlled by PWM signals (RC standard), which are synthesized by a Tiva. This Tiva also receives the frames that the robotic hand's XBee collected from the glove's XBee. The robotic hand's Tiva is responsible for the logic for the various modes the system supports.

In addition to these essential components, there is an a 2x16 text LCD and a rotary encoder with a built-in button to interface with the user. The LCD displays debug information, game results, etc. depending on the mode. The rotary encoder is used to switch modes.



## RESULTS & CONCLUSION

We successfully implemented **Real Time Mimicry** and **Rock-Paper-Scissors**, but did not have enough time to implement **Delay Mimicry**. Instead we implemented **Screensaver** (iterates through pre-defined motions).

We failed to build our own robotic hand due the lack of a working 3D printer. Instead we purchased a pre-built rudimentary robotic hand.

## FUTURE WORK

Implement **Delayed Mimicry**. Both the **Rock-Paper-Scissors** and **Screensaver** modes demonstrate two fundamental components for this mode: interpreting user's finger positions and replaying various positions, respectively.

Utilize the 3D CAD developed for this project and 3D print the custom robotic hand. A lot of time was put into the development of the custom hand, and would be great for the vision to come to fruition.

Add battery power as an alternative to the wall outlet source for the robotic hand for off-the-grid use.

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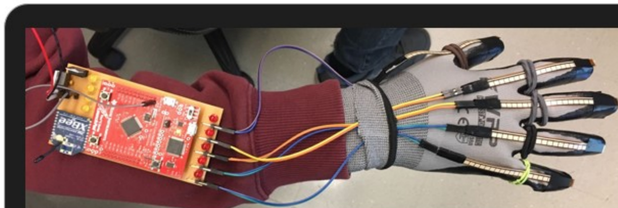

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