GESTURE SENSE

A tool of communication for Mute and Paralyzed people

Group 48

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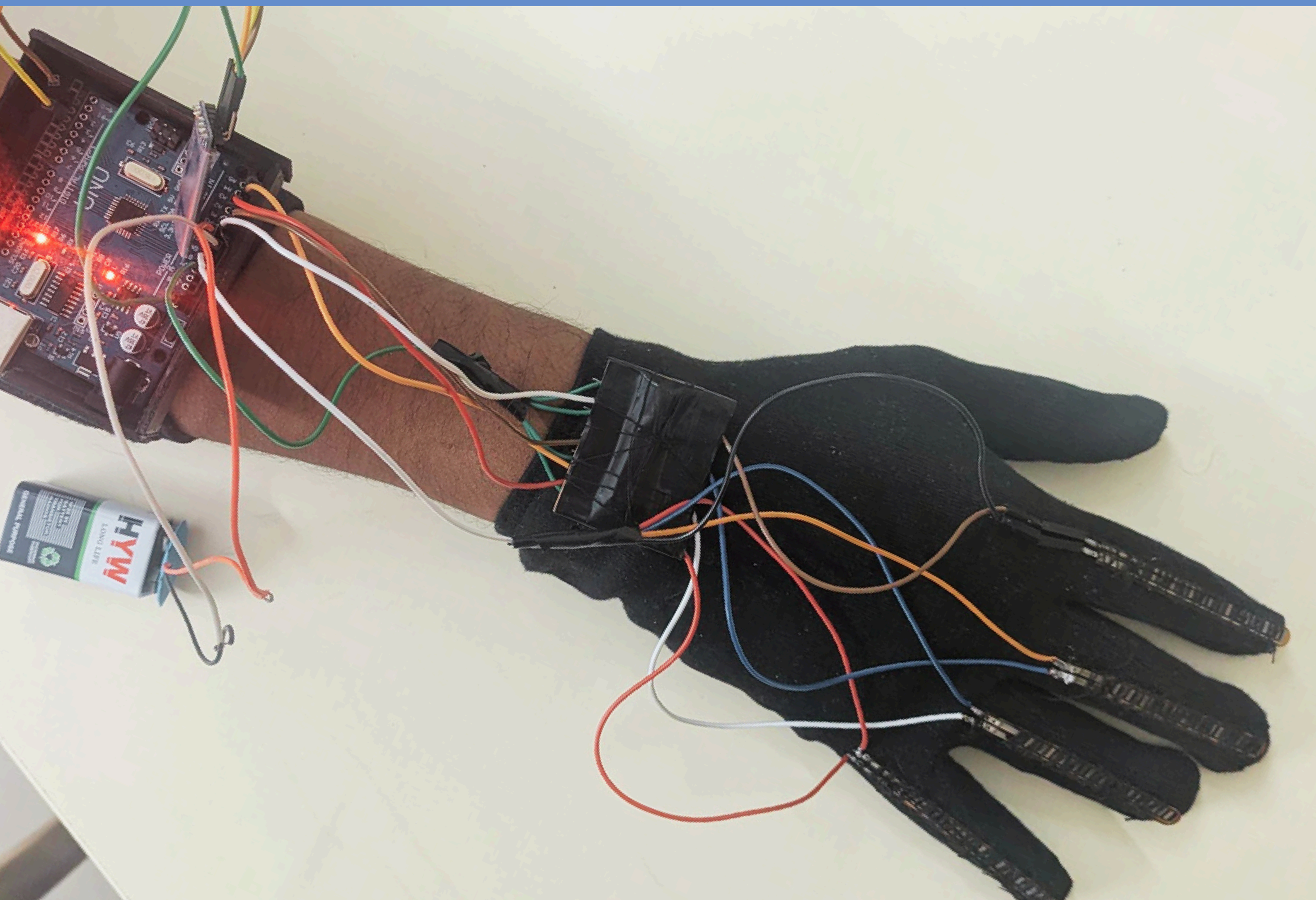
PC122 - PC223



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INTRODUCTION

Communication is a fundamental part of human interaction, but for individuals with speech or motor impairments, expressing even basic needs can be a significant challenge.

Our project, "Flex Sensor-Baed Communication System for Mute, Paralyzed, and Speech-Impaired Individuals," was born out of the need to address this issue. What started as an idea during the ideation phase has now evolved into a functional solution, thanks to the guidance of our mentor, Professor Madhumita Mazumdar, and the collaborative efforts of our team.

The heart of our project lies in a Gesture Sense equipped with flex sensors that detect finger movements and translate them into meaningful messages. This glove provides a customizable, affordable, and easy-to-use communication system, tailored to the needs of users with limited motor skills. From the start, we were driven by the goal of creating a tool that could enhance accessibility, independence, and quality of life for those who face these challenges daily.

During the ideation phase, we consulted with physiotherapist and caregiver to better understand the real-life struggles of our target users. Their feedback shaped our focus on creating a lightweight, comfortable, and adaptable device that could be personalized to fit individual requirements.

Physiotherapist's insights:

We had a discussion with Dr. Vaishnavi Rana (Physiotherapist) and learned that the gloves would be highly beneficial for individuals with vocal cord paralysis, as well as for elderly people who require caretaking and emergency assistance. These gloves could be useful not only for those with permanent paralysis but also for individuals experiencing temporary paralysis. To maximize comfort, the gloves should be lightweight and easy to wear, as thick, rigid materials can lead to irritation and discomfort.

Currently, a simple bell is often used by patients to signal emergencies, but providing a more advanced, efficient gadget like this glove could greatly enhance their ability to communicate and seek help when needed.

IMPLEMENTATION:

As per the ideation submitted in course PC122, we promptly began working on the project upon receiving our materials. Initially, our primary focus was on thoroughly understanding the specifications of each component in the circuit.

1

Implementation on Tinkercad

Before transitioning to the breadboard and physical assembly, we first implemented our circuit on Tinkercad. This step allowed us to validate the components and ensure the functionality of the designed circuit with confidence.

2

Implementation on Breadboard

Once the circuit design was finalized, we sourced additional components from the lab and proceeded to implement the circuit on a breadboard.

3

Final implementation

After verifying the functionality of our circuit, we soldered the wires to the terminal points of the flex sensors to ensure secure and reliable connections.

4

After soldering the connections, we attached the flex sensors to the glove. While stitching the sensors onto the glove proved to be challenging, we were able to overcome the difficulty and successfully complete the task.

5

Once the glove's structure was complete, we crafted a cardboard box to securely house the HC-05 Bluetooth module, Arduino UNO, and a 9V battery. We then mounted the box onto a Velcro wristband using Velcro, ensuring a stable and adjustable fit.

6

Next, we assembled the resistance portion of the circuit by soldering the components and securing the resistors through holes poked in the cardboard. To ensure stability and maintain the integrity of the connections, we covered the entire section with black insulating tape.

7

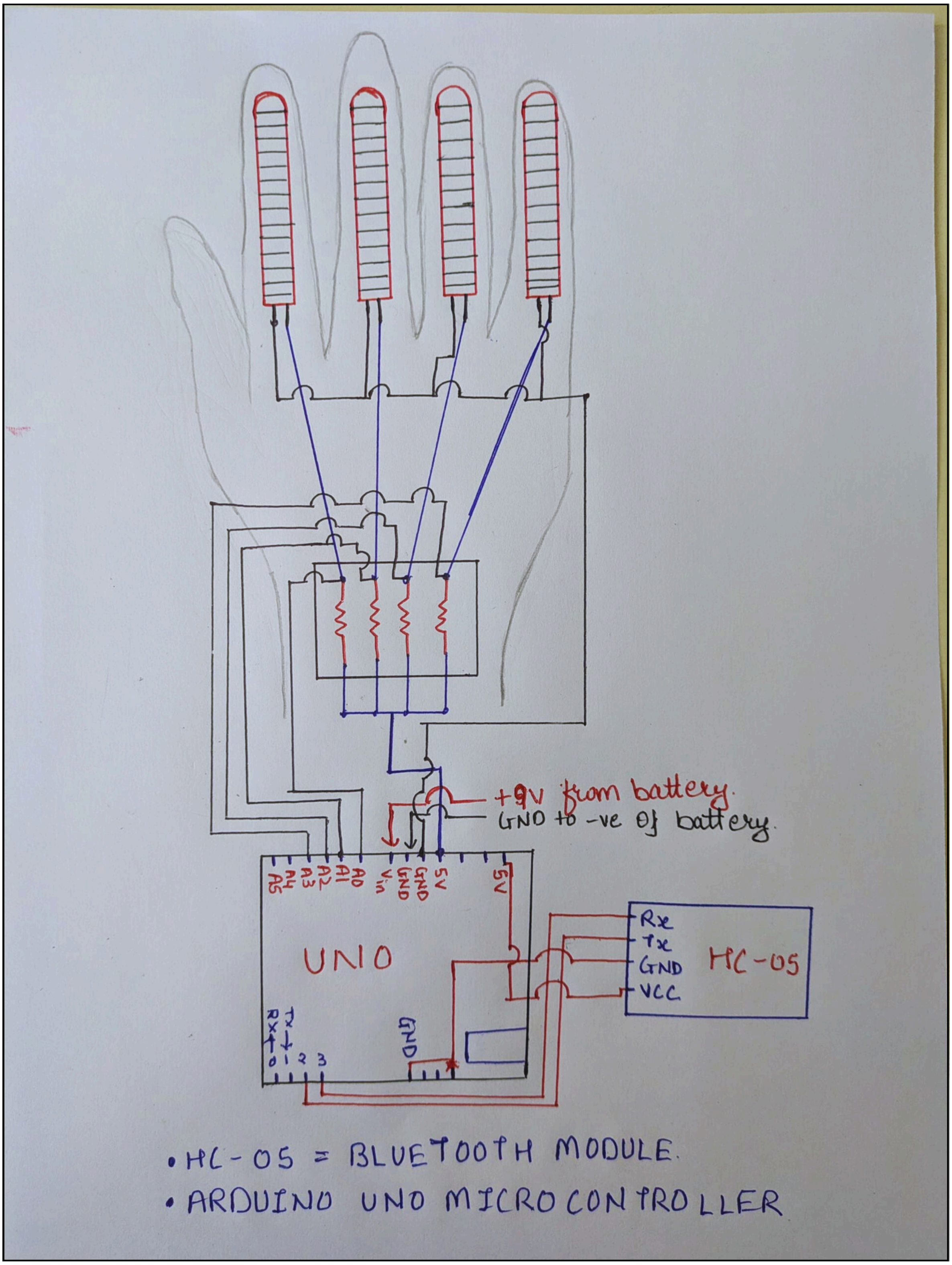
We used jumper wires to establish the connections according to the circuit diagram outlined in the ideation report for PC122, which is also included in the report for reference.

8

Final Touches

Once the circuit was implemented on the glove, we added the finishing touches by painting the cardboard box black for a cleaner appearance. We also reinforced the insulation and secured the flex sensors more securely to the glove to prevent any unwanted movement.

CIRCUIT DIAGRAM:



Note: Resistances are of 3.3K ohm

LINKS:

- Link to the video showcasing the project's functionality: Click Here
- Link to the Arduino UNO code: Click Here

CHALLENGES FACED:

- **Challenge:** In the ideation phase, we specified a 10K ohm resistor, and the circuit worked as expected when simulated on Tinkercad. However, when we implemented the circuit physically on the breadboard, we encountered an issue where the sensor readings consistently showed 1023, the maximum value that the flex sensor can give due to the 10-bit resolution of the Arduino Uno's analog-to-digital converter (ADC).
- **Solution:** To address this, we experimented with 2-3 different resistor values, and ultimately found that a 3.3K ohm resistor provided the best results through a trial-and-error approach.
- **Challenge:** The flex sensors we received were not from the same brand, leading to differences in their rest values and variation rates.
- **Solution:** We carefully observed the rest values of each sensor multiple times and made adjustments in the code to account for these variations.
- **Challenge:** Integrating the HC-05 Bluetooth module to ensure seamless communication with the mobile app was a challenge.
- **Solution:** We researched troubleshooting guides and relevant articles online to ensure a stable connection between the HC-05 and the mobile app.
- **Challenge:** Fitting the Arduino Uno, Bluetooth module, and all the wiring onto the hand proved to be a logistical challenge.
- **Solution:** We decided to mount the Arduino Uno and Bluetooth module onto a Velcro wristband, providing a secure and adjustable setup.
- **Challenge:** Stitching the flex sensors onto the glove was tricky, requiring multiple stitching points to keep the sensors in place and ensure they didn't shift.
- **Solution:** We carefully stitched the sensors at multiple points on the glove to ensure their position remained intact during use.

SCALABILITY AND FLEXIBILITY :

- As mentioned, our Gesture Sense is designed to assist individuals with disabilities, particularly those who are mute or paralyzed. Since paralysis can manifest in various forms, such as Locked-In Syndrome, Quadriplegia, or Advanced Muscular Dystrophy, the sensor placement and response messages can be customized based on the specific type of paralysis. This customization ensures that the glove can be tailored to meet the unique needs of each individual.

- The concept we've developed is not limited to merely receiving messages; it has the potential to be extended to more complex gesture-based responses. With further improvements in sensor quality and advanced software development, the glove can evolve to accommodate a broader range of gestures and provide enhanced functionality.