The Power of Glove

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Background:

As working environments become increasingly dependent on computers, wrist injuries such as Carpal Tunnel Syndrome become more prevalent and halt productivity. Traditional fixes to ergonomics include ergonomic mice, which still limit the user to the tabletop, reducing ergonomic posture.

Project Goal:

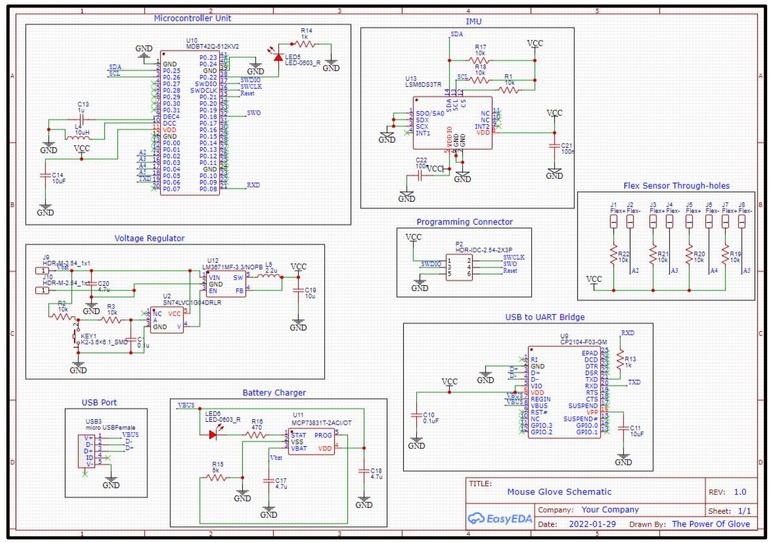
- By replacing the mouse with a glove, it can greatly improve the user's ergonomics [1], and allow handicapped individuals to control the mouse as well.
- Using a hand and arm movements will allow a greater degree of motion around a room, granting the user more freedom to move.

Implementation:

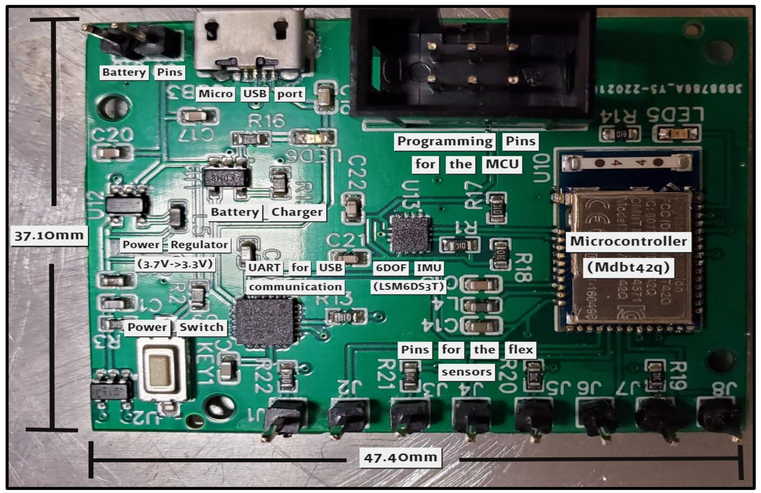
In order to construct the glove, we plan to use intuitive flex sensors in each of the fingers to emulate the clicking and scrolling of a sensor, while using an IMU, containing gyroscopes and accelerometers, to detect the XY-positioning and movement of the cursor. All of the sensors' data will be fed into the microcontroller, which will use Bluetooth to send the information back to the computer.

References:

1. M. Curic and J. Acosta, "Keyboard Mouse Glove with Bluetooth Capabilities for the Physically Impaired," 2019 IEEE International Flexible Electronics Technology Conference (IFETC), 2019, pp. 1-5, doi: 10.1109/IFETC46817.2019.9073770.
2. Kumar, Piyush et al. "Hand Data Glove: A Wearable Real-Time Device for Human- Computer Interaction." (2012).
3. Wu C, Wang K, Cao Q, et al. Development of a Low-Cost Wearable Data Glove for Capturing Finger Joint Angles. Micromachines (Basel). 2021;12(7):771. Published 2021 Jun 30. doi:10.3390/mi12070771



The completed schematic of the PCB, which has all the necessary electronics besides the flex sensor and battery.

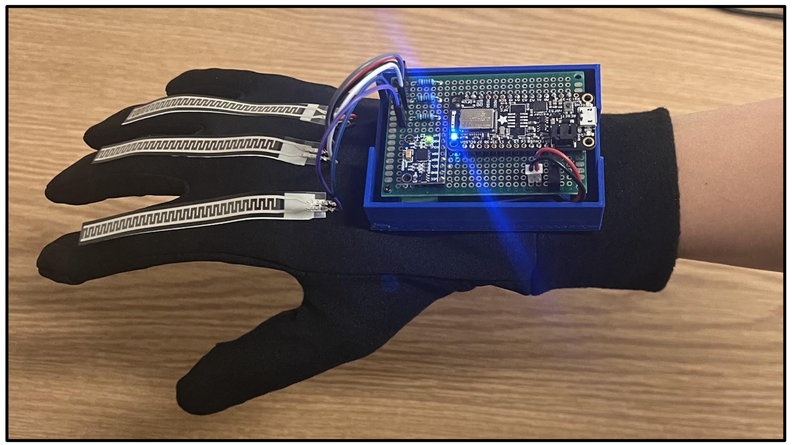


Software:

- Using Arduino IDE, the MCU initiates the Bluetooth connection and HID interface.
- The MCU constantly read the IMU registers and the flex sensors outputs.
- Calculate the angles and rotational speed of the IMU.
- Convert to cursor movement and enable clicks.

Results:

- Created a prototype using Arduino Nano on a breadboard.
- Selected a new microcontroller with bluetooth features and better components.
- Created a schematic with all the new components to create a PCB.
- Designed and ordered PCBs from our schematic.
- Optimized the cursor movement based on hand motion to achieve almost zero delay.
- Included all functions of a mouse using flex sensors.
- Assembled all components onto a glove using a 3D printed fixture.



The Final constructed and fully functional version of the glove mouse.

Improvements:

While we were able to design and print out the PCB with all the necessary components, the board generates high temperature when turned on. The power system would need to be modified and improved to solve this issue. The momentary switch on the PCB also needs to be replaced by a lashing switch for it to stay on without having to hold the switch.

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