McMaster University | Electrical & Computer Engineering

UNIDENTIFIED FLYING MOUSE

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Motivation

Traditional computer mice are designed to give inputs to the computer from the user's hands. This makes it **difficult** for those with **limited hand dexterity**, those who have undergone **hand amputation** or those who were **born without a hand** to use the computer.

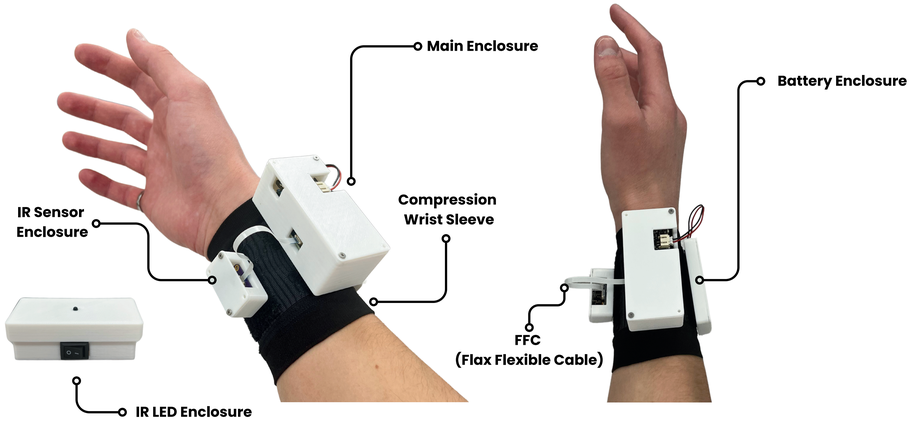
Objective

Design an **input device** which can be used as a computer mouse **without** requiring the **mouse hand**, with the goal of increasing computer accessibility for those who do not have the full use of their hands.

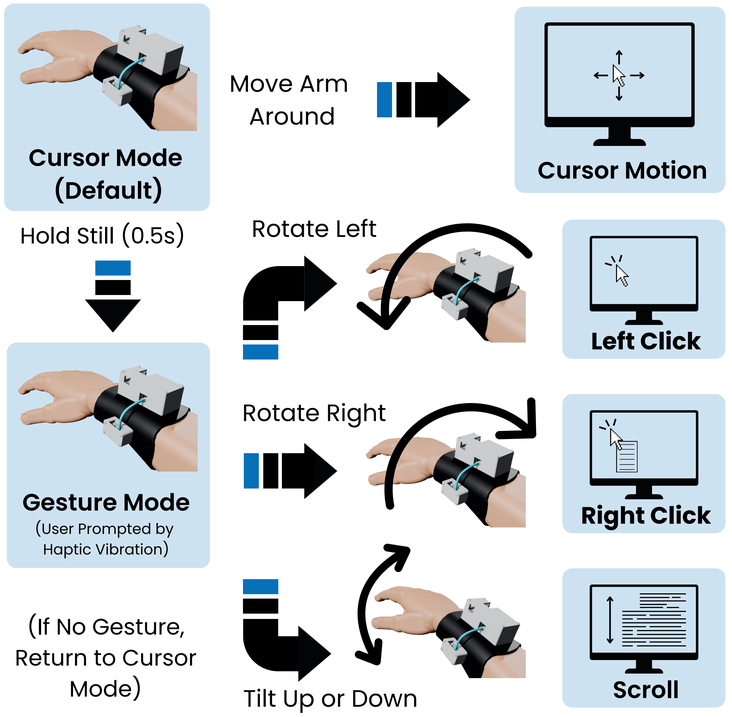
Our Solution

We have created a wrist-worn device which uses movements from the **arm** and **forearm** to perform computer mouse functions.

Our device uses an **IR LED** as a tracking reference, which sits in a compact enclosure on the user's desk.



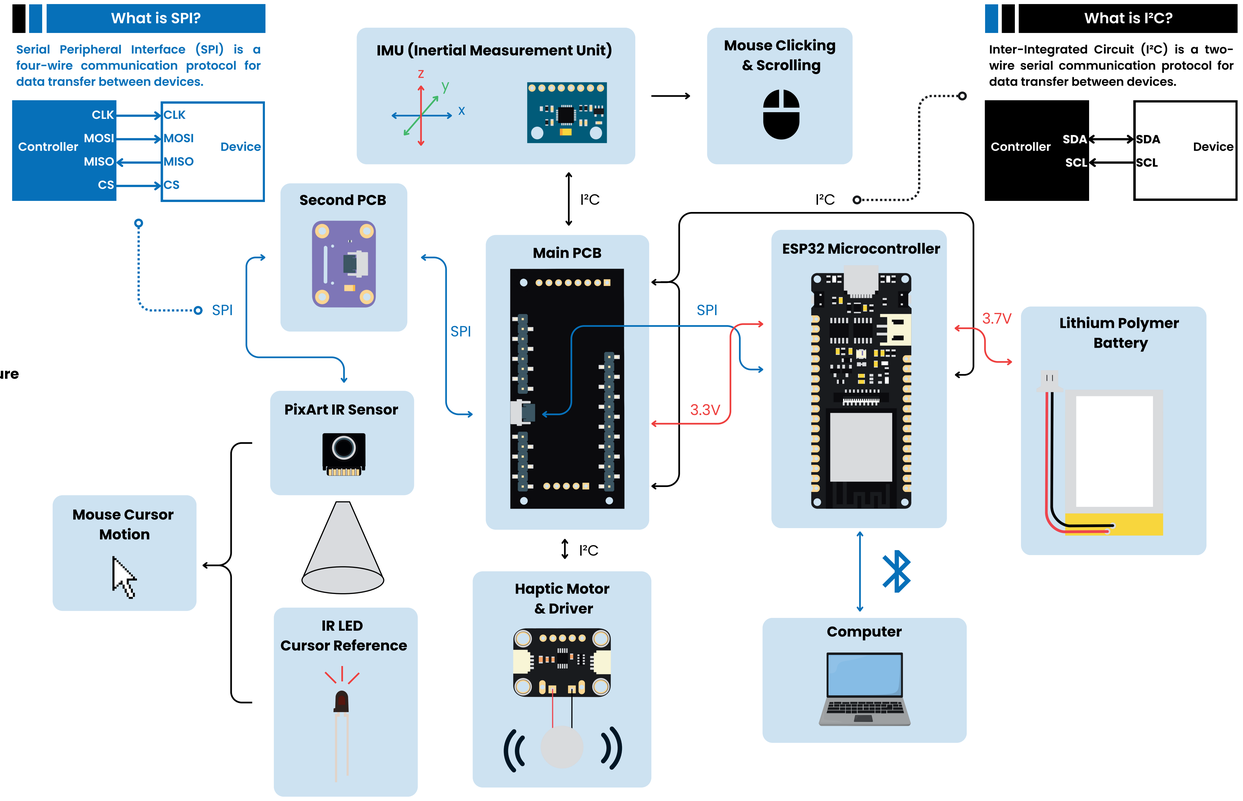
How Do You Use it?



How Does It Work?

- The PixArt **IR Sensor** Tracks an 850nm **IR LED** at 200fps and sends its **x-y coordinates** to the ESP-32 Microcontroller.
- Each coordinate is **compared** to the **previous** one and the **difference** is used to determine the **direction** and **magnitude** to of mouse movement to apply.
- If the mouse remains **still** for 0.5s, the user is prompted via **haptic vibration** to perform a gesture to click or scroll.
- An **IMU** measures **acceleration** and **angular velocity** to capture each gesture.
- The **mouse cursor** or **gesture** commands are sent to the PC by the ESP-32 over **bluetooth**.

System Overview



Software Design Choices

- Codebase entirely contained to the ESP-32 meaning no extra software is needed from the user: Just **pair** with the device using **bluetooth** and the mouse is **ready to use**.
- Mouse movement calculation is very simple, allowing for low computation time and a very **responsive** mouse cursor.
- Cursor movement is separated from other functions with a wait time, limiting mis-inputs.

Physical Design Choices

- Small form factor and lightweight construction for a comfortable fit.
- **Compression sleeve** allows users with various wrist sizes to put-on the mouse using **only one arm**.
- Enclosures secured with **velcro** for easy **attachment** and **removal**.
- Battery power allows for **wireless** operation for an estimated **8hrs** with a 1100mAh LiPo battery.

References & Acknowledgements

[1] B. Trzynadlowski, "PixArt PAJ7025R2 6dof Tracking Demo with Arduino and Windows," GitHub. Accessed: Jan. 03, 2025. [Online]. Available: https://github.com/trzy?tab=repositories&q=PixArt&type=&language=&sort=

[2] University of Pittsburgh the McGowan Institute For Regenerative Medicine, "Prosthetic Hook Mouse for people with upper-limb amputations," https://mirm-pitt.net/prosthetic-hook-mouse-for-people-with-upper-limb-amputations/ (accessed Oct. 20, 2024).

[3] L. M. Keita, B. Alcantara, and M. G. Salazar, "Wireless Mouse for people with upper limb amputation,":://www.dlsu.edu.ph/wpcontent/uploads/pdf/conferences/ditech/proceedings/volume-3/paper-3.pdf (accessed Oct. 20, 2024).

- Special thanks to the **Thode Makerspace** for providing resources such as 3D printers and soldering equipment.

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