

Design and Implementation of an Accessory for the micro:bit Board with a Focus on Universal Design Principles

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Delivery of Technology for Accessibility

Digital Ramps: Hardware and software solutions that facilitate the use of computer tools for students experiencing **learning barriers**, such as low vision, motor difficulties, etc.





micro:bit Program

It is a program that allows **any public school student** from the 5th year of elementary school onwards to **own a micro:bit**. With it, they can participate in various initiatives, such as the STEM Olympiads, Do Your Bit, or Computational Thinking.

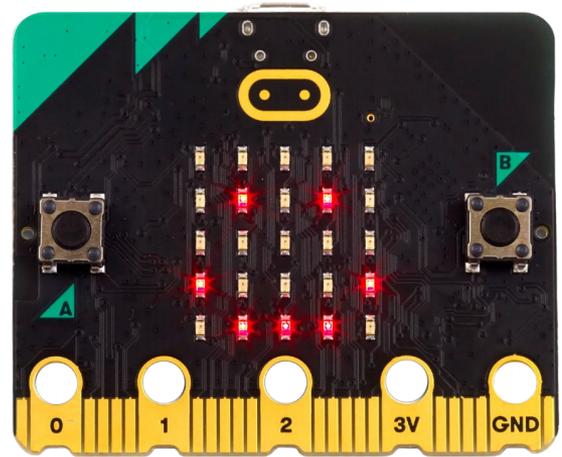
More than **160,000 micro:bit** delivered



Tecnologías para la educación
Technologies for Education



What have we learnt?

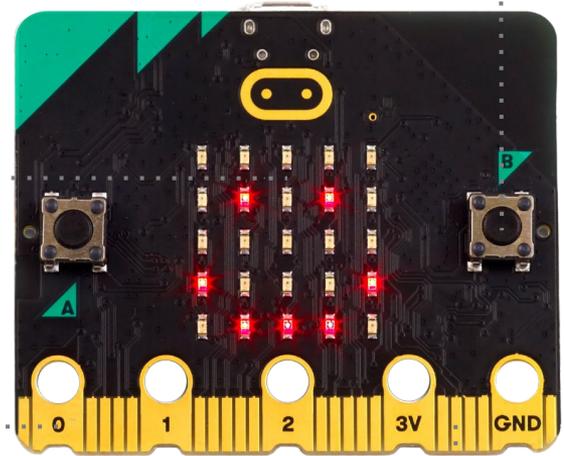


Learning Barriers

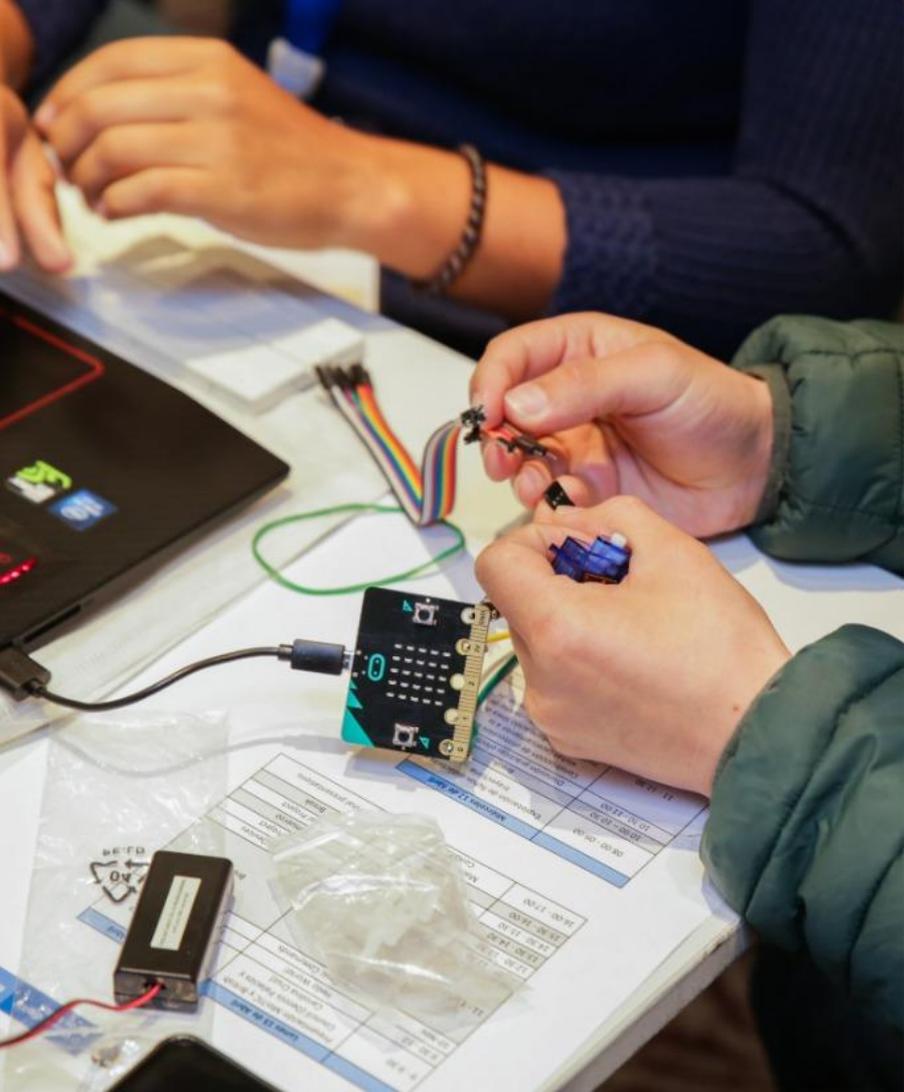
Output information is only visual (5x5 led screen).

Reduced size makes handling and understanding more difficult.

Buttons require fine motor skills.



Recognition of the board is visually inaccessible.



uBit: Accessory for micro:bit

Proposal

Design and implement an **expansion board** for the micro:bit that enables most users to utilise the micro:bit in the same way and **enjoy the same experiences.**

The 7 Principles of Universal Design



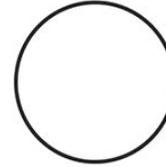
1. Equitable Use



2. Flexibility in Use



3. Simple and Intuitive Use



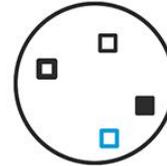
4. Perceptible Information



5. Tolerance for Error

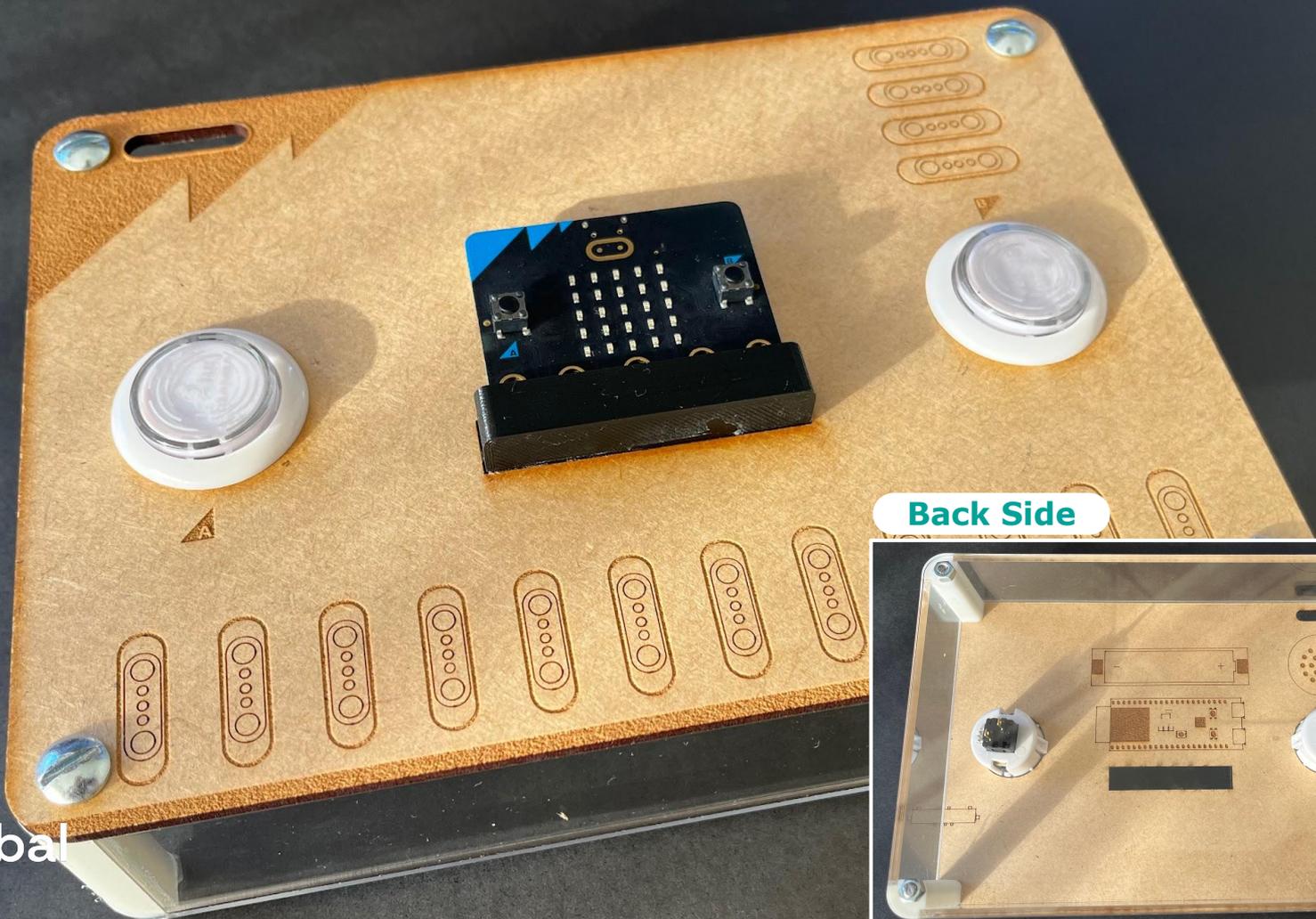


6. Low Physical Effort

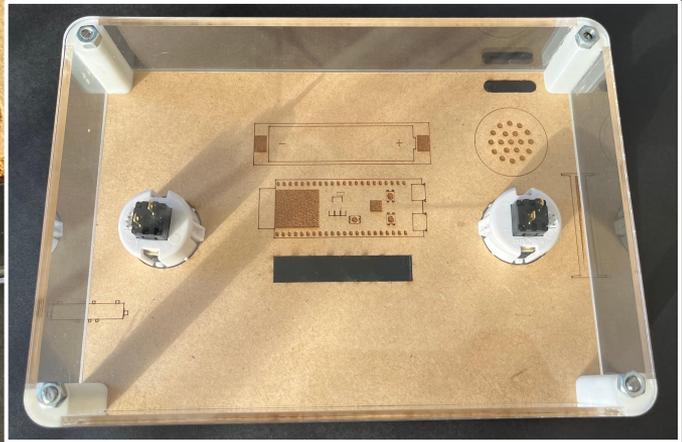


7. Size and Space for Approach and Use

Image source: Interaction Design Foundation - IxDF. 2016. What is Universal Design? Retrieved May 27, 2024 from <https://www.interaction-design.org/literature/topics/universal-design>



Back Side



An ESP32-S2 development board, a small microcontroller board with a black PCB, a USB-C port, and various pins. A white label on the board reads "ESPRESSOR SYSTEMS ESP32-S2 20A L0".

ESP32-S2

A micro:bit development board, a small microcontroller board with a black PCB, a USB-C port, and various pins. A white label on the board reads "micro:bit V2.0".

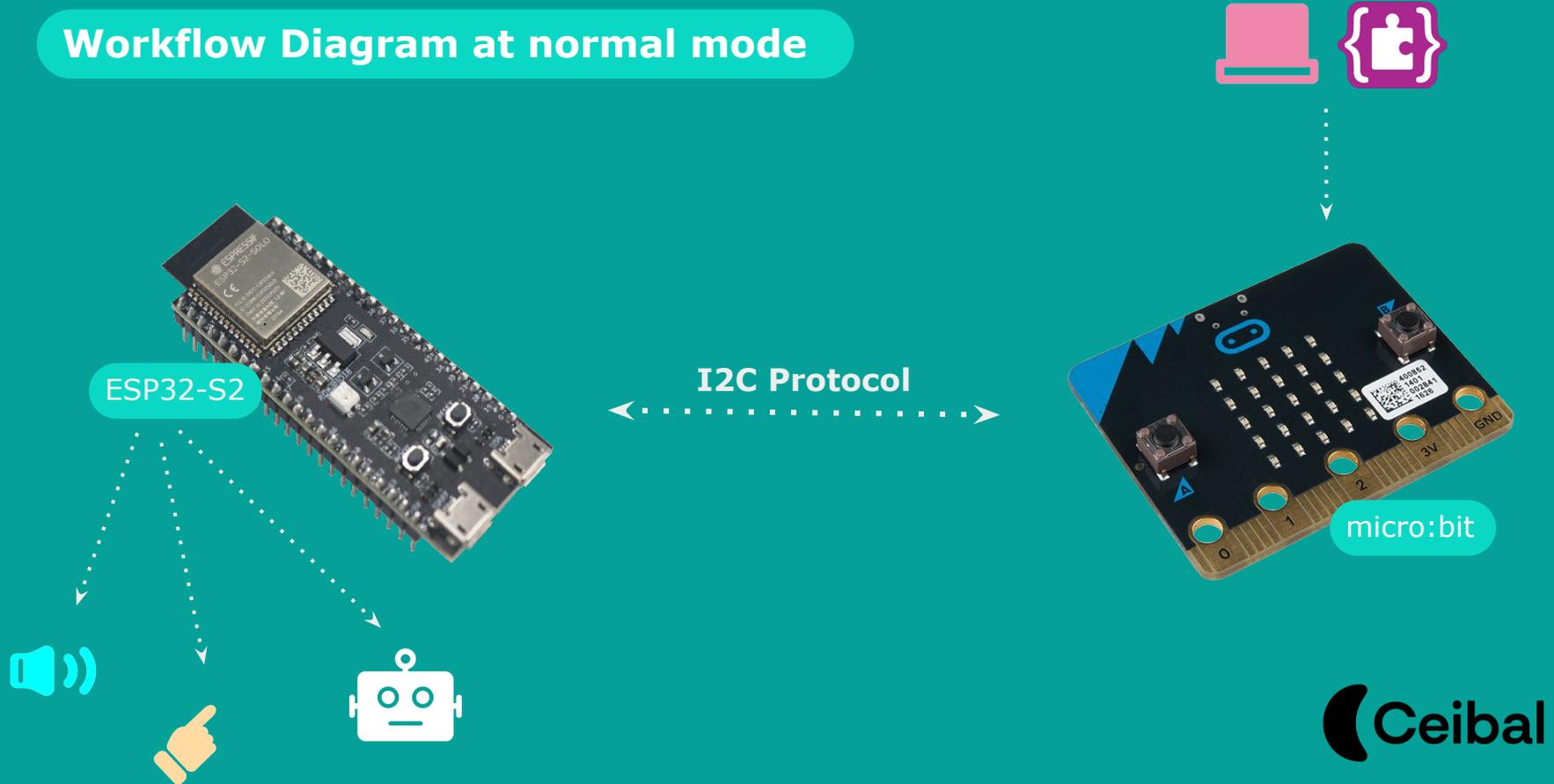
micro:bit

Accessory's Workflow Diagram

3 operating modes:

- **Acknowledging**
- **Normal**
- **Remote**

Workflow Diagram at normal mode

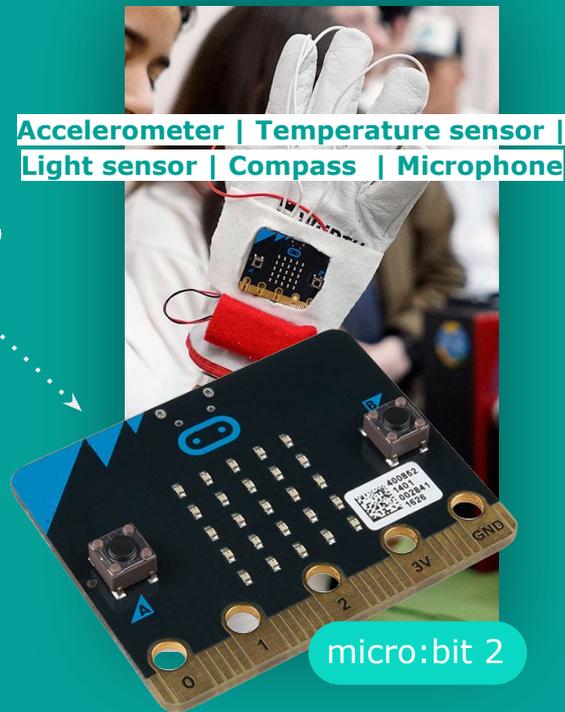


Workflow Diagram at Remote Mode

micro:bit accessory +

Main micro:bit

Radio unique channel



Accelerometer | Temperature sensor |
Light sensor | Compass | Microphone

micro:bit 2

Evolution: Implementation Stages

1

**Accessory Concept
Design**

completed

2

Hardware Design

loading...

3

**Firmware and Hardware
Implementation**

loading...

4

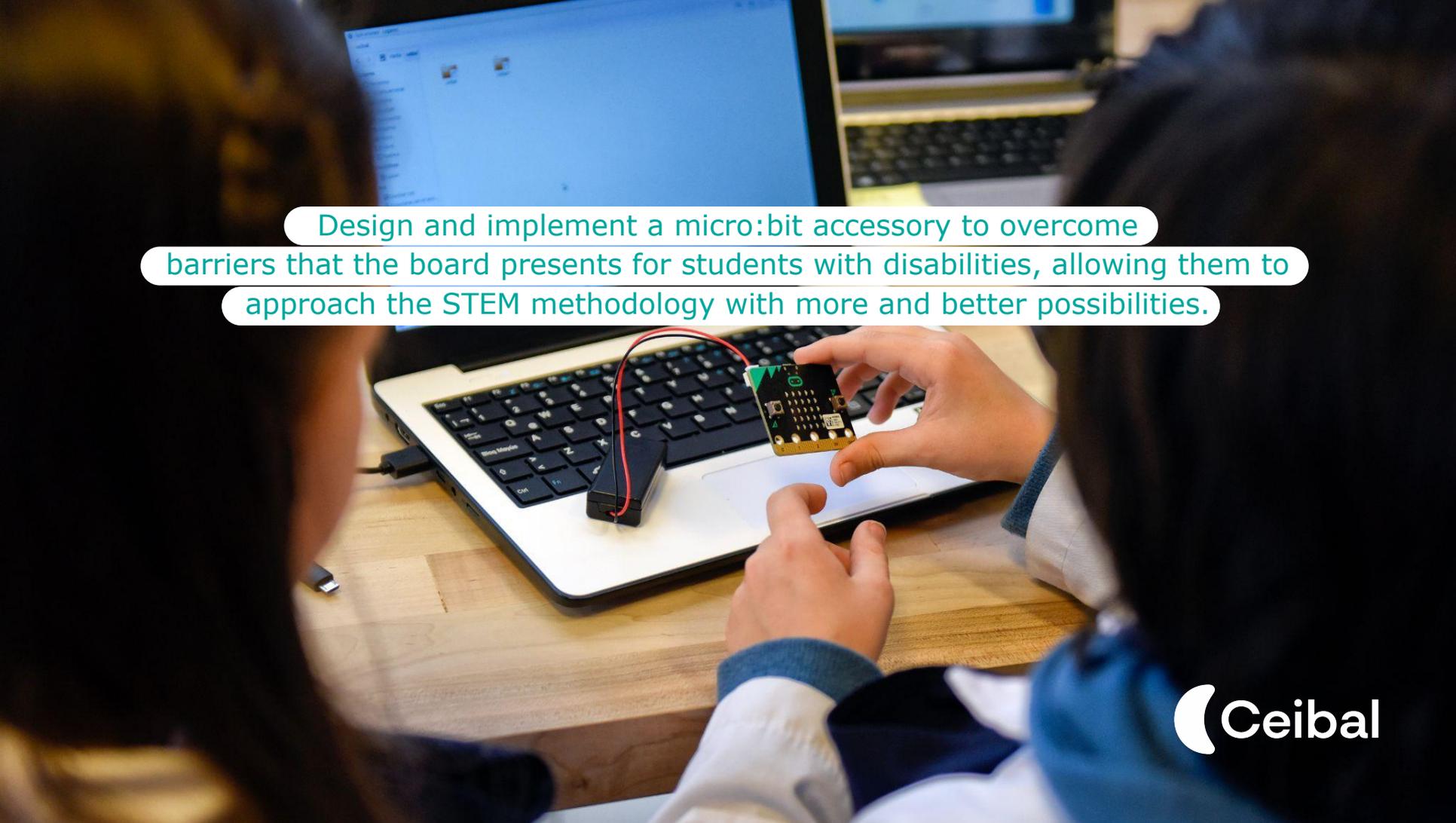
**Makecode Blocks
Development**

loading...

Usability Tests

First prototype test: at Children Rehabilitation Center

First pilot test: in Uruguayan schools within the framework of Ceibal's educational programs

A person is holding a small green micro:bit board with a black USB dongle connected to it. The board is being held over a laptop keyboard. The laptop screen shows a blue interface. The person is wearing a white shirt with blue sleeves. The background is dark and out of focus.

Design and implement a micro:bit accessory to overcome barriers that the board presents for students with disabilities, allowing them to approach the STEM methodology with more and better possibilities.

A person is holding a small green micro:bit board with red and blue wires connected to it. The board is being held over a laptop keyboard. The laptop screen shows a blue interface. The background is slightly blurred, showing other people and laptops in a classroom or workshop setting.

Design and implement a micro:bit accessory to overcome barriers that the board presents for students with disabilities, allowing them to approach the STEM methodology with more and better possibilities.

Thank you
Questions?

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Bibliography



<https://drive.google.com/file/d/1yI8EI8Pf0vjbsPWc1XeI-jsk46wftdun/view?usp=sharing>

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