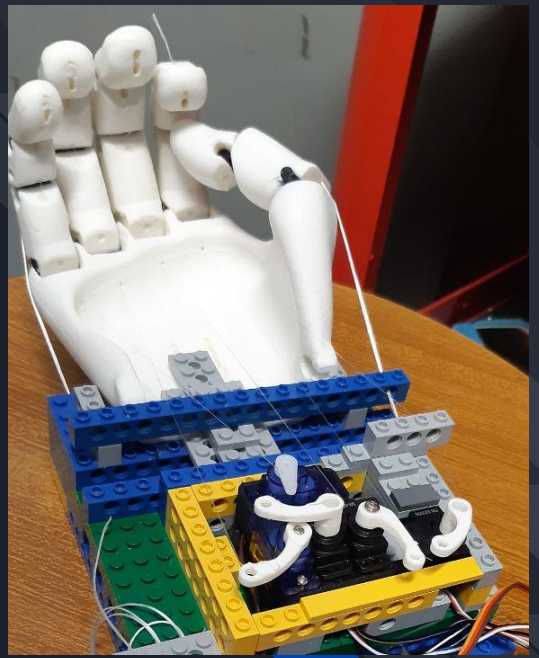
Robotic Hand

by High Five Team

Our project

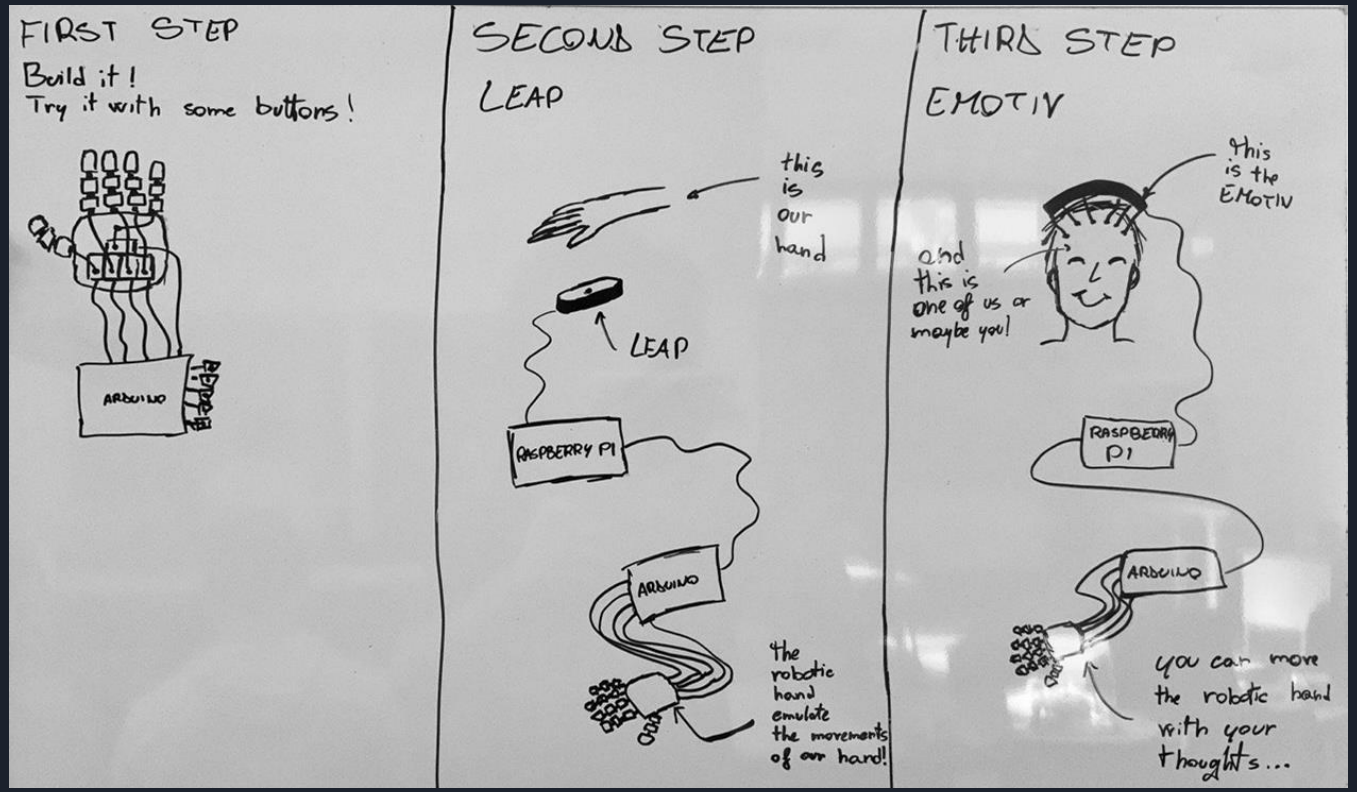
Our idea is to help people who have lost their hand due to accidents. After a long brainstorming we came to the conclusion of creating a **robotic hand controllable with thought.**



Steps of the project

- The first step is to print a **3D robotic hand model** and control it by **Arduino**.
- After printing the hand we move on to the second phase, where we reproduce the movements of the real hand on the robotic hand using the **Leap** sensor.
- Finally, we focused on the last phase and connected our robotic hand with the **Emotiv and Muse** sensor

Steps of the project



The materials

The Leap Motion Controller is an optical hand tracking module that captures the movements of your hands with unparalleled accuracy.

Leap sensor is used for take information about the human's hand and for control the robotic hand.

Emotiv

The EMOTIV EPOC+ is designed for scalable and contextual human brain research and provides access to professional grade brain data with a quick and easy to use design.

Emotiv is used for control the robotic hand with thought.

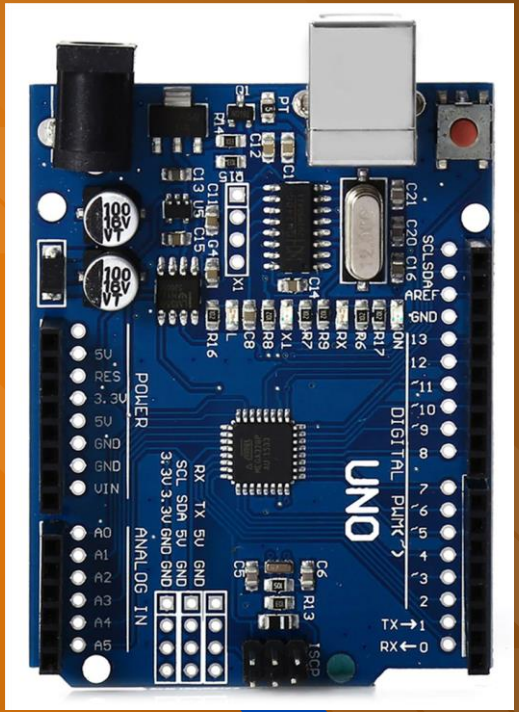
Muse 2

Muse is a wearable brain sensing headband. The device measures brain activity via 4 electroencephalography (EEG) sensors. An accompanying mobile app converts the EEG signal into audio feedback that is fed to the user via headphones.

Arduino UNO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.

Arduino is used to power the motors and based on the sensor data received, Arduino resets the various motors.



Servo Motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, speed and acceleration. It consists of a suitable motor coupled to a sensor for position feedback.

We used these servomotor for moving fingers.

3D printer

We used the 3D printer for creating our hand.

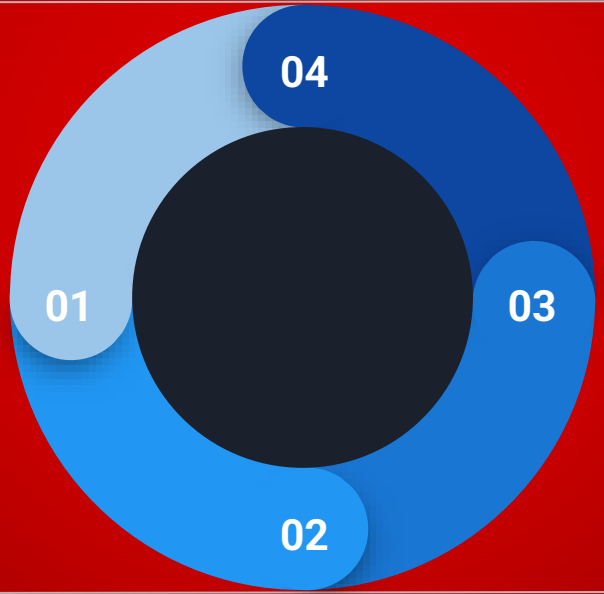
History of the project

The idea

What can we do? Maybe a robotic hand is a good challenge for us.

First Lego prototype

We needed a prototype for testing the first version of program, so we thought at LEGO



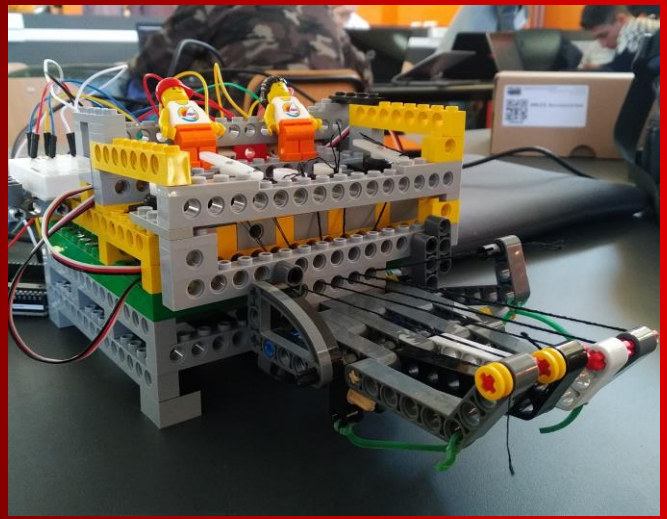
Final 3D Printed model

We changed the design of the hand and printed the final hand.

3D Printed failed model

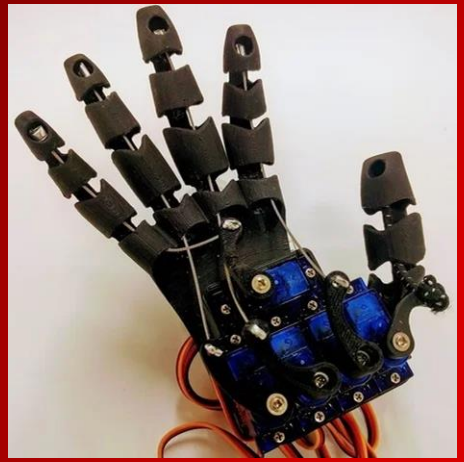
the first 3D printed hand was a failure, we had used an unsuitable plastic

History of the project



First Lego prototype

We needed a reliable model to start testing the first versions of code while we were waiting for 3d printed one, so we thought we'd build it in LEGO technic bricks.



History of the project

3D Printed failed model

After some research we found an optimal prototype for our project, we printed it but the quality was not high and the material was not flexible enough.

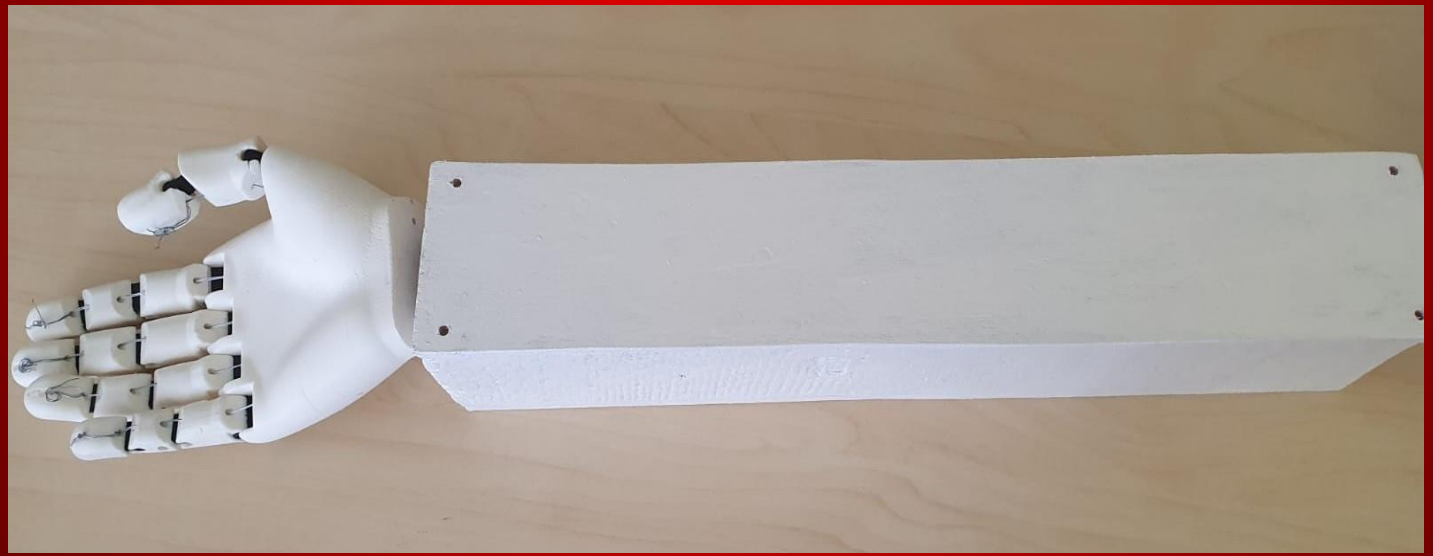
History of the project

Final 3D Printed model

Then we found another hand. Being the hand assemblable, we decide to try to print it in 3D only the thumb, with the appropriate joints and avoid wasting other material.

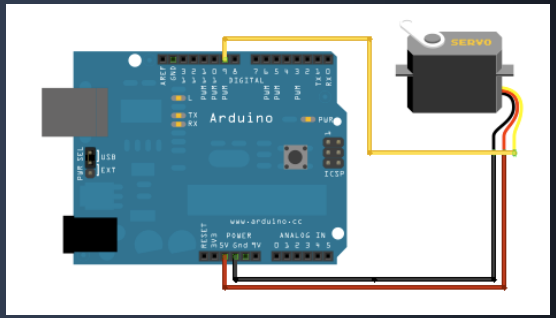
The ForeArm

The last part of our project involved the construction of a wooden forearm that contained the servomotors, the remaining electrical component and allowed the movement of the wrist.



The programs

We started with programming the Arduino to test the servomotors.

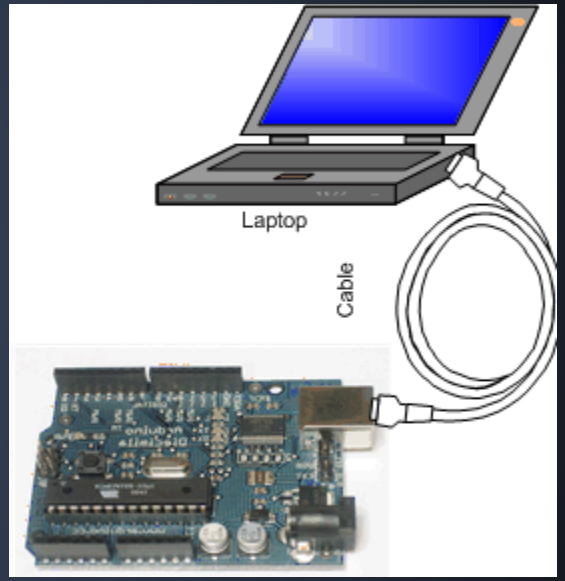


The programs

Then we developed a program to read data from the Leap, an infrared device that reads the positions of the several parts of the hand. At this point we encountered a problem: how to understand when the hand is open and when it is closed. We solved the problem by deciding to calculate the distance between the fingertip and the center of the hand. Shorter the distance is, closed the fingers are.

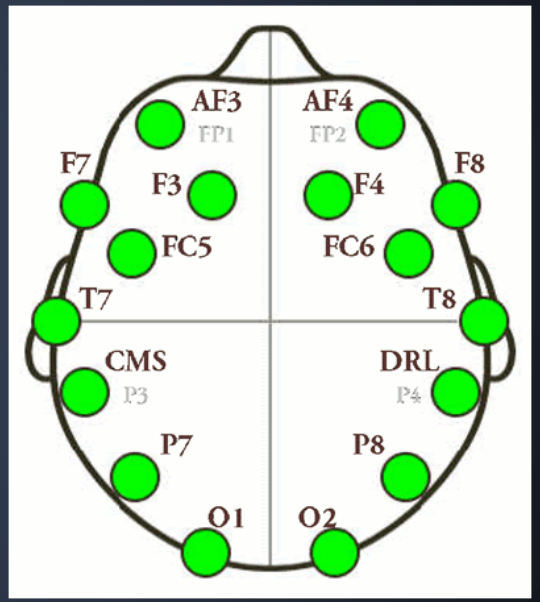
The programs

Now we have to transmit this calculated data to Arduino: so we developed a communication protocol in python.



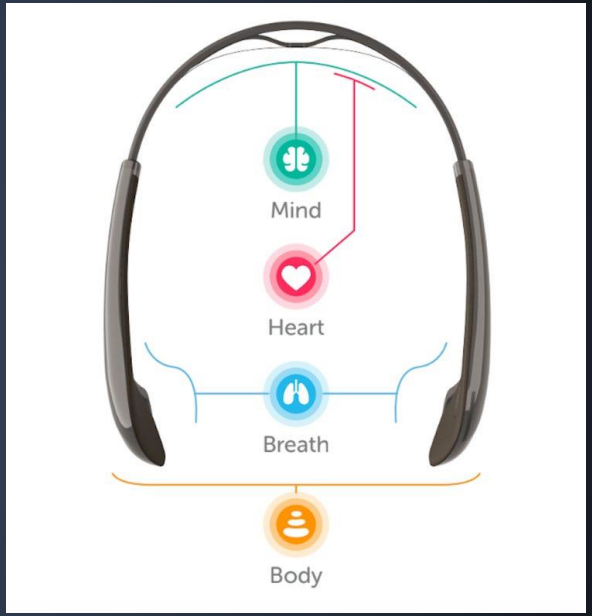
The programs

After, we used the EPOC + programs and our protocol to allow control from the hand with the Emotiv, a helmet that recognizes the impulses that our neurons exchange.



The programs

Finally, we used Muse 2 to read the signals that swap neurons and analyze them.After training, the user can use his hand through thought.



The programs

You can visit our repo in github for downloading the code of our programs.

https://github.com/Bagnis-Gabriele/Robotic-hand

Our success

Our project was as successful that we also gave a press interview: https://video.lastampa.it/cuneo/una-mano-bionica-costruita-con-la-stampante-3d-il-progetto-degli-studenti-dell-itis-di-cuneo/108755/108765

Our team

Our team is made up of Bagnis Gabriele & Giavelli Luca, the programmers and Bruno Luca & Cuniberti Andrea & Genovese Tommaso the technicians.