ElectroCap Project Proposal

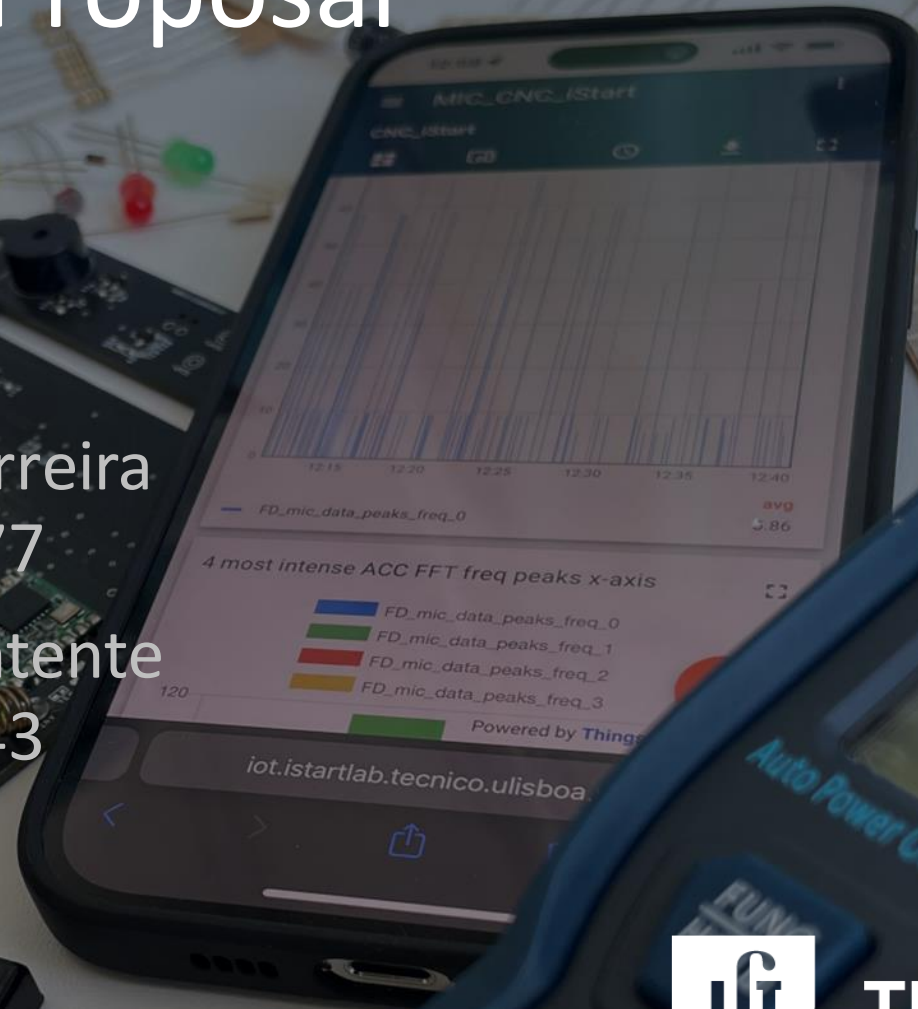# SGECK

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1. Advisors and Mentor

- Scientific Advisor: Prof. Teresa Vazão
- Scientific Co-advisor: TBA
- Coordinator: Prof. Teresa Vazão
- Mentor: TBA

2. Problem definition

Smart gym machines are already on the market today, however acquiring one of these is rather costly for many business owners in the fitness industry. The transition to brand new equipment is a solution that for most local gyms is just simply not an option.

That's why we plan to create a device that can emulate the features and benefits of having smart gym equipment tailored to make everyone's experience easier, whilst being implemented on the already existing equipment. This would not only prevent waste, but it would also provide a better and more affordable alternative for the fitness industry to modernize itself on a much wider scale.

Each machine has a different design, nevertheless, our project aims to create a system that is universal enough to support a large sample of gym equipment.

3. Solution beneficiaries

The product we envisioned would have many benefits in the fitness industry. One could argue that some gyms already have equipment with digital features, however that is not the case for most gyms, where the replacement of all equipment is an extremely unviable solution from an economic standpoint.

A more affordable solution would not only benefit gym owners by giving them a competitive edge, but it would ultimately improve the experience for everyone attending the gym.

4. Technological solution

We plan to use a small sensor network and an NFC system to relay the data back to a mobile app in the user's phone, where the data would be processed and displayed in a graphical user interface.

The sensor network should be able to acquire information about various parameters, such as number of repetitions, working weight and range of motion, so a variety of sensors such as LVDTs, load cells and ultrasonic sensors must be used.

5. Competitors and previous work

There are already some machines in the market that record motion range, and count the number of sets and reps. Most of them come with a screen displaying the information. However, these machines are designed for specific exercises. What we want to implement is broader, since most machines with stacks and weights will be suitable for our solution.

For example, Tonal is a well-known company that provides smart gym home machines and Technogym offers some machines with the ability to display a recommended rhythm and range of motion for a given exercise.

6. Solution requirements

It is required that the kit is versatile enough to support the most used gym machines and reliable enough to survive the typical gym environment.

Performance is not much of a problem as the processing power will all be in the user's phone. However, power consumption and efficiency will be a problem as the device needs to operate for a long period of time on a single charge.

The data collection and processing part of our kit must also be accurate, precise and capable of accounting for certain wrong measurements.

7. Technical challenges

There will be some technical challenges regarding the app development, the power management, the sensor choices and the communication capabilities of our product.

The user experience must be smooth and enjoyable so we will need to invest in good graphic design for our app.

On the other hand, we must also focus on how we can acquire the data for each specific machine while keeping the power consumption low. This will involve the use of different sensors and sensor combinations.
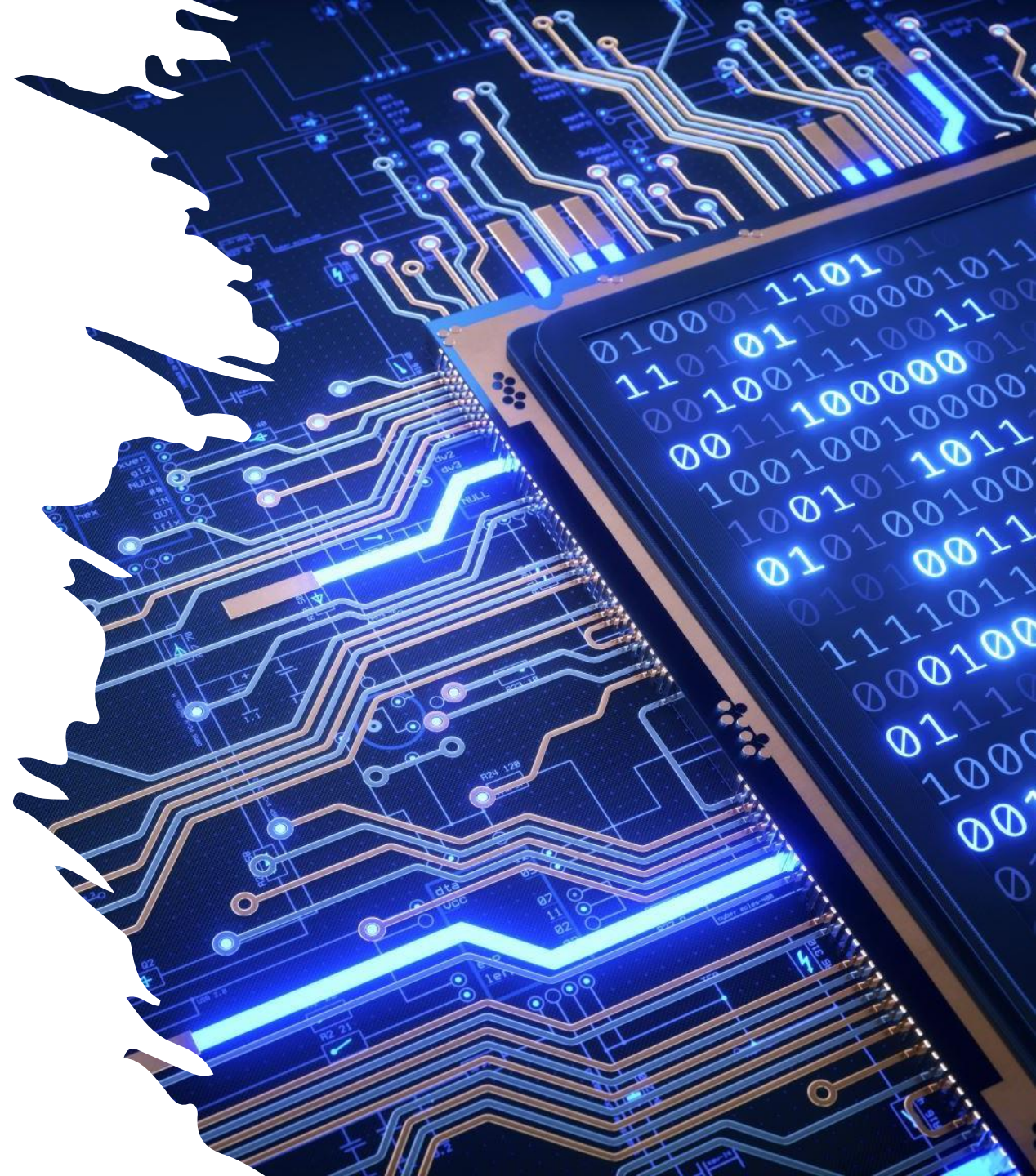
Partners

Having partners can be of upmost importance to cut down cost and time losses and for ease of logistics, as well to receive feedback.

Working with different local gyms and Gym chains such as Fitness Up, Fitness Park, Kalorias and Holmes Place would allow for testing and analyzing designs of different machines, therefore making the final product a more standardized solution that would be able to incorporate a larger sample of equipment.

Partnering up with web/app devs, hardware suppliers could prove very important to know both how to made a more user-friendly product and lowering the overall cost. This will in turn provide us with feedback and a better understanding of the problems we'll have along this process.

9. Testing and validation metrics

Firstly, we will require a robust testing platform such as a gym machine. We could partner up with gyms that the project members go to as to facilitate testing both in a practical sense (since we are familiar with the environment/machines) and time-wise.

We must choose several validation criteria such as power consumption, accuracy, ease of utilization and reliability. To do this, we must find a way to accurately adapt the range of motion based on the user and exercise performed, as well as how the exercise is being done.

One way to do this is with the speed of which the weight stack is moving, indicating at what points it stops and how long it takes to do so gives us an image of the intensity of the set, how many reps we have done in a particular rhythm and even an estimate of how many repetitions the user can do in theory.

10. Division of labor (I)

Eduardo Silvestre	Eduardo Casanova	Duarte Faria
Planner	**Hardware Engineering**	**Prototyping**
Project Planning	Schematic Creation	Conceptualize
Meeting Coordination	Hardware Interconnection	UI design
Scheduling	Quality Assurance	Sketching
Time Management	Budgeting	Installation

11. Division of labor (II)

Duarte Pereira	Tomás Ferreira	Jorge Contente
Testing and Feedback Analysis	**App Management**	**App Development**
Test Execution	Documentation	Data Display
Feedback Analysis	Troubleshooting	Backend Development
Data Analysis	Data Collection	Quality of Data
Problem Reporting	Code Review	Bluetooth Connection

12. Schedule

Name	Start Date	End Date	Duration
▼ Product Design	Feb 14, 2024	Mar 29, 2024	33 days
Product Planning	Feb 14, 2024	Feb 27, 2024	10 days
Conceptualization	Feb 21, 2024	Mar 29, 2024	28 days
Hardware Request & Assembly	Feb 21, 2024	Mar 29, 2024	28 days
▼ App Development	Mar 04, 2024	May 14, 2024	52 days
Data Acquistion	Mar 04, 2024	Mar 21, 2024	14 days
Data Processing	Mar 21, 2024	Apr 23, 2024	24 days
Data Display	Apr 16, 2024	May 14, 2024	21 days
Tests and Feedback Analysis	Apr 30, 2024	May 21, 2024	16 days
Detailing & Complimentary Tasks	May 15, 2024	Jun 05, 2024	16 days

13. Diagram of Components