Activity report 2023-2024

BIOSENSE EPFL

Word of the Presidency

EPFL has a longstanding commitment to giving their students a strong theoretical and practical background. The MAKE initiative addresses the latter by allowing students to build machines and devices with their own hands, while learning how to work as a multidisciplinary team and discovering one's strengths and weaknesses.

MAKE associations such as the EPFL Rocket Team, EPFL Racing Team, or EPFL Xplore are at the forefront of this effort, with micro engineering, electrical engineering, computer science, and mechanical engineering being strongly represented. We identified a need for more life sciences engineers to join the MAKE ecosystem and therefore founded BioSense EPFL. The field of biosensing stands at the intersection of life sciences, micro engineering, chemical engineering, material science, electrical engineering, and computer science, making it highly multidisciplinary and opening a door to new fields to students who wish to round out their profile. We also touch on the subject of clinical affairs and pipelines for the students interested in product development.

We have absorbed the EPFL SensUs team, which will remain our primary focus and will bring EPFL international awards at the SensUs Competition hosted by TU Eindhoven. Additionally, we are preparing two events: First, the BioSensing Days, a research symposium organized by our student members on the theme of biosensing. Second, the BioSignals Hackathon, a competition internal to EPFL, focusing on signal processing and machine learning applied to biological metrics. These two new projects will allow bachelor-level students to join BioSense EPFL and gain the necessary background to effectively compete in SensUs. Driven past members of any of the projects will also receive the opportunity to lead as a project lead or member of the committee.

BioSense EPFL aims to position itself as THE hub on EPFL campus for medtech oriented students, allowing them to grow by climbing the stepping stones that we are building for them. The motto "Empowering the healthcare innovators of tomorrow." reflects the primary goal of the current presidency and will hopefully inspire future leadership to implement strategies tailored towards growing talent into competent engineers and leaders.

On a personal note, founding BioSense EPFL has been an honor and we look forward to watching the association grow under new leadership. The process of founding taught us important lessons that we will carry into our professional life. The successes and mistakes made along the road have formed a beautiful picture that we will keep in fond memory.

Associative structure

The goal of BioSense EPFL is to promote biosensing to students. This was done through participation in the SensUs competition, but starting from next year, two new projects have been created to engage more students with the related theme.

Last year, most of the association activities were performed by the team working on the competition, including semester projects during the fall and the team building a sensor during the whole summer to go to the competition.

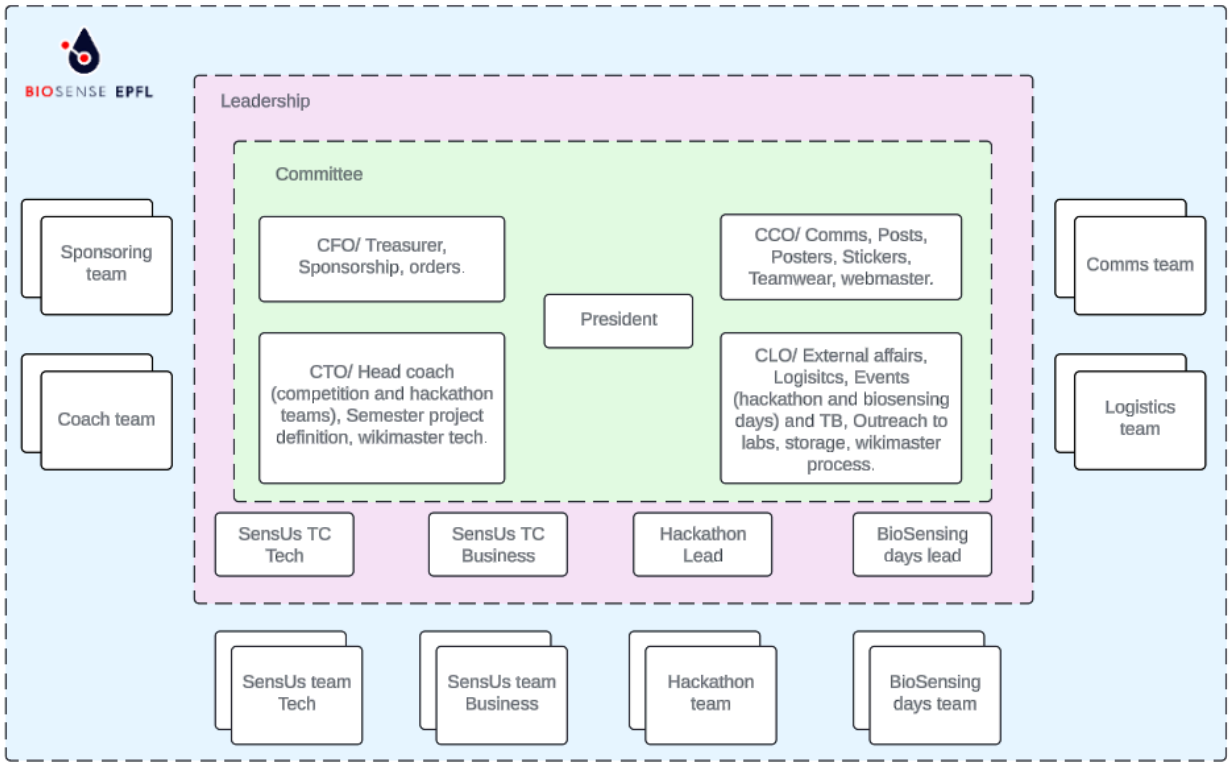
The administrative tasks of the association were conducted by the committee. They first created the association and wrote its statutes. The committee is in charge of the association

resources and to represent it both toward the school as well as external bodies. They also have the mission to ensure that the work in the association is performed well and that everyone feels safe in it. The committee is elected by the Assemblée Générale. The founding committee was composed of 8 members: the president, the vice-president, the treasurer, the head of coaching, the head of external affairs, the two SensUs team captains and the academic representative. Starting from September 2025, it was decided to modify the committee in order to facilitate the growth of the association; it is now composed of 6 members: president, CFO, CTO, CCO, CLO and the academic representative. Each of them might have a small subteam to help them in their work.

The main goal of the association was - and will still be - to host the EPFL SensUs competition team. It is led by two team captains who are in direct contact with the committee. The teal is composed by a maximum of 15 students from any section at EPFL. Their goal is to build a sensor capable of detecting a biomarker as decided by the organizer of the SensUs competition at Eindhoven University of Technology.

There are going to be two main new projects. Firstly, the association will organize a yearly hackathon with biosignal processing as the common theme. To do so, a team of students has been recruited to manage the event and prepare it in advance. Secondly, a small conference event is going to be organized, the BioSensing Days, with the goal of presenting the state-of-the-art in the domain. For both of these projects and the competition team, some leaders are to be chosen by the committee every year to make a link between the members and them.

Finally, it was decided to allow the CTO to plan and supervise some stand-alone projects which could be carried out by a single student or a small team. With the goal to build up more knowledge in the association that could be used in future years by the competition team.



Members of the committee

This year's committee was composed of eight members who are the following:

Julian Bär

President

MSc. Neuro-X

Arthur Eglin

Vice-President

MSc. Life Sciences

Marin Bricq

Treasurer

MSc. Robotics

Prof. Hatice Altug

Academic referent

Full professor, BIOS laboratory

Ali Elmorsy

Head Coach

MSc. Microengineering

Bettina Weber

Head of External Affairs

MSc. Life Sciences

Aleksei Kudrinskii

Competition Team Captain

MSc. Neuro-X

Maximilian Grobbelaar

Competition Team Captain

MSc. Neuro-X

Activities of the committee

Finances

The goal of the treasury is to manage all the funds of the association along the year, which is then verified annually by the account auditors – members of the association elected by the AG. As the association was just created this year, the main work that was performed was to create the structure for the years to come and ensure that the treasurer's job is as straightforward as possible. In this purpose, a bank account was opened for the association at the BCV, furthermore a system of reimbursement has been put in place, and a system for orders is starting to be implemented. This will allow an easier pipeline for members of the association to communicate their needs with the treasurer. The finances also need to find sponsoring from companies to have sufficient funds for all our projects. Finally, the main task is to keep track of the accounting of the association and the balance is presented in this document.

Sponsoring

The main source of income is still from the MAKE project initiative which allows us to secure more than half of the cost for the SensUs competition. Finding external sponsors allows us to both have more income but also creates a direct link with companies which can help us in various ways, including by giving some of their products or giving us insights in other engineering solutions. With the development of the association, it will become an obligation for us to find more sponsoring and for that it will be best to have new members in the finance team along with the treasurer.

Reimbursements and orders

As the association was new, and the bank account not immediately operational, many reimbursements to members were done this year to have fast orders. In the future, a new system of orders will be put in place, so that the finance team can receive them from the teams and decide to directly order or ask the BIOS lab to perform them with the funds of the association on their accounts.

Closing of the account

One closing of the account was performed this year even though the association was created in 2024. This was done in order to have a clean accounting for the new academic year and the new projects.

Balance

Actif	**Montant**
BioSense EPFL account	CHF 956.67

BIOS SensUs account	CHF 5’152.48
Total	**CHF 6’109.15**

Losses and Gains

Description	**Income (CHF)**	**Expense (CHF)**	**Losses / Gains (CHF)**
Committee, logistic	0	396.95	-165.75
Committee, event	0	165.75	-396.95
Committee, communication	0	65.50	-65.5
SensUs, internal expenses	10’000	2’629.62	7370.38
SensUs, external expenses	0	638.25	-638.25
SensUs, competition fees	0	4’222.42	-4222.42
Total	**10000**	**8118.49**	**1881.51**

Coaching

One of the founding objectives of the BioSense EPFL association was to ensure the smooth transfer of knowledge by appointing experienced team alumni as coaches. Led by a head coach, these coaches provide multidisciplinary guidance, drawing on their expertise from previous competitions and other projects. Their expertise spans technical, biological, and business domains, ensuring comprehensive support for the team. Beyond offering technical advice, they maintain close relationships with the team and help connect them to EPFL’s labs, PhD students, and campus resources.

Coaching, however, is not limited to BioSense alumni. A key initiative of the association is to foster collaboration with various EPFL labs, allowing access to experts from diverse biosensing fields. To enhance technical support, PhD students from these labs were brought in to provide coaching, leveraging their deeper expertise and closer connections to EPFL research. This collaboration not only elevates the technical rigor of our projects but also strengthens ties between BioSense and EPFL’s academic ecosystem. Additionally, many of our team members take on semester projects under the supervision of PhD coaches, creating a symbiotic relationship that benefits both students and labs.

This partnership model enables us to explore detection methods that extend beyond the expertise of our host lab. A notable achievement this year was our successful collaboration

with the BioCMOS Group in Neuchâtel, led by Prof. Sandro Carrara. Two of our students worked in this lab, developing electrochemical detection methods that were integrated into the competition team's final prototype, which earned third place overall. This marks a significant milestone, as it is the first time in three years that the EPFL team has incorporated non-optical technology in their sensor, bringing greater diversity to our approach.

To ensure long-term knowledge transfer and retention, we launched a Wiki initiative, led by the coaches and a dedicated Wiki Master. This initiative systematically documents key learnings and experiences, ensuring future teams can easily access and build on the knowledge accumulated over the years, fostering continuity and growth within BioSense.

Creation of the new projects

As this new association already recruited many members with respect to the number of students in the previously existing MAKE project, the committee felt it was time to extend our activities. The global goal of the association being to promote biosensing to students at EPFL, it made sense to the active committee to create two new projects:

Biosensing Days

Biosensing is a field at the heart of today's research, and to better introduce it to students, the committee wishes for the association to organize a multidisciplinary conference on the topic. This event would spark students' curiosity and, we hope, generate greater enthusiasm for the subject at EPFL.

Hackathon

We have also observed that many younger students from the bachelor contacted us to know if they could participate but were scared of participating in the competition team. This led the committee to decide to launch the organization of a hackathon: a weekend focused on an easier task than building a whole sensor but that would still encourage students in a practical engineering problem. They will be guided by coaches to help them in finding solutions but letting them come up with their own ideas.

Activities of the teams

SensUs competition team

This year's SensUs competition focused on kidney health. As such, the BioSense competition team indulged in two key directions, namely (1) creating a biosensor for continuous creatinine monitoring and (2) developing a to-market strategy for the device. For the technical part of the device, the team was hosted and supervised by various laboratories at EPFL. The team in particular explored three different strategies to creatinine sensing. The first by a photonical transduction mechanism, by means of a Mach-Zehnder interferometer. The second and third mechanisms being based on electrochemical sensing, namely by

Screen Printed Electrodes and Ion sensitive Field Effect Transistors. Of which the team decided to participate in the SensUs competition with a hybrid design of the electrochemical sensing techniques. On the business side of the project, the team engaged in various discussions with patients and healthcare professionals about creatinine detection and its effectiveness in the management of kidney diseases. The prototype received enthusiastic feedback from the professionals, who were excited about the potential impact of the project. Nephrologists from CHUV and Politecnico di Milano have helped in assessing the needs of the market, driving the team to the definition of a Business Model Canvas related to their prototype. Additionally, aspects proper to the entrepreneurial world have been discussed intra-team, including finance viability, business feasibility, stakeholder desirability and translational potential of the innovative idea, all with the goal of bringing the most suitable device to the competition.

New projects

With the creation of the association, we decided to launch two new projects as stated before: the BioSensing Days and organizing a hackathon. This past year, most of the work was about recruiting and setting up the team, including their future team leaders. They already started during the end of the summer to come with ideas and how to organize both of these events. We are hopeful these new events will bring more interest to the world of biosensing and engineering in general a EPFL in the years to come.