BUT2 Internship report

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To the university of Tokyo for providing me with a scholarship to help me during my time there.

1 Abstract

In this document, I report on my second-year BUT Informatique internship at the DLX Design Lab, a design laboratory within the Institute of Industrial Science (IIS) at the University of Tokyo. During this ten-week internship, where I was integrated into the design research team led by Professor Tomomi Sayuda, I had the opportunity to work with several designers and Professors applying my skills in Computer Science to the projects. I had the opportunity to work on two different projects during my 10-week internship. The first was Coral Rescue, a small aquarium for home and school use, in which damaged corals are collected and released back into the wild when they recover. The aquarium is linked to a web application and I created a graphical visualization page for the aquarium's sensor data (Temperature, pH…) as well as trained machine-learning models on the historical data in order to classify the new hourly data according to whether or not they contain anomalies, and to assign a quality score to the days using a regression model. The second project I worked on, AiCOM, is a game designed to make the public realize the capabilities and limitations of LLMs[1]. I built a website for the game following the designer's needs and implemented three different game modes. At the end of my internship the university of Tokyo held an open campus event where I had the opportunity to present my work to the public for two full days. Assuring the engagement of people as well as teaching them the process of fabrication and the environmental and societal values attached to the projects.

Résumé

Dans ce rapport, je fais état de mon expérience de stage de deuxième année de BUT Informatique au sein du DLX Design Lab, un laboratoire de design faisant partie du Institute of Industrial Science (IIS) de l'université de Tokyo. Durant ce stage de dix semaines où j'ai été intégré à l'équipe de la chercheuse en design Tomomi Sayuda, j'ai eu l'occasion de travailler avec plusieurs designers et chercheurs afin de leurs apporter mes compétences en Informatique. J'ai eu la chance de travailler sur deux projets différents lors de mon stage de 10 semaines. Tout d'abord Coral Rescue qui est un petit aquarium à destination des particuliers et des écoles dans lequel l'on collecte des coraux endommagés pour les relâcher dans la nature quand ils reprennent des forces. L'aquarium est relié à une application web et j'ai réalisé une page de visualisation graphique des données des capteurs de l'aquarium (Température, pH…) ainsi que entrainé des modèles de machine-learning sur les données historiques afin de classifier les nouvelles données horaires selon si elles contiennent des anomalies ou non et d'attribuer un score de qualité aux jours à l'aide d'un modèle de régression. Le second projet sur lequel j'ai travaillé AiCOM, est un jeu qui à pour but de faire réaliser au public les capacités et les limites des LLM, j'ai construit un site web pour le jeu suivant les designs des designers et implémenté trois modes de jeux différents. À la fin de mon stage, l'université de Tokyo organisait un événement "open-campus" dans lequel j'ai eu l'occasion de présenter mon travail au public pendant deux jours entiers. M'assurant de l'engagement des gens tout en leur donnant des informations sur le processus de fabrication ainsi que les valeurs environnementales et sociétales des projets.

[1] Large Language models

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2 Context

2.1 Integration at the DLX lab

2.1.1 The IIS

The DLX design lab is part of the Institute of Industrial Science (IIS), a research institute founded in 1949 and related to the University of Tokyo. The DLX is one of more than 120 research laboratories that you can find at the IIS. All the labs in the IIS are run by a researcher and composed of students, Professors and workers, The director of the DLX design lab is Professor Miles Pennington.

The IIS is present in two different campuses, one is the Kashiwa Campus at the north of Tokyo in Chiba prefecture, while the main one being the Komaba Campus, located in the northern area of Meguro. This is where I am completing my internship.

2.1.2 The DLX design lab

Integrated to the IIS, the DLX design lab was founded in 2016 in collaboration with the Royal college of arts of London. It is a design lab which is concentrated on practical and physical research. The goal of the laboratory is to "*Create value through design*", designing new innovative ideas as well as staying as eco-friendly and sustainable as possible. It has two labs in the IIS, one in Kashiwa Campus and the main one in Komaba Campus.

The DLX lab also gives design lessons to students of the University of Tokyo majoring in design, the lessons are given by the Professors at the lab.

To get ideas of the projects we work on the lab often organizes ideation sessions with guests, they make the guest play certain games that have the goal to find innovative ideas. I had the occasion to participate in one of these ideation sessions that happened with a few high schoolers that were visiting the lab. The organizer of the event gave us a theme "Connecting people with nature" and we had 10 rounds of 2 minutes were we drew a card that gave us a sub-theme (washing, forest…) and we had to draw an idea of a project that was innovative, could help people or the nature, and connected the theme and the sub theme.

Figure 1 : Myself giving a great idea during the ideation session

2.1.3 Management style and financing

The lab is led by Professor Miles Pennington and is divided by projects. There are a dozen ongoing projects and they are all led by a researcher, sometimes assisted by students or by freelance workers. All the projects are independent from each other.

The projects can either be exclusive to the DLX lab, in partnership with other labs at the IIS or other universities worldwide, or even with private companies that have interest in the research.

The lab conducts a weekly catch-up meeting every monday where all the workers and Professors share their advancements and objectives for the week. This gives everyone an opportunity to know what each other is doing even if they are not working together.

There is also a shared agenda that contains all the events that concern the whole lab.

The DLX lab receives a yearly financement from the University of Tokyo, it can also apply to more funds for exceptional expenses.

The DLX lab also sometimes offers classes programs to people working in the field of design, these programs offer a class per week for a period of 12 weeks and are taught by a few members of the DLX, each class has a different teacher and focuses on different areas of design.

The lab also works in collaboration with private companies that have an interest in certain research areas. They fund the research program and in exchange, have exclusivity or priority on new patents that will be developed by the research.

2.1.4 Integration

My official tutor is Professor Yuri Klebanov as he is the one handling the recruitment and integration of interns. I will be working in the team of another researcher, Professor Tomomi Sayuda as she needs help on software development on a few of her ongoing projects.

The day before I arrived, Professor Klebanov told me to prepare an introduction of myself to present at the catch up meeting on my first day. I prepared a few slides and presented my interests and skills to the around thirty people currently working at the DLX lab across the Komaba and Kashiwa areas.

I was then introduced to Professor Tomomi Sayuda, the researcher in charge of the AiCOM and CoralRescue, the two projects where I will be working on during my internship.

2.2 The DLX lab team

The DLX lab is composed of around 30 people with various skills and backgrounds working on multiple projects in the Komaba or Kashiwa lab (see **Appendix 1** for the complete team photo).

Apart from director Miles Pennington the DLX is composed of 5 types of people,

- Professors , who each lead a project.
- Freelancers hired by the lab to help on certain projects.
- The admin team who handle all the administrative work.
- Master/PhD students who are studying as well as working on their research project.
- Interns like myself.

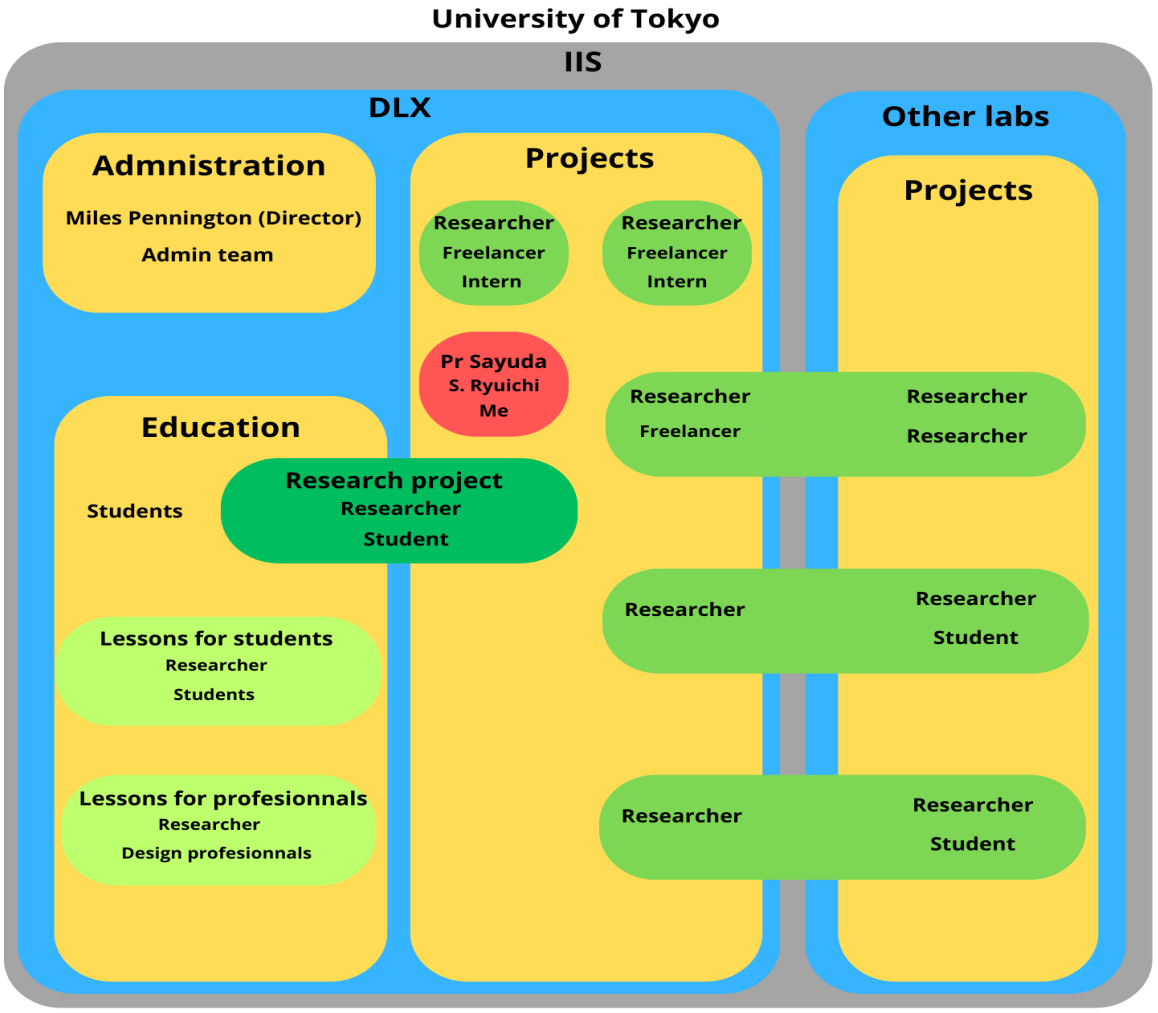

Figure 3 : The organisation of the DLX lab

2.3 My mission at the lab

It was very clear from the beginning of my internship that I would be autonomous and independent. Professor Sayuda introduced me to two ongoing projects where they needed help that I could provide with my skill set, CoralRescue and AiCOM.

From that we discussed what valuable things I could implement to help the projects. The main challenge being that the university of Tokyo will hold an “Open Campus” event at the end of may where all the campuses of the university will be open for the public to visit. It means that I had less than two months to improve the projects and make them ready for the event.

For all the duration of my internship. I am free to propose anything that I think would be beneficial, especially if it can help improve the visitor engagement at the open campus.

3 Professional activity

3.1 Coral rescue

Coral rescue is a project in collaboration with the Tropical Marine Science Institute of the National University of Singapore, it's a small, easy to maintain and cost effective rocky coral aquarium. The aquarium is made to contain multiple corals and is connected to a web app which is in Japanese and English language. The goal is to take damaged corals and to monitor their growth until they are strong enough to put back in the ocean.

For now the project is still a prototype but in the future its purpose is to be placed in schools or in coral enthusiasts home's to allow them to take care of their own corals.

The prototype we have now contains 7 different corals, half of them purchased from a local pet-shop whereas the others are actually endangered coral-species which the lab had to obtain a special authorization from the government, it also has two fishes named Rey and Wes.

3.1.1 Organisation and material

The code for the Arduino is all hosted on Github and the web app is made by wordpress and sakura hosting to host the web server.

Currently working on the project there is only Professor Sayuda and designer Shota Ryuichi who is making a new version of the aquarium, the team does not have any marine wildlife experts in Japan so if we have specific questions to ask we can always contact the scientist team of the National University of Singapore for more specifications about the coral's well-being.

Since the engineer of the project that designed the PCB[1] left around a year ago, the actual team did not have the necessary skills in software development or hardware to continue the development. I had to learn by myself as well as exchanging messages with the engineer who is currently based in London.

[2] Printed circuit board

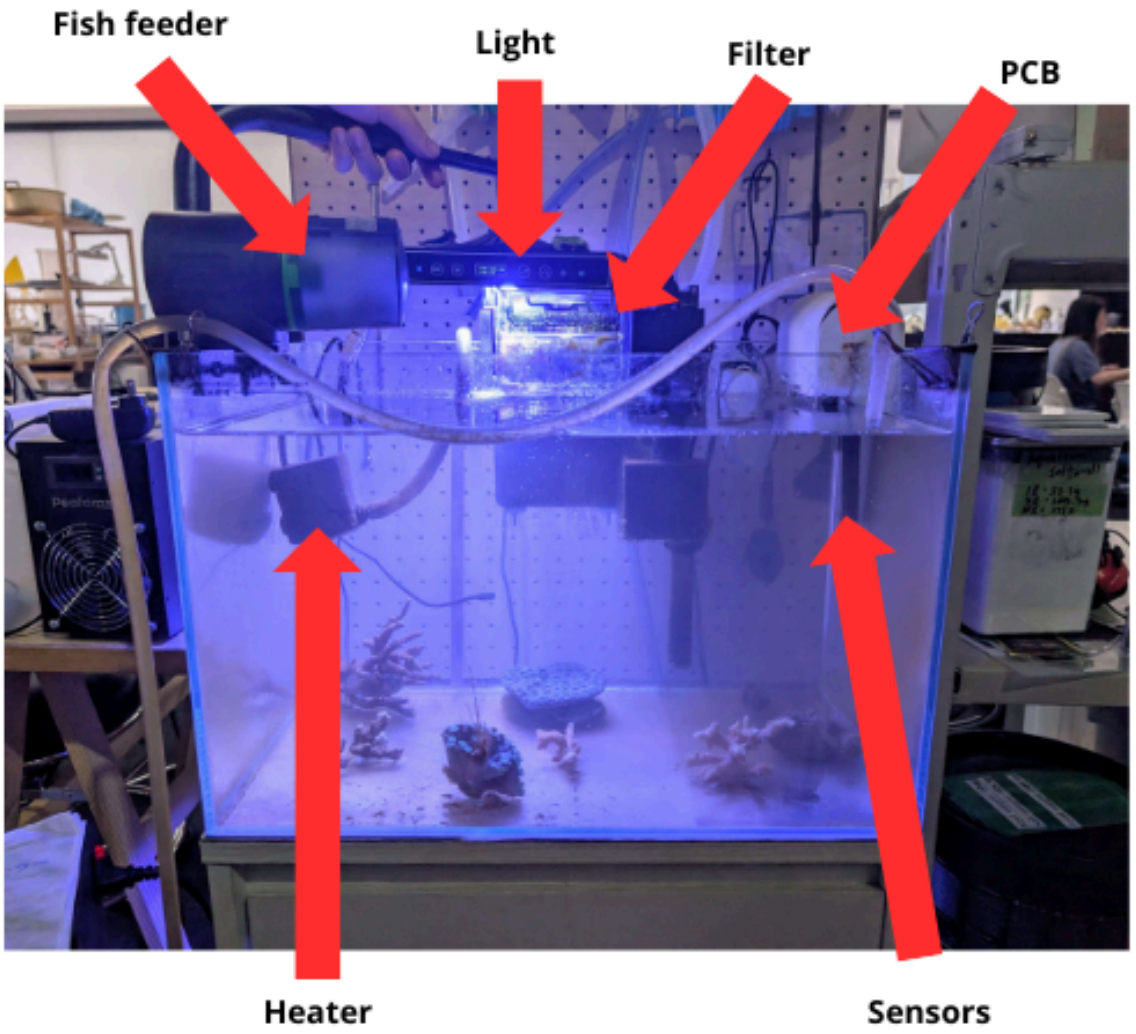

Figure 4 : The CoralRescue Aquarium

To monitor the coral aquarium there is a custom PCB made for the project and it is connected to a few sensors (water level, temperature and pH sensors).

There is also a heater connected to the temperature sensor to make sure that the tank always maintains the correct temperature for the health of the corals.

To function, the PCB uses a ESP32-S3 Arduino board. It's connected to the wifi and regularly sends the data of the sensors to the web app.

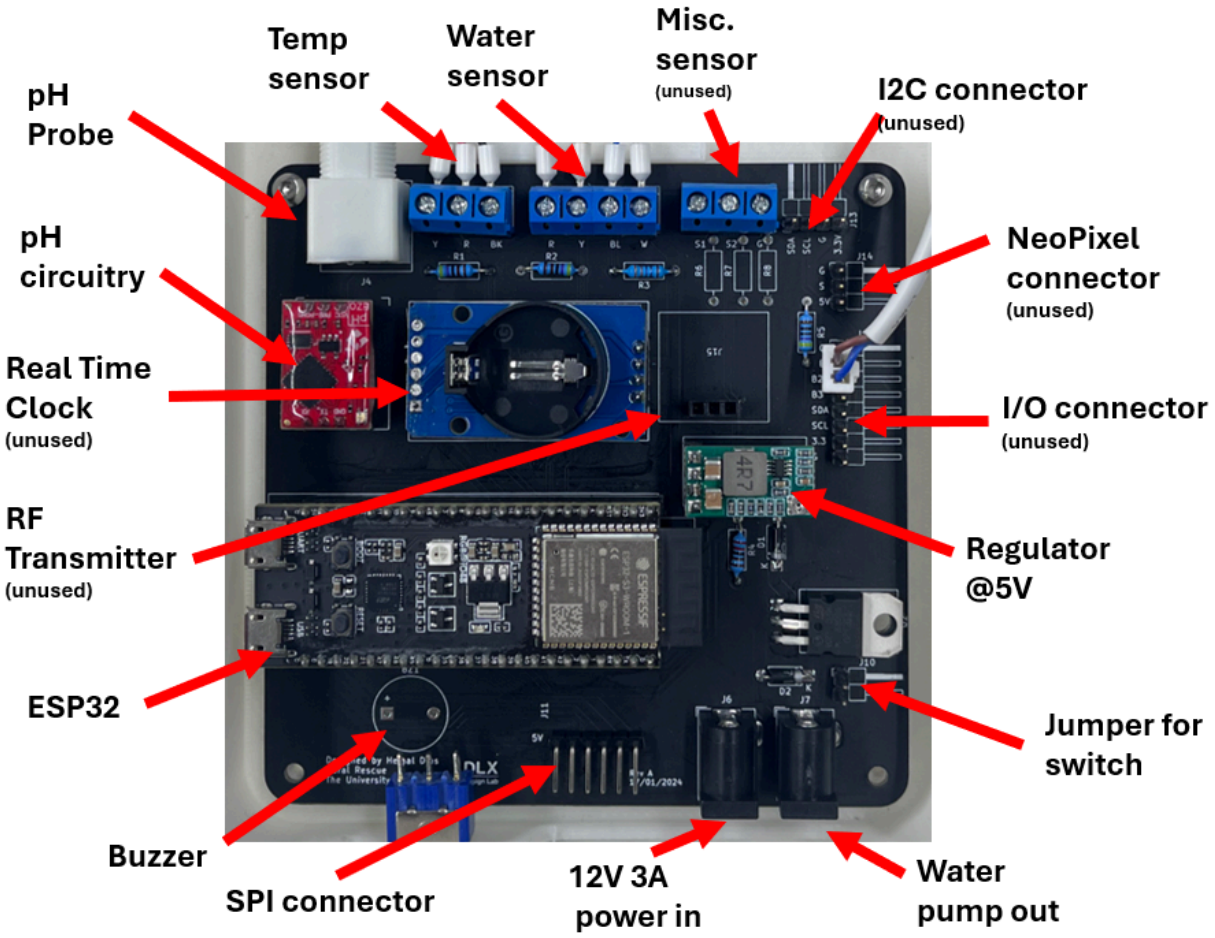

Figure 5 : The PCB of the CoralRescue project

3.1.2 Software development

A problem that Professor Sayuda saw with the current state of the app was that it only collected and stored data from the tank, but didn't really use this information for anything. I offered to rework the data visualization part of the app as well as implement machine learning algorithms trained on historical data to provide the users with weekly insights and information about their tanks according to the most recent data.

3.1.2.1 Rework of the data visualization of the web app

My first idea, in addition to the software side of the project, was to rework entirely the existing graph page that only offers minimal visual information about the pH and temperature values so that these can be sorted by minute, hour, day or month.

I added thresholds on the graph so the user can visualize if the values displayed over the chosen unit of time are too low or too high. I also added a small statistics section that tells the user useful insights about the data (how many times the temperature was too high/too low, average values, last update) , as well as improving the design and the display of the data visualization according to the ideas of Professor Sayuda.

3.1.2.2 Training of machine learning models

To help users visualize the quality of their data and the general state of their aquarium, I trained two machine learning models using the scikit-learn library. I exported historical data from the wordpress website (data output every 15 minutes for several weeks, resulting in around 16,000 lines of pH and temperature evolution data) and created two different datasets: one aggregated by hour and another by day. Both datasets used the mean, standard deviation[3], minimum, and maximum values of temperature and pH over their respective time frames.

The goal being to train these models and to include them in the application so they can process new sensor data as input, run this data in the models and give output information that will be displayed on the app for the users to see and have a better understanding of their data.

With the datasets aggregated by hour I will train an anomaly detection models for hours, and with the one aggregated by days I will train a regression model that gives days a quality score from 0 to 100. To train these models I have to label the data, for now I have lines of data but they do not say which hours are an anomaly or what is the value of each day, the model has to have this information to work.

To label we have two options, supervised and unsupervised training, supervised means labelling manually the lines of data and unsupervised means using an algorithm to automatically label the lines of data.

Both my models will use random forest models, they consist of making a lot of decision trees “vote” for a result and choosing the result that has the most voters.

A decision tree is a basic mathematical structure that starts from a root node and then goes down the branches by making a decision and finally arriving at a leaf node that represents the decision of the tree. The trees will be automatically generated by the library scikit-learn according to my data that has been labeled. To see an example of the functioning of random forests you can have a look at **Appendix 2.**

[3] The average deviation from the average over a period of time

3.1.2.2.1 Hourly Anomaly Detection

With the first dataset, I trained an unsupervised Random Forest Classifier to detect whether an hour was "normal" or not. I used scikit-learn StandardScaler[4] to normalize all hourly data, ensuring consistent scale across different measurements.

With approximately 3000 lines of aggregated hourly data it would be very long to supervise the learning, therefore, I decided to import an IsolationForest mode to detect which hours have anomalies or not. This model used for unsupervised learning went across all the lines of data and automatically labeled the ones that differed from the norm as anomalies. The results are presented in **Appendix 3.**

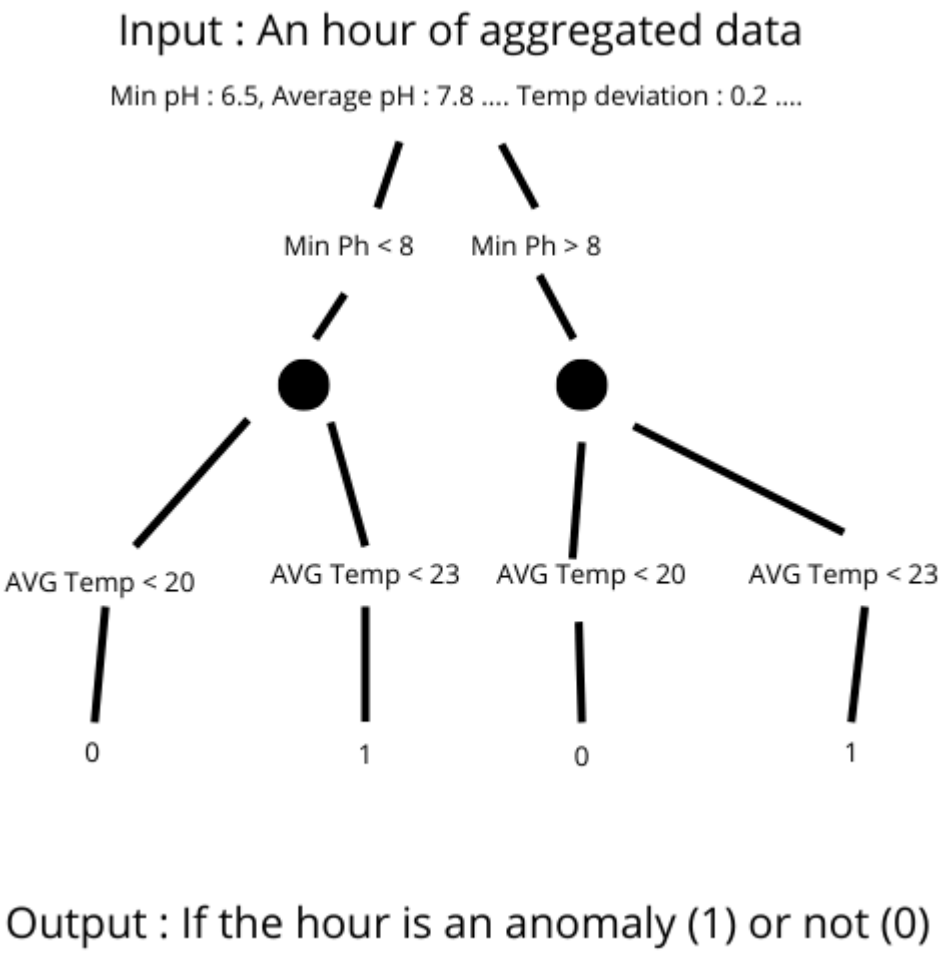

Figure 8 : A simplified diagram of the functioning of one of the decision trees of the forest

[4] Tool to normalize data among the other data entries

3.1.2.2.2 Daily Quality Score

With the second dataset, I created a supervised Random Forest Regressor that takes the current day's data as an input and then outputs an overall quality score from 0 to 100.

This model uses the same logic as the Random Forest Classifier but instead of giving 0 or 1 as an output, it gives a number from 0 to 100 depending on the overall quality of the day's input data.

I only had 150 lines of daily aggregated data. Therefore I decided to go for supervised learning as it would not take too long and as I did not have that much data it's important that the training dataset is as precise as possible. To do so I manually labeled all the lines of data with a score from 0 to 100 based on the temperature and pH mean/std/min/max values aggregated by days. There are a few important factors for the well being of the tank such as stability and not letting the values get too high or low, so I gave a score according to all these factors combined. The model was trained on this.

3.1.2.3 Implementation of the machine learning models

The major challenge of implementing these models to be used daily in the web app by users is that it is very hard to run Python scripts in a Wordpress environment. Python being the most used language for machine learning, I had to use it as it supports a lot of very useful libraries that would have made the development of my models really difficult and less efficient.

I first tried to simply put the python scripts inside the wordpress files and run them via a PHP script. This actually did run the script and I was able to get output in the console but I encountered a massive problem, it was impossible to install the libraries necessary using pip[5] since the server used a FreeBSD linux distribution that is not compatible with pip**.** I tried manually installing the libraries with pip on my computer and then transferring the library files to the server but it was inconsistent and missing some of the root C language libraries that are used commonly in python machine learning libraries.

I also considered deploying a python API[6] to host my models and be able to just call a few endpoints to get the outputs from the models. However, since the project is still in the development phase and is non-lucrative, having to pay a fee every month for the hosting of the API was not an option.

[5] The traditional external libraries installer for python
[6] Application Programming Interface

The problem being that Wordpress can only read JavaScript and PHP files. I decided to export the models to JSON[7] as they would be runnable in JavaScript, and directly make the models work in the WordPress code. All the models are actually already trained and each consist of 100 decision trees. This meant that I only had to take the features of the trees and put them into a JSON format in order to be able to go through the decision trees in JavaScript, similar to what I was doing in Python.

In the Python script I created, I used a function to convert each decision tree in the Random Forest Model into a JSON structure that JavaScript can understand. For each tree in the model:

1. Extract the tree's structure (nodes, features, thresholds)
2. Identify which nodes are decision nodes (splits) and which are leaf nodes (predictions)
3. Convert this structure to a simple JSON format:
    - For split nodes: store feature name, feature index, threshold, left child, right child
    - For leaf nodes: store the prediction value

As well as important metadata like : Number of trees in the forest, feature names (ph_mean, ph_std, ph_min, ph_max) feature important values from the model…

I created a custom Random Forest Regressor class in JavaScript that can load and use these JSON representations to make predictions exactly like the Python model would. The JavaScript implementation:

- Takes the same features as input
- Follows the same decision paths through each tree
- Averages the predictions from all trees to get a final prediction
- Uses the feature importance values for explanations

[7] JavaScript Object Notation

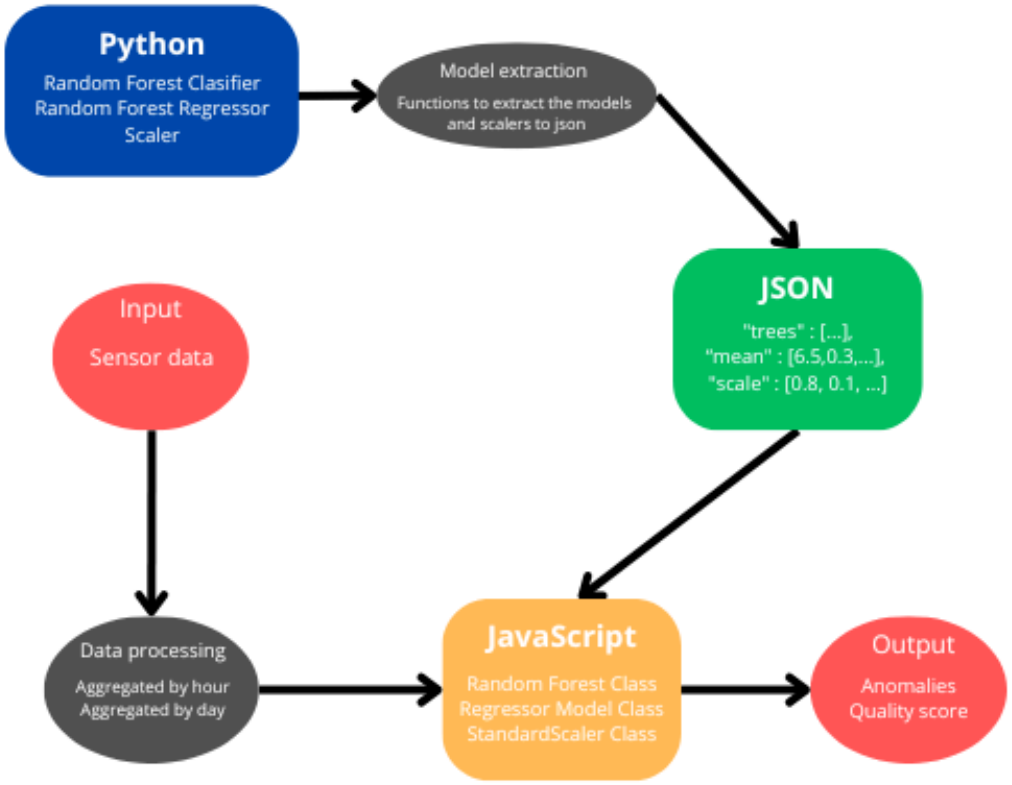

Figure 9 : Models exportation and use

This approach allowed the model to run entirely in the user's browser, eliminating the need for server-side Python processing. I ran a few tests to ensure that I got the exact same results as when I used my models in Python, and it worked perfectly with almost the same speed. This is due to my models being quite simple and only doing classification and regression.

I then made it so every time the app is loaded we fetch the data of all the days of the weeks to give them a quality score and the data of the last hour to detect any anomaly using the models and made a nice visual in the app with the output from the models for the user to visualize :

- The potential anomalies in the pH and temperature values of the last hour.
- The quality score of each days of the week (Details accessible by clicking on a specific day)
- The overall quality score of the week with the lowest and highest quality days.

The home page of the Coral Rescue app with my model integrated into it is presented in **Appendix 4.**

3.1.3 Hardware

When I arrived Professor Sayuda told me that for the recent months they have been experiencing value reading problems with the pH sensor of the aquarium. Even if hardware is not what is taught in my university course, I offered to have a look and try to find where the problem is coming from.

3.1.3.1 Troubleshooting

The problem that they were encountering is that since the last few months, approximately every two hours the pH sensor would emit the value 14 (14 is the highest value on the pH scale, it means that there was a problem with the reading of the pH), and the wrong reading were gradually becoming more and more frequent.

The most logical answer to this was that the pH sensor was broken or that some cables were not plugged correctly on the PCB. However, after buying a new sensor and verifying all the plugs of the PCB the problem was still there. To confirm that the problem wasn't coming from the pH sensor, I tested the same sensor in a separate water container 2 meters away from the tank and it started working properly.

Since the problem was only happening in the main tank I did some research about it and found that the cause of the dysfonctionnement was electrical interference in the water. pH circuitry is well known for being very sensitive to electrical interference and since all the PCB and the sensors are positioned very close to the water in the tank, they all leak a bit of electricity into the tank. At first it was not a big problem, but over the months of using it there has been more and more electricity in the water. The pH circuitry chip is also older and has become more sensitive to electrical interferences.

3.1.3.2 Finding solutions

To solve this problem I proposed two solutions to Professor Sayuda.

- Changing the design of the aquarium so the PCB is not right next to the water.
- Buying a special isolation piece that is made especially to be put under the pH circuitry to isolate it from electrical interferences.

Since the goal of the project is to be installed long term at places where people don't necessarily have skills in electrical engineering we decided to buy the new piece as it would ensure that we don't have any problems in the future. Sadly my internship is ending and since the piece is coming from the USA I won't be here anymore when the piece arrives. I have to leave this last task to Designer Ryuichi.

3.2 AiCOM

AiCOM (AI-Communication) is a project also led by Professor Sayuda but this time it is made in collaboration with the laboratory of Professor Sugano, the laboratory of computer vision of the IIS. The aim of the project is to give people a better understanding of AI reasoning as well as helping to improve and find the flaws of actual LLMs. This all takes place on the AiCOM station.

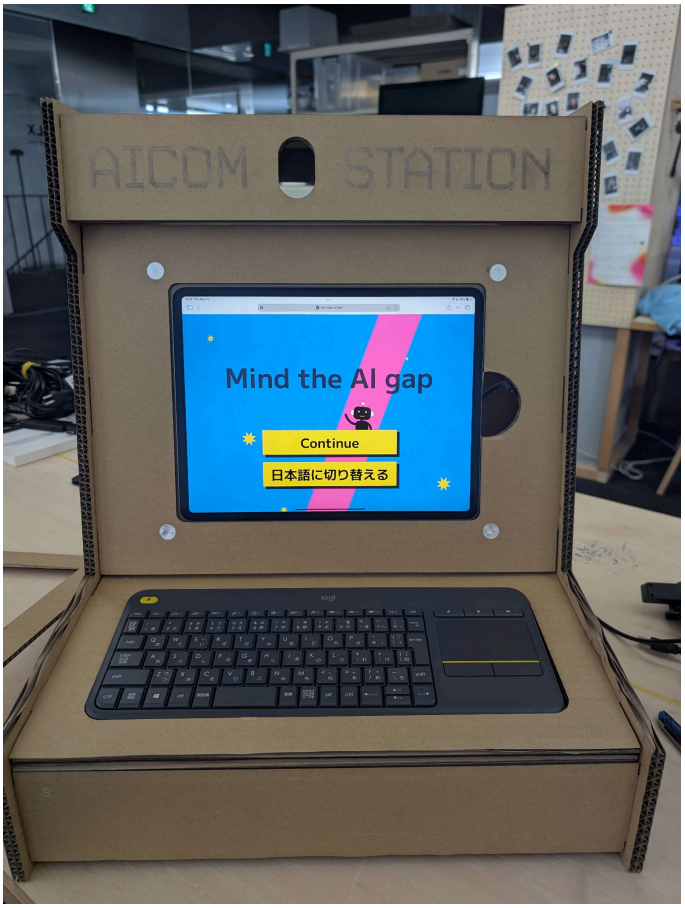

Figure 11 : The AiCOM station

Two players take place in front of the station. The player on the left side is the guesser and the player on the right side is the describer.

The describer will have 8 images displayed in front of him. He picks one that he will have to make the guesser find among the same 8 pictures using a single text that he has to write. Once the describer has chosen his image and a text to describe it, the guesser will try to guess which image the describer chose according to the text. We will use the GPT-4 API to try to guess at the same time with the same hints. The goal is for the describer to find a description that will make the guesser guess correctly but not the AI.

This serves two scientific goals. The first is to help people realize what generative AI is capable of and what are its limits. The second is to save the results of the game when the players guessed correctly and the AI could not so we have a better idea of what is currently understandable by humans but not LLM's in order to perfect them in the future.

3.2.1 Organisation and material

I will be working on this project with Professor Sayuda, Professor Sugano, and designer Jenna Wang, a freelance worker that will make the designs that I have to implement. Professor Sugano and Sayuda work is mostly providing advice and ideas in the weekly meetings the team have. I and designer Wang will be directly working at implementing the ideas

The AiCOM stations use an Ipad 12 Pro, property of the DLX, to function and the code is on the GitHub of Professor Sugano lab.

3.2.2 Software development

When I first joined the project it was less than 3 weeks before the open campus of the University of Tokyo. There was a basic interface with the Python Streamlit library and a working gamemode. To make the game engaging and fun to play for the visitors it was imperative to make the interface user friendly and to introduce new game mechanics for the open campus.

The biggest challenge for me was that the Professors wanted to keep using Streamlit for the app as it was really important to have a technology that allowed them to run AI analysis in the backend.

I strongly suggested that we change the app to react with a python back-end since it would be much easier to create nice interfaces and to maintain in the long term. However, since the open campus was only a few weeks away, we preferred to keep it on Streamlit for now as we wanted to make sure that we have a working prototype for the open-campus.

If needed we will start to develop a more stable version with react after the open campus, depending on how satisfying the Streamlit version is.

3.2.2.1 Implementing new games mechanics

Right now, the game is interesting but lacks diversity. The second problem is that it's really hard for the players to win, the AI is just too good at guessing images with a text.

We knew that we needed to add more game modes to make AiCOM more interesting and engaging and if possible game modes that would make it easier for the players. We had a brainstorming session with the other members of the team and we tried to come up with suitable ideas. We also took notes of actual existing board games that had rules which could be implemented to AiCOM.

Once we had a range of ideas and confirmed these with the responsible Professors , my designer coworkers made the design on figma that I will have to code later on.

3.2.2.1.1 Taboo gamemode

The first new game mode I implemented is the taboo game mode, directly inspired by the game of the same name.

Basically it works like the normal gamemode, except that before the describer writes his description, we run an API call with the image selected. The same AI model that will be used for guessing later provides six keywords directly related to the image. The describer will not be allowed to use these words in their description.

The main objective being if the describer avoids using the words that the AI thinks about first when analyzing the image it will be harder for the AI to guess the image from the description later.

3.2.2.1.2 Elimination gamemode

The elimination game mode uses classic mechanics for these kinds of games. It is the same as a normal elimination game except that it takes place in three rounds. During each round the describer gives a different text and the guesser and AI can both eliminate between 1 and 7 images as long as there is only one image left for both at the end of the third round.

The key that makes this gamemode easier for the players is that when the AI eliminates images, it doesn't take into consideration the description of the previous rounds, only the current one.

Implementing this game mode was really challenging. I had to completely change the logic compared to the two existing game modes. This was due to making some of the game phases repeat themselves.

3.2.2.2 Improving the graphic interface

The hardest part of this project for me was to meet the expectations of designer Wang and Professor Sayuda about the design of the website.

They had a lot of things planned and a clear vision of what they wanted the app to look like. As I was the only one working on the code and using Streamlit, it made it quite hard to consistently replicate the design of the Figma.

It was a really interesting experience for me to work closely with a team of designers and it really taught me to think about design and integration as much as possible in my computer science logic. It also taught me to explain programmation concepts in a simple way to people that are not used to or have no understanding of computer science..

Finally we did a great job at finding the right balance between design ideas and do-able coding implementation. The before and after changes to the app are presented in **Appendix 5**.

After polishing the game for a few days and making sure that the design was on point, we were able to finish everything planned before the Open Campus and were very happy to be able to introduce AiCOM to the public and collect feedbacks as well as game data at the Open Campus, in **APPENDIX 6** you can find a picture of the team at the Open Campus.

I also made it so every game result is saved to a JSON file with all the details (Image chosen, description, date etc…) and was very happy since on Sunday alone we had 83 games played by the visitors of the open campus, a good result for the first time AiCOM is playable by the public.

4 Societal and environmental impacts

4.1 My environmental impact during my internship

I chose to live in a sharehouse only 3 kilometers away from the university, therefore, I kept my CO^2 emission very low over the course of the internship. My transportation to work alternated between rented electric scooters and walking. On the campus of the IIS there are two cafeterias and two different food trucks everyday so I didn't have to go far to eat.

4.2 DLX Design Lab

The DLX Design lab might not be a company, but it is still very concerned about having a positive environmental and societal impact. All the projects of the labs are about health, environment or improving general everyday life through design but also as low cost and low material as possible. For example, during my internship there was another intern working on the ATTUNE project which is a project of a microscope made to analyze the capillaries of one's fingers and to play music according to them, the goal being that anormal capillaries (showed on the pictures and in the music) can be a sign of serious blood diseases. The administration of the lab also makes sure that all the garbage is properly sorted and disposed of.

4.3 IIS and The university of Tokyo

The University of Tokyo also acts on these aspects and knowing that the DLX-Design Lab is part of UTokyo, it applies to them too. The University makes a lot of effort to improve their environment and societal impact with a lot of different actions over their campuses. Some of these actions include :

- Managing the wastes (recycling, reusing…).
- Managing purchases, mostly raw materials to ensure that there aren't any unnecessary purchases.
- Managing the water consumption and the employee travel plans.
- Promoting bicycles as the main mode of transportation for the employees, the campus contains places to park your bicycle next to each building.
- The work hours of the Professors are monitored and when they do too much overtime, they receive a warning.
- There is a yearly medical check-up for each employee.

5 Conclusion

This ten-week internship at the DLX Design Lab has been an invaluable experience that allowed me to apply my computer science skills in a real-world research environment while working alongside talented designers and Professors from diverse backgrounds. Through my work on the CoralRescue and AiCOM projects, I not only enhanced my technical abilities but also developed crucial soft skills that will benefit my future career.

On the technical side, I successfully implemented machine learning models for the CoralRescue project, overcoming significant challenges in deploying Python-based models in a WordPress environment. By converting Random Forest models to JSON format and implementing them in JavaScript, I created an innovative solution that runs entirely in the user's browser, demonstrating my ability to adapt and find creative solutions to technical limitations. Additionally, my work on the AiCOM project challenged me to rapidly develop new game mechanics and improve the user interface using Streamlit, at the same time collaborating closely with designers to balance aesthetic vision with technical feasibility.

Beyond the technical achievements, this internship taught me the importance of interdisciplinary collaboration. Working with designers like Jenna Wang and Professors like Professor Sayuda showed me how different perspectives can enhance a project's outcome. I learned to communicate complex programming concepts in accessible terms and to appreciate the value of design thinking in creating engaging user experiences. The weekly catch-up meetings and the collaborative atmosphere at DLX reinforced the importance of teamwork and knowledge sharing in a research environment.

The autonomy granted to me during this internship was both challenging and rewarding. Being able to propose and implement my own ideas, such as the machine learning visualization features for CoralRescue, gave me confidence in my abilities and taught me to take initiative. The pressure of preparing for the Open Campus event in just two months also improved my ability to work under deadlines and prioritize tasks effectively.

This experience at the intersection of technology, design, and environmental research has broadened my perspective on how computer science can contribute to meaningful projects. The DLX Lab's focus on creating value through design while maintaining environmental and social responsibility aligns with my own values and has inspired me to continue pursuing projects that have a positive impact on society.

Moving forward, the skills and insights gained from this internship will be instrumental in my career development. The experience of working in an international research environment in Tokyo has enhanced my cultural awareness and adaptability. I am grateful to Professors Klebanov, Sayuda, and the entire DLX team for this opportunity, and I look forward to applying these learnings in my future endeavors in computer science and beyond.

ANNEX

APPENDIX 1

Figure 2 : The team of the DLX lab at a goodbye party

APPENDIX 2

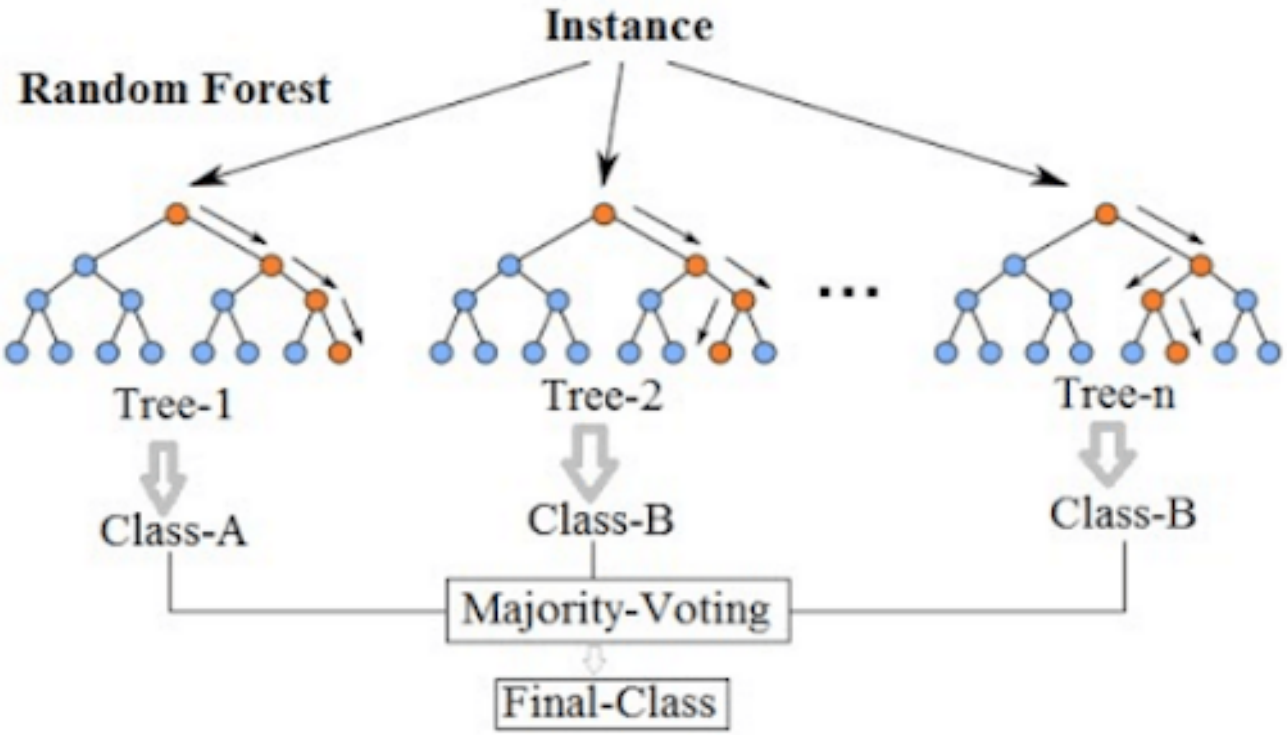

Figure 6: Functioning of a Random Forest model

APPENDIX 3

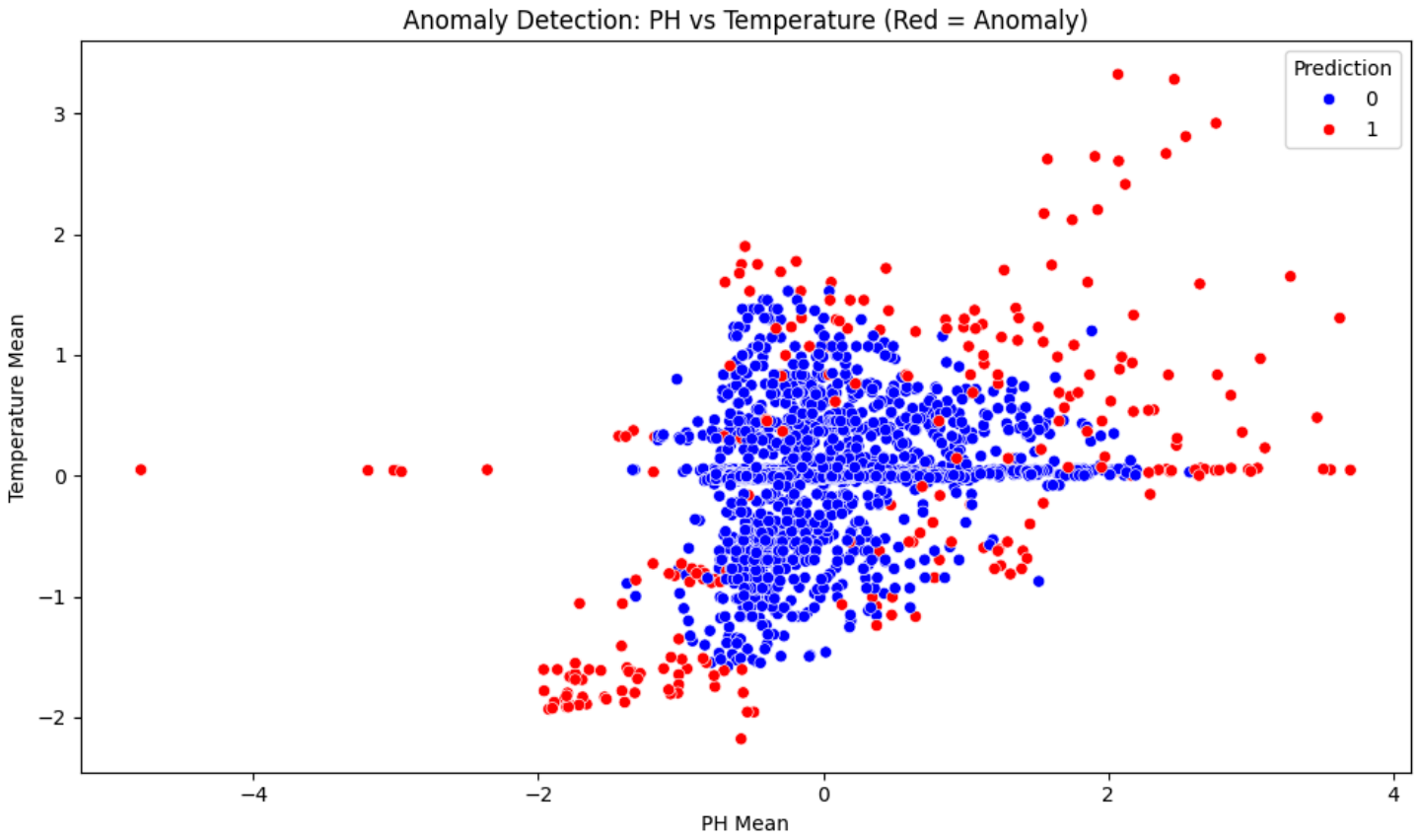

Figure 7 : The Isolation forest detecting anomalies in the data points (1 = anomaly)

APPENDIX 4

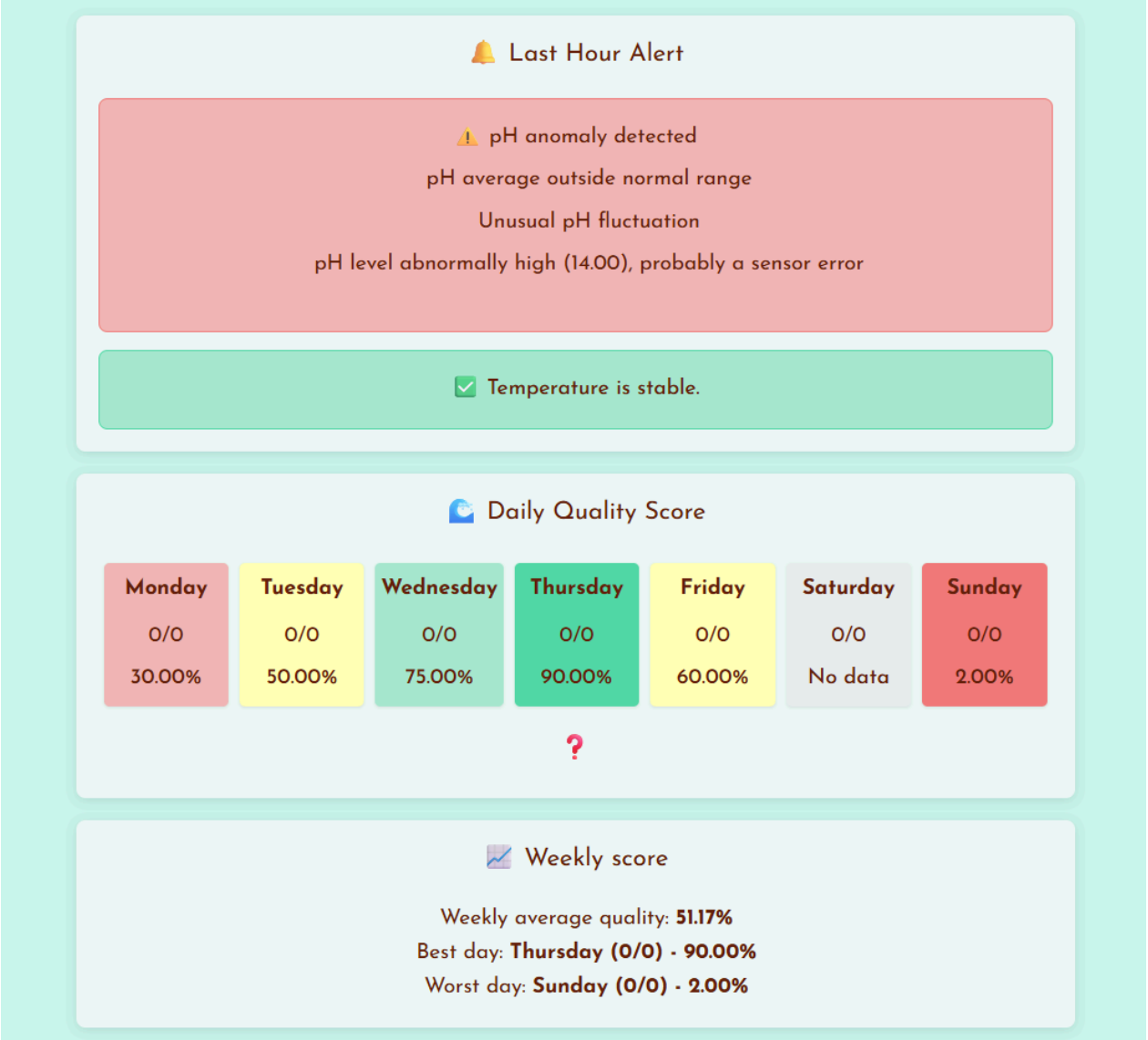

Figure 10 : Display of the models in the web app

APPENDIX 5

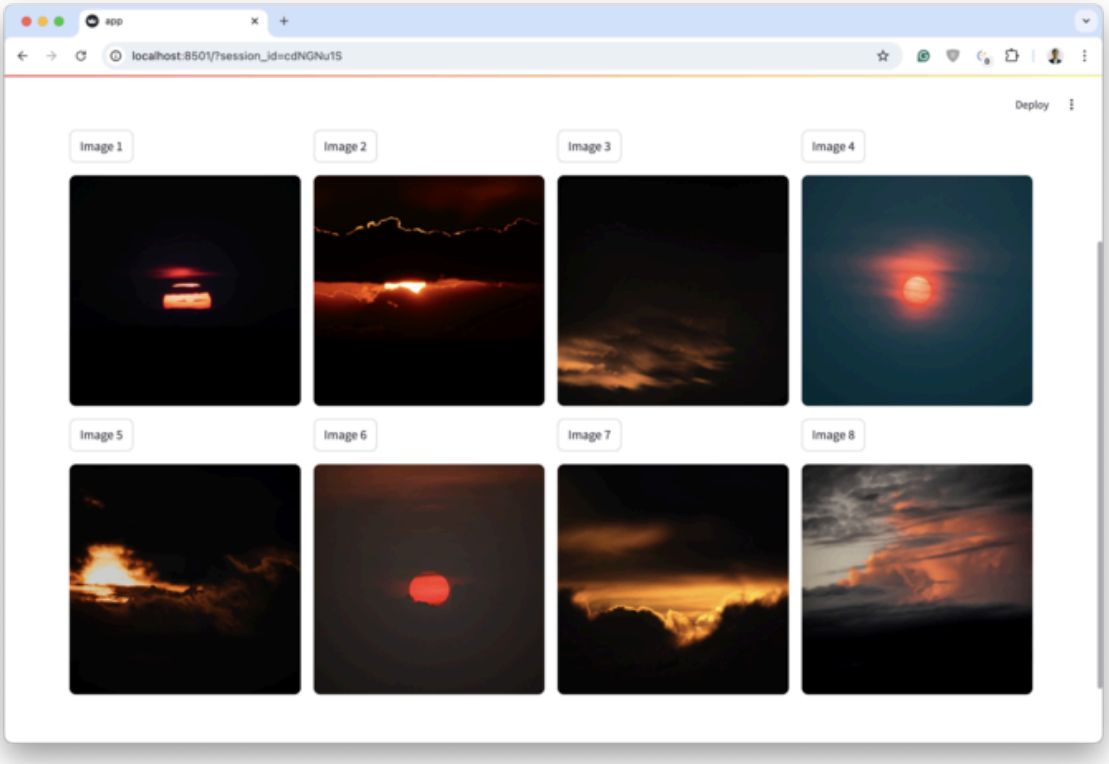

Figure 12 : The game interface before I started working on the project

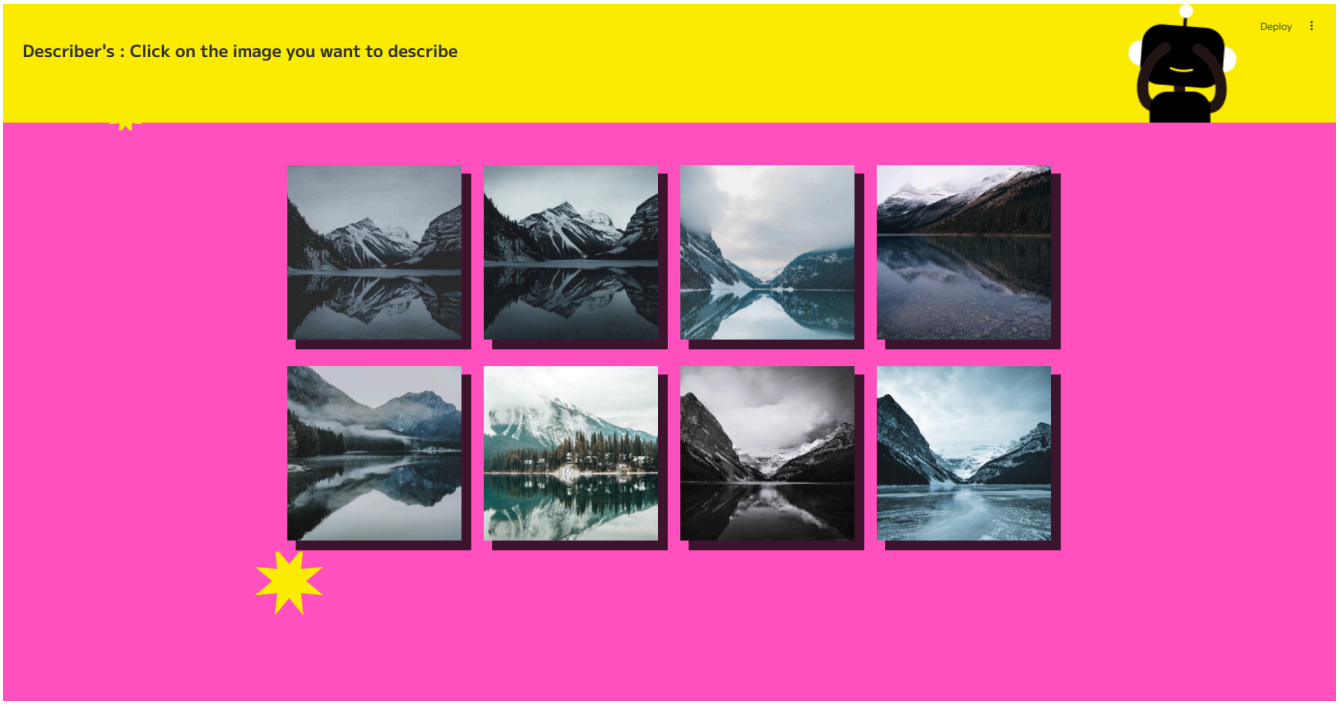

Figure 13 : The same interface once I finished working on the project

APPENDIX 6

Figure 14 : Myself, designer Wang and Professor Sayuda at the Open Campus introducing AiCOM to the public