Dear Honors Bachelors students,

We are almost at the end of this academic year. Time to wrap up, complete the different courses and of course also finish the tasks of the Honors Academy. Also this year we had to do many activities from home due to the COVID-19 pandemic. Fortunately, that changed this spring and after two years of mostly working from home, we finally returned to campus. I saw many activities on campus with the Honors Bachelor Symposium being a (or perhaps the) highlight of the year. I was amazed by your creativity, originality and performance in the projects you performed in one of the 9 tracks. It was great to see the projects, talk to you and see the results. I am really proud and grateful to be part of the Honors community and to work with and for you.

And... we can read about these projects in this wonderful yearbook. It’s already a tradition: the Honors Academy Yearbook! The third edition already!

Last year we had the peer review of our bachelor’s and master’s honors program. This year we have implemented a number of recommendations, including an increase in our honors staff. Soon after the summer holidays you will meet our new employees.

Some of you will be finishing your Honors Bachelor’s degree. Congratulations to all of you. I wish you every success in the next phases of your studies. And perhaps a continuation in the, also very interesting, Honors Master program.

Best regards,

Mark Bentum
Dean of the Honors Academy
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ABOUT THE TRACK

How can society and science benefit from AI?
Which are AI downsides?
Which are AI limitations and how they can be overpassed?
Do I really like working on AI or is it just the societal hype?

Take few more reflections moments.

One common approach would be to define AI as the study of intelligent agents. Agents can be anything, from devices to pieces of software. They can learn from data/environment/experience to maximize their chances of succeeding in a goal. Reflection moment: Are these really universal truths? Traditional AI problems involve reasoning, planning, learning, perception, pattern and image recognition, etc. AI encompasses several subfields.

Within this honors track, the main focus will be on machine learning, data mining, deep learning, deep reinforcement learning methods, but also other subfields (e.g. symbolic reasoning, evolutionary computation) and related fields (e.g. complex systems, neuroscience, optimization) will be addressed. The work will be performed in multidisciplinary teams, following the problem-based and design-based learning approaches. All teams will focus on the technical and scientific aspects of AI, except one which will focus on AI philosophical aspects. All teams will interact with each other.

11 projects
18 students
**Meng Fang**  
**Track coordinator**  
It is a wonderful year. We have new coaches to join the AI honors program. We organize meetings and activities together for students and provide lots of guidance and support for student’s projects. I can also see that the honors students are smart and self-motivated. Some students attended AI competitions and achieved good ranks, such as data-centered AI. Some students worked together to solve a real-world problem, such as question answering systems. Some students joined research labs and contributed to professors’ research projects, such as AI for chemical engineering. I’m very proud of the achievements of the students. I think the honors program is a great opportunity for students to challenge themselves and learn AI knowledge.

**Stiven Schwanz Dias**  
**Coach**  
My first experience as a coach was really rewarding. I am grateful to see how quickly students developed new key skills over the course of this academic year. Besides being able to develop very creative ideas to handle challenging problems related to their projects and personal development plans, they were also able to successfully spread their ideas through seminars and organize themselves into effective teams to perform a multitude of tasks e.g. establish & pursue multidisciplinary project goals, promote a hackathon day, join an AI competition and most importantly help each other to pursue their individual self-development goals. Lastly, I think the honors program is a great opportunity for students to improve their self-awareness regarding points for further development and explore their natural gifts in a challenging but always friendly environment.

**Yulong Pei**  
**Coach**  
Being a coach of the Honors Academy is an exciting journey. Different from teaching courses and supervising students, in the Honors Academy programs, you will work with students with different backgrounds and different ambitions. The projects are challenging not only because they are mostly open questions but also because they include technical work, collaborating with teammates, managing time, etc. The coaching is bidirectional. It means that you help students to achieve their goals from both perspectives of research and personal development and at the same time you can learn from these young and creative students. Overall, observing students improving themselves and becoming better in projects, teamwork, time management, and lots more practical developments makes me feel that this work is really rewarding.

**Zeno van Cauter**  
**Coach**  
Zeno van Cauter is a researcher at Eindhoven University of Technology. He received both his BSc in Data science and MSc in Data Science & Engineering from Eindhoven University of Technology.
ABOUT THE PROJECT

Large, ordered datasets are required for training computer models in image-related tasks. Within the fields of chemistry and chemical engineering, such models have great potential in optimisation and automation, but image datasets are not readily available. This project serves as a preliminary step in addressing the issue, where a binary classification task of molecular orbital diagrams (a type of chemical image) and "other" images was performed by a computer model. With the end goal of using a convolutional neural network model to label and organize images into several classes in a centralized database, the initial steps in preparing and testing the code needed to be completed, something done with the aforementioned binary classification task.

Running the binary classification task using the EfficientNet-B7 pre-trained model for 1000 epochs yielded an accuracy of around 85%, something which seems to level out after only a few epochs. The dataset was skewed with a 1:5 ratio of molecular orbital diagrams to other images, resulting in a confusion matrix of mostly false guesses. Therefore, increasing the size of the molecular orbital diagram dataset will be the next step of the project, after which more image classes will be added to the task.
MEMORIES

I was fortunate enough to work with an external research group for my honours project - the Process Intelligence research group based at TU Delft. My interactions with them have been the best part of this project, where I have been able to learn a lot. Attending general meetings where students present their projects, joining online lectures, and attending workshops through them has been very interesting. Through these I have learned about databases, different fields within artificial intelligence, and applications of these within chemistry and chemical engineering. Weekly meetings with my coordinator in Delft - a PhD student named Lukas - has also given me guidance and allowed my project to progress smoothly.

LESSONS

I have learned a lot both about myself and the material I have studied. Through the honours project and a greater workload, I have been forced to become better at time management, a goal I had set for myself already at the start of the year. I have also furthered my interest in this topic, and begun to grasp its potential in the field of chemistry and chemical engineering. By having a lot of self-monitored learning, I have also become better at employing self-discipline, as it has been required to complete my tasks in a timely manner.

In regard to the material itself, I have learned about writing, maintaining, and using SQL databases to their full potential. Furthermore, learning how to use platforms for collaboration such as Github has been useful. Lastly, of course the fields of general machine learning and more specifically computer vision have been explored, resulting in a lot of new knowledge.

MEET THE TEAM

Johan Karl Lindvall
- 1st year

Coach:
Meng Fang

"And I knew exactly what to do. But in a much more real sense, I had no idea what to do."
- Michael Scott
ABOUT THE PROJECT

The TU/e website is used by many (prospective) students around the world, but in our opinion it is not the most convenient website to use as it consists of many sections and pages, which might make it confusing to navigate through. That is why we wanted to create a chatbot for the TU/e website, which would support mostly prospective students in their questions about the Technical University of Eindhoven, as they do not have access to the many resources the university offers to their students.

Due to lack of data, we sadly do not have a chatbot that is ready for implementation in the website, but we did manage to create two prototypes based on question-answer data that would be similar to the style of questions and answers that prospective students would ask the chatbot. Additionally, we have manually set up a relatively small dataset consisting of 73 questions and answers we figured prospective students would ask.

From these two prototypes, one took a bit too long to train to be useful for now, so we will focus on the other one.

This model is a finetuned BERT model, this prevented a long running time which was the issue for our first prototype.

We found out that the model outputs rather short answers and sometimes they were a bit odd. However, it would work better if it would receive larger input text. We additionally discovered that it was inconvenient for the model to receive hyperlinks, which were used to refer the prospective students to a certain page for further information, as the tokenization from the preprocessing messed that up a bit. After removing the hyperlinks the model thankfully performed a bit better.

Although the chatbot is not ready for real usage currently and there are improvements left to be made, the results are promising and the model can be efficiently used to produce a chatbot that will help prospective students have a better understanding of the TU/e.
MEMORIES

The best memory of this Honor’s year is one of the earliest meetings our group had. Back then, we were still looking for an exact project to do, as we only knew we wanted to create a chatbot and were all interested in learning more about NLP. Initially, we started off with the idea of creating a chatbot for medical use, but thankfully stayed away from that as we figured none of us has any medical knowledge.

Then, one of the group members pitched the idea of creating a chatbot for the TU/e website. We all got very excited by this idea and were discussing the things we found difficult of the website. Even though it was one of the first few times we met, the atmosphere was very nice as we discussed freely how we felt about the website. Everyone was already very eager to start working on the chatbot, which started our project off great! I think that meeting set a great first impression for me as to what kind of group it was; a very ambitious and driven group, consisting of people who are excited and eager to learn more.

LESSONS

We have learned mainly how to do such a project where you have so much freedom and barely any restrictions. Although it certainly was challenging at the beginning, as we were unsure on how to tackle certain problems and how to get everything started up, we now have a better idea of how to do projects effectively, efficiently and in a more proper structure. If we were to do it all over, we are certain it would go much smoother.

Furthermore, we learned a great deal in co-operation and communication. We have a rather big group, which caused some issues in these aspects, as it makes it a bit more difficult. These kind of issues would occur much more often in the future, so we’re glad we had the opportunity to learn how to handle this early on. It was very noticeable that throughout the project everyone was improving at this, which made working on the project easier as well.

Finally, we have learned to manage expectations. At the start, we were all very excited and even considered the idea of our chatbot being used for the actual TU/e website. However, we sadly did not manage to do that. We have learned that it is important to have realistic expectations.

MEET THE TEAM

Andreea Murariu
- 1st year

Aurelia van den Berg
- 1st year

Damlıa Savas
- 1st year

Leander Huyghe
- 1st year

Isidora Stojadinović
- 1st year

Linh Nguyen
- 2nd year

Coaches:
Yulong Pei
Meng Fang

"How can the usage of the website become more efficient and for whom?"
The project was primarily concerned with the validation of a novel AI-based model known as the Deterioration Index model or DI model which was used to predict the deterioration of patients in hospitals. The project was in collaboration with the student team FruitPunch AI and the Elisabeth TweeSteden Ziekenhuis (ETZ). While deterioration is a very generic term, it was restricted to the events of the need for a Rapid Response Team, the transfer of a patient to the ICU or the event of death.

Prior to the undertaking of the validation study, another model called the Modified Early Warning System or the MEWS model was used for the prediction of deterioration of patients. The task at hand was to use data analytics to analyse historical medical data and their respective predictions of deterioration using both the MEWS and DI model to determine which model was more suitable for use. The entire process was an iterative one with the methods and approaches being validated by the data science team of the ETZ.
MEMORIES
The ability to be able to see lines of code on datasets translating into real-world implicating results would definitely be the most rewarding aspect of the past year. The individual growth involved both on the hard and soft skills side of things was also something that truly encapsulated the entire honors experience. At each point during the journey, despite the challenges presented, the ability to get over the hump and showcase results which were very well received was something that makes the entire journey worth it. Simply put, it was the journey and not the destination that truly mattered over the past year.

LESSONS
The biggest learning curve on an individual level was the transition to acquire the hard skills required for data analysis. Being a subject that is not directly related to my background in mechanical engineering, I had to spend long hours acquiring the necessary skills needed for the project. These included learning about working with libraries such as pandas and numpy along with the statistics needed to validate results of data analysis. Within the project itself, it was my first experience working in collaboration with a company wherein the work involved was directly responsible for translation into use for real world problems. Hence several skills such as the ability to be able to communicate with both technical and non-technical audiences and the different ways to present the same results to cater to the different audiences were also learned along the way. Finally, an underrated aspect of the entire project was also learning about and handling privacy sensitive data and the limitations associated with the same when it comes to working on a project.

MEET THE TEAM
Hriday Govind
- 2nd year
Coach:
Stiven Schwanz Dias

"Being persistent may lead you to the door, but consistency is the key which unlocks it"
- Kenny Dasinger
ABOUT THE PROJECT

After establishing my foundations of reinforcement learning, I decided to apply my knowledge by working on reinforcement learning projects. An environment is the space where the reinforcement learning agent practices and learns. Usually, there are two primary ways of training in an environment:

- Training in the real world: The agent can be directly trained in the real-life environment with all its complexities. This removes any sim-to-real bias that may be introduced due to transferring knowledge from a simulation to a real-world environment. However, this method poses several challenges; the primary being -- there are large financial costs to train agents for longer times and involve several safety constraints.

- Training in a custom-built simulator: This approach offers great flexibility as any real-world process can be modelled as an environment. The environment built from scratch can abstract away or introduce more complexity as required and often is several times cheaper. Simulators also allow the training algorithms to be deployed in parallel to reduce training time. With the advancements in physics engines, it is increasingly possible to mimic the real world and prevent the sim-to-real gap to a large extent.

The environment consists of two kinds of agents - blue and red. The blue agent is placed in a maze environment with 7-10 hostile red agents that are set to chase the blue agent. The blue agent is equipped with a weapon with exactly 100 projectiles. The overall theme of the game is for the blue agent to shoot all the red agents before the red agents get too close.
MEMORIES

Best memory is winning the data centric AI competition hosted by Andrew Ng and attending the round table conference he hosted. The private conference with Andrew Ng and the winners was a fantastic experience! I learned a lot about the most innovative approaches to data-centric AI and how to democratise them. I’m glad for this opportunity from the most significant AI leader, who inspired me to explore AI in the first place.

LESSONS

The first year in the Honors AI track has allowed me to explore different sub fields in artificial intelligence such as data engineering, computer vision and reinforcement learning through competitions, workshops and reading and implementing research papers. This ties in perfectly to the goals I set for myself in the beginning of the year. I have learnt how to understand and read research papers and be able to extract relevant details to fully understand it. I also gained a strong grasp over the fundamentals of reinforcement learning. Although I haven’t been able to conduct a workshop on it, having study sessions with the other students and explaining concepts to each other definitely helped me reinforce the concepts. Furthermore, I also conducted workshops in other fields of machine learning which not only improved my technical knowledge but also helped me developing my presentation and speaking skills.

MEET THE TEAM

Nidhis Shah
- 1st year

Coach:
Meng Fang

"Usually, the blue AI agent is pretty stupid, but after learning for a long time, it learns to perform 360° no scope trick shots."
ABOUT THE PROJECT

Reinforcement Learning (RL) is a field of research in machine learning, it is unique however in the fact that no data is necessary to train an RL agent. These agents instead learn by simulating memory in what is referred to as a “gym” environment. In this gym environment, the agent learns by repeatedly making random choices and being given either a positive reward for a good action or negative reward for a bad action. The action, reward and current state of the agent are stored in memory and processed, from this the agent learns which behaviour is beneficial and which isn’t.

RL is arguably one of the most promising fields of machine learning currently since it is the field most closely resembling “real” Artificial Intelligence. Real-world applications are limited however, this is due to the field still being in its infancy stages having started 70 years ago with most of the breakthroughs happening in the last decade. Even so, reinforcement learning is currently capable of many things, such as high-quality image compression or even the ability to copy human movements in simulations.

Our goal was to learn more about this field by participating in a more fun and applied way. We decided to do this by participating in competitions.

Our first competition was called Lux AI. The Lux AI challenge is an annual competition hosted on Kaggle, in which teams of at most 5 people develop an agent to compete against other team’s agents in a game. Lux is the name of the game in which the agents compete. On the Lux AI challenge website, the premise of Lux is given as: “the night is dark and full of terrors. Two teams must fight off the darkness, collect resources, and advance through the ages. Daytime finds a desperate rush to gather and build the resources that can carry you through the impending night. Plan and expand carefully – any city that fails to produce enough light will be consumed by darkness;” during the game agents must manage an economy and various units. Ultimately the aim of Lux is to outlast your opponent, or finish with a higher number of city tiles.
MEMORIES

Our favourite memory from this year was the project we undertook to create a unity environment. This project as we were finishing up with the RL courses on Coursera, we found ourselves working alongside the ‘RL Research’ honors team again. For an overview of the environment, we created: The agent is a penguin, and it can move inside a disc-shaped world. Half of the world has ice on the surface, and that is where the baby penguin will be placed at random, when the world is initialised. The other half of the world is made out of water, and in the water multiple (around 4 - 6) fish swim around. The objective that this environment presents the agent (penguin) with is to eat the fish and feed them to the baby penguin, one by one. This is done by offering a positive reward when the baby penguin receives a fish, and a negative reward for every timestep that passes - representing the growing hunger of the baby penguin. There are three types of fish that we created: the big fish gave a bigger positive reward when it is fed to the baby penguin, the poison fish gave a large negative reward if it was fed to the baby penguin, and the fast fish made the agent move faster, but gave no reward when fed to the baby penguin.

LESSONS

As a team we were able to gain strong intuition of RL techniques and apply them to various online challenges with moderate success. Achieving a high rank however, remained unattainable with the skills we developed. Considering that during the LUX AI Challenge we were all beginners to RL and RL related competitions we managed to achieve an above average rating we are confident that if we were to try the challenge again we could reach the top 10%. This confidence is largely due to our heightened intuition and from the lessons we learned from reflecting on our short comings. Similarly, creating and improving training environments for RL agents in unity is another skill we acquired and subsequently sharpened during our project. The fruits of our labor were briefly reflected in starting the Connect-X competition, where despite the short amount of time we could bestow onto it, we were able to quickly start working on an agent and improving it. Furthermore, our general group work and communication also saw notable improvement, along side our RL capabilities, kudos to our weekly meetings and holding one-another accountable. Overall, we developed our knowledge of RL techniques while maintaining a healthy work ethic in our team of three.

MEET THE TEAM

Omar Khaled Abbas Abdelgalil Khalifa
- 1st year

Tudor Macovei
- 1st year

Marcell Merényi
- 2nd year

Coaches:
Meng Fang
Stiven Schwanz Dias

"I think data science is for weird people"
- Marcell Merényi
ABOUT THE PROJECT

We, as Team SimEnergy, are trying to disaggregate energy consumption data collected from smart metres into individual electronic appliances. This is done by building several AI models for predicting the power usage of each appliance.

The energy crisis is occurring all across Europe at the moment. This year particularly, factors such as supply contraction, extreme weather conditions, and the Russo-Ukrainian war have directly pierced through our energy bills. Considering the fact that the residential sector covers the second largest portion of global energy consumption, it is more crucial than ever for each household to modify its usage behaviour and for energy stakeholders to improve operational management.

Luckily for us in the Netherlands, most residential houses are installed with a smart metre device, which keeps track of usage more accurately than conventional measuring devices. Such widespread accessibility of smart metres, as well as the potential of an energy disaggregation scheme, gave us enough motivation as to why SimEnergy can be applied to a wide market and be in good use, even for people who don’t know much about technology or don’t know how to use it.

Disaggregating total power might not be doable in the past. But now with smart meters, time-series power data per second is collected over several weeks and becomes big data, allowing the usage of AI. Furthermore, with the advancements of more AI techniques, such as neural networks, it is now more possible than ever to provide more accurate analysis and prediction. For example, the model can be used to find out the signature/power pattern of each appliance from sequences of data and predict using total power easily. Since different AI model type fits different power pattern, several models will be built to compare their performance on the appliance, and hence choose the best one for each appliance. Besides building the model, we will also investigate the possibility of creating a synthetic dataset from the provided online dataset to create unlimited labelled data and increase prediction accuracy. In the end, we will find out different visualization methods or applications of the predictions to benefit different target groups, mainly household users and grid operators.
MEMORIES

Looking back at the year, there are many memorable moments that we can recollect. Developing the 1st AI model was definitely one of the highlights since this gave us a sense of accomplishment that we managed to reach our goal. Seeing the codes running smoothly and generating reasonable results is something we have strived for almost half a year. We still remember the moment when we did not have a very clear idea of what to do exactly. And now, there is a huge leap in the project's progress. Knowing the correct direction helps a lot in the future of SimEnergy.

Furthermore, we recently organized a Hackathon to promote the project's idea and allow the formation of creative ideas. We have put a lot of effort into promoting, determining the content of the challenges, inviting judges, funding, and more, which are things that a regular AI-related Honors team rarely does. It was out of our initial expectations to set up such a large-scale event. In the end, we were satisfied to see the participants enjoying the Hackathon and coming up with new ideas on how to keep our project moving on. It also allows us to meet more people interested in our project and find potential new members.

LESSONS

One important lesson we learned from this year was the significance of preliminary research. As a starting team, we were very excited to start with the project and rush into technical work. However, it came to our attention that much research is needed because the idea of disaggregation is too broad and not specific enough. As a result, we were quite miserable at the very beginning. We gradually found out that the motivations and direction of the project should be deepened first by researching. Only then can we come up with suitable methods to solve the problem.

We also noticed that it is particularly crucial to communicate often for our team because three members are from the Energy Transition track (Arif, David, Jiyeon), while 1 member is from the Artificial Intelligence Track (Marco). Thus we may not be on the same page if one side or the other does not update on their progress and achievements.

Lastly, we learned that it is important to ask for help when necessary. One of the troubles we have faced is the lack of reliable GPU when running the models. Fortunately, we asked for others’ advice and find out about the GPU platform provided by the HPC lab. If we only keep complaining, the project will be unable to move on. Hence it is crucial to request assistance and implement the suggested solution.

MEET THE TEAM

Cheuk Lam Mo (AI)
- 1st year

Arif Ashworth (ET)
- 1st year

Jiyeon Han (ET)
- 1st year

Marco Mo (ET)
- 1st year

David Melamed (ET)
- 1st year

Other students in project team:
Liam Geschwindt
Stiven Schwanz Dias
Tiago Elias Castelo de Oliveira

"To learn without thinking is blindness, to think without learning is idleness."
- The Analects of Confucius
ABOUT THE TRACK

In this track the students learn about algorithmic problem solving and related computing skills, and put that to the test by participating in competitive programming contests.

The students in the track typically engage in various activities ranging from participating in and training for programming contests to executing research and company projects. While the first year students focus on developing their algorithmic problem solving skills, organizing training sessions and participating in programming contests, the second year students combine participating in programming contests with a research project or company project. All students also participate in the track seminar, where they conduct research into one of their favourite computer science topics and share this with the entire track in presentations of 30-45 minutes. Overall, the students do not only improve their technical skills in programming and problem solving, but also further improve their professional and personal skills along the way.

The first year students participated in more contests than ever, not only considering our standard contests, but also exploring programming contests in completely different areas, like algorithmic trading and cybersecurity. The second-year students of the track demonstrated their skills in a project.
**Kevin Verbeek**  
**Track coordinator**

I’m an associate professor in the Algorithms, Geometry, and Applications cluster of the Mathematics and Computer Science department. I have been coordinating my track since 2015, and I still enjoy to stimulate talented students to reach their full potential!

The year 2021-2022 was the year that we returned to campus (we are ignoring the brief lockdown in December-January), and I was happy to see that this resulted in the students investing a lot of time and energy into the honors track. I was impressed to see students independently delve deeper into their interests by starting or joining various student teams next to the honors track, and I’m eager to see what this will bring for next year.

The second-year students of the track demonstrated their skills in a project. One group of students developed algorithms that allow a robot to efficiently explore an unknown complex environment and efficiently compute paths in that environment. Another group of students set up a programming contest by themselves, where participants had to implement an AI bot for the board game Azure, with server-side support from yet another group of students. This contest was won, perhaps not surprisingly, by a team of the track’s first year students!

I hope to see everyone in person(!) again next year, and for those who graduated honors, I wish you a successful remainder of your academic career!

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**Willem Sonke**  
**Coach**

This year I coached eight second-year Honors students in the Competitive Programming and Problem Solving track. While the first half of this academic year was still overshadowed by COVID, in the second half I was able to meet with the students in-person, which made this year of Honors coaching much more enjoyable for me. The students were divided into two teams. One of them organized a programming contest in which participants were tasked with writing a bot to play the boardgame Azul. The other team worked on adding features to the server software used by our other students to train their problem solving skills.

I am proud that both teams managed to make their project a success, and that in the process all students acquired both technical and non-technical skills. I wish all of them the best of luck in their future careers.

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**Pantea Haghighatkhah**  
**Coach**

Digital Tabletop Competition

Your team is: Jury3

LEAVE TEAM
GET TEAM PASSWORD
VIEW DOCUMENTATION

Visualize Games

Search for games
Select which game you want to view

VIEW GAME

Upload Source Code

Choose File
No file chosen
UPLOAD FILE

TRACK | COMPETITIVE PROGRAMMING AND PROBLEM SOLVING

Gavel Training Server and Tabletop Programming Contest Extension

ABOUT THE PROJECT

In the Competitive Programming and Problem Solving Honors Track, one of the core tools that students use to practice their skills is the Gavel Training Server. It represents an interface between students looking to test their problem-solving skills and DOMJudge, a backend system made for running algorithmic programming competitions.

Our initial goal was to document and add new features to the existing Gavel Training Server. Afterwards, we got contacted by another second year CPPS team that were working on a project that entails hosting a competition where teams of three people would program a bot that would play against other bots in a tournament style competition. The bots would play a one-versus-one board game with predefined rules.

Thus, we split into teams of 2, with Teodor Lunug and Paul Zelina working on the Gavel Training Server, while Steyn Mulder and Lukas Peciukonis would be working on creating a web-based environment that would help host the board game programming contest.

Teodor and Paul encountered multiple problems with the current implementation of the Gavel Training Server. Since the server and all its associated components were developed and last updated in 2019, many of the tools and technologies associated were outdated and setting up a development environment proved challenging. Thus, the main output of this work was to create an installation guide, to help guide the next year's development team, such that they avoid having to go through the same steps we went through. Furthermore, to help guide current students, we implemented the ability to view different training problem's categories, ranging from mathematics, greedy, or dynamic programming problems. This will enable users to have more efficient training sessions.

Steyn and Lukas worked on creating a web interface for the board game programming contest, with features including user accounts, team creation, team joining and leaving, uploading of source code, and visualizing games. Furthermore, the development team worked on hosting the webservice, such that it can be accessible through the internet, from the same link that the Gavel Training Server can be accessed. The team worked closely with the other team from the track, to ensure that the work output was adequate, and all necessary features were implemented in due time, before the competition started.
MEMORIES

Since both sub-teams had limited experience with full-stack web development, many problems and challenges were encountered and a significant amount of research had to be undergone to be able to deliver adequate results. Nevertheless, this enabled all of us to broaden our knowledge and to be proud of the results we delivered.

While we are sure that many projects encounter similar problems, in software development, some errors arise from the most mundane things, such as a misplaced comma in the code, writing a wrong URL, or simply using an older or newer version of some specific development environment. While such errors are relatively simple to solve most of the times, they can sometimes be very difficult to track, leading us to sometimes spend concerning number of hours trying various fixes.

From our perspective, the best memory is hard to quantify. Perhaps, what can be better said is that the best memories came from whenever we managed to solve some problems that initially seemed very difficult. The satisfaction that comes from understanding the source of problems and the technologies that have been used to a better degree, made for some very memorable moments.

LESSONS

As has been mentioned in the previous sections, developing, documenting, or maintaining a full-stack web-application requires familiarity and knowledge of many technologies, ranging from front-end development, UI design, database management and SQL querying, containerization tools such as Docker and experience with diverse tools such as Firebase, APIs, or JavaScript package managers. Furthermore, the constant process of debugging and approach to various problems, will be something that will be encountered by each of us in the future. The experience we now have with this process, will most definitely be valuable in all our future projects and endeavors.

While the technologies, in and of themselves, were a significant part of our learning experience, we have also learned how involved a full-stack application is and how much time is required to integrate and develop all the required parts. Furthermore, working on a project for a longer amount of time enabled us to become familiar with one another and helped us realize the importance of clear, concise communication and frequent meetings, to both work on the development part and to help fix issues that ultimately arise.

This experience has proved valuable to all of us, and we believe that both the technical and soft skills we have gained throughout the project will help us in both our academic and professional careers going forward.
ABOUT THE PROJECT

After competing in programming competitions during our first year in the Competitive Programming and Problem Solving, we thought it was time to organize our very own programming competition! During the Digital Tabletop Competition, teams consisting of three team members were tasked with writing a bot that could play the board game Azul. The team whose bot won the most amount of matches at the end of the competition, would win. After a kick-off session on the 4th of May, all teams had two and a half weeks to work on their bot, with an intermediate competition to see how well they were doing so far in between. Other CPPS students, as well as other TU/e students and even Fontys students competed in our competition.

After we had chosen which board game we wanted the competition to be based on, we started the real work. From November until May we worked on adapting a game engine that would let the bots communicate with each other, creating the visualization of two bots playing the game against each other and set up our example bot.

We designed our very own version of the tiles from Azul and made sure the player boards looked nice too. Next to coding and designing, we had to attract participants, so we visited some lectures and promoted our competition during the break, created an interest form and invited those interested to our competition’s Discord server. We collaborated with another CPPS team, the Gavel server team, who created a website for us on which participants could upload their bot and view games once they were published. We set up our own documentation website as well (which you can still find at https://digital-tabletop-competition.github.io (Links to an external site.) ). At the award ceremony we of course handed the team that ended first place the board game Azul. We just hope they will find people who still want to play with them after thinking about the best strategy for the game for so long.
MEMORIES

Actually pulling off the competition would probably be the best memory for us this past year. It started with a successful kick-off presentation – with pizza, snacks and soda – followed by an afternoon during which groups were welcomed to stay in the reserved room and start working on their bot. Soon, the first few questions came in on our Discord page, which we kept an eye out for and answered as soon as possible. The intermediate competition was also a test from our side, to see if our competition manager worked the way we intended it to and how long running the whole competition would take. Luckily everything went smoothly here as well. After the results of the intermediate competition were published, the real wait began, as we had to wait another week to know the final results of the DTC.

When the final deadline of the competition arrived, on the 21st of May at 23:59, our coach needed some subtle reminders to provide us with the uploaded bots, as he was the only one with access to the server. When we finally got the results in, it was really fun to see that the team that had ended up in last place during the intermediate competition had now ended up in first place. We had a very fun award ceremony and would like to thank everyone who participated!

LESSONS

During the past year, we learned what it was like to be on the other side of a programming competition. We had to make choices regarding organizational aspects – would we do a full competition and have all bots compete against each other, or would we let every bot only compete against two others and have them advance that way? – but also about technical aspects – which programming languages would we allow during the competition, will our competition manager be able to work for C# as well as for Python?

We learned that it is important to communicate to an audience in a clear way, especially when explaining the logistics of the game and the competition, when answering questions on the Discord server or when specifying what the input and output of the bot should look like. We also had to think about how to communicate with another team, working on some sort of deliverable for us. The Gavel team needed us to provide them with information regarding what the website should be able to do and how it should look, we gave them deadlines and specifications to keep in mind as well. Finally, we learned that providing pizza during a presentation is always a good idea ;)

MEET THE TEAM

Gijs Pennings
- 2nd year
Koen Ligthart
- 2nd year
Sarah de Ruiter
- 2nd year
Viktor van Bilsen
- 2nd year
Coaches:
Willem Sonke
Kevin Verbeek

"We learned that providing pizza during a presentation is always a good idea ;)

Digital Tabletop Competition

Welcome to the home page of the DTC. Use the info below to find the information you need.
- Competition rules: organizational information, registration, and information about the schedule, as well as
- a technical description of how bots are to be run.
- Game rules: rules of Azul, the board game your bot will play.
- API specification: detailed description of the interaction between your bot and the server.
- Tournament rules: description of how to use the server to test your bot.

Important links:
- Keep up to date on all questions on the official Discord server.
- Download the kick-off presentation, server, and example bots here.
- Register your team, submit your bot, and watch matches on the competition server.
ABOUT THE PROJECT

In addition to participating in programming contests this year, we also had an extended project. Our project was to create an efficient environmental awareness and pathfinding algorithm, that could be applied to a robot and allow them to observe, path around, and remember the basic layout of its environment and their obstacles. We wanted to apply this to a rescue bot, that could be sent into dangerous environments such as collapsed caves or crevices, and explore and map out the area. We created the simulation in Unity, with a simple spherical placeholder bot and a complex environment around it. The bot is provided with random goals, and it must navigate around the environment and reach said goal, as quickly as the environment will allow it.

The pathfinding strategy used is an adapted version of Lifelong Planning A* known as D* Lite, which makes use of LPA*'s heuristic nature and switches the source and the target nodes, meaning paths are generated from the goal to the bot, rather than the other way around. Because of time pressure, we ended up just using A*, which functions in Unity but has possible repercussions for the practical applications of our algorithm.

For the bot’s environmental awareness, we first created a simple grid around it and recorded which cells were occupied as they were hit by a raycast. We had concerns with runtime, so we decided to use a more complex strategy to record which areas of the grid were “empty” and which were “occupied”. This is when we were introduced to the concept of Quadtrees as an underlying data structure. A quadtree partitions the entire available space into four partitions, then checks if each of the partitions is empty. If they are not, then the partition is repeated on that cell, and the process is repeated for each of the 4 partitions. This creates a grid that gets more specific only as needed, making it cheaper to store than an entire grid. Especially in environments with large amounts of adjacent free space, such as looking around a room or cave, this could drastically reduce the time it takes the bot to comprehend it’s surroundings.
MEMORIES

Throughout the year the team has had a lot of great memories. First right in the beginning when we participated in EAPC (Eindhoven Algorithmic Programming Contest), getting a good enough score to qualify for the next round - BAPC (Benelux Algorithmic Programming Contest) - this year being hosted at the Vrije Universiteit Amsterdam at the end of October, was first of all a good achievement for us. Because the contest got delayed by quite a bit, it left a lot of room for just having a nice time, and it was a good intermission in a generally busy time. Although the placement we managed to get in BAPC was not the best of our performances as a team, travelling to participate in a contest and everything around it ended up being a great memory. In addition it was a goal of ours to reach this stage in the competition, so it felt good to accomplish!

In general, participating in contests with the team is always fun, and a part of what makes the honors track so interesting. There are always new challenges and aspects to the contests that make you to think in different and new ways, and having the team to bounce ideas of has been both a learning experience and a good time.

LESSONS

Both as a team and as individuals, we have learned a lot this honors year. First of all, having extra experience in contests from previous years has given us a basis to build further knowledge on - and we have gotten to a point where it’s easier to point out what type of problem we are facing and what solutions could be useful. In addition, we have been able to utilize this knowledge in regular courses of our degree program, which has allowed us to develop these skills even further.

On another note, the extended project is probably the one thing we have learned the most from - in more ways than one. First of all it has given us a different perspective of team-work and organizing a project like this, which turned out to be quite different from contest-practice like we are used to as a team. Although it was challenging at times, we think what we accomplished ended up being good. Secondly, the theoretical content has taught us a lot - from the use of quad trees, to research on various pathfinding algorithms to use as a basis for our own algorithm. This is not something we would have necessarily been exposed to without the project, so it has been nice to learn something new in a bit more of a practical and self-guided setting.
ABOUT THE PROJECT

Our track consists of several elements. However, the main focus lies in the various programming competitions that we join during the academic year. We begin the year by getting to know our groups and with the weekly lectures given by our coach, Kevin Verbeek. These lectures covered the basic algorithms and techniques that we can use in the programming competitions, which range from topics like Graph Theory to Geometry. These lectures serve as a way for us to build a solid foundation of practical knowledge for the competitions that follow. While some of the lecture topics were familiar to us from courses like Data Structures, the material we covered within the Honors track focuses on applying the information in order to be able to solve and implement real-world problems. Following the lectures, our teams went on to participate in several different types of programming contests. These include competitions such as ICPC, MIT’s Battlecode, Google Hashcode, Google Code Jam, Hackathons, Game Jams, CTFs, and more.

This wide range of competition types shows that our teams are varied in their interests. The supergroup includes two smaller sub-groups made out of three people each. This format allows our teams to mix for different competitions and gives us more flexibility in the contests we choose to participate in. Besides programming competitions, another big part of our track is preparing and holding an individual seminar of around 30 minutes. This task can be challenging, especially when taking into account the fact that the seminar topic was unfamiliar to most of us. However, everyone on the team was able to successfully complete their seminar. The chosen topics are a continuation of the lectures given by our coach. For our team, the topics included: Polynomial Interpolation, Randomized Algorithms and the A* Algorithm. Holding the seminars gave us the chance to practice some important soft skills, such as presenting and constructing a cohesive talk.
MEMORIES

In the beginning of our track, we had our first competition of the honors year. This was the first time we had to perform as a team and the event was organized in person on campus which was great, because of all the online events of the months before. During the competition we were collecting a lot of colorful balloons which increased the level of fun, of course. Furthermore, it was amazing to challenge ourselves and see how we would perform after having only trained for a few weeks. Next to that, for some of us this was the first time competing in a coding competition which created some extra excitement. Besides all the fun, it was also hard work however, in the end the hard work resulted in some euphoric moments when we solved complicated problems and our solution got accepted. The best part of the day was when we all had dinner together at Dadawan and we, of course, brought our balloons there! We were able to reflect on the day and get to know each other better while enjoying some good food. For us, this was a great memory, because we were able to solve complex problems, collect balloons and spend time together.

LESSONS

There are many aspects to what we have learned. For instance, we have gotten to know each other on a personal level quite well. Participating in competitive competitions can be quite stressful and therefore, making it through that helps bond the group even closer. However, there are, also, the technical aspects to what we learned. For instance, we learned about dynamic programming, a technique used in problems that have an optimal substructure. Moreover, we were introduced to graph algorithms. For instance, Dijkstra’s algorithm is used to find the shortest path on a graph with non-negative edge weights and Edmonds-Karp algorithm is used to solve a max-flow problem. On the other hand, we, also, touched on geometric problems such as finding the convex hull of a set of points which, in 2d, can be done using a Graham scan. Alongside these technical aspects, we were, also, required to specialize in a specific topic and give a seminar on it. This required us to improve our ability to present and teach an audience new concepts. However, we were not limited to these aspects, as groups we were allowed to participate in diverse competitions. One of our subgroups participated in a CTF (capture the flag) event that required them to learn relevant hacking skills. All in all, we grew through the participation in competitions and the technical knowledge we acquired along the way.

MEET THE TEAM

Bas Paardekooper
- 1st year

Collin Harcarik
- 1st year

Lisa Verhoeven
- 1st year

Pascal Otjens
- 1st year

Radu Pogonariu
- 1st year

Sanziana Tudose
- 1st year

Coach:
Kevin Verbeek

"Segmentation fault"
ABOUT THE PROJECT

We are a group of driven students who want to improve their programming ability and compete against other groups to become one of the best programmers there are. There are a lot of things we do to become better at it. We started the year by getting lectures about all the basic algorithms and how to implement them in real problems. Then our first competition started, the EAPC (Eindhoven Algorithmic Programming Competition). Here we have find as many solutions as possible from around 10 to 12 problems using programming in a time span of 5 hours. Here the best teams go through to the next round, the BAPC, which has the same format. After these starter competitions we were allowed to start choosing our own competitions in which we wanted to compete and our own teams with which we did them.

For competitions you could think of for example Code Jam, which is an individual competition, or Hash Code, where you get an NP hard problem and have to approximate a good solution. Next to these kind of competitions we also had competitions where we had to program a bot to play a game in a few weeks of time, like Battle Code or DTC (Digital Tabletop Competition). To do well in these competitions we also had trained either alone, by just trying to solve example problems, or together, by trying rounds of the competition of previous years and thereby improving our teamwork. Not everything of our year was competitions though. All of us also got a topic to look further into and become an expert at. Then everyone would give a seminar about their topic such that everyone of our year would get to learn about all the topics that other people studied.
MEMORIES
Looking back at this year, we can really say we had a blast. We got to know a lot of new people and connect with them through our common interests. There are a lot of great memories that come through my mind right now. One would be when we all went to our first competition EAPC and saw that for each problem we would get a balloon of a certain color once we solved it. At that point on we remember everyone being so excited each time they would solve a problem. We also remember when we went to the EAPC, how we laughed and had a blast right after the competition ended. Another memory that comes to my mind is when we gathered for a social event of our track and we all started sharing stories, playing videogames, drinking eating, we had so much fun. It feels like the year and our team has just started with these competitions but the year has already flown by. We also remember the tension there was in the room for every single competition we did whenever the scoreboard was being revealed and we would get to hear at what place we ended up at.

LESSONS
We have learned a lot this year. Because of the lectures and seminars we got a lot of theoretical knowledge about all kinds of algorithms and fields in computer science. Next to this we of course also learned a lot by training together. We learned a lot of basic ways to solve problems and learned to work together as a team under the stress of the clock. Throughout the year we all have been steadily increasing in our programming ability and even though some of us had more experience than others at the start of the year, we all managed to learn something from one another. Each and every one of us also has become an expert in one topic that they chose to do there seminar about. Everyone knows a bit about all the topics, because of the seminars we had to give, but everyone is way better in their own topic since they had to prepare it. Next to this we trained a lot for these competitions. From this we learned how to work in a team and found a good strategy to approach the competition. We used that to lose as little time as possible that we are not spending on solving the problems.

MEET THE TEAM
Dea Llazo
- 1st year
Maarten Dankers
- 1st year
Marissa Manago
- 1st year
Minh Pham
- 1st year
Wout Huynen
- 1st year
Coach:
Pantea Baghighatkhah

"Teamwork makes the dream work!"
ABOUT THE PROJECT

In the Competitive programming & problem solving track (CPPS), we learned advanced techniques to solve algorithmic problems and the skills to efficiently implement such algorithms. These skills were put to the test by participating in international programming contests.

The first competition that we participated in was the Eindhoven Algorithmic Programming Contest (EAPC). This competition took place in the middle of October, therefore we did not have a great amount of time to prepare. Despite this, we still managed to achieve good results.

The next competition that was in our schedule was HashCode, which took place at the end of February. We had plenty of time to practice and improve our problem solving skills in the meantime. This is a slightly different type of competition, since it is about optimizing the solution to an NP-hard problem, instead of the regular problems we have to do in the other competitions. We placed 1700th out of over 10000 teams, which is a nice result considering the fact that this was our first time participating in this type of competition.

Despite the fact that we practiced for HashCode, we made sure to spend the majority of our training time on preparing for regular algorithmic contests by learning new algorithms and data structures and solving various types of problems. This was done so that we are ready for Codejam, Kickstart, and the next iteration of EAPC.

During Codejam, which is an individual competition in comparison to the previous competitions, almost all of us managed to pass the qualification round and go on to the next round. Only one of us managed to qualify further onto the 2nd round.

One of us also participated in the DTC, a contest organized by the 2nd year students, which is a competition where you have to make a bot which plays a boardgame strategically and has the goal of beating the bots of the other teams.

The last competition that we participated in during this year was Kickstart. All of us did decently well.

Finally, all of us had to prepare and present a selected highly-technical algorithmic topic, such as impartial game theory and Delaunay triangulation.
MEMORIES

Although this year was full of great memories related to the Honors track, the most enjoyable part of the CPPS track was participating in the competitions. For all of us attending, a competition related to programming was something new and initially we did not know what to expect. However, we quickly managed to adjust to the pace of the contest and it became extremely enjoyable. Each time we solved a problem and saw our team rising in the leaderboard we got extra motivated and got inspired to try our best for the rest of the problems. Overall, seeing the results of the time we invested in practicing for the competitions was satisfying.

LESSONS

During the past year we spent a considerable amount of time learning new algorithms, data structures, heuristics, and problem solving approaches. Moreover, we improved on our time-management skills and continuous learning abilities by consistently training for competitions during the preparation phases. More importantly though, via the preparation for our seminar topics, we gained extensive experience in researching a technically challenging topic. In combination with this process, we were able to hone our presentation skills by compressing the information we have gathered in a format that is presentable in 25 minutes and is also able to convey all necessary information without making the topic too complicated, while still communicating the reasoning behind the theory of the topic.

```
std::deque<int> get_path(int target_node) {
  // shortest path to node
  std::deque<int> path;
  // if no path exists, output -1
  if (node_info[target_node].parent == -1)
    path.push_front(-1);
  else {
    // calculate path
    int curr = target_node;
    do {
      path.push_front(curr);
      curr = node_info[curr].parent;
    } while (curr != -1);
  }
  return path;
}
```

"Practice makes perfect"
ABOUT THE TRACK

The Empowerment for Health & Wellbeing track is an ambitious, hands-on and human-centered endeavour into understanding the health of people. Its students aim to contribute meaningful innovations and designs to society, and to help inspire the next generation of systems in healthcare.

In this track, students pursue a variety of health related topics, such as Dementia, Sports, Medication Adherence and even Medical Devices. In these projects, students generate deep insights through engaging with stakeholders, doing both literature and field research as well as synthesizing all their findings into working prototypes.

The track builds on our multidisciplinary nature; we engineer hardware and software, do qualitative interviews with patients and caregivers, run lab tests as well as putting our prototypes into the hands of users in real contexts.
TRACK COORDINATOR

Roy van den Heuvel
Track coordinator

I’m Roy, and while currently PhD-candidate at the department of Industrial Design. I’ve had many roles, ranging from project manager of health projects to design-researcher to student coach. I love working with students on difficult health and wellbeing related topics such as behavior change strategies, sports & vitality and clinical innovation. I’ve been with the Honors Academy since 2014, making me something like a piece of furniture in the organization. This year has been my last year Honors Academy, since I’m putting more energy in my own research. I’m being succeeded by Victor Donker, who has a lot of experience in healthcare technology and entrepreneurship, so I’m very happy to see that the track will be in good hands for the upcoming years.

We’ve had a pleasant Honors year and had some very nice project output in the end. I was happy that halfway the year we could meet up physically again and work together on projects, workshops and the discussions. We had difficult and ambitious projects this year, which sometimes led to a bit of a rollercoaster of activities, deadlines and managing stakeholders for students. I’m happy that everyone managed to keep up and complete their projects successfully.

I’m also very happy with the engagement of the students with all the track activities, such as the workshops and the pizza making activity at the end. I had a ton of fun, and I hope that all the students had a great time too. Thanks, everyone!

TRACK COACHES

Juliette van Haren
Coach

Juliette is an industrial design and neuroscience graduate based in the Netherlands. Working in the field of biodesign and as a design researcher at the Eindhoven University of Technology on the Artificial Womb.

Jun Hu
Coach

Dr. Jun Hu has a PhD in Industrial Design and a Professional Doctorate in User-system Interaction, both from TU/e. He has also a B.Sc in Mathematics and an M.Eng in Computer Science. He is a System Analyst and a Senior Programmer with the qualifications from the Ministry of Human Resources and Social Security, and the Ministry of Industry and Information Technology of China. He has more than 280 peer-reviewed publications with an H-index of 28 in conferences and journals in the fields of HCI, IoT, AI, industrial design, computer science and design education.
ABOUT THE PROJECT

Premature birth
Premature birth is a big health concern. Every year over 800,000 babies are born before 28 weeks. Prematurity can cause complications which are extremely dangerous for the child. An example of such an issue is underdeveloped lungs. When a child is exposed to air, it is a rough physiologic adaptation which is full of risks, especially when the lungs are not fully developed yet. These babies need to be transferred to an artificial intelligence (AI)-based incubator to support their development to increase their survival chances. 50% of infants in pregnancy up to 24 weeks do not survive, infants which survive often have life-long problems with chronic conditions such as brain damage or impaired long function. This displays the greatness of this problem in children’s health care. That is why they want to solve this problem with The Artificial Womb Project, which aims to increase the chances of survival for extremely premature babies. The intention of the project is, to replace a +/- 24-week-old baby, from the mother’s womb with an artificial one. To connect the baby with a machine, an artificial umbilical cord is placed. This machine provides life support and certain measurement values to keep a close eye on the baby’s health and well-being.

Approach
In order to contribute to imitating the pulsatility of a 24-week-old infant, research has been done first on the biomedical values (for example the blood pressure in the veins and heartbeat) and the engineering part needs to be clear, such as the use of sensors etc. Additionally, peristaltic pumps which are currently used to experiment with this case, need to be investigated. Subsequently, several experiments must be executed on the created prototypes in our project. First, background information was collected, after which experiments were conducted in order to answer the following research question: “How can current peristaltic pumps be improved at a biomedical and engineering level to simulate a neonatal cardiovascular system?”
MEMORIES

It is hard to point of the very best memory, but surely the moment our team created our end-of-year deliverable was amongst our top memorable moments. The whole journey of conducting research, applying theory to practice, contacting experts, considering several approaches, all lead to the us finally develop a prototype. What made this moment so significant to us, was not only that we, to a satisfactory extent, created what we were planning to create, but that it was the end of a journey for us. It felt incredible to be able to 3-D print components, like casings and roller pumps, something none of the team members had experience in prior to this project. It was also not a straight forward process to choose what type of silicone tubes to use, how to create and control the electric circuit, how to add biological correctness to our design, thus after all of these test, experiments and several failed attempts, it felt really good to see the whole system work in a way that we found to be presentable. Another aspect of this deliverable, was that we had managed to function well and structured within our team, so regarding task division, organization and documentation.

LESSONS

Looking back at our honors year, we have learned a lot of new things. Being in a multidisciplinary team allowed us to learn from each other, but as well, everyone could focus on their own field of knowledge and learning goals. This resulted in a good team dynamic where we were teachers of each other. However, our amazing coaches, Roy van den Heuvel and Juliette van Haren took the time to help us out as well. They provided new knowledge related to cardiovascular flow and neonates and new skills like 3D modelling. Talking with experts and stakeholders gave us even more knowledge to support our project. Learning by doing, like making our prototypes, was challenging at times, but was a major contribution to our development as engineers. However, not everything went smoothly during our project. It took us quite some time to get a good understanding of what The Artificial Womb Project entails and how we could contribute to it. This resulted in planning issues later on in the project, where we had to work hard to finish our final prototype and the report in time. However, the most important thing is that we had a lot of fun making a baby, as it should be.

MEET THE TEAM

Brant van Herk
- 1st year

Fleur Gulikers
- 1st year

Pavie Varinac
- 1st year

Coach:
Roy van den Heuvel

"Getting into the flow"
ABOUT THE PROJECT

In the past year, we worked on the Autonomous Walking project aiming to help blind people navigate, orientate, and detect obstacles in an unfamiliar environment. This challenge was presented to the Autonomous Walking Team, whom we have worked closely with on this project.

There were about 39 million people blind in 2020 and this number continues to grow. Next to societal stigma, traveling independently outdoors introduces challenges which can be categorized into three types: navigation, orientation, obstacle detection & element recognition. To tackle these problems, first, the needs of the target group and current existing assistive technologies for blind people were gathered using literature research, benchmarking, and user research (interviews, observation). The findings were collected in a customer journey map. Using the insights, a holistic concept that addresses the three outdoor challenges was defined as a platform in the form of a mobile application. The platform connects assistive technologies as possible input or output devices. A community aspect was also added, with people capable of adding annotations to routes to guide blind users.

For this project, a Vanity MVP for the mobile application, an input (smart glasses) and output device (smart shoe sole) were created. Using these example designs, (ethical) considerations and design guidelines for companies such as start-ups were defined to further develop this concept.

In short, although the concept developed still requires validation, this project brings a step forward in the research and development of the movement towards autonomous walking future for the blind and visually impaired people. Our team hopes to have contributed a small step towards a more inclusive future of society for blind people and to have inspired further research in this domain.
MEMORIES

Working with a large group of people was definitely the highlight of this project. The supportive and genuine ambiance was inspiring and motivating. Therefore we would like to thank everyone that guided us, facilitated us, and inspired us in this project. It was nice to have you. Roy van den Heuvel, as our coach. You have been always open, supportive, but also critical, which guided us along our project. Thank you.

Our stakeholders, we extremely value your guidance and help at any moment we need. Annet Aris, thank you for supporting us with planning and managing our project. We are also very grateful for your help in narrowing down our literature research. Thank you, Thijs te Velde. Your ethnographic workshop was inspiring, and your guidance in the design phase supported us a lot. Margot Scheltema, we appreciate your constructive feedback in our meetings. It was so kind of you for helping us finding participants for our target group interviews. Karst Hoogsteen, who sent us interesting papers, helped us in writing, and gave valuable feedback for our literature report. Thank you for taking the time to do all of these. Many thanks to Karthik Mahadevan. You helped us a lot in developing the smart glasses. It was also nice of you inviting us to the Envision event. Lastly, thank you, Michiel Janssen, for reviewing our work and all the input you gave in the meetings.

Lastly, we want to say a big thank you to all the participants that helped us for our interviews and all the responses of the newsletters we heard from you. It was very inspiring, and great to have your support in our project.

LESSONS

This project brief was quite complex. A holistic solution is not an easy problem to solve and creating a design that tries to implement all different types of functions is difficult. However, we tackled this by starting with smaller objectives and milestones. This made it easier for us to grasp the context of the problem and made it easier for us to move forwards in trying to implement a proof of concept.

Since working with the visually impaired, we learned to acknowledge the importance of ethical considerations. We gained an understanding of the importance of keeping people in the research involved no matter who we are working with. At first, we had a tough time trying to find participants but with the right intentions, some dedication and the right connections, we managed. Being part of team Ecutity, we learned how to work together in a multidisciplinary team where we learned from one another. We had some struggles but managed to overcome them and are grateful for all the support we got not only within the team but from our coach and stakeholders as well.

MEET THE TEAM

Ameena Arafa
- 1st year

Michal Kuchar
- 1st year

Ramya Krishnan
- 1st year

Thijs Hendal
- 1st year

Bi-rong Wang
- 2nd year

Emilie Barrow
- 2nd year

Yining Miao
- 2nd year

Coach:
Roy van den Heuvel

"Who is up for stand-up comedy next week?"
ABOUT THE PROJECT

Many people struggle to manage long-term work-related stress. The 'Collective Stress' project focused on the effect of personalisation and repeated active reflection on stress levels over time, using student teams as a target group. Interventions for collective stress management are often seen as a 'one-fits-all' solution, yet our research showed that there are large differences in how people use stress-management tools, due to personality, preferences, and past experiences and hence tools are not equally effective for all. These differences suggest that a higher degree of personalisation of tools would lead to more effective stress management. As part of the research, an experiment was conducted to explore the influence of using tools supporting mindfulness and reflection on stress management every day.

This influence was analysed using both quantitative and qualitative methods, applying the reflexive thematic analysis framework to participant interviews. Additionally, management of individual stress levels could help reduce the sensitivity to the stress of others, helping to maintain a calmer collective environment. It was also confirmed that personalisation of stress-management interventions is needed to optimise their effectiveness within the collective. In this research, special attention was paid to the collective aspect of work-related stress. The findings were analysed and interpreted in the perspective of providing inspiration and ideas for designers, with design cards being the final output of the project.
MEMORIES

This honors year was very memorable to all members of the team, with many hours spent interviewing participants, analyzing transcripts and translating the results collected to useful design prompts. The midterm presentations, organized by the Honors Academy, stood out as an amazing experience and memory. Hearing about the projects in other tracks was both interesting and inspiring, and connecting with other like-minded people was very rewarding. Especially for our team, the midterm presentation was very beneficial as it gave us a chance to pitch our research and recruit participants for the experiment that we conducted. Of course, we also really enjoyed non-academic activities this year, with going out for lunch to get to know the team being a very memorable experience.

LESSONS

As with any group project, this year taught us that having the right team dynamic is extremely important not only for the performance of the team but also for building trust and motivating each other. Trusting your teammates with both work and understanding of any circumstances gives you the space to develop in the way that you want and creates a mutual understanding that it is okay to have off days/weeks. Trust and a good team dynamic is especially crucial for less well-defined projects, where it becomes impossible to control how everything within the project is going. Since the research will often shape itself, the project has to change course and adapt to the findings that emerge. Nonetheless, we learned that ultimately, it is the researcher’s job to tie all the pieces together and form a coherent story, through which the results of the project can be shared with others. Having had to consider many factors and research paths, it is rewarding to see it all come together in the end.

MEET THE TEAM

Hanna Broszczak
- 1st year

Irina Azimova
- 2nd year

Laura van Weesep
- 2nd year

Coaches: Roy van den Heuvel
Jun Hu

"Participating in the experiment was a traumatic experience" - one of the participants, joking (hopefully)
ABOUT THE TRACK

Students from our Track contribute to forwarding the energy transition by addressing climate and energy related problems through research in, design of, and sometimes even implementation of energy innovations.

Our students formed this year four multidisciplinary teams and focused on the following topics: electrolysis of CO2 to formic acid, electricity generation based on the triboelectric effect, developing an autonomous vehicle for the polar regions, developing a flow battery, wireless charging of electric vehicles, developing a heat battery and awareness of energy efficiency. Team RenewCO2 and Team Nano designed there first prototypes and have contacted the first customers. Team Polar visited the south pole and grew to a team of 28 students with a lot of sponsors. Better/e started to design a flow battery in cooperation with battery companies. Team InCharge developed a lab scale prototype for wireless charging of vehicles. Team Therosel developed their ideas for a heat battery system in cooperation with Celsius and team SimEnergy started to develop a data analyzing algorithm for smart metering data for energy efficiency. For persevering and looking at the positive side of things, the teams should all be very proud of themselves. All students have worked nearly independently within the teams, took responsibility and above all ensured a positive atmosphere to work in, even in the difficult (corona) period. Well done!

7 projects
26 students
TRACK COORDINATOR

Han van Kasteren
Track coordinator
Facilitating the projects of excellent students of our university has been a privilege as our students always persevere to a point where they are able to amaze you. It’s often not the objectives they reach as a team, but the steps they take as an individual to make this happen, because they are part of this well-functioning, highly ambitious team.

This year, all our teams managed to have a socially engaged team, seemingly without much effort, which is remarkable. This has been very beneficial in the (socially) difficult period caused by the measures taken to prevent dissemination of COVID-19. What I learned on top of this, is that our students are resilient. They are highly motivated for, and dedicated to, their team’s objectives. Therefore, they still managed to deliver. Thank you for your continued dedication and effort.

COACHES

Tiago Elias Castelo de Oliveira
Coach
I have been working with two teams of the Honors Academy at the Energy Transition Track for the past year, and I could not be prouder of them. It has been incredible to see their synergy working together, developing their skill, as well as their technical aspects. Both teams, InCharge and SimEnergy have been developing their idea beautifully and successfully. I am glad to be collaborating with them and being able to provide them with personal-professional support as well as technical ones. The most important aspect of our work together is that they will be learning with me as much as I will be learning with them.

Mark Cox
Coach
I have been working for Honors Energy Track since 2015 as a coach. Like every honors year also this year it has been a pleasure to see students grow in their personal development and the results of their efforts towards new energy solutions. I am especially proud of how honors students realize their dreams despite scientific and practical problems. The honors students realize sustainable products which existing companies and scientist cannot make.

Yali Tang
Coach
I am coaching the Team Better/e in the Energy Transition track. The past year is a tough year, not only due to the impact of Covid, but also because this relatively new team has to confront a new challenging project together with a new coach. Therefore, team building, project design, and time management are the most aspects I have focused on to help the team. I have witnessed, and am proud of, the development of each individual team members (especially the first-year students) after going through different project phases (ups and downs). Within this year I have also been developing my own coaching style. As a coach I feel satisfied if I have, in any ways, helped them on the project as well as their self-development.
ABOUT THE PROJECT

In recent years, the contribution of renewable energy sources (e.g., wind and solar) to the grid has grown rapidly. This development has increased the need for low-cost and large-scale storage to guarantee a reliable power output. During the day, generally more renewable energy is supplied than is used and currently most of this energy goes lost. In the night however, there is a lack of renewable energy and less sustainable alternatives are used. By creating a battery, the renewable energy generated during the day, can be used throughout the night. Redox-flow batteries (RFBs) have shown the potential to contribute to improved energy efficiency and flexibility of the electricity grid through load levelling.

The goal of Team Better/e is to contribute to the development of new and innovative redox-flow batteries. The manner in which this is accomplished is by creating an open source battery stack. The fact that it is open source means that it is easy for anyone to adapt the work we have already done, and further iterate on it.

For example, someone has created a membrane that performs really well in the laboratory. Because our stack is open source, it is really easy for them to manufacture it but with their membrane in place. This is beneficial to speed up the development of redox-flow batteries and to increase their presence in the real world.

This year, we have focused on creating a single cell redox-flow battery. Currently, this battery is being manufactured and in the next couple of weeks we can start testing it. The next goal is to create a stack consisting of three unit cells, which will be the main focus of the next honors year. All of the results will be published on the open source platform from FAIR-battery, with whom Team Better/e is in collaboration.
MEMORIES

Looking back at this honors year, our best memory is to work on this project with more people and actually seeing the progress happen. It is very nice to show up to the weekly meetings and that everyone has a new and exciting update. This was possible this year because we acquired more funding and were really focused on having a prototype in the end. In the last weekly meeting we had, we all saw and held the self-designed cell casing for the first time with our own hands.

LESSONS

In the previous year, almost all of our team meetings had to be online due to corona. So at the beginning of this year, when it was possible again, we immediately hosted offline meetings again. However, as you all know, corona came back for a little bit during winter and a lot of meetings were held online again. Throughout this year we learned that prioritizing seeing each other and spending time in real life together is really beneficial for the progress that is made.

Currently, we have set blocks of times throughout the week where our subteam and our whole team meet. It is really fun to work hard together, and then also take your well-deserved coffee break together and chat. This is something we maybe knew in the back of our heads, but we now saw the effect of it in real time.

"Iron redox flow batteries store energy with the flow of electrons."
- Kristo Milva

MEET THE TEAM

Goof Roelands
- 1st year

Kristo Milva
- 1st year

Paul Volcokas
- 1st year

Erik Nijkamp
- 2nd year

Alexandra Vacaru
- 2nd year

Anne Floor den Ouden
- 2nd year

Coach:
Yali Tang
ABOUT THE PROJECT

The team focuses on improving the current state of dynamic wireless charging (DWC).

Dynamic wireless charging is the concept of charging electric vehicles while they are in motion. This can be achieved by using coils in both the vehicle and the road itself. The vehicle is charged by electromagnetic inductance. Here a current runs through the coil in the road, generating a magnetic field that passes through the coil in the car, inducing a current in the vehicle that charges its battery.

Electric vehicles play an important role in the energy transition. However, there are many reasons why people are still hesitant on using electric vehicles as transport. Research shows that, besides the costs of an EV, the biggest reasons for consumers to not buy an EV are the driving range, the lack of charging places and the time it takes to recharge. These disadvantages can all be effectively solved by using dynamic wireless charging.

This solves the current problems that EVs present. Since the vehicle is charged while in use, the dimensions of the battery could be drastically reduced. Thus, making the EVs and their technology substantially cheaper.

On the other hand, the driving range of these vehicles will be infinite because with this technology, there will not be the need to stop to charge your vehicle. Of course, this also eliminates the necessity of having a broad network of charging stations and charging times.

Many other technological corporations have already done research and built preliminary prototypes. However, these technologies are far from the public eye since they lack efficiency and are not cost effective. The team’s mission is to make the existing technology more efficient and more affordable since this is the main obstacle that DWC faces nowadays.

After researching different challenges the technology faced we were determined to change the materials on the mechanism to make the current technology cheaper and/or better.

To do so during the second part of the year the team devoted itself to design and build a working prototype of an scaled down DWC system. This set up would be first tested with copper which is the mainstream material used on this technology around the world and then others starting with aluminum. Comparing the results the team would how successful where other materials.
MEET THE TEAM

Jon Almagro Aranguren  
- 1st year

Mikey Muangsin Gustavsson  
- 1st year

Koen Verdurmen  
- 2nd year

Mahmoud Mahmoud Hesham  
Mahmoud Mohamed Fahmy Elkady  
- 2nd year

Marwan Marwan Magdy Ahmed Helmy Abdelraouf  
- 2nd year

Other students in project team:
Erik Elifel  
Jesse Smeets  
Karim Mahmoud  
Tudor Piora

Coach:  
Tiago Elias Castelo de Oliveira

"Recruit more diverse people (different majors)" - Tiago

"No! I think we need more Egyptians" - Jon
ABOUT THE PROJECT

Society has learned to efficiently harvest energy from major energy sources such as the sun, wind, or rivers. But what about the small motions – walking, opening a door, or vibrating objects? These everyday small motions can be used to harvest energy and power some small-scale electronics.

Team NANO is a team of interdisciplinary students, founded in 2019 as part of honors Energy Transition track, aimed at creating a novel kinetic-electrical energy conversion technology. Since then, many students outside of honors have joined as well.

The core of the technology is a nanogenerator. The generator consists of two sheets of a combination of polymers, designed specifically according to materials tribo-polarity. Energy generation requires a cyclic process of pushing the plates together and releasing them. Once the plates come into contact triboelectric effect takes place, due to which electrons are transferred from one plate to the other. Once the plates are apart from one another again, we are left with two plates with opposite charges, which makes a potential difference.

Therefore, once the plates are connected with a wire the charges can flow from one plate to the other through the wire, and therefore an electric current is created.

There are many potential applications for this technology, such as public space, wearable electronics, self-powered sensors, and medical applications. However, after validating with several companies the team decided to focus on self-powered sensors since they show the greatest potential. In parallel to that another group of students, NANOMed, are exploring medical applications of the technology in a university in Warsaw as an extension to Team NANO.

Last year the first prototype was made, which serves as a proof of concept. This year the team is working on measuring precisely the maximum and average output power as well as improving the current prototype to generate more electric power. The project is still only at its start and the nanogenerator does not consistently produce enough energy to power any devices. However, the team is very passionate and working hard to make this dream come true.
MEMORIES

The best memory for the team was returning for work and meetings back on campus. There were some team members that had seen each other only online. Therefore, it was a great feeling to have everyone back on campus. The meetings had a totally different dynamic and atmosphere. The productivity of meetings rose since everyone was more involved and active during discussions.

We also organized several team evenings that brought the team together in a different way. It was a great opportunity for everyone to get to know each other by sharing stories and having discussions on all kinds of topics.

LESSONS

Throughout this year we have tried a different learning method rather than a linear one, we adopted a “circular learning” approach. This implies executing research and practical work in parallel to one another. The results are then analyzed, compared to the literature research done, and the areas which still lack knowledge will be further explored giving a start again to the research period, while the practical period will start again to optimize our prototype. This has worked very well for all our members so that each of us has had the opportunity to work on all the tasks equally and the knowledge gain has never paused.

To keep everything well documented, as the heredity of the next Team NANO members, we have created numerous instruction documents with step-by-step procedures, and theory papers with summaries of all our research and experiential findings. In addition to these written documents, we have also created more visual ones such as presentations and videos. Making this a yearly habit will allow knowledge retention. Lastly, we have learned ways to best motivate the team by either organizing on-campus meetings rather than online, work sessions, team evenings, and by getting non-Honors team members acquainted with the Honors academy environment through track meeting dinners participation.

MEET THE TEAM

Federica Marano  
- 2nd year

Nils Lurie  
- 2nd year

Other students in project team:  
Bagavathi Mohan Neela  
Blanca Bordas Diaz  
Dimitri van Dam  
Lina Bartel  
Medora James  
Yavuz Bozkurt  
Zinovia Kourtellari

Coach:  
Mark Cox

"It’s still sticky..."  
- Nils Lurie
ABOUT THE PROJECT

Over the last century, the atmospheric concentrations of key greenhouse gases increased due to human activities. These anthropogenic carbon dioxide emissions are proving a major challenge to the earth's climate. Future carbon dioxide emissions in the 21st century will lead to adverse climate changes on both short and long time scales that would be essentially irreversible. In the same way, the physical climate changes that are due to anthropogenic carbon dioxide already in the atmosphere today are also expected to be largely irreversible.

Team RenewCO2 aims to facilitate the sustainable utilization of captured carbon by means of developing a system that converts carbon dioxide into formic acid by using electrolysis. The team believes in formic acid as a carbon capture utilization solution to the current carbon dioxide problem. The team is actively working to bring this technology much closer to daylight, while maintaining close collaboration with experts.

The mission of Team RenewCO2 can be defined as: “Facilitating the sustainable utilization of carbon dioxide”, which accurately reflects the goal of Team RenewCO2 believing cycling CO2 to formic acid has the potential for solving the concentration of emissions of CO2 in the air.

Furthermore Team RenewCO2 has the core vision: “Facilitating the sustainable utilization of carbon dioxide”, as Team RenewCO2 wants to up cycle a hazardous substance into a potentially useful one.

Specifically, we do this by developing a commercially viable, aqueous triple compartment electrolyzer, which is a chemical reactor that uses an electrical potential to drive the conversion of carbon dioxide.

To this end, the 13 team members from both TU/e and Fontys conduct experiments on the electrolyser cell to for instance investigate the optimal parameters of the electrolyser cell, and costs and benefits of different scaling-up approaches. Furthermore, we also develop models within Matlab that provide insights into the transport phenomena within the system, and conduct market research as well as attend various networking and entrepreneurial events to work on the marketability of the technology.
MEMORIES

The team agreed that the best memory of this year was the recruitment event that we organised earlier this March. The months prior was a period filled with uncertainty as the current members were all graduating this year, which could potentially lead to no members left to continue the work of the team. There is a common misconception in regards to the efforts needed to recruit people, and months of effort leading up to the recruitment event was put in, during which the team acquired team attires, a team mascot, and various stickers for enlarging the visibility of the team. All the effort fortunately led to a very fruitful recruitment event in the end, which was organised in the form of a lunch lecture. The recruitment event itself had a very relaxed environment, and it was especially rewarding to personally network with the enthusiastic participants of the lunch lecture, during which the team got to see their personalities and curiosities. Of these participants, 7 of them eventually decided they resonated enough with the team, successfully enlarging the existing team by 7 new members. Not only was it nice to see the months of effort leading up to a successful recruitment event that essentially ensured the continuation of the team, the enthusiastic engagements of the fellow students provided a nice reminder to the older members the core vision of the project.

LESSONS

The team did not have an entirely set-back free year, and we collectively agreed it is crucial to plan ahead of time. For instance, we had to deal with a long period of uncertainty as to whether the team would still continue in the following years due to the lack of team members. This thereby created a large sense of urgency and a lot hinged on the recruitment to go well. It fortunately did turn out to be successful, but it would be nice to plan ahead of time in the future so there was less pressure. Furthermore, the morale of the team was not at its peak at the beginning of the year owing to passive members. As much as active members can be very impactful, so can passive members create a demotivational environment within the team. This sort of issue should therefore be addressed as soon as possible by having a talk with them. Lastly, never underestimate what could go wrong, especially for technical stuff. Always have a plan B and take it one step at a time. A detailed plan of approach would in this case always help and professors or experts around are always more than willing to help.

MEET THE TEAM

Jia Man Chen  
- 2nd year

Cristian Arturo Garcia Lopez  
- 2nd year

Francesca Mori  
- 2nd year

Julia Krzemenska  
- 2nd year

Coach:  
Han van Kasteren

"The pH of formic acid might be low, but growth and fun at Team RenewCO2 are definitely not."
ABOUT THE PROJECT

We, as Team SimEnergy, are trying to disaggregate energy consumption data collected from smart metres into individual electronic appliances. This is done by building several AI models for predicting the power usage of each appliance.

The energy crisis is occurring all across Europe at the moment. This year particularly, factors such as supply contraction, extreme weather conditions, and the Russo-Ukrainian war have directly pierced through our energy bills. Considering the fact that the residential sector covers the second largest portion of global energy consumption, it is more crucial than ever for each household to modify its usage behaviour and for energy stakeholders to improve operational management.

That is why we believe that energy transition begins when consumers of energy receive accurate data about their consumption patterns. Through research, it has been confirmed that the display of real-time energy data at the device level consequently has effects on the demand side, reducing usage up to 20% through the change in daily consuming behaviour or detection of any malfunctioning electronic appliances. Such an analysis and simulation of one’s energy profiles could imply information as precise as how much money one could save by taking a shorter shower every day, or what time of the day it is most efficient to use your dishwasher. Not only in-house residents but also external stakeholders such as grid operators and producers of electronic devices are able to improve operational strategies or manufacture more efficient appliances through such detailed data.

Luckily for us in the Netherlands, most residential houses are installed with a device called a smart metre, which keeps track of the usage more accurately than conventional measuring devices. Such widespread accessibility of smart metres, as well as the potential of an energy disaggregation scheme, gave us enough motivation as to why SimEnergy can be applied to a wide market and be in good use, even for people who don’t know much about technology or don’t know how to use it.

Disaggregating total power might not have been feasible in the past. But now with smart meters, time-series power data per second is collected over several weeks and becomes big data, allowing the usage of AI. Furthermore, with the advancements of more AI techniques, such as neural learning, it is now more possible than ever to provide more accurate analysis and prediction. This is why we started investigating the project SimEnergy.
MEMORIES

Looking back at the year, there are many memorable moments that we can recollect. Getting into Innovation Space was definitely one of the highlights, since this gave us a sense of accomplishment that we managed to solidify a position there; the lively and inventive atmosphere is something we find suitable for a start-up team like ourselves, and motivates us to make good use of the facilities and resources there. Just like Innovation Space, having access to the cozy meeting room at the Disruptor building on campus for our work sessions is something we feel grateful for. We can still remember the first time we set foot there, amazed by the welcoming space.

Furthermore, we recently had a wonderful opportunity to participate at the Energy Now Congress Eindhoven 2022, whereby many like-minded people congregated to share their ideas on the future of energy in our cities. Whether young or old, employed or not, a wide range of enthusiastic people came together to look at creating the future, and we as SimEnergy had the honor to host a workshop to present ourselves and hear what people think about our vision and business model. It was a truly enjoyable experience for all.

LESSONS

One important lesson we earned from this year was the significance of preliminary research. As a starting team, we were very excited to start with the project and rush into technical work. However, it came to our attention that much research is needed because having the basic knowledge is essential and allows us to specify exactly what we want to achieve with the sorted data, who we want to serve this product to, and which disaggregation methods/models may be most useful.

We also noticed that it is always best to communicate as much as possible, and this is particularly important for our team because we have a member from the Artificial Intelligence track (Marco) therefore we may not be on the same page if one side or the other does not update on their progress and achievements.

Lastly, we learned that things take time. Rome wasn’t built in a day and that applies also to building a student team with prospects of being a startup in the future. It takes daily effort to lead things in the right direction; for instance, organizational matters can be in the way, but must be done for the team’s sake. In spite of all these challenges, we are more than positive about the outlook of SimEnergy and we will make it work meticulously, delicately and successfully.

MEET THE TEAM

Cheuk Lam Mo (AI)  
- 1st year

Arif Ashworth (ET)  
- 1st year

David Melamed (ET)  
- 1st year

Jiyeon Han (ET)  
- 1st year

Marco Mo (ET)  
- 1st year

Other student in project team:  
Liam Geschwindt

Coaches:  
Tiago Elias Castelo de Oliveira  
Stiven Schwanz Dias

"Showing climate leadership is doing our own homework"  
- Miguel Arias Canete  
(Former EU Commissioner for Climate Action and Energy)
ABOUT THE PROJECT

In the Netherlands, almost 40 percent of total energy production goes into the production of heat, which as of now is mostly supplied in the form of natural gas. In light of climate change, the transition away from these fossil fuels was already a must, but now with the skyrocketing gas prices, should be accelerated. A big problem is that the alternatives to gas are generally not as cheap or as convenient.

An important alternative being worked on is a heat network supplied by industrial waste heat or solar collectors, but these require pipes to be laid and are generally not viable outside population-dense areas. A promising new technology, heat batteries, that are mobile units of energy that do not lose energy over time are currently in development, provide a more convenient method of transporting energy.

Being a new technology however, there are still many questions surrounding the requirements of such a heat battery, and what all involved parties need before it can be implemented. So what we want to do is model the usage of a heat battery, for example, as a replacement of a heat network, to get parameters needed to guide the technology towards a state where it can easily be implemented, and by doing so help with the acceleration of the energy transition.
MEMORIES

Within the team, we have always had a comfortable atmosphere of trust and friendship. Each meeting was casual, and occasional work sessions were combined with a nice working environment. Our several brainstorm sessions, combined with a detailed snack schedule were filled with enthusiasm for the future of the team. Laughter and excitement were also often coupled such sessions, and helped stimulate additional motivation. Fun was not all the team was involved with, hard work was definitely necessary for Therosel. Tears were shed, voices were raised, but because of each member's modus operandi to the project, we managed to face these hardships together. Several team bonding events were also organised: we went bowling; had drinks at hubble; and would sometimes combine meetings with dinner. This close friendship bond meant that all of the achievements made as a team—coming into the top 40 for the TU/e contest, making our first steps towards a long-term ambition - were also shared as a team. So, what would we say was our best memory? Our best memory was working as team Therosel towards a goal, together. ;)

LESSONS

From this honours year, we have learned many new soft skills which we would normally not have learned during our studies. For example, we learned how to approach an interview in a more professional manner: we have now even come in contact with several companies! All of this communication with external parties has also given us the space to define the team, define the project in a much more well-rounded manner than we could have ever expected when we started out in September of last year. Another soft skill that was developed throughout the year was the approach we had towards working in a team. Having feedback sessions every couple of months, may seem arbitrary, but this was a defining moment for our team when we learned how to clearly explain any frustrations that were prevalent. These feedback sessions were also pivotal to our communication skills within the team, since we learned to state more clearly what our aims and ambitions were for Therosel. This was coupled with an improvement of time-management skills; we now have a shared gmail calendar; we also now use an app to organise all of the tasks that had been set to members.

MEET THE TEAM

Jasmine Frijters
- 1st year

Lars ten Hacken
- 1st year

Raoul Sanches
- 1st year

Vicky Hübken
- 1st year

Coach:
Mark Cox

"Energy and persistence conquer all things."
ABOUT THE TRACK

The innovation theme of our track is Artificial Intelligence for High Tech Systems. High tech systems have a significant positive impact on changing and shaping our modern lives and societies. Recent advancements in Artificial Intelligence (AI) take this change to the next level of smart high tech systems.

This year we focused on the Perception, Prediction and Planning (P-Cubed) challenges of smart high tech systems with relevant use-cases in autonomous racing cars and human-robot interaction. Our students found a lot of chances to learn and apply advanced AI & Robotics knowledge to real engineering challenges. In addition to developing hard skills, we also offered our students many opportunities to develop and improve important soft skills such as presentation, communication and teamwork.

Our first-year program was organized in modules that cover different AI & Robotics topics on coordinate transformations, deep learning, deep perception, robot programming with ROS, robot localization and mapping, and autonomous navigation. Each module was completed with mini challenges to enhance learning by applying the new knowledge on realistic settings. Students presented their creative work at the end of each module and received constructive feedback from both coaches and peers. In the second year, students continue with their own innovative challenges on smart high tech systems.
TRACK COORDINATORS

Elena Torta
Track coordinator
I am an assistant professor at the Mechanical Engineering Department. I have a PhD in autonomous robots and human-robot interaction and substantial industrial experience.

I have always been fascinated by autonomous robots and artificial intelligence. I want to find the best way(s) autonomous robots can integrate into human daily and work life to make it better. This is applicable to robots in the household but also to medical robotics. My passion for autonomous robots that help people and artificial intelligence is what I try to transmit to the honors academy students.

Ömür Arslan
Track coordinator
I am an assistant professor in the Department of Mechanical Engineering at TU Eindhoven. My research focuses on the algorithmic foundations of robotics and aims at integrating perception, control and learning for mobile robots that safely move around and interact with people.

This year was my second experience with the Honors Academy as a track coordinator and coach. I don’t only work on robotics, but I love and am very enthusiastic about robotics. Robotics is a multidisciplinary research field and often requires teamwork. I find the Honors Academy as a great education environment to find and train new enthusiastic and creative roboticists (i.e., future collaborators and teammates). It was a great pleasure for me to work with our highly motivated and talented Honors Academy students.
The Agriculture Automation Team (or The AA Team) consists of a group of second year honors students with various backgrounds. We have Zhengyang and Wytze from Automotive technologies, Daan and Jan from Electrical engineering, Tom from Mechanical engineering, Otto from Data sciences and David from Computer science. Everyone has followed the High Tech Systems track last year except David who joined this year.

The team approached the farming company Genson Group in Sint-Oedenrode with the question if they were interested in working together on a project about agriculture automation. They were enthusiastic about the idea and had multiple project proposals. These proposals were evaluated by the team and the strawberry sorting was picked.

When strawberries are picked in the field they are put directly into boxes, however the boxes need to contain the correct weight in strawberries to be sold in the shops. These boxes are brought to the correct weight by weighing the boxes and then adding or removing strawberries. This is currently all done by hand but the farmer would like to automate this process.

The two main challenges were to develop a gripper that could delicately pick up strawberries without damaging it and to develop software that could identify and guess the weight of individual strawberries within boxes. A motion system was needed to be able to validate these systems.

For the gripper system we have looked at multiple options and in the end we used a vacuum system with a 3d printed flexible nozzle.

The motion system was inspired by 3d-printers and CNC machines. It was constructed out of aluminium profiles and 3d-printed PLA parts. This was strong (enough) and allowed for fast iteration of the design and a low development cost. It used 3d-printer electronics and ran on marlin software, which is easy to control using Python.

The software used a depth camera to find the strawberries as it proved to be very difficult to identify individual red strawberries on a background of other red strawberries using a regular camera. This identification proved to be the biggest challenge but after a lot of different approaches one was found that worked. We are currently finishing the integration, there is still a lot of room for improvement and are making sure the whole project is well documented so that another group could continue with the project.
MEMORIES

The best memory is seeing the progress over the year and the realization that we managed to build a whole robot with working software within a year. It was really nice to go from milestone to milestone, from the first time we got the motion system moving to picking up its first strawberry to finally being able to identify multiple strawberries in a box. These milestones kept the team going, especially when we got stuck on something.

Working with the farmer was really fun and valuable as well. It taught us that getting things done is better than perfect and taking forever. It also gave us insight into all the things that you have to take into account. That for example all the materials have to comply with food regulations, that it should be easy to clean, that you have to take into account the conveyor belt system that is already in place, how you will manage all the spare strawberries and many more.

Another fun aspect of the project was that during our bachelors we have done projects, but these have all been done before. This project was new and innovative. We had to be creative and could not google our way out of it, which turned out to be quite a challenge from time to time.

LESSONS

What we have learned was mostly about how to manage a project that has so many aspects. We built a prototype from the ground up, which required us to design a lot of software and hardware. The main challenge was to let the systems that we designed work well with other open source systems that we used. It was often quite fast to get a system to work, but it would often take twice that time to have it work with the rest of the system without bugs.

Another lesson we learned was how to find the best combination existing methods to solve a new problem. We had to find a way to identify individual strawberry in a box full of them. There are a lot of different object identification methods out there, but it is tricky to find the combination that yields the best results as you can’t just throw everything against the wall and see what sticks as the performance of most methods highly depend on its parameters, so it takes a long time to try all methods the corresponding parameters. This is something we underestimated but got the hang of in the end.

MEET THE TEAM

Daan Meulendijks
- 2nd year

David van Scheppingen
- 2nd year

Jan Kollmorgen
- 2nd year

Otto Kaandorp
- 2nd year

Tom Janssen
- 2nd year

Wytze de Vries
- 2nd year

Zhengyang Lu
- 2nd year

Coach:
Ömür Arslan

"If a hammer can't solve your problem, use a bigger hammer"
ABOUT THE PROJECT

Brain-computer Interfaces (BCIs) have recently attracted the attention of researchers for mediated robot control. Such technologies extend the boundaries of human robot interactions and would have numerous potential applications. This project presents a study on electroencephalogram (EEG) based control of a robotic system. The main objective is to investigate the effect of different experimental plans, that utilize a variety of neural capabilities, on the quality of EEG signals for directional control. In an attempt to illustrate this, this research is an endeavor to find the optimal experimental setup that allows AI models to capture and classify the brain signals in order to control a mechatronic system. For this Intention, a Convolutional Neural Network (CNN) was developed to generate recognition patterns from the EEG signals, which are obtained from the different experimental setups precisely designed for directional control. The conducted study has four different experimental plans. As such there are differences in data gathering between the plans. All plans used the same OpenBCI cap and electronic boards to gather the EEG data.

Each data gathering session was manually started using the OpenBCI GUI. The boards used will apply their own filtering of the data using the bias channel and the reference channel to eliminate environmental noise due to electrical appliances and electromagnetic interference. After this it will store the data in a .csv file together with the timestamp of the data point, two analog channels, the accelerations of the helmet in the three cardinal directions and a few other things called other. The GUI will apply and display some filtering to the data stream but these will not be stored. After this post processing step of matching timestamps, the data is analyzed for feature extraction and imported to the Machine learning model which is optimized accordingly. After the training models are completed, the models are tested on controlling a simulation of the Turtlebot in gazebo within ROS. The Team is planning of publishing a paper about BCI mediated Robot control by the end of the academic year to present our findings.
MEMORIES

Throughout this honors year we had to meet quite frequently to test our experimental plans and obtain EEG recordings. This was essential as we are creating our own datasets to train the machine learning models. That being said, we spent long periods of time recording each others brain signals. Sometimes the recording sessions would take about 4-5 hrs at a time, which gave the team hours of bonding time. Since the BCI cap we are using is noninvasive (meaning that it monitors the brain from the outside, without the need for surgical implantation) a gel needs to be added between the electrodes and the scalp. This means that a well deserved shower was needed after every recording session.

LESSONS

Throughout the honors year the team has developed a lot in both the technical, as well as, the professional aspects. The team got introduced to the world of neuroscience and brain anatomy, which was something completely out of the scope of our studies. However, with the help of our coach we were able to conduct Q&A sessions with neuroscientists and find relevant research papers to the project. The team investigated quite extensively on the use of the openBCI headset and its documentation for optimal data accusation. Furthermore, the team learned how to construct experiments in a structured and systematic way to ensure that the data acquired is reliable and would not result in biases. Additionally, the team improved quite significantly on documentation and reporting to showcase the progress and the results of the study. Last but not least, the team learned how to present the findings in the form of a scientific paper to be published. In conclusion, we believe that the team learned a lot throughout the project, however the field of BCIs is still an open field with plenty of open problems.

MEET THE TEAM

Eoin Higgins
- 2nd year

Ismail Elmasry
- 2nd year

Nicolas Michael
- 2nd year

Simon Poot
- 2nd year

Coach:
Elena Torta

"Expanding the Realm of Possibility"
ABOUT THE PROJECT

The main goal of our Honors track (High Tech Systems) is to learn and apply advanced scientific knowledge such as machine learning, motion planning and human-robot interaction to real engineering projects and challenges. During the first half of this year, our team learned about various topics through small 'sprints'. The first three sprints focused on human-robot interaction (and specifically the functionalities of the humanoid Pepper robot), evaluation of model performance in machine learning and the concepts of convolutional neural networks. The other three sprints introduced us to autonomous localization, mapping and navigation in robotics, and also to ROS, which is an open-source framework for robot software development. For our end-of-year project, we picked the following challenge: implementing an autonomous tour robot in the Atlas building. This challenge combines the concepts of localization, mapping, navigation and obstacle avoidance and therefore requires a good understanding of the ROS framework. Furthermore, this project could also benefit from machine learning models in for example object recognition and speech recognition.

For our end-of-year project, we started with literature research on localization and navigation algorithms. Next, we tested these algorithms in a simulated world of Atlas, based on detailed maps that we received from the 8th floor. Currently, we are working on implementing these algorithms on a physical robot in the real setting. We use a turtlebot, which is a ROS standard platform robot that includes a LIDAR sensor to assist in localization/navigation. Other challenges that we are working on are dynamic obstacle avoidance and sending goals linked to the topography of Atlas through a suitable application. We still have many issues to tackle, but we hope that our efforts will result in an autonomous tour robot of Atlas (and potentially other buildings) that will be able to guide (and of course impress) visitors on the TUE open days!
MEMORIES

One day, we spent a long time trying to establish a connection between the Turtlebot and a laptop, without success. Several times we thought we had fixed all errors and then a new error showed up, even though this is really not supposed to be difficult. We mentally prepared for a long afternoon, because establishing a connection was just the first of many steps. Then all of a sudden, things were looking up; we sshed into the Turtlebot, ran the start up sequence and then the navigation node and suddenly the Turtlebot started autonomously navigating (for the first time in our project). Incredible moment!

LESSONS

During the first semester, we gained a lot of knowledge on human-robot interaction, machine learning, robot navigation, localization and mapping. Most of these topics include literature research, programming and mathematics. We learned the basics of machine learning and how to check if the model is under- or overfitting. We also learned about different localization and navigation algorithms, such as ACML (adaptive monte carlo localization) and SLAM (simultaneous localization and mapping). ROS is a difficult framework to understand if you are a beginner like us and it is sometimes challenging to find good documentation. Therefore, we often spent quite some time on researching the syntax of ROS packages. Throughout the year, we worked in a team and helped each other with understanding the different concepts. At the end of each sprint, we prepared a presentation about what we had learned during the sprint and our result of the mini-challenges. We also spent quite some time in the Impulse building, on figuring out how to establish a connection between a laptop and the turtlebot and how to control the turtlebot hardware. So, we learned about many different concepts; machine learning, robot navigation, programming and of course soft skills like presenting and team cooperation.

MEET THE TEAM

Arlette Beekman  
- 1st year

Egor Larionov  
- 1st year

Jonathan Sum  
- 1st year

Lora Simic  
- 1st year

Robin van Mook  
- 1st year

Scott van den Berg  
- 1st year

Coach:  
Elena Torta

"Did you run source ~/.bashrc?"
Intro Weekend
We started off the year with the Intro Weekend, where all new Honors students got to know each other and the association! With the weekend being filled with activities and workshops we had an amazing first event!

Monthly drinks
Even though the regulations with Covid were very irregular this year, we were still able to organize a few Monthly Drinks and Dinners this year! It was great to relax in between our busy study schedules.

Batavierenrace
This year we participated in the Batavierenrace for the first time! Together with our sister associations H.V. Ockham and the NSHV from the DHC we formed a team and ran from Nijmegen to Enschede!

City Trip to Brugge
The first multiple day event organized by the Activity Committee was the City Trip to Brugge! With visiting museums, playing some traditional games and relaxing on the beach it was a successful weekend!

Chess Tournament
Since chess is a big part of the daily life in the Honors Room, we organized a chess tournament to determine who is the official Conflu-chessmaster.

Gala
We were lucky enough to have two galas this year! We kicked off the year with our postponed Lustrum Gala and ended the year with our Sunset on the Beach Gala! Both were nights to remember!

Lunch Lectures
Throughout the year we’ve had the pleasure to organize lunch lectures to enrich the minds of our members even more!

Presentation Roulette
To work on our on the spot presentation skills a presentation roulette was organized where everyone had to present someone else’s powerpoint!

Battle of the Rooms
Through a competition with battles spread over three weeks we got to bond with our neighbors Cosmos and AEGEE!
This year we were so lucky to be able to welcome a lot of new honors students to our community at an in person event again, during the intro weekend! After a year that was mainly online, it has also been great to be able to welcome people to the Honors Room again, where there was always the opportunity for great discussions, a game of chess, and to create new friendships - and sometimes even time for work.

H.S.A. Confluente wants to create the opportunity for Honors students to get to know each other better and to form one big community, and one way to do this is by creating moments where this can happen. We want to thank our committees, without whom it wouldn't have been possible to organize all the events where we could get to know each other better! This year was filled with interesting lunch lectures, trainings and workshops, but also with fun activities such as paintball, laser tag and the city trip to Brugge! We were also able to bond with other associations in- and outside of Eindhoven through the Battle of the Rooms and the Batavierenrace. We of course also cannot forget about the two galas that framed our year. This year will be finished off the Study Trip to Budapest, which we are very excited for!

It was a great pleasure to serve this community as the seventh board of H.S.A. Confluente, and we hope you have all enjoyed this year as much as we have. We'll see you again next year!

Viktor van Bilsen  
Chairman

Sarah de Ruiter  
Secretary & Commissioner of Internal Affairs

Hriday Govind  
Treasurer

Marissa van Koesveld  
Commissioner of External Affairs
ABOUT THE TRACK

We live in a hyper-connected world. Social media networks such as Facebook and Instagram link different people from all over the globe. Moreover, the internet no longer only consists of just computers but connects a great variety of smart devices, from thermostats to self-driving cars.

Typically, such networks are large, consisting of millions or even billions of entities, and have a truly complex structure. These complex networks enable new information to spread very rapidly. Sometimes news even reaches a fraction of the world population in a matter of hours. This inter-connected world thus gives rise to new and exciting possibilities for society. However, it also introduces new challenges to society. For example, networks are used by some people and organizations to influence others negatively, by spreading false information very effectively.

In this Honors Academy track, a multidisciplinary team of students is challenged to identify real-world network problems that have a huge impact on society. Through stimulating activities, the students learn to work in a team, do research in network science, and communicate their findings to experts and a general audience. The final deliverable is a research program that the team will execute in their second year, which will have a true impact on the future of our networked society.
 TRACK COORDINATORS

Erik Steur
Track coordinator
In this second year of existence of the track Networked Society, we had two student teams. A team of first-year Honors students had the task to define a research project on networks and their role in society. A team of second-year Honors students did execute a project on the characterization of echo chambers in social media, which was defined in their first Honors year. Both teams did an excellent job; the first-year students identified a very interesting research topic related to cryptocurrencies, and the second-year students impressed me with their research results. What I am most proud of is that our students managed to create a very pleasant environment that stimulated learning and personal growth.

Remco van der Hofstad
Track coordinator
The students this year were pretty amazing. The second-year honors students set out on a really ambitious project to do their own research. For this, they invented a mathematical model and collected data to test it. This is highly mature. It was a pleasure to be part of this journey, to help with a bit of advice here and there, and to see them flourish. The first-year honors students found a topic of interest to them, and will use this next year together with the new students. Helping all the students with the PDPs, each with their own ambitions, expectations and hopes, is a highly rewarding process of which, in the end, one learns a lot about oneself as well. So, a big thanks to all involved, and I am looking forward to welcoming a new crowd next year!

This was our second year as a track and hence the first year we had second-year students. They had defined a research plan in the previous year and had to execute it. Seeing how the students took charge of their own project and the results they produced was a great experience. In addition, we also had new first-year students that we could help finding their own research questions within the field of network science. I am very curious to see what research will be done next year.

One personal highlight of this year was the Escape room outing we did with the entire track. It was nice to experience the students in a more informal, yet equally challenging setting. We had lots of fun trying to solve the puzzles and even managed to escape. Overall, I am proud of the motivation that our students show to learn new things and their creativity in finding solutions to problems.

Pim van der Hoorn
Track coordinator
We’ve had a pleasant Honors year and had some very nice project output in the end. I was happy that halfway the year we could meet up physically again and work together on projects, workshops and the discussions. We had difficult and ambitious projects this year, which sometimes led to a bit of a rollercoaster of activities, deadlines and managing stakeholders for students. I’m happy that everyone managed to keep up and complete their projects successfully. I had a ton of fun, and I hope that all the students had a great time too. Thanks, everyone!
ABOUT THE PROJECT

The first year of Networked Society track is organized a bit differently than the other tracks, thus during the first year we do not have a specific project that we work on throughout the year, but instead we do a lot of research on all kinds of network topics in which by the end of the year we try to find a research question that will be explored in-depth during the second year of the track. The topics that we researched on during this year are fiber optic networks, vehicle to vehicle (V2V) and vehicle to everything (V2X) networks, smart city with blockchain implementation networks, brain networks, and blockchain networks. It was purposely intended that we research on completely different network topics because we wanted to learn how to do research but also how to grow academically outside of our fields of study.

Each topic was unique, some of them were very interesting and intriguing, some of them were very complex, but in the end we decided to continue with the blockchain networks, specifically we are studying the robustness of those networks towards attacks and failures.

The reason we chose to research blockchain networks is that, first and foremost, this topic best suited my teammate's and my background, and second, while studying those networks, we discovered that there is a lot of misunderstanding about them, and as we dug deeper into them, we began to ask questions like, are they as secure and private as they proclaim to be? how decentralized are those so-called "decentralized networks"?, etc...And so on, one question led to another, while we continued to explore the blockchain network. After some data collection, post-processing, and further analysis, we discovered some intriguing answers to our questions.

Our final findings will be published as an online article on the networkpages.nl website by the end of the first honors year.
MEMORIES

Looking back on the year, I can say that I have a lot of amazing and memorable experiences. So far, I've really enjoyed this track, particularly the weekly coffee sessions; in fact, during those weekly coffee sessions, we've had some great and sometimes hilarious discussions, but also during the times of lockdown the coffee session was a great way to reconnect to my peers and also it makes the day less boring, but more importantly, I've made some great memories from them. Of course, the honors academy is about more than just extra challenges and societal issues; it also cares about the students' well-being. We had a few unforgivably late dinners together with our coaches in our track, during which we discussed a variety of interesting topics, moreover, we also did an escape room with our coaches after a few months of work, which was a fantastic experience that I will never forget.

So far this year has been about the little but awesome memories that when I look back I realized that the whole year has been an amazing experience and also has given me a lot of great memories!

LESSONS

The things I've learned in my first year have amazed me, and I can happily say that the network science is far more diverse and interesting than it appears on the surface. It's incredible that you can think of anything as a network, and even more incredible is the conclusion you can reach from it. One of the things that has shocked me is that, while you are reading those sentences, I can say that assuming you are an ordinary or random person in the world, you are connected to me via a chain of five friends between us, and that holds almost for every person in the world. So in a weird way everybody is somehow connected to everyone else in the world.

Apart from cool fact like the previous one, during this year I have learned how to conduct research, how to properly read research papers, how to distinguish a good paper from a bad one (there are a lot of them!). Furthermore by studying topics that are unrelated to my field of study, I have extended my knowledge on other fields such as the brain networks, blockchain networks, ...etc.

Overall, the Networked Society is a track that never fails to amaze you with new things that you've never heard before!

MEET THE TEAM

Blendi Ahmeti
- 1st year

Filip Gunnarsson
- 1st year

Coaches:
Erik Steur
Pim van der Hoorn

"A man in life needs 1 cup of science, 1 bottle of care, and 1 ocean of patience"
- Ismail Kadare
ABOUT THE PROJECT

While our team was mainly exploring the field of network science in our first year, during this year we conducted our own research in one particular application we handpicked at the end of the first year. This topic was investigating social media platforms specifically for the presence of echo chambers. Echo chambers are tightly-knit communities of individuals that all share the same – often strong and polarizing – opinions. An example would be the so-called ‘antivax’ groups on Facebook, or the infamous subreddit r/The_Donald centered around the 2016 American elections. Especially during the COVID-19 pandemic echo chambers became a widely known phenomenon and issue due to everyone living more and more online. These echo chambers can feed extremism and incite violence, as could be seen for example during the Pizzagate debacle, or the attack on the US Capitol.

Our contribution
As echo chambers have just recently come into public view, there is not yet a vast body of research surrounding the topic. Especially in the direction of identifying them in the wild, research is lacking. One issue is the fact that qualitatively echo chambers are mostly described on the community level, which makes it hard to monitor platforms for echo chambers.

What scientist for example do is look at the interactions of two polarized communities within their own group and across the two. If the interactions within a group are in some sense more ‘positive’ than interactions with other groups they label the group an echo chamber. However, it remains a challenge how to group individuals in a meaningful way, how to quantify interactions between them and how to decide how more positive interactions within have to be than across.

We have taken a different approach. We collected data from Reddit and analyzed several subgroups that can be labelled echo chambers intuitively and by literature. Instead of focusing on the difficult-to-track group level, we looked at post-comment chains to see whether these differ in characteristics from those in non-echo chamber groups. We use the group level only for validation. Contrary to literature, we do not start with an a priori definition of what an echo chamber is and then check whether our subreddits conform to it, as one is not yet agreed upon by academia. We first look at the data of known echo and non-echo chambers to figure out what criteria can safely be used to characterize something as an echo chamber. This is an important step in being able to monitor social media for echo chambers, the first step to diminishing polarization.
MEMORIES

Since this is our second year in the Honors Academy, our first year took place during the pandemic, which means that it was entirely online. This year however we were lucky enough to be able to have in-person meetings with our own team, as well as our coaches. Seeing as we had spent a whole year online, our coaches decided that we should take advantage of our newfound freedom and organize some fun activities for our track.

One day, one of the coaches suggested that we go play an escape room together. We all eagerly said yes, and they started organizing the outing. It was the birthday of one of the other coaches the day before we were set out to go, so it felt a bit like a belated birthday celebration as well. Turns out we were too many people for one escape room, but that proved not to be a problem. We formed two teams and did two escape rooms in parallel, to see who would finish faster. The good conversation that we had and friendly competition between the teams combined with the fact that we could finally see each other in-person is what made this, in our opinion, the best memory that we made this year.

LESSONS

During our second honors year, we have started to work on novel research around the properties of online echo chambers. The literature on this topic and its relation to the network structure is meager and we have attempted to start bridging this gap in knowledge. To do this, we had to develop and strengthen several skills. As such, the most important lessons we have learned are the importance to stay inquisitive, employ critical thinking and collaborate with each other and experts. These lessons have proved to be essential in discovering new knowledge. As is always the case with research, there are many interesting directions to pursue and one of our challenges was to reign in this overall curiosity and focus on a particular path of research, assessing the potential of each direction. In a nutshell, we have learned to do scientific research as a team of curious students.

"How about 'On the listenout for echo chambers' as a title?"
- Maurik

"No."
- Everyone
ABOUT THE TRACK

In the intensive care, it is very dangerous for patients to get sepsis. It is an inflammatory reaction of the body, and it can quickly become life threatening if it goes undetected. For this reason, a biosensor could save lives through early detection of sepsis.

SensUs is the one and only international student competition in the field of Sensors for Health. Each year, we challenge students from all over the world to develop sensors for a large problem in healthcare. Every year SensUs has a new theme. This year we challenge Teams, worldwide, to develop sensors for rapid detection of sepsis!

In the SensUs Organization, we develop new ideas and solve complex problems by working together. You can join if you are analytical and structured, or creative and out of the box, or somewhere in between. The students develop expertise in communication and judgement, in sensors for health, and in management skills. They learn to communicate and negotiate with companies, and with students from all over the world.

In SensUs, you work on the future of healthcare and learn what it takes to make international impact. We are team SensUs and we compete for the quality of life!
Menno Prins
Track coordinator

I am a professor at TU/e in the departments of Biomedical Engineering and Applied Physics. The SensUs Competition started seven years ago, initiated by a group of students in the Honors Academy with me as their coach. SensUs has grown and has become a vibrant community. Every year I am excited and proud to work with the students and see how their efforts generate new ideas, new activities, and a smashing competition with worldwide impact!

The students define the theme of the SensUs competition, define the rules, coach the Teams, involve companies, work with healthcare professionals, and organize the entire contest week when all participating teams come together in Eindhoven. Teams participate from North-America, Asia, Africa, and many countries in Europe. The students develop expertise in communication and judgement, in sensors for health, and in management skills. They learn to communicate and negotiate with professionals and with students from all over the world. I am honored to coach the students. My mission is to train and inspire young scientists and engineers and to lay the foundations for solutions that will in the future improve the quality of life of patients. SensUs brings talented young people together from different scientific disciplines and from different countries. Every year I am proud of how the students develop new ideas and handle complex problems. It is amazing how the students develop themselves and realize every year a completely fresh competition that is full of innovation!
ABOUT THE PROJECT

Keeping an overview of the Organization and the progress of the Teams. With an interdisciplinary student team and participating Teams from all over the world, this is a great challenge within the Chairs&Co subgroup.

The Chairs&Co subgroup consists of two Chairs, a Secretary, and a Treasurer. The two Chairs are leading the SensUs Organization and are in charge of keeping an overview of the different subgroups. The Secretary is in close contact with the participating Teams and checks their progress via Feedback Moments. The Treasurer keeps an overview of the budget, making sure that the budget is well-spent. As Chairs&Co, we make sure that the members of our Organization act professionally and ensure the quality. Moreover, activities for the whole Organization are organized by the Chairs&Co, including Personal Evaluation Sessions, Alumni evenings, and Fun Activities.

This year, the Organization faced a great challenge since the number of members shrunk in comparison to last year. We had to learn more about maintaining great communication between the departments, prioritizing tasks, and being a strong team. As an Organization, we kept innovating in order to take on new challenges.
MEMORIES

Our best memories are the plenary evenings we had. Together with the whole Organization, we had plenary evenings where we discussed organizational-broad topics and challenges. Afterwards, we ate together and had some fun. Throughout the year, we have seen that the team got closer to each other, and we saw the positive effect on the quality and progress within the team. A fun memory is the Fun Activity we had, where we went on an easter egg hunt in innovation Space.

Looking back, it is safe to say that you can often do more than you think at the start. With at the beginning a smaller Organization, but still a lot of enthusiasm within the group, we achieved a lot. We challenged ourselves and set out new initiatives. This requires a well functioning Organization, a good and fun setting, and good planning skills.

Furthermore, what will stay with us is how cool it is to work in a multidisciplinary team and have the same end goal!

LESSONS

Due to the COVID-19 situation, no one in the organization has ever experienced a real life event, even though we will be organizing one on campus again this year. With a slightly smaller organization and only two members who are second year members, it is quite a challenge to keep up with all the work.

Next to this, we have also organized the very first SensUs Kick-off Event. We organized it with one person from every department, and we made everything work pretty last minute. Making a quick switch from an event at the Zwarte Doos to a video filmed in the Blauwe Zaal, there were plenty of challenges that were overcome to achieve the end result. We are all very happy, so check it out on our YouTube channel!

MEET THE TEAM

Vera Teurlinx
- 2nd year

Other students in project team:
Anne-Lieke Craenen
Hans Douben
Petra Aantjes

Coach:
Menno Prins

"The challenge to keep an overview of a multidisciplinary international Organization."
Hey! We are Anke, Roy, Rick and Sarah, and we are the events department of the SensUs Organization 2022! We are all Bachelor students Biomedical Engineering, whilst Roy is a Bachelor student Computer Science and Engineering. We are responsible for the logistics in and around the event.

Our job is to make sure all students will have a pleasant experience during the SensUs Innovation Days: the period in which the SensUs Event will take place. Hence, we arrange a camping, for all students to sleep in during their stay in Eindhoven, and take care of most of the facilities and activities during the event with their corresponding logistics.

Being part of an organization, we also try to establish a fun activity every now and then for both our department and the rest of the organization, and make sure to frequently inform everyone on what we did and on what we are currently working on. We can then use the feedback we obtain during these plenary evenings to make better, well-informed decisions.
MEMORIES

Although some of the challenges might seem difficult and planning organizational work next to school work might be difficult at some points, it is great to be able to socialize and do fun activities with others within the organization to keep each other motivated, since of course after all we are still a team of students!

LESSONS

Of course, arranging an event does come with its difficulties. Making certain choices together with trying to make sure the organization agrees with our choices, working within a limited budget, and arranging a collaboration with multiple companies whilst making sure we coordinate everything well are examples of such challenges.

This does give us a big learning opportunity: as students without prior experience, organizing an event for around 150 people is not an easy job, but provides a great means of developing oneself. Hence, within the Events department, we are able to improve ourselves regarding communication, planning, negotiation, logistics, and other skills that come with organizing an event! Teaching oneself to find alternative solutions and to act quickly if things do not work out is an immensely valuable skill to have in the future.
ABOUT THE PROJECT

We are Sam, Sandrina, Noortje and Kim working in the External Relations department of SensUs. We can proudly say that we are the most diverse department of SensUs this year! Sandrina is originally from Moldova, but moved abroad to study Data Science. Sam is a Psychology and Technology student, Noortje is a Bachelor student Biomedical Engineering and Kim is a Master student Biomedical Engineering. However, we all share the same interest regarding innovation in healthcare.

We are representatives of SensUs to the outside world and more specifically to the professionals and companies. In External Relations, our initial task is to maintain the partnerships with SensUs’ current partners, inform them of the organization’s progress and make sure the partners are well prepared for the competition. Additionally, we invest in acquiring new partners, by attending conferences and networking events, such as Innovation for Health, and by pitching SensUs. For this reason, we got the chance to broaden our network.

Moreover, to organize the Sensus Event, we have lots of collaboration with other departments of the SensUs organization. For example, brainstorming about the execution of the Meet the Partners event together with the Events department. We also make sure there are some fun activities organized for just the External department and the whole organization to keep up the energy of the team!

Our goal and normal was and has been to establish partnerships based on trust and mutual benefit. To make sure we achieve our goal, we discuss every meeting beforehand, evaluate the meeting and make sure every member has all the information to well inform the partner.

Within the External Relations department, we got the opportunity to develop our verbal and written professional communication, teamwork, leadership skills but also our planning and pitching skills.

One of the greatest things about us is that everybody is eager to take initiative. This is very important, as a partner can contact us every moment of the day and expects a response fast. Also, every member of this group evaluates a new idea very carefully and critically, as every member wants to give her partner the best possible.
MEMORIES
Our SensUs year was a real roller coaster of ups and downs. We lost some partners, but we also acquired 3 new partners of which we are very proud. We learned a lot! In the beginning of the year, we started with acquisition training, which really helped us to get up to speed. Later in the year, we evaluated decisions made in previous years critically and innovated some processes and ideas. Also, we talked with and listened to the advice of External Relations alumni.

LESSONS
One of the most valuable lessons we learned as a team is to always keep trying! No in the External Relations world does not mean no, instead it means try differently. Therefore, we advise future honors students to challenge their creativity and problem-solving skills to find solutions from a different perspective on various tasks External Relations members need to tackle.

We are proud of our work this year and wish good luck to the new External Relations! Also, keep in mind that being in a student team is much more than having a lot of meetings and responsibilities, you get to meet amazing inspiring individuals who help you level up. Next to that, spending a lot of time and going through a lot together makes you bond with your team and make lifelong friendships.
ABOUT THE PROJECT

We are Floor van Veen, Myrthe Boone, and Noah Olmeijer, working in the Technology Department of the SensUs Organization of 2022. Because of our strong interest in the technological aspects of organizing a student competition on biosensing, we three became part of this department. During our stay at SensUs, we think of the technical challenges the teams need to solve. Challenges like what molecules the teams need to measure and how to determine the competition’s winner. These challenges allow us to be creative in a technical environment and learn a lot about biosensing in the process!

Myrthe is a third-year Bachelor’s Biomedical Engineering student, and she loves to find creative solutions to some complex mathematical and technical challenges. During her stay at SensUs, she worked on an algorithm to determine the winner of the Analytical Performance Award from biosensor criteria and data gathered during the SensUs Innovation Days. This algorithm can collect data from an online datasheet and process it to return a score. The scores will be presented live during the Eindhoven Testing Event and will offer an objective base to determining the winner of the Analytical Performance award.

Floor is a second-year Bachelor’s Biomedical Engineering student, and she spent time doing research on the theme of this year: Acute Inflammation with a Focus on Sepsis. She worked on developing a testing plan to check whether the plasma samples containing IL-6 we made were viable. The plan includes testing for stability in different environments and at different concentrations, and with the help of an expert at Maxima Medisch Centrum, an assay could be performed there. The information on the stability will be helpful to the teams participating in the Eindhoven Testing Event and us.

Noah is a second-year Bachelor’s Biomedical Engineering student, and he enjoys researching, working on, and managing all kinds of tasks and themes within the Technology Department. He was concerned with developing the sample preparation plan to produce plasma samples containing IL-6. This plan is provided to the Sample Preparation Officers that will produce samples for the Distributed Testing Event (DTE). The DTE is a new initiative of SensUs to let the teams participate in a practice event at their universities. We believe that this initiative will be a great way to introduce the teams to a student competition on biosensing.
MEMORIES

Within the Technology Department at SensUs, one of the most important tasks is determining the theme for next year. Therefore, we have the opportunity to work with experts and professionals in various fields of healthcare and technology. Doing research on potential new biomarker themes has challenged us to think critically, ask the right questions and consult with experts that helped us to see problems from a different perspective. Because we regularly need feedback, we meet with our advisor from the SensUs Advisory Board, Menno Prins, to send us in the right direction every week. Although, we still are responsible for our own tasks and determine our own course of action, which appeals to us and has taught us valuable lessons on independence.

LESSONS

The most important lesson we learned in this department is not to be afraid of the unknown and to be persistent. During our year, we experienced some setbacks, such as a delay of delivery times of necessary materials or not finding the information we needed. Disappointment or failure is something we will encounter later in life or in our academic career as well. However, these setbacks didn't stop us from completing what needed to be done. By understanding and helping each other, we could overcome our fear of uncertainty and catch up with our schedule. This makes us proud to be part of this year's Technology Department and SensUs Organization.
ABOUT THE TRACK

Smart Cities addresses various topics from the perspective that smart and innovative solutions are required for the built environment. Implementing these solutions is challenging. The fundamental problem is that needs and preferences of citizens, quantitatively and qualitatively, tend to change faster than what an inert physical environment can accommodate. The temporal scales of change considerably differ, creating inefficiencies in the urban system. Optimal interventions can only be instantaneous because, over time, people’s preferences and the properties and performance of the built environment diverge. Over the year, emerging information and communication technologies enable new strategies for urban interventions, thus bridging or narrowing this gap.

We invite all students to join us and work out the most challenging problems in the urban context together. With a compact series of lectures/talks/discussions at the beginning, you as a student will be equipped to define a self-chosen assignment on a specific topic and form groups to conduct the project.
**TRACK COORDINATOR**

Faas Moonen  
**Track coordinator**

Dr. Faas Moonen is an associate professor of Innovation Structural Design at the Built Environment. He has been the coordinator of the Smart Cities track from the beginning.

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**COACHES**

Iris Moonen  
**Coach**

Last year I’ve had the honor to coach the honor students Lin, Ana and Lorenzo. They not only have a really interesting project in which they try to bring out the best in a neighborhood and the people in it, but the three of them show to be very hard working and fun students. I’ve enjoyed being their coach and can’t wait to see what next year has in store for them. Next to this, I’ve enjoyed the regular Smart Cities track presentation meetings that we had this year. There are so many interesting projects, and everyone can be very proud of the work they have done this year. Everyone is doing such a great job!

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Lisanne Havinga  
**Coach**

Lisanne Havinga is Assistant Professor at the Building Performance group at Eindhoven University of Technology. She received her Ph.D. in 2019 from TU/e. Her research focuses on developing modeling and simulation strategies to support decision-making in the energy transition of the built environment. The evaluation of innovative technologies and their potential in addressing the key challenges of the energy transition is a priority.

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Floor van Schie  
**Coach**

Floor van Schie graduated in September 2017 with a combined master in Architecture and Structural Design at the Eindhoven University of Technology, focusing on the integration of these two disciplines. Since November 2018, Floor has been working on the two-year Post-Master of Smart Buildings and Cities as PEng trainee (Professional Doctorate in Engineering), with dr. ir. S.P.G Moonen of the department of Innovative Structural Design. During this period, Floor is researching the design of the GEM-tower, a sustainable energy solution for festivals. Floor is focusing on the architecture of the tower, building technology and methodology.

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Mark Cox  
**Coach**

Coach for the tracks Energy Transition and Smart Cities. Mark is introduced on page 40.
ABOUT THE PROJECT

Our team does not have a "strict project" to say, we have a goal. Our task is tackling down multiple architectural competitions by experimenting with sustainable and modular building methods. The team started few generations ago with a similar idea, its original project being a modular tiny house. After completing the initial competition, the team decided that a beneficial learning objective was to continue on finding sustainable solutions for various built environment scenarios, instead of focusing only on one. This way our progress became fluid and dynamic, with real and objective feedback given by field juries. We strived to learn by simulating working besides fully fledged firms, this way assessing whether our architectural ideals make sense to the rest of our field.

This year we have managed two international competitions, with a third currently in process. The Hangar Ticinium, held in Pavia, Italy, allowed us to visit the site in person and understand the struggles of sustainable renovation. Multiple requirements; material issues, monumental restrictions and stakeholder needs, stood in the way of our design proposal.

Besides the complexity of the brief, we also had to deal with an unusual typology of a building; a hydroplane base. Our take on the Columbarium competition consisted of the smart material use of bio produced resin to create an urn system. The complexity of this assignment was meet with the emotional side of architecture, since we had to create something that was mindful of people's resting places.

As far as our on-going competition is involved, Museum of emotions, the aim is to create an exhibition that blends in with the environment and explains itself silently. Our deliverables are not allowed any sort of text, which means the architectural expression is fundamental. The contest also provides a Sustainable Reward for the project with the most efficient green approach, for which we are striving for.
MEMORIES

By far our best moment this year was getting the funds to visit the site for our Hangar Ticinum competition in Pavia, Italy. There, we experienced what site visiting outside of university projects looks like. We only had one chance to survey, one chance to gather information and no guideline to help us in the process. So it was a totally new experience for most of us, in an extremely scenic environment as well, which resulted in us spending hours on site. We also got to visit one of our teammates and dear friend's hometown since he lived a few hours to where the competition was held. We got to enjoy food and architecture home to Italy, and we ended up chatting with some other competitors too.

MEET THE TEAM

Diana Marin
- 1st year

Julka Lewandowska
- 2nd year

Other students in project team:
Hyeji Joh
Luca Cecca
Sohyun Won
Vit Madle

Coach:
Floor van Schie

"Best ideas are made in the clu"

LESSONS

Our visualisation skills definitely improved as we worked on deliverables with a high demand in quality. Along this we also learned how to design and present our projects in such way that attracts most. We learned that a good design is a concise and self-explanatory design. It was interesting and somewhat heart-breaking to see how some of our ideas were already thought of, which made us go more in-depth with our concept analysis.

Being a part of a team ultimately taught all of us how to compromise on a project, which has hardly happened during our singular university projects. We had to act like a team, which meant multiple creative outputs and creative styles. What we all agreed on, including our non-Honors members, is that this experience helped us simulate the real life work experience.
ABOUT THE PROJECT

The aim of this project is to design a pavilion for a festival (Festival EB & Vloed) by the sea in the west of the Netherlands. The festival, initially to be held in September 2020, has been postponed to September 2022 partly due to the pandemic but mainly due to the internal organization of the festival, is to be held in various locations in the town of Renesse. The following page shows the different locations within the festival. The main concept of the festival is to present sustainable innovation ideas and to create spaces that allow people attending the festival to meet, interact and discuss sustainability-related ideas. The main idea is to design a pavilion on the beach location of the festival, the design needs to represent energy in some way.

Additionally, the pavilion must address the theme of circularity (which is a constraint we have from last year's design), while simultaneously addressing the theme of energy (a theme related to the pavilion location).

The concept behind our pavilion is that of a windmill. The concept is to place the pavilion in a densely populated area or on one of the paths to attract more visitors. The main structure is two semi-circles (slightly shifted) made of steel pipes allowing for a semi-private interaction space. Each pipe will have a couple of windmills in different colours to make the pavilion more lively and engaging. This concept will represent the idea of natural wind and showcase the way in which wind power is used to make energy. The pavilion will be made completely from reusable/recyclable material. The pipes will be either rented or borrowed steel pipes, while the windmills will be made of recyclable material gathered in a plastic residue campaign. The floor of the structure will be the beach sand on-site.
MEMORIES

This honors year has been filled with multiple joyous memories, but one of our favourite memories was during one of our testing experiments in which we tested whether we are able to drill water into the sand using water pressure. Before the experimenting phase, our group went through a couple of challenging months in which we were re-designing and re-think concepts over and over in an attempt to make them interactive, lively, feasible, and circular. However, after finally settling on a design concept our group was looking forward to moving a step further in our design process and starting detailing parts of our pavilion. One of these steps was to test whether it was indeed to drill steel pipes into the ground without using heavy machinery.

During the experiment, we ran into some issues that were a little disappointing, but we finally succeeded. We managed after some attempts to finally get the pipe 2 meters into the ground - which was one of our happiest moments during this honors year. This moment was a turning point in our mentality, as we now had hope that this design could go very far - since this was one of our first big successes so far.

LESSONS

This honors year has taught us a lot, most of all to be patient and to persevere. We initially had some challenges with our group organization and so we learnt that to remain on the task we needed to keep going no matter the issues we were facing - we needed to continue with our project process. During the first half of this year we were constantly coming up with new design concepts, which after re-evaluation would get rejected or discarded meaning that we needed to start again - this was highly disappointing. Nevertheless, we needed to be patient and remain on task. Eventually, we ended up coming up with a satisfying design that we wanted to explore and improve upon.

This year also taught us the importance of doing thorough research before jumping into an experiment. For instance, we had an experiment in which we attempted to drill pipes into sand that was too compact, during the process the sand below the pipe exploded on us. Another experiment we conducted was finding the best windmill model, however, conducting research before might have made the process easier. Our process was still successful, but research might have saved us time.

Throughout this year, it was clear that as long as we remained patient with ourselves and with the design process and remained on task and worked no matter the circumstance, we would succeed.

MEET THE TEAM

Rosanna Al-Mahaqeri
- 1st year

Sofia Ghigliani
- 2nd year

Coach:
Faas Moonen

"Success is the ability to go from one failure to another with no loss of enthusiasm."
- Winston Churchill
ABOUT THE PROJECT

Due to convenience, people make conscientious decisions to allow a certain amount of radiation in their homes through appliances such as WI-FI routers and microwaves amongst others. These appliances generate a marginally low amount of radiation, thus not causing concern to human health and are considered acceptable for living. However due to increasing urban congestion as well as the introduction of electric vehicles and growing number of mobile base stations, the distance between residential houses and EMF sources is steadily decreasing. Without proper insulation, this radiation can enter homes and become a disturbance most people disregard due to lack of awareness and concern about its possible effects.

Literature on health risks from low frequency emf exposure is contradictory. In their 2011 evaluation, the International Agency for Research on Cancer (IARC) points to a possible connection between low frequency emf and cancer, but the connection was not determined strong enough to be conclusive. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) also point to a link between this exposure and childhood leukaemia, but the results were deemed inconclusive due to the quality of monitoring.

Regarding governmental action on the matter, the ‘EU recommendation’ on the limitation of public exposure to EMF, published in 1999 by the Council of the European Union (EU), describes basic restrictions emf fields and reference levels for the strength of electromagnetic fields outside the body. This EU recommendation has not been changed since its initial publication. Different European countries are addressing this matter in different ways. Some apply the minimal requirements, some take stricter measures justified by the precautionary principle, and the rest are either very lenient or not applying the regulations.

Despite the possible health consequences or general perception on the matter, EMF is becoming a pollutant. Team Layer is investigating methods of insulating low frequency EMF radiation in residential construction and controlling electro-magnetic pollution.

We developed a prototype in order to measure the effects of our shielding and wrote a report on our findings in which we describe recommendations in design in accordance with EMF protection.
MEMORIES

We're a bit of a random group. Two of us are from the built environment while the other two are studying electrical engineering and we don't get to interact much outside of our Honors project. We've had fun working on the prototype for our project but I think our nicest memory was filming the promotional video. We went for a very cheesy "infomercial warning you about the dangers of the world" type of vibe. We had slow motion walking, conversations into the camera, and none of us could keep a straight face. We're quite serious about our project and the pollutive potential of emf, but it's still very easy to make our promo look like a public safety announcement against microwaves, so we had fun playing that out in the video. In the final scenes our future electrical engineers were introducing the prototype in the honors room, and my friend and I knocked down a 1000 piece poster we had to put together very quickly. Around the end we couldn't find one of the pieces, and ended up searching the room for about an hour alongside our videographer. We never managed to find it but I still see it in my dreams sometimes. Darn puzzle piece!

LESSONS

Other than quite a lot on EMF radiation? Probably how to cut very large pieces of mdf to construct oversized prototypes. Measuring low intensity radiation with normal meters is also very difficult. It took a lot of tinkering to get proper readings. Our biggest struggle was trying to organise meetings as often as we needed with very contradictory schedules. It was our first time in an interdisciplinary team for an honors project, so juggling our tasks was also a challenge. For the architecture students it got a little boring once we got to the prototype testing phase, and the tech team had to struggle with the measurement equipment quite a lot before we could proceed with documenting our findings. Trying to cooperate as a team of two very different disciplines was a novel and entertaining experience.

"Anyways, if it doesn't work, we'll make more hahaha"
- John Asaad, fellow team member
ABOVE THE PROJECT

Sustainability is becoming increasingly important in all sectors, and Rijkswaterstaat, the Dutch infrastructure institute, is working hard to innovate and make their operations as sustainable as possible. For this reason, Rijkswaterstaat is working on the Proeftuin InnovA58 project. A project that consists of a Resting Place 2.0, an Innovation Lane, and The Innovation Pavilion.

This 'Resting Place 2.0' is a rest stop for travelers, a charging station for electric vehicles, as well as a place to enjoy nature and learn about the area. The 'Innovation Lane' is a highway expansion that is used to test innovative energy-production and smart-mobility technologies, such as four newly developed asphalt types. Lastly, The Innovation Pavilion is where the new innovations tested on the 'Innovation Lane' are presented to the public.

This Innovation Pavilion must be an example of what is possible in terms of sustainability and nature-inspired architecture; it should be energy-neutral, with materials obtained locally to avoid transportation emissions; it should be made out of biobased or reused materials; it should incorporate biophilia to create a symbiotic relation with nature; and lastly, the pavilion should also be adaptable to the different needs, such as flexible storage for testing equipment, presentations, and meetings.

So, for the past two years, Team Virida has been working on the design of this pavilion, together with a collective team. This collective team was formed in order to bring together professionals with the similar ambitions and sustainability interests, to learn to work in a symbiotic way, by exchanging knowledge and experience. This collective team consists of approximately 30 members, and there is no single leader that makes all of the decisions; instead, the Collective as a whole makes all of the decisions! Making it, as you can imagine, difficult to move forward. We ended up diverging from this team at the end of the year to finalise our research and final design. However, it did give us the opportunity to learn more about the professional world and how to work in a new symbiotic way.
MEMORIES

We have had many great memories together as a team, from our weekly meetings, to our bonding dinner night that took 1.5 months to be planned. But one of the most rewarding (and stressful) moments, was when we built our 1:10 physical model. After months of researching and designing, we finally got to start ordering the real materials; cutting every single wooden beam and column in an unique way, to make each piece fit tight like a puzzle and create a stable structure stable while using no metal joints; stack every single layer on top; and even making tiny window frames and rolling division wall. After many hours of work, seeing it all come together was really gratifying for the entire team, as it meant that we had succeeded in constructing a stable structure in a non-conventional way and that it could be used as future reference for others.

VIRIDA

LESSONS

Over the past years, we faced many challenges, but one of the things that we learned the most is how to come up with solutions and move forward regardless of the obstacles.

After having our preliminary design, we realized that the collective team was slowing us down to finalize our goals, as it was mainly focusing on organizational and learning aspects instead of the design of the pavilion. So, we decided to take the matter into our own hands and started researching whether the preliminary design was feasible, following the main values established in the beginning. This allowed us to learn about new construction methods, materials, and concepts to solve the problems from the preliminary design. And consequently, led us to apply these new solutions to a new and improved design that incorporates biophilia, wooden joints and connections, biobased and reused materials, and adaptable spaces.

This year also provided us with the opportunity to learn more about professional work together with the collective team’s professionals, how to set our position within the team, and to broaden our knowledge on important topics for future sustainable building.

MEET THE TEAM

Emma Kaandorp
- 2nd year

Isabella van den Bussche Bravo
- 2nd year

Ka Hao Cheung
- 2nd Year

Marissa van Koesveld
- 2nd year

Wilke Schellens
- 2nd year

Coaches:
Lisanne Havinga
Jan Schevers

"If you think you are too small to make the difference, try sleeping with a mosquito"
- Dalai Lama
ABOUT THE PROJECT

Microplastic particles have been found everywhere. Recent research shows that these particles are not only in our oceans but also in the air. This is a major problem that affects contamination of the food chain, health risks and environmental changes. But as we cannot see it, the problem is easy to ignore.

We want to make the invisible visible. We believe that this problem can’t be solved by only filtering the plastic from the air, the population has to be educated on the problem and act accordingly. We want to approach a solution by implementing design interventions in the city that educate the public aiming for behavior change. We believe that by intervening in someone’s routine or someone’s surroundings we can get people’s attention and make them reflect.

The current state of our project is still in its beginning phase. Next to the design concept, we are working on our online presence and the business tactics. We love brainstorming, creating and building things. But we also think about the psychological part, how do we attract people and keep them interested? How to teach the general public something? Apart from this we are hoping to next year start with looking deeper into Data Visualizations and construction constraints, which we are looking forward to.

We also looked into the business part - How can our project create value for the society while also being self-sustaining? In the coming year, we want to create a finance plan and dive deeper into the business world of non-profit organizations. Our first year as honors students has been challenging but exciting. One of our best memories would definitely be Intro weekend. During this weekend we met many new people from different tracks and with various ambitions, which got us in touch with the honors community and inspired us to join committees at Confluente. Secondly, being part of the TU/e Contest was an experience out of our comfort zone and very enriching. By taking part in it we met very enthusiastic people, who helped us improve the market and communicational aspects of our project. It was also interesting to talk to other students in the contest and get to know their ideas and process.

Our goal this year was to set a foundation for the project that we wanted to start building in our second honors year. With the challenges in the last year, we learned what we are capable of and where to ask for help. We are looking forward to motivating students from other faculties to join our team, dive deeper into data physicalization and start prototyping in the upcoming year!
MEMORIES

Our first year as honors students has been challenging but exciting. One of our best memories would definitely be Intro weekend. During this weekend we met many new people from different tracks and with various ambitions, which got us in touch with the honors community and inspired us to join committees at Confluente. Secondly, being part of the TU/e Contest was an experience out of our comfort zone and very enriching. By taking part in it we met very enthusiastic people, who helped us improve the market and communicational aspects of our project. It was also interesting to talk to other students in the contest and get to know their ideas and process.

PLASTIC POLLUTION

A problem of incredibly high importance is plastic pollution. It is estimated that the sea contains more plastic debris than plankton. The environment is facing the threat of plastic waste to at least 2.5 million marine animals being killed per day. Plastic waste harms marine life and is threatening the ecosystem. It also reaches our food chain, which has a grave impact on our health. The cycle of producing, using, and disposing of plastics is harmful to the environment and unnecessarily costly. It is responsible for the contamination of our air, water, and soil.

LESSONS

Definitely the most valuable lesson would be that a good foundation is key. We were very enthusiastic this year and dived straight into this project. We soon realized that starting a project from scratch is a lot more work than we anticipated. We realized that having a great foundation makes your future work easier and smoother. So take the time to do it properly.

An other thing that is very helpful is getting feedback and talking to other people, this helped us a lot as otherwise you get lost in research and it is hard to make the next move.

MEET THE TEAM

Carmen Enriquez Comendador
- 2nd year

Claire Vos
- 2nd year

Elena Dagg
- 2nd year

Coach:
Mark Cox

"Life in plastic, it's fantastic!"
- Barbie Girl, Aqua
ABOUT THE PROJECT

Living Lab 040 focuses on discovering the city of tomorrow, where the main aim is people being connected to each other, within a city that contributes positively to their health, well-being and social life. In other words, a city that is adaptive and agile.

The potential project site is located in the north of Eindhoven, in the new unconventional neighbourhood of Buurtschap te Veld. The site area where the Lab will be realized is around a total of 8500 m², which will be filled with a maximum of 119 experimental residential buildings. The buildings will be trying out new construction techniques, living concepts or smart technologies, whatever is imagined in the future of living. There are five main principles which are the central basis to urban planning analysis, research and design of the Living Lab project.

The first is efficient organisation. The city of the future will have to make room for more people, while also being adaptive to changes in demand and desires. Since Living Lab is an experimental project at its core, there must be room for flexibility in the design process, as the project will be subject to constant changes.

Followed by the second principle, which is spatial attractiveness. Living Lab 040 does not only focus on densification, but it also aims to increase the quality of life. Thus, an attractive, contemporary representation of the space needs to be provided within the compactness of the site.

The third principle is using well-being as a starting point. When thinking about the city of the future, the community living at the sight is an essential element. For example, thinking about self-organized market with products from one’s own community garden or meeting the care demand of the elderly as a community and working on accessibility.

The fourth principle is building smart. The main aim is using less materials, and anything to be used for construction should be circular, either reused or designed for deconstruction. For this project, we give way to greenery as much as possible.

Lastly, the fifth principle is being agile in the use of space in order to be as efficient as possible. Where the building should be as compact and as circular as possible. For instance, if the location is no longer suitable for living, the building can be easily moved, and if the materials are no longer suitable for the unit, they can be reused separately.
MEMORIES

During a phase in our project in which we were trying to incorporate companies into our design, we managed to have a meeting with a company in Eindhoven called the Eindhoven Engine. All of the team could attend that meeting and luckily it was located on the campus itself. Before the meeting everything felt quite real and formal since we noticed that a company like the Eindhoven Engine would take us seriously and dedicate some time and effort to meet up with us.

The meeting itself was not necessarily the high point of the memory, however, it was more the feeling that people where actually interested in our group and our ideas.

Another high point from this year, was the last quarterly track meeting we had. A couple of weeks prior to the meeting, the team changed the direction of the project in to a more research based project instead of a design based project. This was paired by making a customer journey map which gives us a good idea of the movements throughout the building and we made a strict planning till the end of the year. During the quarterly meeting we received a lot of positive feedback on the changes we made and the direction in which we were taking ourselves. This did feel rewarding since we were unsure about this important change of direction.

LESSONS

There are a lot of things I have learned in this honours year. The first of which is that working with a client can be difficult. Throughout this project one of the challenges of the team has been to keep in touch with our client. In the end this also forced us to make a change in direction of the project and to accept the fact that not everything we had planned at the start of the year was going to finished. In our initial plan the team wanted to start to construct a building this year however, unfortunately we did not come close to that.

Another thing I learned is that sometimes it can be difficult to stay motivated for a project when things are not going the way you would like or were expecting. The plan of the team has changed multiple times throughout the project. Especially in the beginning of the project. In the start we did not have a very clear idea on what, when and how the project would go. This would sometimes mean that you would work on something for a week to decide that next week the direction of the project would go somewhere else.

MEET THE TEAM

Arjen Smetsers 1st year
Thomas Cronk 1st year
Jana Mostaňa 2nd year
Layla Layla Omar Eladel Mohamed Abouallam 2nd year
Zeynep Yelken 2nd year
Coach: Floor van van Schie

“The future depends on what we do in the present.”
- Mahatma Gandhi
ABOUT THE PROJECT

The goal of our project is to create a closer community of people so that they can support each other and thus live better and independently for a longer time. Every community is made of different types of people. Most of them are capable of living by themselves, but there are also people who need extra help. For example, the elderly, people with dementia, the mentally and/or physically disabled, the homeless or people who suffer from mental problems, like depression.

However, the Dutch healthcare system is very fragmented and it is designed to provide specific solutions for specific types of patients: there are retirement homes specifically designed for older people, mental hospitals for people who suffer from mental illnesses and special housing for people with dementia. Each facility functions like an island and people in need are taken out of society and put in a special ‘box’. This system is not only very expensive and inefficient, but it also makes people feel less valuable within society.

The problem is that during the upcoming years and up until 2050 the proportion of the world's population over 60 will nearly double and there will be a shortage in personnel within the healthcare industry.

We believe that the solution lies in the neighborhoods themselves. By improving the social cohesion, elderly and people in need will have somebody to rely on. There will be no need for them to leave their hometown to go to a healthcare center or for nurses to travel long distances to reach them, unless they have a severe disability.

The neighborhood where we live in has big influences on our well-being, even though most of us do not realize this. Nowadays, we do not even know our neighbors anymore. As we grow older, we tend to get more and more lonely and secluded in our own homes, which will have major health consequences.

Our project aims to find what brings people together in a neighborhood; we have been researching this both from a sociological and an architectural perspective. We tried to understand which would be the target groups that have matching strengths and weaknesses, and we also looked into how can public space become a place for interaction.
MEMORIES

Honors projects are very challenging and require a lot of hours to dedicate to it. We are a team of three students, coming from different majors and we met within Honors. We came together because we share the same goal and vision. Because of the need to brainstorm a lot and get creativity flowing, along the project we have had countless, long, meetings between the three of us. These meeting hours are part of our best memories of the program so far. We make use of this time to make substantial progress but at the same time, we also got to know each other well. These meetings are informal in a way that we can be relaxed in a working environment, we can make jokes and tell our life stories time to time but still achieving our goals in the end. For this reason, the group bonding is strong in our team and we enjoy our time together. During the year, there have been moments when we had a high Honors workload and this resulted in us staying in the Atlas building until its closing time. However, we always managed to get work done as a team and to later reward ourselves with a nice team dinner date!

LESSONS

Among the takeaways from our Honors project, two are the most important ones. Firstly, the target groups of our research were vulnerable individuals and especially the elderly. Investigating their struggles and needs made us develop great empathy towards them and we appreciated being confronted with something that young people do not usually get in contact with. Secondly, a challenge that we had during the year was managing our relationship with our client. This project started with a request from the client, which is a consultancy firm for healthcare companies. In the beginning, our cooperation with them was exciting for us, but after about a month, once we had delved deeper into the matter, we realised that their research question and method would not be leading to very innovative results. We brainstormed a lot as a group about the direction that we believed the project needed to take and, once agreed on that internally, we presented it to both our coach and the client. This required us to be determined and self-confident in our ideas and to have a dash of fearlessness, especially when confronting the client. They did not share the same view as us, which made the conversation a bit uncomfortable for both parties. Nonetheless, looking back, we are happy with our process and results and we recognize these discussions and confrontation as useful learning experiences.

MEET THE TEAM

Ana Poenariu  
- 1st year

Lin Shu  
- 1st year

Lorenzo Cammarota  
- 1st year

Coach: Iris Moonen

"I don’t know my neighbours."  
- Most people who live in cities
We are creating outdoor furniture that follows three major rules presented by the client:

- Nature-friendly: We want to give nature a safe but natural place to grow and develop. With all the habitat destruction going on in the world, we feel it is important to do our best to try to preserve the wildlife that lives around us. At the same time, we wanted to create a space where humans could safely interact with this nature and get to know it better, so they have better reasons to take care of it. This includes greenery, small mammals, birds and much more wildlife that we sometimes don't even know is around us.
- User-friendly: We want to make sure whoever uses the bench feels comfortable no matter what they want to use the bench for. We mainly targeted mothers that are watching over their kids, teens and young adults that need a safe and comfortable place to hang out, and elderly people, who need a place to rest when taking strolls.
- Circular: We are targeting a design that can be disassembled and reassembled easily and recycled. This is because, looking at the current options for outdoor furniture, we see that many options have a lot of not recycled and not recyclable materials.

As a group, we also thought a couple other pillars were important to come up with a good design:

- Innovative: One of our main goals was to come up with a design that was unlike the bland and stale designs of benches that can be seen in parks across the world.
- Eye-appealing/Interesting

Throughout this year, we designed and built a bench that we believe fit all the criteria. Our main client was the municipality of Zaanstad, more specifically the neighbourhood called Kleurenbuurt. This neighbourhood was renovated recently and our bench is meant to aid their new goals that were mentioned before.
MEMORIES

We have had quite few memorable moments throughout this academic year. However, none of them compare to the first time we made a scale model of our bench. After numerous meetings, consultations and drawings we decided it was time to get our hands dirty. This part of the design process was exciting because we were finally able to physically test out our ideas and the methods we wanted to use.

So we started by making the formwork for concrete. It was not an easy task because of all of the holes and incisions the concrete block was supposed to have. The process included a lot of sawing and gluing the plywood in the workshop in Vertigo, which we did together with our coach Floor van Schie. When we finished that, we proceeded with pouring of the concrete, which was the most fun part. We mixed the concrete ourselves, poured it into the formwork and put it on a shaking table that allowed for an even distribution of concrete in the formwork. It was a great lesson for us since we had no experience when it comes to making of the concrete. When the concrete dried, we were able to fix the seating area to it and the model was finished. We consider it to be the most educative and exciting moment in the whole design process we had.

LESSONS

We learned quite a lot throughout this project. One of the thing we learned throughout the project was the importance of thinking about how to work with other people. Of course we learned a lot about working with the teammates as we always divided the work according to each of our specialty and discussed amongst each other. Not only the teammates, the project involves a lot of people to help us and to guide us in some way. We had meetings with an architect for the feedback for the design, guidance by our coach Floor in which we mainly discussed about the actual making of the bench and materials, people working in the university workshop, and so on. In this process, we learned the importance of communication and planning, as we the process takes other people's time as well so the plan needs to be well thought of and the communication needs to be clear for a smooth progression of the project.

We learned a lot about the design process as every teammate was involved in the design process. The design involved the aesthetical looks of the bench, digital integration, the detailing, and design in terms of social connection. The process was always not linear as there has been a lot of changes in the design after countless discussion with many different people, sometimes completely changing the whole design. Not only designing on paper, we were able to learn about designing through the actual making of the bench prototype and experimenting because that's the time when we get to know the real problems.

MEET THE TEAM

Igor Sztormowski
- 1st year

Manuel Borges Vaz Pinto Soares
- 1st year

Matea Shumkovska
- 1st year

Kazuma Takahashi
- 1st year

Coach:
Faas Moonen

"Make it simple but impactful"
ABOUT THE TRACK

In the field of Smart Mobility and in particular Cooperative Connected Automated Mobility, we see many opportunities to use technology to solve mobility problems. By adding smartness, we aim to decrease the negative effects of traffic jams, traffic injuries and deaths down to 0% and even lower the overall emissions from traffic and mobility solutions. Mobility impacts us all in our daily lives and the number of people, from industry, academia, and government, trying to provide mobility to all of us is therefore immense.

With the trend towards further automation, connectivity, and cooperation of all modalities of transportation, Smart Mobility is further evolving towards Cooperative Connected Automated Mobility. This field focuses on connecting self-driving vehicles, traffic management systems, mapping, efficient powertrains but also vulnerable road users (such as pedestrians and cyclists) and other modes of transport to establish a mobility system for all, and making use of IoT, data science and Artificial Intelligence to achieve this.

In year 2021-2022, the track had 3 projects:
- 5G-MOBIX - Remote driving for AD vehicles: the team focused on the improving a remote driving system for an automated driving vehicle, testing connectivity, and adding fail safety to the system
- Team POLAR: this team aims to develop a sustainable and automated research vehicle that can perform research on Antarctica, with this year a research trip to Antarctica and a first small scale model of the vehicle being build.
- TU/ecomotive: the team reinvented itself after 2 years of silence and is aiming to build a CO2 neutral vehicle from scratch, considering both production, use and end-of life phases, with 8 Honors students involved in core competences of the team.
**TRACK COORDINATOR**

**Jos den Ouden**  
**Track coordinator**

This year we had 3 teams with a strong focusing on our three topics: societal challenges in field of CCAM, part of one of the Automotive student teams and a project initiated at Honors. All topics fit very well within the Smart Mobility track, combining both sustainability, cooperative and connected mobility, and autonomous vehicle technology.

Most Smart Mobility track students really choose this track to be able to collaborate within a team. We have seen this year (compared to previous years with COVID restrictions) a stronger collaboration between the students with impressive results. Collaboration with TU/eP4 was very good, with help of Louise and Jop for being excellent coaches; they not only managed to build an entire vehicle, but also encourage each of the Honors students to ‘own their own future’. Being the main coach for 5G-MOBIX - Remote Driving project myself, I am proud to have seen the team testing and improving the system with the TU/e self-driving vehicle.

I am still proud that we have also shown what collaboration between tracks can do; with our earlier collaboration with Energy Transition and this year even extended with High Tech Systems students joining Team Polar and growing this team into the next phase. With even a trip to Antarctica in December 2021!

*We will surely continue and explore this kind of collaboration further in the future!*

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**COACHES**

Louise de Laat & Jop van Aken  
**Coaches and managers TU/eP4**

The honors students are part of the TU/eP4 team; EM07. This student team aims to shape the future of sustainable mobility by implementing the most recent innovations into concept cars.

This year’s team of TU/eP4 is presenting the world’s first CO2 neutral car from scratch. This concept has been chosen because the transport sector is responsible for the biggest share of greenhouse gas emissions and this means that this is the area where we have the most room for improvement. Also, the choice has of course been made with the green deal in mind.

In 2030, Europe should have reduced their CO2 emissions by 55% in comparison to 1990. In 2050, Europe should be the first climate-neutral continent. With TU/eP4, we give a great example of how it can also be done within the (automotive) industry and we show the possibilities of how these sustainability goals can be achieved.
ABOUT THE PROJECT

This project aims to develop a safety net for autonomous vehicles by enabling the manual control of this vehicle from a remote location when the vehicle is experiencing a system malfunction. Autonomous cars are rapidly becoming a reality. However, these cars will never be immune to failures. Just like a regular car nowadays can have a puncture, the sensors of such a vehicle could break down and result in the car losing its autonomous capabilities. The system we created uses sensorial input of the autonomous vehicle, sends it to a remote station, and translates it to a clear visualization for the remote driver. This year, the project is made up of five students collaborating to further optimize the remote driving system, in order to be able to be used for a user test, in which a Toyota Prius would be driven remotely at low speeds on the TU/e campus. To control the car's heading and acceleration, we have created a remote station setup equipped with a seat, pedals, and steering wheels.

In order to visualize the car's environment at this remote station, we process the data transmitted by the car's cameras, GPS, and LIDAR into a camera and virtual visualization. The camera visualization gives a frontal and rear view of the car's environment. The second visualization maps point cloud LIDAR data on a map of the car's location. Both visualizations have been created using the Unity game engine. Although we would prefer to have the system operating under a 5G-connection, this is not yet possible due to delays in 5G deployment by external parties. Therefore, our remote driving system currently uses 4G technology. Anyways despite the difficulties faced, we were able to make quite significant progress towards our goal. We are really happy with our progress and can't wait to see where the project goes especially with all the ideas and plans that have been laid down for next year too.
MEMORIES

Being together since the beginning of the academic year, this year’s team has made a lot of great memories together, many of which were made during the project’s exhibition at Dutch Design Week. Even though it was only the beginning of the year and the two new members had just joined the team, we still managed to have a lot of fun together. Even though we faced several difficulties such as transporting the remote station by foot to the exhibition, by working together we managed to come up with the necessary solutions. We were very successful in representing and demonstrating the 5G-MOBIX project during this exhibition and we even got several interested parties to contact us about the business perspective of our project. Bringing the remote station to the exhibition caught a lot of attention, with everybody thinking they would be able to sit down and actually drive the car remotely, which was very amusing to us. Although the week passed by really fast we tried to make the most out of it and what made the experience even better was that the team got to get closer together, learn about each other, and spend time together.

LESSONS

This was a great year, especially with the pandemic restrictions gone, since we could meet with the team in person for most of the year and had the opportunity to grow together. A lot of lessons were learned from each other but the main lesson that we had to learn as a team was that you can never be sure something works until it has been thoroughly tested. Despite all the Github code and endless documentation online, what is expected and what the actual outcome turns out to be are usually completely different things and most of the time spent in the project was actually debugging until the required results were achieved. We had to learn this the hard way by making a lot of mistakes and dealing with a lot of obstacles. The take-home message at the end of the day is that the good things in life take time and the pleasure you get when your hard work is finally realized can hardly be described in words.

MEET THE TEAM

Endi Isuf  
- 1st year

Rodrigo de Miguel Satue  
- 1st year

Milind Tripathi  
- 2nd year

Monica Lacatus  
- 2nd year

Nikolaos Soulis  
- 2nd year

Coach:  
Jos den Ouden

"Teamwork makes the dream work."
ABOUT THE PROJECT

TU/ecomotive is a student team at The Eindhoven University of Technology that was founded 9 years ago in 2012. Each year a new concept car is designed from scratch. Every part and component of the car is precisely engineered and manufactured by the team. Last year, the team decided to address the problem of waste in the world that keeps on growing. With Luca, the sixth car of the family, TU/ecomotive have shown that waste can also be a valuable resource and demonstrated that even a car can be created from it.

For this year, the team decided on tackling the issue of carbon emissions. The main goal for this year is to create a functioning car that has zero net emissions throughout its life cycle, meaning from the manufacturing process to the very end of its life cycle.

The main goal of the 2021-2022 year for TU/ecomotive is to develop a carbon-neutral car made from bio-based and recyclable materials from scratch. This global goal can be split into a list of sub-goals that have to be achieved for each department – develop a monocoque chassis out of composite materials (eco-friendly); developing and implementing a steering, brake, suspension, and powertrain system for the car; programming and ensuring proper functioning of the electronics such as dashboards LED indicators, ignition operation, Drive/Parking/Reverse actuators, lights actuators; designing an aesthetic yet sustainable interior for the vehicle; design and install dashboard, steering wheel, infotainment system, glovebox and cup compartments, arm rests and other displays for rear and side view; develop and implement Direct Air Capturing system that captures CO2 from air.
MEMORIES

There are several memories that we will remember from this year. One example is the team barbeque that we had towards the end of the year, that was organized because the team won the Networking prize in the TU/e contest, where we had a lot of fun as a team just chilling and talking together, instead of only working on the car. For others, it was having meetings with the various sponsors that we had, in which they gave us new information, showed us some interesting parts and machines, and most importantly, got us further in what we wanted to achieve. Some of them gave workshops for the team as well, for example one about how to glue different materials together, or one about flow in the team. There were also quite some fun moments within the team, for example the general member meetings, or rather the meetings afterwards with beer and chit-chat were fun as well, especially if the meeting beforehand was a bit too long. Otherwise, some of the different squads adding memes about the members themselves was often hilarious to see. However, all of us working together to create an awesome car is also one of the best memories that we will have from this year (at least, if it will work that is).

MEET THE TEAM

Aurelia Kriwat  
- 1st year

Christian Friedmann  
- 1st year

Daniils Balonuskoks  
- 1st year

David Markovic  
- 1st year

Lars Hilkens  
- 1st year

Sarp Deger  
- 1st year

Vadims Kisels  
- 1st year

28 other students are part of the team

Coaches:  
Louise de Laat  
Jop van Aken

LESSONS

As a group, we have all greatly improved our technical knowledge. Every member was assigned a specific task to work on, some examples being, brakes, suspension, simulation, doors, electronics and steering. At the start of the year, we had no experience on these topics and had to learn everything from scratch. A lot of research and trial and error was done and by now, all of these tasks are in the final stages of completion, showing the immense progress.

The group has learnt how to work and collaborate with a large group of people as well as external entities such as sponsors or manufacturers. In the last year, the TU/comotive team had grown significantly and it was very important to effectively communicate and work with other parts of the team. An example of this would be between the suspension and monocoque team where both had to be adapted to one another. Every member of our group had to work with a sponsor or a manufacturer at some stage and had to set up meetings or communicate the work progress. A great example of this being the work done with EPC (Equipment And Prototyping Center) at TU/e for manufacturing of numerous components.

"We are not the monkeys, but we've got the key"  
- Scooter
ABOUT THE PROJECT

Team Polar is creating a sustainable, autonomous, and affordable research vehicle for Antarctica. "Why Antarctica?", you might ask. Well, the current research infrastructure in Antarctica is very inefficient: heavy trucks are powered by kerosene and driven by humans across largely empty landscapes. Not only is kerosene an unsustainable fossil fuel, the fact that it has to be imported via ship makes it cost orders of magnitude more per litre than in developed land. Add to this that any non-replenishable fuel imposes a range limitation on the vehicle and it becomes clear that any sort of fuel (including clean alternatives like hydrogen) is not a good fit for Antarctic research. Then we have the human element: carrying around one of us adds extra weight, consumes energy for heating the cabin and requires the transportation of food and other bulky supplies. It also requires breaks to be added and is extremely dangerous on account of crevasses in the ice which have claimed lives in the past.

Therefore, we are proposing a research vehicle that is powered by solar panels, where the dirty engine has been replaced by a battery-powered motor. We also remove the humans driving the vehicle, instead adding sensors and a guidance computer to autonomously navigate the continent.

These changes not only increase research efficiency but significantly drive down the costs of the operation, hence our three pillars of sustainability, autonomy, and affordability.

Of course, this all sounds great but in practice it is quite difficult to get this to work. Given the many challenges associated with this project, it is no surprise that past attempts at a similar vehicle have failed to varying degrees. Cold temperatures cause many headaches, among which the necessity of heating batteries, the fact that lubricants become rubbery and that plastics become brittle and weak. Add to this the difficult to navigate terrain, snowstorms, low light intensity and remoteness, and even then, you are only beginning to scratch the surface. And that’s just technical problems; getting anything to Antarctica is a bureaucratic nightmare in itself. Nevertheless, we at Team Polar are determined to pioneer a zero emission Antarctica.
MEMORIES

We have had many great memories this year so it's hard to pick just one, so we will cheat a little bit. A pivotal moment was when two of our team members, Ewout and Oscar, had the amazing opportunity to go to Antarctica and do measurements of the solar spectrum there. This was enormously valuable to the team not just for our application, but also because it brought us a ton of publicity. Our team appeared in newspapers, on talk shows and in radio interviews. Team Polar was plastered everywhere and we were suddenly on the map.

Having started the year off with no sponsors, signing our first sponsor contracts was also a great memory. This feeling of pride and accomplishment hasn't worn off even now, having gathered 12 sponsors and tens of thousands of euros in funding. We truly achieved a lot this year.

Finally, and most importantly, the easing of Covid restrictions allowed us to finally bond properly as a team. From ice-skating to drinking wine in the paddock to gender-swap parties to bowling to barbecues to secret Santa Christmas potlucks, there is almost nothing we haven't done as a team. And we have grown into one big family because of it. This means we are sad to say goodbye to some of our members that are leaving, we wish them all the best!

LESSONS

Again, it’s quite a challenge to be concise here because we have learned so much. At the start of the year, we had almost no budget, little planning on how to proceed with our prototype, and no sponsors. Oh, how the tables have turned. We learned how to contact companies effectively, to convince them of our project and to negotiate a contract with them. We learned how to make a multi-year planning and to look into the future. We solidified our vision for the team. We discovered how to make the most out of our connections to the benefit of the team. We learned how to sell the team but not sell out. We understood the real cost of parts and custom manufacturing. We discovered the kindness of the staff at innovation Space, ERES and the Honors Academy, helping us with our needs when we asked them.

If we had to give advice to newer teams, it would be this: if you need something, ask for it. Don’t wait, don’t send an email and expect a response. Go to the person directly and, if that’s not possible, call their number. Almost everyone is happy to help you and if they aren’t, no harm is done. Be proactive and convince yourself of your idea; that is the first step to convincing others of it.

MEET THE TEAM

Laurenz Edelmann (ET)  
- 2nd year

Jord Sieben (ET)  
- 2nd year

Amin Mimoun Bourass (HTS)  
- 2nd year

Niek Boksebeld (HTS)  
- 2nd year

Ioana Stefanescu (SM)  
- 2nd year

Oscar Mannens (SM)  
- 2nd year

Radu Radulescu (SM)  
- 2nd year

13 other students are part of the team

"Time to get our hands wet."
- Laurenz Edelmann
Honors Academy Staff

Kathinka Rijk
Each year, I am amazed by the wonderful results that Honors students manage to achieve in such a short period of time and on top of their regular program (not to mention in times of a pandemic). In addition to the amazing results, I see a community of talented, motivated and positive students who help and support each other throughout the program. Congratulations on the results you achieved, it really shows that when you combine innovative ideas, enthusiasm, hard work and team-spirit, magic happens! Best of luck with whatever the future brings!

Marijke van Deelen
My name is Marijke van Deelen and I work as a policy officer for the Honors Bachelor program. Together with my colleagues I develop policy and regulations that guarantee and improve the quality of the Honors program. Therefore I am also in regular contact with the Student Council, Confluentes and track coordinators. I love being surrounded by highly motivated people who want to grow personally and professionally, so working together with Honors students and staff is right up my alley! Congratulations to all graduated Honors students! And to those of you who are continuing your Honors program, hopefully see you on campus soon!

Lenny Apon
My name is Lenny Apon and I am the Education Coordinator of the Honors Academy and innovation Space. My tasks focused mainly on coordination, organization and communication. I aim to create a crossover between the great activities which takes place at the Honors programs and at innovation Space’s vivid community. I am impressed by the great honors projects at the demo market and I am happy to see some as you as a (trial) student team at innovation Space. I am sure we will see many of you with great careers as start-up or CEO of one of the organizations of the future.
Rachel van de Pol

My name is Rachel van de Pol and I am responsible for the student administration and organizational tasks within the Honors Academy for both the Bachelor and Master programs. The past two years have been challenging for all of us. I am proud of our students for their dedication and creativity in these certainly challenging times. It is great that we can once again organize campus activities and meet each other in person. Congratulations on what you have achieved this year and have a nice summer!

Evelijn van Hilten

Hi all, I am Evelijn van Hilten and the student assistant of the Honors Academy staff. I am an Industrial Design student and therefore support the staff with diverse design tasks, such as the yearbook and the Symposium. Luckily, we could host a lot of the events on campus so I could meet more Honors Academy students. I enjoyed assembling the yearbook with all your amazing projects. I hope you enjoy seeing your own and your peers’ work, and wish you a relaxed summer!