Master Thesis:
Sensor Fusion

Week of Inspiration

Meet the Board

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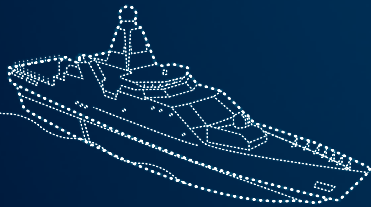## POSSIBILITIES

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Presidential note.

Dear readers,
While you are reading this you will obviously know about the great 88th board, how everything runs smoothly and of all the beautiful achievements we have made… I hope. Because while I am writing this we have had five weeks to start functioning as a board and things are starting to come along. Every day gives new adventures and no week is the same.

And during those five weeks I finally found out what it is like to be a board member, and it is strangely… civilian. You have a certain time you want to be in your workspace, and instead of just skipping classes, which I would normally do, I actually will be there and try to do some work. And instead of switching rooms and study space several times a day I have one base station where I perform all my tasks. Of course the constitution drinks made sure that I got enough of vitamin B and made me feel more like a student again, otherwise I am afraid I would one day wake up with a chest pocket grown on my shirt.

And boy those were some constitution drinks. Wonderful moments to show how much of a presence the Scintilla board could be. As we are the oldest study association, we of course expected that we would not have to wait a long time before we could present ourselves to the association we were visiting, but we were often disappointed. So as a self respecting board we often took the liberty of 'gently' forcing our way to present ourselves. Under the shouting of "WIJ ZIJN" we then tried to get to the board and maybe along the way secured some item from the other association.

Another beautiful thing about being a board member at those constitution drinks is that you meet lots of new people with whom you can drink coffee, have a beer and have a talk. Basically, all the tasks a president should perform. Sometimes even this can lead to some nice collaborations between different associations, which as an electrical engineer is a very scary thought I know, but still fun sometimes.

But we still have a long way to go as a board and settling down is only the first step to a hopefully very bright future, in which we will try to help Scintilla rise to a new level!
Dames en Heren, op de koningin, op Scintilla!

Koen Raben
President of the 88th board of E.T.S.V. Scintilla

100th Cantus Scintillae
Sign up for this historic moment on the 10th of November. You can't miss this once-in-a-lifetime event!

Ice skating
On the 14th of November, EE sports will go ice skating.

Active members activity
All active members can sign up for an activity organized especially for them on the 25th of November!

Scinterklaas
On the 7th of December, Scintilla will be visited by Saint Nicholas!

31 Junction

In this edition we interview Anne-Johan, teacher of module 3 and the new program director of Electrical Engineering.

24 Roboteam

In this article Christophe elaborates on the diversity within a new team at the University. The RoboTeam consists of a diverse group of people who will try their best to make the best soccer robot of this year.

Meet the Board! 06

They are already functioning for almost two months by now. But we do not know what goes behind the pretty faces of these cute boardmembers. Read all about these 5 idiots and their tall guy in this article.

Bachelor 13

Bas Keet tells us about his bachelor thesis: Characterization of a semi-transparant thin gold layer. Do you, just like us at the Vonk, not really understand what this title means? Read all about it in this article.

Editorial

It's that time again, a fresh Vonk falls on the doormat. And this is not just a special time for you, because it is also a special time for me, since this is my first editorial.

With two new members the Vonk team is growing stronger every year and as I am writing this, we are finishing up this edition. Meanwhile my kiddos (the two new members) are begging for me to give them more praise and attention here. And as a good dad, of course I am going to ignore them.

Marissa is having a lot of fun putting the pohto page together and hopes you will have as much fun looking at it. I'm wearing my winter jacket today. It's getting that cold already (yes I'm weak).

This Vonk's Puuzle is a nice binairy one, and as usual there is the grand prize of a cake to be won! Guus is looking great today and yes I realise this is a very incoherent editorial, but this is my first try so shh.

Well have fun reading this Vonk and good luck with the Puuzle!

Rik

The 88th board of Scintilla

During the cantus of the introduction it was not long before they were known as 'the five idiots and the tall guy'. Of course these wonderfull people are much more than that. In the following article they will introduce themselves personally.

Heya, lovely Scintilla members,

Being a board member, I would like to get to know as many of you as I can, but to return the favour I will first tell you something about me.

I am Koen Raben and will be the president of our lovely association for this year. As president I function as the face of the association, often being the first line of contact between people and the association. This means that you can come to me when you need to contact the association and in exchange you will find that I scream out a lot of very useful information in one of my speeches.

But how did I come to this beautiful position I am in now? Well it all started about 3.3 years ago when I came to this university. As a cute first year student I walked around here, not really sure what to think of all of it. Then one faithful day someone dragged me to the committee market of Scintilla. There was my do-group parent who was very glad to see me so he could actively force me to start with the first-years committee.

So there I was, now an active member of Scintilla and organizing all kinds of activities. And I got a taste for it. So after my first year I wanted more and I joined the SKIC, the committee that organizes the introduction camp. During my second year I also joined the Borrel, with which I organized and enjoyed lots of drinks throughout the year. Then came the third year, where I joined Scintilla's Committee for all likeable activities (SCALA) and continued on being active with the Borrel.

And after that year I got the chance of becoming a board member. So together

Author: the 88th board of Scintilla

E.T.S.V. Scintilla

with my other 4 idiots and Mr tall guy I am now part of the 88th board of Scintilla.

But that's my history with Scintilla, now something more about the rest of my life:

I was born in a small village in Gelderland close to the german border, in an area some of you may know as "de Achterhoek". There I lived for all of my life until I came here at the university. Now I live here on campus and greatly enjoy it. In my spare time I like to entertain myself by playing some music, as I have a wide range of instruments. Not that I can play all of them that well, but I have them, so it's something. I also try to squeeze in a little bit of sports here and there, especially running has my preference.

But the thing I enjoy doing most is having a nice talk and a nice drink with good people, be it at Scintilla, my home or somewhere else with some friends. So if you see me somewhere having a drink, join me! I always love meeting new people and you will find that I can usually give you a lot of information, whether its information you actually want, that's another thing.

So enjoy your time here, and I hope I get to meet all of you!

Koen

Hello everyone,

Hopefully by now everyone will already know me but for the people who still do not I shall introduce myself. I am Bas van Laerhoven, 21 years old and this is my fourth year at the University of Twente. Last year was quite a struggle to pass all the exams and collect EC's. Halfway through last year I decided that it would be nice to have some rest from studying in the next year and to be able to do something completely different. After my decision of taking a break next year I started looking for what I would

like to do in the next year if I was not going to study. The most interesting option for me was becoming a member of the 88th board of Scintilla.

Already from the start of my student life I have been active within Scintilla, I started as the chairman of the Parents Day committee. Being part of a committee brought me a completely new experience of having the responsibility to plan an entire day for your parents and fellow students. I liked this experience of responsibility and the satisfaction of organising such an activity for other people. So, in my second year I joined the SKIC, where together with my other committee members I could organise a complete camp for the new students. In my third year, I joined SCALA and had a fun time making new friends and organising the Christmas dinner and a lot of other activities.

So that is the story how I ended up here, the remainder of this year I will be the secretary of the 88th board of Scintilla. I hope to learn a lot about all kinds of board stuff. Furthermore, I hope to get to know all the members of Scintilla even better. As the secretary, I will be handling most of the communications of the board, this gives me the opportunity to become better in my communication skills both online and offline. Also, I will be taking the minutes of all the board and general meetings, so I need to write down all the important information and decisions, so we can keep track of what we are doing and we have something to look back to in the future. If you want to hear about me or you want to tell me your own story I advise you to come find me in the Scintilla room where I will be most of my time in the coming year!

Bas

Greetings,

My name is Gino van Spil, I am 21 years old and I am the treasurer of the 88th board of E.T.S.V. Scintilla, which means I will be in charge of tracking all the in-

come and expenses of our association. I started studying Electrical Engineering in 2014. I did not become active during my first year here in Enschede, since I was here to study after all. I also didn't live in Enschede yet. This has all changed quite a bit, since otherwise I wouldn't be doing a board year. In my second year I organized the Scrapheap challenge (now called the Moteq Re-Engineering challenge) and I joined SOT. In my third year I joined De Vonk, the committee which is responsible for the magazine of our association.

Although I didn't have my bachelor degree yet (I also failed the infamous module 6...) I wanted to do something else for a year. I wanted to learn new things and especially other skills that are not treated during the electrical engineering course. During the year I became more and more enthusiastic to do a board year, so here I am! Although I said I wanted to do something else this year I will follow some courses to obtain the last 15 EC I need and earn my bachelor

degree this way.

The choice to become a treasurer wasn't a hard one for me. I like numbers a lot, which does sometimes help during the study. Also, I was treasurer at two committees before and therefore I wanted to bring it to the next level. Being a treasurer of an association is of course something different than being a treasurer of a committee, but it is something I am looking forward to.

Next to learning a lot about finances a hope to learn also a lot of other things during my board year. I hope to get in general some better communication skills and also hope to get to know the members of Scintilla.

So that is all that I wanted to tell right now. If you want to get to know me better you can always come by the Scintilla room where I will be sitting the most of next year. I am looking forward to my board year and I hope to see you soon!

Hello Vonk-readers,

Some of you may know me already, but for those who see a new face, I'll use this opportunity to properly introduce myself. My name is Friso van den Boom and I will be responsible for the majority of the external representation of the study association. This means I will also be helping students come into contact with companies in the field, and eventually help them transition into the professional world. (at least I hope so)

So, after reading about what I am going to do, you've reached the paragraph where I talk about what I've done in the past. The story starts 21.5 years ago in a house in Wageningen, where my parents still live. I went to high school in Ede. After getting my driver's license and high school diploma, I moved to Enschede. This was three years ago and I've been studying electrical engineering ever since. During my first year I mainly

focused on my study. However, I also was a guide for the Student for a Day programme, which was fun. Nevertheless, After a year decided that I wanted to do a bit more with my time here at the university. I joined StOEL and SKItilla. I also joined the student team Green Team Twente. My time at GTT was very valuable to me, and definitely taught me a lot of practical skills that complement the education that we all enjoy. If you ever get the chance to join one of the student teams, I say: go for it.

But, to put an end to this sidetrack, I joined more committees the next year. I joined LEX and STORES, but also SCALA. I even spent some time as "interim chairman" of SCALA. Organizing the activities was a lot of fun, and so were the jovial weekly meetings. The absolute summit for me was SCALA's Christmas dinner. It was such a nice evening, and it felt great to see how much everybody enjoyed it. My second favorite committee-related experience is racing down a mountain slope with a large part of the SKItilla group. I would have never picked up snowboarding if SKItilla hadn't existed, but I'm glad I did.

But, enough reminiscing about past experiences, let's look into the future

(cheesy line, I know). This year will be fully devoted to the board year, which means I will not study for a year. After this, I will finish my bachelor and eventually try to become a master of science. I am not sure what kind of science, and hope to have picked a master by the end of the year, maybe even a company I want to work for later. And, who knows, I might have helped you find your future employer as well.

Until then, enjoy the start of the year and catch you later!

Friso

Hello members of our beautiful association,

As the current commissioner of internal affairs, most of you might know me as the guy who's going around with coffee, convincing you to join another activity or simply as the guy who's found often in close proximity to the AbScInt. I am grateful for this opportunity to tell a little more about myself, for there is a bit more to my life as a board member than coffee and beer.

Let me start of by telling you that I'm currently a fourth-year student who (hopefully) will have his bachelor's degree after this year. I have been active from my first year on, and can absolutely recommend it to all who are reading this and haven't made the step yet.

In my free time, which is unfortunately very rare these days, I play lacrosse at Phoenix Lacrosse Enschede and like to occasionally grab a drink or two with friends. I love being busy all the time, so never hesitate to ask me for help with anything. This is also why I love my function as Commissioner of Internal Affairs; being able to help so many people on various aspects of their student life.

Coming year, I hope to make a lot of people enthusiastic for the association, make new friends both inside and outside of Scintilla and improve on skills that will come in handy in a professional environment.

I'm looking forward to seeing all of you at one of our amazing activities, in the scintilla room, or even as your student assistant.

Best of luck to everyone!

Olaf

Hi all!

As a member of the new board for Scintilla, it might be nice if I'd introduce myself. Well, I am Stef van Zanten and I have been charged with all educational affairs and the administration of the STORES coming academic year. This means that, next to the general tasks of a board member, I will be safeguarding the educational quality for our members and be looking after the finances of our electronics shop. I am greatly looking forward to this task and it might be fun for you to know how I ended up here.

I was born roughly 21 years ago in Harderwijk and moved to Enschede after obtaining my high school diploma in 2014. Since then I have been studying Electrical Engineering and have been greatly enjoying my time at this university and at Scintilla in particular. I decided to join the freshmen committee (Sjaarscie) in my first year as a student, as I wanted to be active within Scintilla. I have learned a great many things from my time as a treasurer at the Sjaarscie and it laid the groundwork for me joining a new committee a year later: the SKIC. Together with a few others I have organized the Electrical Engineering Kick-In camp 2016 and again learned a lot. The past academic year I have joined several new committees: SCALA, the BHV (first responders team), the finan-

cial audit committee and the Lunch lectures and excursions committee.

With all these committees you might wonder if there was time left to study, haha. Luckily there was. I have obtained my bachelor's degree in Electrical Engineering last July after completing my thesis on the conversion of Amplitude Modulation into Phase Modulation in transceiver systems. Next to my study I have been a student assistant and I have coordinated the Student-for-a-day days (meeloopdagen) at the faculty of EEMCS. After my board year I will probably continue with a Master's degree in Electrical Engineering. But first I am really looking forward to helping our association to the next level! As a board, we are planning on several improvements that should make your studying experience even smoother, but if you have any suggestions, feel free to drop them in at Scintilla!

See you around!

Stef

Scintilla and Education

Author: Stef van Zanten

As a study association, Scintilla's primary goal is, of course, to safeguard all educational interests of her members. You could wonder, however, how the association executes this task, as some of these efforts might not be immediately obvious. Educational-related action that Scintilla takes can roughly be linked to the four pillars that the association was founded on. I will be discussing them one by one, with good confidence that Scintilla's dedication to the educational cause will become more insightful.

Expanding practical and theoretical knowledge

Many basic, practical, skills could be beneficial to Electrical Engineering students, but are not covered by the regular curriculum of the Electrical Engineering Bachelor's degree. One might think of soldering, improving one's MATLAB skills and a Microcontroller course. Since these skills can be very beneficial for the study progress and study experience of Scintilla's members, we facilitate the development of these skills where possible by organizing several courses.

On the theoretical side of things, the association offers a platform of knowledge by maintaining an exam database, a member network, and contact with various companies. Through the organization of lunch lectures and excursions we bridge the gap between students and their future employers so that our members can optimally decide what their future plans will be.

Attending to the concerns of members
In case members have requests, problems, disputes, doubts or other issues, Scintilla offers them a place to discuss these matters. The study association has access to many other institutions that could be of help and can offer advice on who to contact if an issue cannot be solved directly. Next to the initiatives members have, Scintilla also organizes regular evaluations of modules through the committee for educational affairs, StOEL.

Safeguarding educational quality

Scintilla is also actively involved in improving the overall study experience. The commissioner of educational affairs takes part in multiple meetings with several other relevant parties, of which the program director and the other study associations are the most important. We are closely involved in the development of the Teaching and Examination Regulations that contain your rights as a student. These documents have been compiled in close cooperation with the other study associations as we believe that we can achieve more when our associations combine their strengths.

The commissioner of educational affairs also actively visits lectures and lab sessions to monitor the quality of the study. Through both formal and informal channels, feedback can be provided to university staff.

Strengthening the bonding between members

Scintilla has several committees that organize activities to improve the bonding between members. Good connections within the study association and beyond can be very beneficial for problems you might encounter during your studies. Next to that, the soft skills that can be obtained by doing committee work can help you with better planning and cooperation. And of course, having fun is very important for staying motivated!

I hope it has become a little clearer how Scintilla foresees in her pledge to safeguard the educational quality of her members. Suggestions are of course always welcome! Also for any questions, you can contact the board.
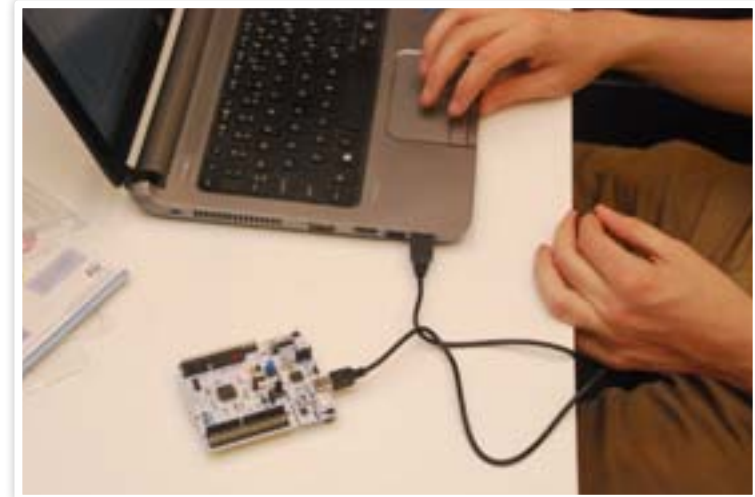
WHAT THE @#$!!#$@ THIS IS IMPOSSIBRU!

Do you have one of those dreadful subjects? More homework than you could ever handle, horrible teacher? STRESSSS??

HIT HEAD HERE

Or simply report to StOEL
http://www.scintilla.utwente.nl/stoel/
StOEL is not responsible for potential head injury

Four years later

It doesn't feel so long ago, me, sitting in the Scintilla room before a Cantus, proudly announcing that I managed to get a job at Thales as a software engineer. But it's been over four years! Some things have changed in the meantime; I changed jobs (not employer), met my now-boyfriend, moved house (started building one as well… but that's a whole different story of mostly waiting and therefore boring), attended less and less Scintilla gatherings and got two cats. Student life definitely over. As I could definitely feel the morning after the last Zomercantus!

Author: Jet van Dorp

(C) Jenne Hoekstra

But as this section is trying to tell you: there's life after graduation. I tried to lengthen my student life by becoming a PhD-student, but that was not the afterlife for me. I quit and found a new job (as mentioned above) at Thales, as a software engineer.

> *"There's life after graduation."*

Most of you should at least know the name Thales – there's excursions and advert(orial)s in the Vonk, there's sponsorships of things like Create Tomorrow and the Solar Team Twente. But with a name taken from a Greek philosopher, just knowing the name doesn't give you a lot of information. Ask an older employee at the university – do they know Signaal? We've been in business since 1922 and have been making (naval) radar systems since WWII. Thales Netherlands now no longer just produces radar, but also a combat management system (an OS for your ship and its various sensors and weapon systems), OV-chipcard readers and gates, military communication devices and even serious games (although technically that's

in cooperation with the UT). We also collaborate with an Electrical Engineering professor, prof. Frank Leferink! And this is the end of the infomercial.

As mentioned, I started as a software engineer, but have since changed jobs and am now a technical author. Heh, yeah, that does not mean I'm writing things like this all day and being all technical about it. My colleagues and I write user manuals for the radar systems that Thales produces. And it's not little booklets that end up in the trash

first thing after you buy one. Our systems are rather complex, not only to operate (although we try to keep that as simple as possible!) but also to maintain (again, we try to do our best, but even your bike needs at least preventive maintenance, as do our systems). We write about how your radar works (in principle, not too much detail) and write procedures to keep your radar up and running, and, just in case something breaks down, how to replace parts. In order to do so, we work together with

almost every other department there is, finding things out, trying things out.

> *"…we work together with almost every other department there is, finding things out, trying things out."*

The nicest thing about my job is that it's very diverse. One week I'm trying out how to get that server out of its rack and describing the procedure, the next I'm writing an instruction for the shipyard on how to install the antenna of our newest radar (humblebrag, maybe you've heard of it, SMART-L MM, it's the only one that can track ballistic missiles). I am 'head author' on two 'products', the SMART-S Mk.2 being one and all hardware for our Combat Management System Tacticos being the other. Next to these two, I'm also working on different products (like SMART-L MM and the

Goalkeeper), as we're only a team of 10 people. We try to keep the 'switching tasks' to a minimum though.

As for the 'life' part – I try to enjoy as much free time as I can, working 90% (1 day off in alternating weeks! Useful for writing this Afterlife, which I'd promised to finish last week… Sorry Vonk!) but during my working hours I've also managed to wiggle in some 'fun stuff' (the work is fun, but hey, I'm paid to do that anyway). I'm a mentor to one of the members of the Solar Team Twente, try to be available for tours of the company to students (have guided Thor, but not Scintilla sadly) and every Thursday I have lunch with my mate Erwin (who works as a software engineer and architect-to-be for Tacticos). In my actual spare time I run (quite a bit), watch too much TV and movies and collect LEGO. Having a bit of wine with my friends (most of whom I met during my student life) is how I perpetuate feeling like a student every now and then.

However, as an engineer, you're never done learning. You'll be a student again at some point in your future career, albeit for a much shorter period. Last summer, I did a summer school in Den Helder on maintenance (there's a lot I didn't know, being an Electrical Engineer and not really specialised in me-

> *"…seeing all those ships with 'our' systems on it made me feel incredibly proud."*

chanical). The case of the week was on maintenance on Navy ships. Walking around the Navy harbour, seeing all those ships with 'our' systems on it made me feel incredibly proud. Our little country, with one of the oldest Navies in the world (it is – look it up!), with the amazing technology that is made in Twente, by people like you and me.

(C) Jenne Hoekstra

Ooga Chaka

Matthijs van Minnen

After a year of working on the 0-Vonk (the special edition during Kick-In) I got the opportunity to write a piece for the real version. Unfortunately this is not as easy as it sounds. A full year of preparation on what is supposed to be a perfect camp leads to three days of organized chaos, at least for all the freshmen… For the members of Scintilla's Kick-In Committee these three days are complete chaos. There is not much time to socialize or make friends with the new year full of excited Electrical Engineers, since you're constantly running around. So very little time to get a good impression of all the new students.

Luckily, many interesting situations arise when you include many people with the same mindset, a limited amount of sleep and a seemingly endless supply of beer. When asked for memorable situations I would like to refer to the first evening during the 'Dropping'. The freshmen were dropped at a location far away from the actual campsite. The candidate board at the time was supposed to be located in the middle between freshmen and campsite. After dropping half of the freshmen we realized nobody had spotted the candidate board yet. So we went to check it out.

What we found was the candidate board and obviously, they had gotten bored. They were given a supply of beverages for both themselves and the freshmen.

By the time we got there, they had finished both. There were no freshmen there anyway so it wasn't a problem, but it did make them more cheerful. We realized that in their current location, nobody would visit them. So we packed up and loaded all the stuff in the van. Surprisingly, a 20kg beer-table wasn't the hardest to get into the van. Instead, it were the candidate board members. It was at that point that we realized we shouldn't relocate them but instead bring them back to the camp location.

The ride there was interesting to say the least. Perhaps they should consider a career change as they could certainly start a six-headed boy-band. The song that immediately jumps to mind is

'Hooked on a feeling' normally performed by 'Blue Swede' but that night exclusively by the candidate board. Whilst most members introduced the song by starting the: "Ooga-Chaka-Ooga-Ooga", the External Affairs to be took the floor as lead singer. To add to the immersion, the beer-table was used for drumming. Surprisingly, they knew the entire song as well as the lyrics, which made the ride home so much more entertaining.

It is confronting to see so many people having fun whilst you have been running around to get everything arranged. And it might seem like the camp is a complete hell, but the opposite is true. Looking back at a successful camp with over 80 happy freshmen is very satisfying. It is no wonder that year after year the committee is filled with enthusiastic idiots that are willing to sacrifice mind and personal health to deliver an experience that is shared by each member of Scintilla. With the committee as a whole we are looking back at a year with maybe too much fun organizing which resulted in a camp where everybody had his or her own interesting stories to tell.

Characterization of a semi-transparent thin gold layer

Author: Bas Keet

Speed, size and efficiency. These factors play a formidable role in the analyzation of proteins in the human body. Our bodies contain a roughly estimated amount of 100.000 unique proteins. We have only identified about 17.000, the limiting factor here is speed. A lot of our proteins deteriorate and break down quite fast, faster than we are able to separate and analyse them. In order to increase this number we thus need to step up our speed.

Separation of the proteins or other analytes is often done with chromatography. Due to the different sizes of the analytes, they will take less or more time to go from the mobile to stationary phase, see Figure 1. This separation of analytes can be increased by 'shaking' the liquid in the mobile phase. With this shaking we mean an additional vortex like movement next to the normal propagation of the liquid in the mobile phase. This will decrease the time needed for analytes to move from the mobile to stationary phase. Once the analytes are separated in the stationary phase, they can be further analysed. This 'shaking' can be created by electro-osmotic flow; flow of a liquid due to an applied electric field. In order to create this electric field an inert and highly capacitive electrode is needed. Inert because the electrode should obviously not react with the liquid or analytes in the channel and capacitive in order to create the electric field. The larger the capacity, the more electro-osmotic flow can be generated and the faster the separation. However, as an additional requirement for the electrode it should also be transparent. This is in order to be able to analyse the induced electro-osmotic flow with luminescent particles.

Now, my assignment was to see if I could create and characterize an electrode that might be able to create a larger electric field then the semi-conductor ITO (indium tin oxide). Therefore, I measured on a conductor and mostly inert material; gold.

Gold is not really a transparent material, but by using only a very thin layer transparency can be achieved. This was done in the Nanolab by depositing a 25 nm layer of gold on a MEMpax waver by sputtering. Between the MEMpax and the gold we deposited a 8 nm layer of titanium for additional adhesion. This
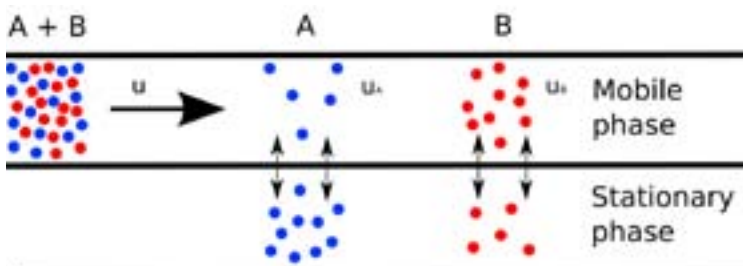
Figure 1: Example of mixed analytes being separated by chromatography.

Figure 2: The MEMpax/Ti/Au wafer after fabrication.

composition of layers (MEMpax/Ti/Au) resulted in a transparent waver with a yellow glow as can be seen in Figure 2.

For the measurements an electrochemical cell was used. This cell contained a KCl solution and the working electrode in Figure 3 corresponds to the gold layer. With this setup the working electrode acts as a donor or acceptor for the electrons participating in the oxidation and reduction reactions. The reference electrode keeps the same potential between itself and the working electrode. The counter electrode ensures that the current does not run through the reference electrode. This setup makes for accurate and sensible current measurements on the reaction of the working electrode to specific voltage sweeps. As for the electrical engineering part here, this cell can also be characterized by an electrical equivalent. This equivalent consists of the solution resistance, the double layer capacitance (the capacity of the gold layer in the KCl solution) and a faradaic impedance. This faradaic impedance can be split into a series re-

Figure 3: Electrochemical cell setup. Adapted from "Fundamental Electrochemistry", K. Ward (2012). Retrieved from http://compton.chem.ox.ac.uk/index.php?title=research&topic=fund.

sistance and pseudo capacity. Figure 4 gives this representation.

But of course, simply measuring the resulting current from an applied voltage would be too straightforward. Within this electrochemical cell there will not only be a current due to the capacity of the working electrode but also a current due to some faradaic processes. These faradaic processes are reduction and oxidation processes that occur within the solution and at the surface of the several electrodes. While the charging current depends on a changing voltage over time the faradaic currents are constant for given voltages. By using a combination of cyclic voltammetry and staircase voltammetry the correct current can be measured [1], [2].

The current that we want to know is the charging current of the capacity of the gold layer. With cyclic voltammetry a linear voltage sweep is applied. In this case both the faradaic current and charging current are measured. However, a capacity only generates a current when a change in voltage is perceived. Using a staircase like voltage sweep with the same slope and correct sampling time the charging current can be avoided. After these two measurements it comes down to a simple subtraction to get to the charging current. With the current and scan rate (thus change in voltage) known, the capacitance is again a simple division. From this measurement the capacitance ranges from 0.632 to 1.17 F/m^2. This large range is due to the capacitance of the double layer depending on the scan rate. A higher scan rate gives a smaller capacity. This range was obtained with a range from 0.025 to 0.4
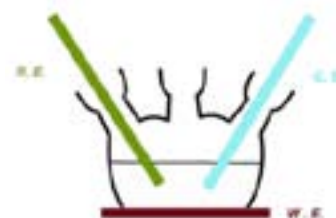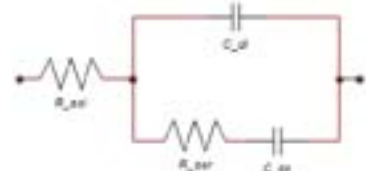

Figure 4: Representation of the equivalent of the electrochemical cell.

V/s as scanrate.

To get these values was quite the challenge. I had to find out the hard way that using large voltages resulted in the gold layer oxidizing and breaking down. This made measurements inconsistent which is really the worst kind of result. What seems fine at first gives a horrible result in a repeat of the measurement. Anyhow, a range between 0.5 and 0.8 V worked and was used.

Using one method to determine the capacity is not that reliable, thus I used two. Another way of determining the capacity of the gold layer is by electrochemical impedance spectroscopy (EIS) [3]. EIS also uses the setup from Figure 3 but uses a frequency sweep with low amplitude sine waves. From the resulting phase shift and magnitude a bode plot can be made [1]. Since the equivalent of the electrochemical cell is a simple R-RC circuit (the pseudo capacity can be neglected here) the charging capacitance of the gold layer can simply be derived from the bode plot, Figure 5.

From the low frequencies in this graph the capacitance can also be calculated. Next to that the resistance of the solution and gold layer can be derived from the higher frequencies.

$$Zhigh = Rsol \text{ and } Zlow = 1/(j\omega Cdl)$$

But in this graph you can already see that for high concentrations the behaviour of the electrochemical cell starts to deviate. This deviation is because of the Debye-Hückel length [4]. The capacity measured on the gold layer is because of a double layer. This is created since charge cannot cross the interface between the electrode and electrolyte if the potential across it is changed. The charge on the electrode (made by electrons and holes) will be mirrored by the electrolyte (created by anions and cations). The whole array of charged species and oriented dipoles at the electrode-elec-
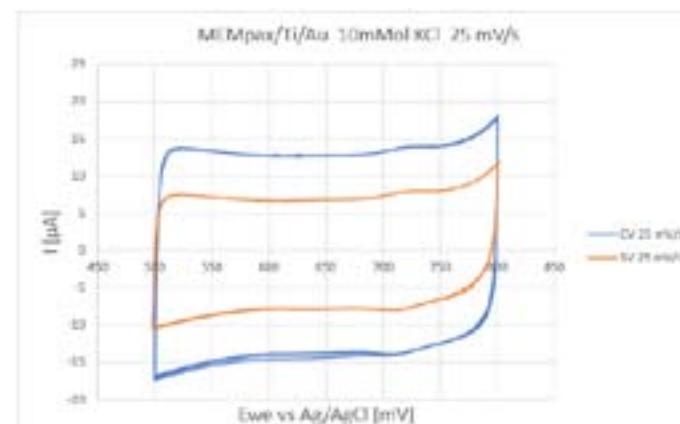

Figure 5: Comparison of the current from a CV and SV at 25 mV/s.

trolyte interface is the electrical double

$$\kappa^{-1} = \left(\frac{\varepsilon_r \varepsilon_0 k_B T}{2 c^0 z_i^2 e^2} \right)^{\frac{1}{2}}$$

layer. The double layer thickness can be described by the Debye-Hückel length. This length depends on the concentration of the electrolyte. For large concentrations this length becomes really small. At some point this length becomes less than the roughness of the electrode. This means that the electrode will not function as a smooth electrode anymore. The electrode will start behaving more like a porous electrode. This behaviour means a larger surface and thus a higher capacity. However, it also means a lot of parasitic capacitances. This behaviour is not really predictable and should thus be avoided in practical applications.

The capacity as derived from the EIS measurement was around 0.671 F/m^2. For this result the higher KCl concentrations were not used because of the porous behaviour that these show.

With the taken measurements it can be concluded that a semi-transparent gold electrode can function as an inert electrode for double layer charging in several KCl concentrations. If the concentrations become too high the elec-

trode will include constant-phase elements thus changing the impedance to a more complex structure than a simple RC-circuit. The other downside is the voltage range. This range is now rather small but luckily this can be increased. In order to do this other solutions than KCl could be used or the pH of the solution could be buffered [5]. By buffering the pH the start of reduction and oxidation reactions can be shifted to a different potential.

Furthermore, the charging current of the gold layer is quite linear with respect to the scan rate. This means that the double layer capacitance also behaves linearly with the scan rate. And linearity is nice since it makes calculations easy. The capacity as measured by CV
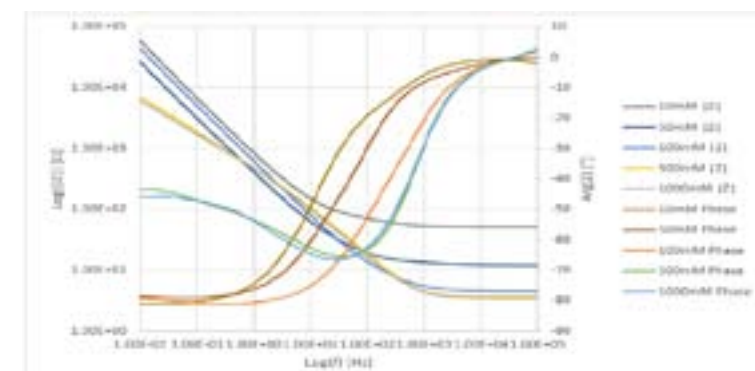
with 10 mMol KCl is around 0.66E F/m2. According to EIS the capacitance is 0.67 F/m2 which is quite similar. Considering this capacity, the gold electrode is better than ITO. While ITO has a capacity of 0.17 F/m2 that of gold is almost four times larger. The drawback at this point is that there are still some faradaic processes interfering in the measurements. If these are removed or a different more non-faradaic potential window is found, gold could be a better double layer capacitor then ITO. We still have to consider the yellow glow of the electrode and the limited current rage, otherwise gold is a very good alternative to ITO.

[1] A. J. Bard; L. R. Faulkner (2001). Electrochemical methods fundamentals and applications. New York: John Wiley & Sons, Inc.
[2] R. G. Compton; E. Laborda; K. R. Ward (2014). Understanding Voltammetry: Simulation of Electrode Processes. London: Imperial College Press.
[3] Basics of Electrochemical Impedance Spectroscopy (2017) [Application Note]. Retrieved from https://www.gamry.com/application-notes/EIS/basics-of-electrochemical-impedancespectroscopy/
[4] A. M. Bond; F. Scholz (2010). Electroanalytical methods: guide to experiments and applications. New York: Springer.
[5] J. B. Bushman, A Brief Explanation of the Nernst Equation: Its Importance in Explaining Anode and Cathode Polarization and Potential Changes. Medina, Ohio USA: Bushman & Associates, Inc.

Figure 6: EIS for five different KCl concentrations.

The Week of Inspiration:

A look at the event and one of its topics, Fusion Power

Authors: Idwer de Vries, Leon Smook. Levi van der Heijden

The Week of Inspiration is held every year at the University of Twente a week before the Dies, this year from the 20th of November till the 24th. It involves inspiring lectures, workshops and a 'Happening' event, where the Week of Inspiration concludes with a combination of cultural enrichment and entertainment.

At the Week of Inspiration, there is always something for everyone. From topics digging deep into the core of natural sciences such as 'The Scientific Challenges of Fusion Power', presented by Steven Cowley, to more social topics such as 'The Illusions of Consciousness' by Susan Blackmore, writer of the book 'The Meme machine'. The talks by the several speakers are structured by first having a small TED talk-esque lecture about their topic, followed by the possibility to have a discussion with the speaker about the topic. The goal of these talks is to spark interests in topics you might never have thought about, thus inspiring and stimulating the discovery of new interests!

The Scientific Challenges of Fusion Power

At the beginning of the 20th century research into nuclear fusion was sparked by a discovery of Francis William Aston. In 1920 he found that the mass of four hydrogen atoms is higher than the mass of one helium-4 atom. This gave rise to the notion that by fusing hydrogen atoms into helium mass may be converted into energy. Over the course of the following years knowledge on the mechanisms of nuclear fusion was expanded gradually.

The Manhattan Project increased interest in nuclear fusion. A result of this was that in 1946 a first patent for a design of a nuclear fusion reactor was patented by the United Kingdom Atomic Energy Authority (UKAEA). This design was a first so called Z-pinch reactor.

In a Z-pinch reactor electrical properties of plasma are exploited. Plasmas are conductive, so when a current runs through the plasma a magnetic field is created around the plasma. This field creates an inward force, which increases the plasma density. This increased density has a higher magnetic field as a result, which means an even greater inward driving force. This causes extreme plasma densities at extremely high temperatures; perfect conditions for nuclear fusion. Simultaneously, this causes one of the main problems with these fusion reactors. The extreme temperatures are damaging the reactor beyond repair, so before any useful energy is retrieved, a meltdown will take place.

The problems encountered in the first Z-pinch reactors continued to be major challenges in nuclear fusion. Not only is it imperative that the plasma is controlled, but also the conditions should be sufficient for nuclear fusion to occur.

Those issues are strongly connected.

First of all, extreme temperatures - several million Kelvin - need to be reached in the reactor. In order to achieve these temperatures, several methods have been tested. One of the first methods applied was nuclear fission. This method was mainly used during the cold war in order to optimise nuclear weapons. The heat that is produced by the nuclear fission compresses and heats the nuclear fusion fuel. This sparks a nuclear fusion process in which neutrons are expelled. These neutrons then cause further fission which gave a detrimental increase in the effectiveness of the weapon. However, this technique seemed non-viable for energy applications.

> *"The other challenge is the confinement of plasma in the reactor."*

The development of laser technique in the 1960s gave rise to new insights on how to enable nuclear fusion. From the 1960s onwards more and more ultra-powerful lasers were developed and applied in experimental setups for nuclear fusion. This method has been developed so far that a functioning prototype of a fusion reactor is planned for this year and that should be ready for operation in 2022.

The other challenge is the confinement of plasma in the reactor. The plasma should be kept separated from the walls of the reactor, since these cannot withstand the extreme temperatures. There are several methods to ensure this separation. First, magnetic confinement can be used. This is the technique behind the aforementioned Z-pinch reactor. Besides magnetic confinement, also electrostatic confinement can be used. Here, an electrostatic field is created by a cathode inside and an anode wire cage.

The charged plasma ions will accelerate toward the centre due to their positive charge. In the centre of the reactor they might then fuse with another incoming ion. Finally, inertial confinement is used [7]. In this method a fuel target is packed in a pallet. This pallet is then compressed with the aid of a laser. The increased density then enables nuclear fusion.

But even when there is no physical contact between the wall of the reactor and the plasma, heat will still be transferred by radiation. As a result, the reactor walls need to be cooled continuously to prevent a melt-down.

There are still many challenges concerning nuclear fusion, yet continuous efforts to understand and control the mechanism have already resulted in several small scale prototypes. These may not yet produce net energy, but they are a good start. If the development of this technology continuous to progress, nuclear fusion might grow out to be one of our primary energy sources. Since about 0.015% of hydrogen isotopes are deuterium, nuclear fusion based on these isotopes can possibly supply the world with an energy source for at least several millions of years.

The major potential of this technology ensures that a lot of research is done on it. One of the key figures in this research is Steven Charles Cowley. He is a theoretical physicist and international authority on nuclear fusion. He has contributed to several international research projects in fusion reactors, such as the Joint European Torus (JET), and the International Thermonuclear Experimental Reactor (ITER). On the 23rd of November from 12:40 - 14:00, Steven Cowley will visit the University

> *"As a result, the reactor walls need to be cooled continuously to prevent a melt-down."*

of Twente as part of the Week of Inspiration.

Want to learn more about the Week of Inspiration, the speakers and their topics, the several workshops we will offer and the Happening event, which will involve Christiaan Kuyvenhoven, famous actor and pianist who studied at the Michail Markov music school in Enschede? Like us on Facebook @weekofinspiration or go to our website, www.utwente.nl/weekofinspiration!

Steven Cowley, Presenter of one of the talks.

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KAMP-drink

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Pubquiz

Sensor Fusion

Author: Kevin Selman

Hi, I'm Kevin! During my master Electrical Engineering, I chose a specialization in 'Biomechatronics & Neurotechnology', which is coupled to the 'Biomedical Signals & Systems' group. After searching for a suitable topic for my master thesis, I stumbled upon a very interesting topic in collaboration with the company Xsens Technologies B.V..

The subject they described for my research was: "Development and Validation of a position aiding system for inertial motion capture using Microsoft HoloLens". In other words, the topic was focused on sensor fusion of an inertial motion capture and a computer-vision based device. This new system had to be developed and validated. The two systems used for this were: the Xsens MVN Awinda (inertial motion capture) and the Microsoft HoloLens (Computer-Vision based device). There's a reason why we want to fuse these systems together, and that's due to errors in absolute position. I will explain it in a bit more detail below.

In inertial motion capture, inertial measurement units (IMUs) are attached to specific body segments and their data is fused to derive segment orientations. Using these orientations, the full body pose can be reconstructed accordingly. Absolute position is acquired through double integration of the acceleration data. However, using double integration of accelerations directly to estimate position will result in significant drift. To solve this problem external contact updates through zero-velocity updates are utilized to improve absolute position estimation. Even though these methods

are applied, accumulated errors in calculated sensor orientations cause errors in absolute segment positions compared to the real-world. To decrease the absolute position drift, my thesis was focused on validation and development of a Computer-Vision device to improve the absolute position estimate and create a new combined accurate system enabling fully 6-DoF ambulatory motion tracking. Combining these points of interest, a research question was defined: "Can an inertial motion capture be fused with a Computer-Vision based device to create an accurate ambulatory system with respect to absolute 6-DoF position tracking?"

A secondary device was introduced to help improvement of determination of the absolute position: the Microsoft HoloLens. This device was used, because it does not hinder the primary system in any way: it is portable and easy to set-up. Furthermore, it might be accurate in position tracking due to the recognition of the environment. Systems like GPS are not usable indoors, Ultra Wideband (UWB) system require stationary base

stations and are thus not portable and systems like ultrasound tend to have problems due to obstruction, reflection and interference. The Microsoft HoloLens uses Visual Simultaneous Localization and Mapping (V-SLAM) to extract features from the environment to create a virtual map. From this map information about the environment can be coupled and an absolute position of the user can be estimated. The cameras of the system are the sensors and provide visual data, which is processed to estimate absolute position according to the environment around the device.

The Microsoft HoloLens first had to be validated to know how accurate it is in absolute position tracking. Validation of signals from two systems wasn't as easy as you might think. The signals had to be interpolated, synchronized in time and global coordinate systems had to be aligned. Interpolation creates extra data points in a signal, to increase the number of samples. The Microsoft HoloLens was operating around a sample frequency of 60Hz, but was never stable. This interpolation stabilized the sample frequency, so the system could be compared sample by sample to the inertial motion capture running at a steady sample frequency of 60Hz. The second

part is synchronization in time. This is required due to both signals not starting at the same time. To solve this problem, the cross-correlation was calculated to find a dependence between both systems. The higher the value, the more related the systems are. By doing this over the whole signal, the highest correlation can be found over the samples in the signal. The difference in samples can be shifted, which results in a synchronization in time. Last there is still the problem of incorrect global frames. Movement over a single axis in one system does not relate to the same movement in the other system if they are not aligned. By transformation and rotation, one system can be aligned to another system. In my research I used an iterative closest point (ICP) algorithm, which tries to find an optimal 3D transformation from one frame to the other. This is done through comparison point-to-plane calculation of the least sum of squares, resulting in optimal transformation and rotation matrices used to transform one global coordinate system to the other.
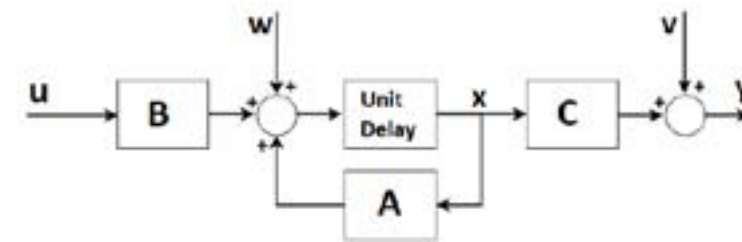

Figure 2: Kalman filter state-space transition model.

Sensor fusion (or combination of the signals from both systems) was performed using a Kalman Filter, which is more an estimator rather than a filter. When programmed correctly, the Kalman Filter combines two or more systems and creates an optimal estimate from the inputs given. In my case, the Kalman Filter should provide an accurate absolute position estimate from the information given by the inertial motion capture and the Microsoft HoloLens. Two algorithms were created to correctly fuse the systems and acquire an accurate estimate of absolute position. This was all first tested and verified in Matlab and later applied in a real-time

application in Unity.

The combined system showed to be indeed more accurate. Over movement over the transverse plane (horizontal movement) an accuracy of under 0.1% drift in absolute position tracking was reached, compared to 2% in the inertial motion capture. This reduction becomes more noticeable over longer distances travelled. For example, after walking 1000 meters, 2% drift would result in a possible 20 meters difference in measured position compared to where you actually are. For the new combined system created, this is reduced by 19 meters over the exact same path. This allows to more accurately determine the position of the wearer of the system. The drift over vertical displacement was almost 0%, due to the algorithms already applied in the inertial motion capture.

So, "can an inertial motion capture be fused with a Computer-Vision based device to create an accurate ambulatory system with respect to absolute 6-DoF position tracking?" Yes it can and even in real-time! Unfortunately, the exact details of the algorithms created are secret and the results are not public yet. You can always ask me to have an interesting discussion about this topic. However my created algorithms are secret. Many more systems can be fused to create a more stable or a more accurate system. Maybe you will be the one with an incredible idea to combine two or more systems through sensor fusion in the future and create new algorithms on your own!

Figure 1: Xsens MVN Awinda (inertial motion capture) suit.

Superbike

Electric Superbike Twente is the youngest student team of the University of Twente. The idea started with the urgent need to deploy a real racing team. In March 2017, the two founders, Tim Veldhuis and Lars Haarmeijer, published their idea. Together with 3 others, the core of the team was formed. The first finance was found in QING, promotion was done together with Electric Motorcycles, job applications were done and finally: the team was complete just before summer 2017!

The mission

What is the purpose of starting another student team? The thing is, current (automotive) teams are mainly focused on efficiency. But what if that doesn't trigger people to change their current transportation routine? Then we just keep driving gasoline cars and motorcycles, without moving forward. The acceptance of new techniques in any field is always hard. To accelerate the transition to sustainable techniques, sustainability should offer more than just the same experience. Sustainable transportation should be better, in order to convince people to switch. The mission of Electric Superbike Twente is exactly that: we want to show that sustainability is cool, exciting and fun, and offers better performance!

The team

During this first year, 15 enthusiastic students want to prove that one year is enough to design and build an extremely fast, fully electric motorcycle. Five team members form the mechanical team (mechanical engineering, civil engineering, advanced technology) and will mainly focus on designing a custom frame. Of course, more mechanical components are involved, and those will be carefully selected by the mechanical engineers. Five others form the electrical team (electrical engineering, applied physics).

This team will build our own battery and management system and our own vehicle control. On top of that, we have students from industrial design and international business administration. We work full time in the Future Factory, which is our building together with Green Team Twente, right in front of the main entrance of the campus.

The race

Everything we do this year will come together in August 2018. We will compete in the MotoE-competition. Opposed to most race classes, this competition allows a lot of free thinking and engineering. Most rules aim to ensure safety of the drivers. This means that almost all technical specs are free of any limits.

Author: Jeroen Goudswaard

The challenge

Anybody who is not an engineer always says: electric vehicles are simple. Just a battery and a motor with one moving part. In reality, things are slightly more complicated. All components should be closely measured: the battery pack, inverter, driver, stress on the frame, suspension behavior, and a lot more. Again in reality, things are even more complicated. In automotive applications, everything, but literally everything, is connected to each other. All sensors deliver their measurements multiple times per second, and the vehicle control systems need to react accordingly.

> *"In reality, things are slightly more complicated."*

Battery management

In the battery pack, a lot needs to be measured continuously. Our design features close to 1500 Lithium-Ion 18650 cells, with a maximum power output around 150 kW (approximately 500-700 V with 300 A). The pack is split in multiple parallel modules. In the pack, we need to measure the temperature of the cells, coolant and air. Naturally, we want to know voltage and current of every module as well.

> *"Damaging a few too hot battery cells seems like an easy choice, but what if this may reslut in a fire?"*

Of course, charging and discharging of the cells introduce their own complications. During charging, the cells need to be balanced, kept in their temperature range, not be overcharged and what not. The same holds for discharging, but with the advantage that we can lose a lot of heat to the air, since we are speeding our way to a maximum of 250 km/h.

Inverter and motor

Logically, the inverter controls the motor. Depending on the driving dynamics we aim for, we need to program the vehicle controller that is connected to the inverter. What behavior do we want the motor to have under full acceleration? Do we want to limit the maximum allowed slip of the rear wheel during ac-celeration? Do we want a motor brake feeling when letting go but not yet braking? This list goes on and on, and this is just the simple management of driver input to motor output. On top of that, the vehicle controller will take all the sensor data into account as well.

Everything comes together

Now the fun part: combining all sensor data, driver input, safety regulations and desired output. This is not just as simple as making choices based on one or two inputs. It is merely making choices based on safety. For example, a too hot battery should not cut off power when the driver is in a sharp turn. That may result in a crash and severe injuries of our driver. The next question in this example is: do we allow the driver to accelerate while one of our sensors reports a problem? What means safety in this case? The driver may want to accelerate out of a possible accident. Damaging a few too hot battery cells seems like an easy choice, but what if this may result in a fire? Or what if the stress on the frame is too high, and yet the race situation is too dangerous to limit anything on performance?

Since we only started in September, we now have a lot of questions. In 2018, we will have an awesome, super-safe, super-fast and electrifying superbike. It will accelerate to 100 km/h in under 3 seconds, whilst also accelerating the adoption of electric transport!

Want to know more?

We have a super-fast website (like our superbike), in case you want to know more (superbiketwente.nl). Of course, feel free to contact us via info@superbiketwente.nl and follow us on Facebook, Instagram, Twitter and LinkedIn.

RoboTeam
Of diversity and dynamics

Author: Christophe van der Walt

In supercurricular student teams such as the RoboTeam, all sorts of interesting blends of people form. Competing in the small sized league of the RoboCup is no mean feat, and as such, quite a sizeable team is needed in order to make this happen. On both an academic and a cultural front, diversity within a team can lead to lots of interesting ideas and ways of working, on one end, as well as miscommunications and misunderstandings on the other. With that in mind, we're going to spend the next few hundred words looking what sort of consequences one could envisage this having on our dynamic as a team.

Let's first take a look at the electronics team. Academically speaking, they're not a very academically diverse bunch as they all come from electrical engineering backgrounds. This does have the advantage of clear communication lines, seeing as they all come from the

> "This makes for quite a varied and elaborate set of ideas on how to tackle any given problem."

same study and are used to the same way of tackling problems, which saves on an initial "getting used to another person-phase" that a lot of new teams have to go through. In terms of nationality, however, matters are different. Electronics only boasts one fully Dutch person, with others from Argentina, Croatia, France, and China. While I don't see this having too much of a direct effect

on the team dynamic, you never know what might come of this. Having different points of view on the world around us (even if it isn't electronics related) is never a bad thing where working as a team is concerned, in my opinion.

On the other hand, the software team is quite the opposite. In terms of cultural background, we're quite boring. All of us have Dutch passports, and the only person who isn't fully Dutch is me, but if I trace my South African lineage back far enough, I'll probably find I come from the Netherlands on that side as well. One advantage this gives us is that we have the potential to be versatile in terms of what language we use to talk about things. If we can't find a word in English, the Dutch word would do fine too, which might make for less halting conversations at times. Our own diversity is in our various educational backgrounds. Technical Computer Science is obviously well represented, but we have members from AT and BMT as well. This makes for quite a varied and

elaborate set of ideas on how to tackle any given problem, seeing as we've all been taught differently. As far as I'm concerned, this always makes for a better finished product, seeing as typically all angles of it have been covered.

Finally, we have the mechanics "team", composed of one Dutch mechanical engineer. Working alone does circumvent the problem of internal communication altogether, but also puts all the responsibility on one person. There isn't much else to say on the diversity front, where mechanics is concerned, unless the person in question turns out to have a split personality disorder.

This was all just to point out that ours is quite an interesting group in terms of diversity. Obviously, the main driver of our team dynamic is going to be the complementarity of our respective personalities, but it's interesting to speculate as to what kind of an effect such diversity could have. Whether any of this is accurate, even in the slightest, remains to be seen. We've only been working together for three weeks as of the writing of this paper. I am nevertheless hopeful with regards to how well we work together.
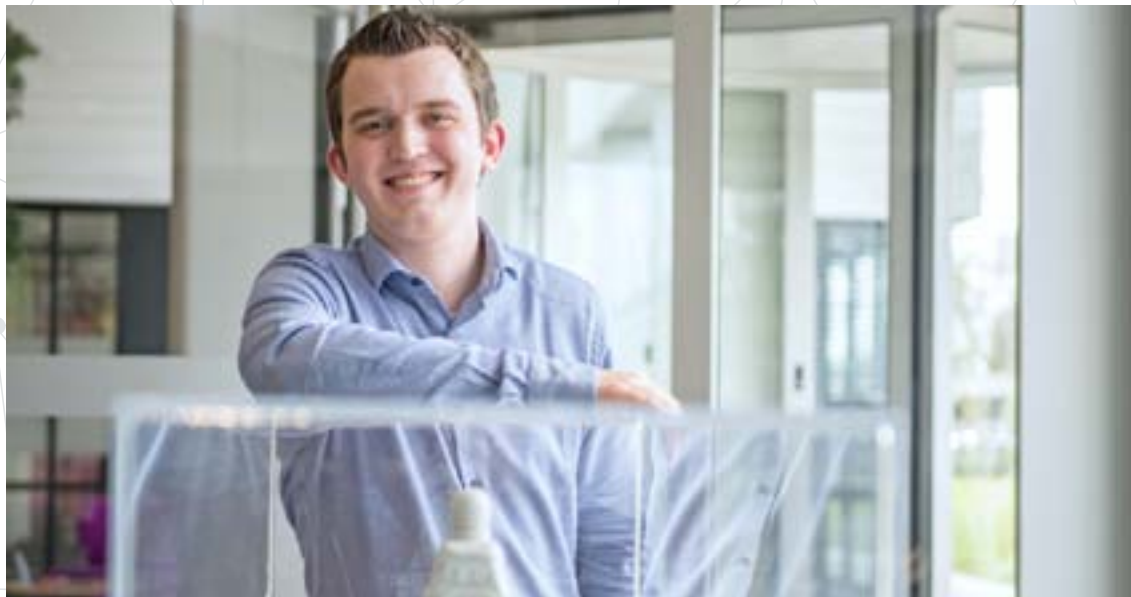
Pak **jouw kans** bij Thales

''Hallo, mijn naam is Colin Heppener. Ik ben 20 jaar oud. Ik ben derdejaarsstudent Informatica aan de Haagse Hogeschool. Ik heb net mijn stage bij Thales afgerond. Ik kende Thales niet, maar toen ik op het HBO-i-job evenement in Rotterdam was, kwam ik in gesprek met ze en toen ik hoorde dat ze zich bezig houden met allerlei gave technologie voor onder andere de Koninklijke Marine werd ik steeds enthousiaster. Ik stuurde daarom een open sollicitatie en kreeg al snel een reactie terug met een aantal mogelijke stageopdrachten.

HIGH TECH CAMPUS

Ik ben in november gestart op de afdeling Application System Engineering bij Thales op de vestiging in Hengelo. Ik had weinig van de stad Hengelo verwacht, maar ook door de omgeving werd ik verrast. Thales is gevestigd op een campusterrein met allerlei high tech bedrijven en heeft zelfs een eigen Starbucks. Van Thales kreeg ik naast een stagevergoeding ook een vergoeding voor mijn huurkosten, daardoor reisde ik enkel nog in de weekenden naar huis.

VEEL ANDERE STAGIAIRES

Ik werd goed ontvangen door de afdeling en voorgesteld aan veel andere stagiairs. Bij Thales hebben ze zo'n 150 studenten per jaar die stage lopen en afstuderen. Ze hebben ook hun eigen studentenvereniging die allerlei activiteiten organiseert. Heel leuk om zo andere studenten te leren kennen en te horen wat er bij verschillende vestigingen en afdelingen gebeurt. In de stageopdracht die ik heb gekozen zorg ik voor de uitbreiding van een bestaande game genaamd Naval Robocode. Het is een game waar het gedrag van een schip geprogrammeerd wordt om het vervolgens op te nemen in een missie tegen andere schepen. Het doel van de game is om zowel met de Java-taal te oefenen als strategische beslissingen te nemen. Ik mocht nadenken over extra functionaliteiten in de game, dus het was een vrij open opdracht. Ik koos ervoor om missiles toe te voegen aan boord van de schepen. Daarvoor moest ik eerst een aantal nieuwe dingen

in Java onder de knie zien te krijgen, voordat ik kon starten met bouwen. Toen ik dat eenmaal onder de knie had, begon voor mij het leukste gedeelte van de opdracht: het visueel programmeren middels blokken slepen in plaats van code tikken.

MIJN EIGEN STUDENTENCOMPETITIE

Elke twee weken presenteerde ik de voortgang aan de afdeling en toen we zagen dat de game een volwassen niveau had bereikt hebben we een competitie georganiseerd onder de Thales collega's. We hebben een avond georganiseerd waarin ruim twintig collega's op zogenaamde mocks meespeelden. Het eerste uur waren we nog druk met programmeren, het tweede uur met gamen, daarna nog met het maken van aanpassingen en in de laatste ronde speelden we de game in het Thales klanten democentrum; een ruimte waarin de combat management ruimte van een schip is nagebouwd. De collega's reageerden enorm enthousiast op de game en inmiddels is besloten om de game met mijn uitbreiding later dit jaar als competitie aan studenten aan te bieden!

GOEIE BEGELEIDING

Op mijn afdeling werd ik heel serieus betrokken bij alles wat er speelde en doordat er met een Scrum methode wordt gewerkt krijg je een goed beeld van waar collega's op een system engineering afdeling zich allemaal mee bezig houden. De sfeer was trouwens heel informeel, alle collega's namen de tijd voor me om dingen uit te leggen en ik kreeg de ruimte om mezelf te zijn. Het was voor mij absoluut de moeite waard om naar de andere kant van het land te reizen. Bovendien is Nederland eigenlijk ook weer niet zo groot. Ik ga nu weer even aan de slag met mijn studie, maar zodra ik mijn papiertje heb gehaald ga ik zeker kijken of ik mijn eerste baan bij Thales kan scoren.''

EN NU JIJ

Wil je ook stage lopen bij Thales of ben je op zoek naar je eerste baan? Kijk dan snel op www.thalescareers.nl!

THALES

Crossing borders

Author: Camilla Spaan

Upon reaching your third year there is this magical moment of the so-called minor. Which means that for 6 months you can experience how different your life could have been, if you would have chosen an economical study. Luckily for us there are more things we can do when decided what we want to do. Want to build a motor? Go for it! Car? Even that is possible. Or do something even crazier and move to a different country for a few months, which is exactly what I decided to do. Me, the girl who is always cold and lives on tea together with Céline, decided to move to Norway for 6 months.

So, what happens when you decide to pack all your winter clothing and move to Trondheim, Norway for 6 months? Mostly, you are surprised that in September it already feels like autumn but with a lot more sun than you would expect. The best part about that is: it gives you no reason to sit inside and watch that series you wanted to see for the last three years. You end up spending all your weekends on those amazing trips around the country. Nights spend in little wooden cabins, which are straight out of a hobbit movie. Sitting outside next to a fire, wishing for the northern lights to appear (which doesn't happen, since you are looking for it), swimming in a river with a temperature of 5 degrees. All the things you normally would not dream of doing, are suddenly the most amazing activities you have done in your life. Even walking 8 hours straight to the top of a mountain and back, sleeping in a tent when it is freezing outside is something you don't mind doing anymore.

Luckily, it is something that I don't have to experience on my own. Thanks to the orientation week (like the Kick-in) I ended up with this random group of people that make sure the cabin trips are even more memorable than they would have been otherwise. Those trips, having dinner, going to parties or just hanging out together is what makes this place

> **"Those trips, having dinner, going to parties or just hanging out together is what makes this place feel like home."**

feel like home.

Sometimes the traveling could get a little bit too much and luckily there is always the university to help you change your days a little bit. For me that means spending most of my time reading for my courses, visiting the university for a few hours a day and preparing for the exams at the end of December. The best part about studying here is that you can chose 4 different subjects you are interested in ranging from artificial intelligence or space technology to human behaviour studies. If the exams do not overlap with each other, it is possible to take the course you would like. Next to studying they offer more than 20 different gym classes and sport associations you can join if you want to. The best part is however that you can rent a cabin for a few euros for a whole weekend

> **"Norway was one of the best decisions I have made so far"**

and it is equipped with everything you need! Go in the winter and learn how to ski, or go fishing if that is what you enjoy. And if you think you want some Norwegian friends, you can always try the locals that are hanging around the cabins you are visiting.

Norway was one of the best decisions I have made so far and I'm looking forwards to the upcoming few months. Hopefully I learned some Norwegian by the end of the semester so I will be able answer those very nice locals that are wandering around here.

Céline's side of the story

Since most of you know (and have already read), Camilla and I used to drink tea together and do a lot more. Even when I get into the Scintilla Room, people call me Camilla. I know it is strange to see only me and not Camilla but as you can read, we are both doing fine. We still have contact via tags in Facebook posts about puppies or any other article/picture/thing where we think about each other.

Furthermore, Camilla broke her phone while hiking so next to tagging each other, I also keep her updated about what is going on here. Telling her what is happing at Scintilla and how lonely drinking tea is right now. But I will get there. I will be social and meet new people to drink tea with. And otherwise I will just get into the Scintilla Room and annoy someone else (lately, Chris is one of my victims)

But, the 6 months will be over soon and with some luck I will even join Camilla in Norway for a few days upcoming January. Otherwise we will be together again in February for Module 11. I will get used to being called Camilla and by the end of this year, you all might be used to the fact that Camilla and I can do things apart from each other, although we are always together in our hearts.

Datasheet

Author: Céline Steenge

This time two more recipes for main courses. One simple vegetarian dish and another quick and simple dish with a lot of variation possibilities. There is also a recipe for a dessert with a lot of chocolate.

Popeye Pasta

You might have a day where you don't feel like eating meat or a roommate which is not really into meat. Here is the solution!! A delicious oven dish which is not too difficult. Oh, and when you do feel like you need some meat, You can still add it.

Ingredients (4 people):
- 350 Ingredients (4 people):
- 350 g of broccoli
- 150 g of sun-dried tomatoes (jar, 295 g)
- 300 g penne rigate (bag, 500 g)
- 450 g leaf spinach cubes (deep frozen)
- 2 eggs
- 250 g ricotta (tray)
- 125 ml whipped cream (cup)
- of broccoli
- 150 g of sun-dried tomatoes (jar, 295 g)
- 300 g penne rigate (bag, 500 g)
- 450 g leaf spinach cubes (deep frozen)
- 2 eggs
- 250 g ricotta (tray)
- 125 ml whipped cream (cup)

What to do:
1. Heat the oven to 190 ºC. Cut the broccoli into roses and cut the tomatoes in small pieces. Cook the pasta according to the instructions on the packaging. Add the broccoli in the last minute.
2. Grease the oven dish. Mix the pasta, the broccoli and the frozen spinach in the oven dish. Beat the eggs and mix it with the tomatoes, ricotta and whipped cream. Add 1 tablespoon of oil from the pot of sun-dried tomatoes. Season with salt and pepper.
3. Spread the mixture of pasta and vegetables in the oven dish. Bake in the oven for about 30 minutes.

Variations:
When you are not in the mood for vegetarian food, add some bacon strips and/or ham cubes.

OrEEo chocolate blocks

This one I tried as I really wanted chocolate. Not just a bit but like really a lot of chocolate. You should not eat too much of this but you probably will. If you can't handle sugar very well, you might want to close your eyes and throw away this recipe.

Ingredients:
- 300 grams of chocolate (200 grams of milk & 100 grams pure)
- 1 can of condensed milk (400 gr)
- 150 grams of Oreos
- For decoration a little bit of white chocolate

What to do:
1. Cover the (oven) dish with sealing foil.
2. Break the chocolate in pieces and melt it in a pan. Do not forget to stir, otherwise the chocolate will burn and it will smell terrible.
3. When the chocolate is molten, add the can of condensed milk and stir well.
4. Get the pan of the fire, crumble the oreos above the chocolate and stir again!
5. Put the mix in the (oven)dish and rasp some white chocolate on top.
6. Put the mix for at least 2 hours in the fridge.
7. Try to get the mix out of the (oven)dish and cut.

Strangled wires

Easy meal for when you do not have a lot of time but do want to eat a proper meal. You can make this dish as difficult as you want!

Ingredients (4 persons):
- 400 grams of chicken breast
- 1 red paprika
- 250 grams of mushrooms
- 1 leek
- 1 stalk of broccoli
- 2 cloves of Garlic
- 250 gram of Wok noodles
- 1 bottle of wok sauce oyster soy

What to do:
1. Bring a large pan with water to a boil.
2. Cut the chicken, vegetables and garlic.
3. When the water is boiling, add the wok noodles and let them cook for 2 minutes.
4. Pour down the wok noodles and cool them with cold water.
5. Stir-fry the chicken for 3 minutes in a little bit of oil (approx. 1 tbs).
6. Add the vegetables and stir-fry another 3 minutes.
7. Add some salt and pepper. Also add half of the bottle of wok sauce and the 2 cloves of garlic.
8. Mix everything well and add the wok noodles. Mix again for another 2 minutes.

Variation tip:
When you are a bit lazy (and we know you are), you can also buy 800g Chinese vegetables mix. Of course you could also change the chicken to seafood. Furthermore, cashew nuts could also add some extra bite to the dish.

Of course, do not forget to send your own recipes to vonk@scintilla.utwente.nl so everyone can become a master chef!

Junction

Anne-Johan Annema

Anne-Johan Annema is very well known for module 3. But when he became program director we decided to pay him a visit and ask him some tough questions.

Author: Nahuel Manterola

An important question to start with, what is your favourite colour, and why?

Blue. I think it has to do with it being the wavelength where most of the energy is. It's not like I can see the difference between bluish green and greenish blue anyway. Once my wife wanted to buy a car. I found her a really nice blue one. I called my wife and she said it was fine, as long as it wasn't green. "That's no problem", I said, "it's very blue". When I got home my wife assured me the car was green and after some discussion I conceded. I'm fairly certain the rest of the world is colour-blind.
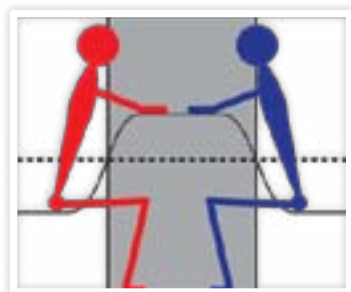
What did you study and where?

I studied in Enschede. I did Electrical Engineering in the Hogekamp. First, I studied a year at the Technische Hogeschool Twente. I got my bachelor's degree and then the name changed to Universiteit Twente. Then I graduated at ICE, which later split up in ICD and SC. Then I started working at Phillips NatLab in Eindhoven. I did a lot of research in between the fields of semiconductor physics and circuit design. Around 2000 I started working at the UT again.

What was your dream job when you were a student?

I didn't really have a dream job. I just wanted to invent new stuff and make enough money to buy a house with a garage where two cars can be parked next to each other. This didn't work out though, the cars are parked in a line in my current garage. My current car doesn't even fit inside my garage because it's too wide.

Anne Johan Annema

What kind of student were you?

I always went to the morning lectures, this way I had to leave my bed. I only went to the seminars when I couldn't solve a problem myself. I worked on my homework for an hour and then just sat in the living room with my housemates. We watched the A-team with the whole flat. I lived here on the campus, by the way. Did all the stuff students are supposed to do, like burning down couches, barbecue in the back of a car and disposing of the TV after a night of watching it by throwing it from the roof. Just the typical stuff.

What kind of hobbies did you have?

I worked on cars quite a lot. I also sailed and played tennis in Groningen. As a student I was a member of A la Kart, the karting association. Right now, I don't play with cars anymore. They are fully electronic now, I can't really change too much. I couldn't even do the motor management upgrade of my car. I'm still playing tennis at Ludica, but I don't have too much time for other things at the moment. I exceeded the 40-hour work week before I became program director, but now I don't have any time left at all. On Thursday morning I'm done with my 40 hours, and then I have two more days to go, if I'm lucky. I also have a software company which makes industrial level IC design software.

What keeps you up at night?

Literally? Everything. Birds, leaves, anything. I fall asleep quite quickly, but I'm not a deep sleeper. Other things that keep me awake are work-related. The text margins of exercises for example. The text is way too close to the borders! It doesn't look right. The font doesn't help either, but people told me a sans serif font is easier to read. That is why

I like Comic Sans. I use Comic Sans in my slides so that you need to do a little bit more work while reading. This will hopefully make you remember everything a little bit better.

Do you have any advice for students?

Yes, multiple pieces of advice. In the first year, many students try to put in the least amount of work. If you want to put in little work you should aim for a 7. Elsewise you'll miss information in the next module and you'll have to work harder then. If you want to put in more work, aim for a 6 or an 8. If you want to work really hard you should fail a course, then you'll have to do it all over again. And if you really feel like doing a course for the second time, pick one you really like.

You are well known by students for module 3. What part of module 3 are you proud of?

What I try to do with my courses is show the students the subject is really fun. I try to teach them the subject, but I also try to teach them an attitude towards learning. I think that's also very important. If you completely forgot my course but remember how to handle new information, I'm already happy. This might be why my module is a little different from other modules.

Do you regard a module differently from the perspective of a program director than from a teacher's perspective?

For my own module, certainly not. If you organize a module you should do it well. I've been a member of the OKC for 15 years, so I've been doing course evaluations for a long time. I've also joined some groups which evaluate the whole bachelor degree. My perspective hasn't really changed for any module.

Thanks to module 3 you are associated a lot with Luv u more, but what kind of music do you really listen to?

That's really different from Luv U More. I mostly listen to music from the 60's or country. I have a jukebox from the 50's, an AMI200, with 200 tracks. In 2 weeks I'm going to a fair in 's Hertogenbosch with jukeboxes and old cars. They don't pay me enough to buy a new jukebox,

> *"I use Comic sans so you need to do a little bit more work while reading and remember everything a little bit better"*

though.

Since when have you thought you might become program director?

To be honest, a few people asked me to become program director a few times. And I refused each time. It's not that I think I can't do it, but I didn't think I would have enough time. I also have eight PhD students, a few MSc students and I need to give lectures. I can't just drop one of these. A few years ago, I gave a few courses at the same time, and that was just too much. There are things you need to stop doing. I felt like I had to say no. Now I've made arrangements to divide the coaching between others. This way I have enough time left. You can't just do both since the quality will suffer.

What are your biggest plans as a program director?

I think there's a lot of workload for the students and the teachers. On one hand,

> "Workload is hours of work times the annoyance per hour."

this is good, since people should work hard. On the other hand, I think hours can be spent more efficiently. Workload is hours of work times the annoyance per hour. I think the planned studying hours should be fully used, but they should be made less annoying, more fun and more challenging. It's better to spend 8 hours on something that you like than spending 4 hours on something you don't. So, I hope to make modules more efficient.

I started with 'one versus 100' quizzes about the material in module 3. I think this is a good way to have fun, but also to reflect on the material the students have been working on. Something I started last year is the peer-reviews. Here the students review the paper of other randomly chosen students. This is a great opportunity to learn from each other because you can see what others do better or worse. Also, the feedback from other students is taken more seriously. If I put feedback on a test it is ignored, but when the feedback is given by a fellow student it is taken into consideration. Besides, the quality of the reviews is quite good, since the students receive a grade for the review.

These kinds of things only cost time to setup, but when it is implemented it's beneficial for the teacher and for the student. There are more examples of

The AMI200

ways to improve education without increasing the workload, just by making things more efficient.

In which ways is Mark Bentum unreplaceable as a program director?

I have a lot of appreciation for the good work Mark has done. Also, as a program director, he was fairly invisible to teachers, always operating in the background. He solved a lot of problems be-

fore they even reached teachers.

What do you hope to improve on the work Mark Bentum did?

As a program director, you always build on the work that was left by your predecessor. He has done a great job, and I'll continue trying to improve the program. I want to focus on making the program more efficient. I don't think it's really different. It is just moving on-

wards.

Do you think you'll return to teaching after your job as program director?

Well, I'll be program director for around 3 years. They don't pay me well enough to retire afterward. The chance is quite large that I'll return to being a teacher.

Is there something you would still like to achieve in your career?

I always said that I didn't want to be making arrangements for everything all day. I would like to focus on education and research. Becoming program director might have been a bad move in this regard. I don't really enjoy to fly around the world for meetings. Other people enjoy this a lot more and they will, therefore, be much better at it than I am. It's a part of the job sometimes: in September I spent half of the time abroad. The part I enjoy most is doing my job well and getting appreciation for it. Whether this is in research, which improves the world, or in education, where I hope to prepare students for the future. I would like to see our whole electrical engineering program to be world wide renowned, in a more visible way. Right now, we're really good but too modest. I would like us to deliver a lot of good master and Ph.D. students to the Dutch or European industry. That might sound a little idealistic. If I wanted lots of money or glory I wouldn't be here. It's not that hard to get a job somewhere else.

From where do you get applications?

Mostly from the United States, with view over the bay area. That would pay very well, but I don't think it would make me happier. I'd much rather play some tennis at Ludica in my lunch break. I think this is a great place to live.

I'm really happy if I manage to teach quite some students at a high level with a high motivation, seeing them getting great jobs afterwards.

Final question: what makes you proud right now?

Most of all about all the things that went well, that made people happy. At home, this means I'm really happy with both my children. They both study physics right now. They just couldn't study electrical engineering since that's what their dad does. So, they got as far from it as possible and chose applied physics. I've always told them math is quite easy and logical. The way teachers

> "I used to participate in Scintilla's computer destruction. We always won and were always disqualified."

explain it is not always that easy, but if you understand the underlying theory it all makes sense. I try to do the same with my courses. I don't want students to blindly follow a formula they are taught, it should become an equation or relation, not a formula. They should understand how things really work. I'm also really proud when a student excels. I also really enjoy winning or getting nominated for education prizes. I'm not too proud of the invention awards I got. At Phillips, they used to give you a printed dollar for each invention. I thought that it was ridiculous they would hand these out around an official lunch with directors. I made a badly drawn paper frame for it and hung it upside down in my office at Phillips. My direct boss asked if I didn't find this disrespectful to the board. I said, "yes, but giving an employee a printed dollar instead of a real one is even worse". If I go abroad to a

conference I enjoy that quite some people I don't know recognize my name. This might be because I have an unusual name outside of the Netherlands, but also because of the work and my inventions. I don't have that many, but they are really good. I'm proud of that as well. Oh, I used to participate in Scintilla's computer destruction. We always won and were always disqualified. The first year we got disqualified for having two members instead of four. The second time was in the abandoned Hogekamp. After destroying the computers, we started destroying the furniture. Up front I asked the building's management if it would be a problem if a hammer went through a table by accident. They didn't exactly say no, so we really went for it and managed to destroy a few tables. Another time the organization had put their mugs on the ground, so we destroyed those too. The last time we participated we very carefully read the rules, which stated we could not use electrical tools, so we hired a gasoline-powered tile pounder. For some reason, they disqualified us again. We tried to do as much as possible within the rules, something I try to teach my students as well. At Advanced Technology they had a course explanation where they told them not to break components. I believe you haven't tried hard enough if no component breaks. You need to find the limits of what you can do. That's an attitude I want to bestow upon you.

I'm really curious, what's up with the keyboards?

My PhD students gave this to me on my birthday. They said: "you always have coloured slides and Comic Sans text", so they bought me a keyboard to match this. It's not that handy for using Latex, though. I don't have the necessary keys, like brackets. I have an emergency keyboard with these keys, but I prefer not to use it. You shouldn't look a given keyboard in the mouth.

Too much fun?

Merijn den Houting

As of writing this we are currently in the fourth week of this year. For me, that means the fourth week of the very first module of Electrical Engineering. Going to university, so much has suddenly changed. I moved to Hengelo so I won't have to try catch a bus that doesn't even bother to stop where I used to live, I got an enormous amount of freedom on what I do and when I do it and most important of all: my whole life somehow got much more interesting here.
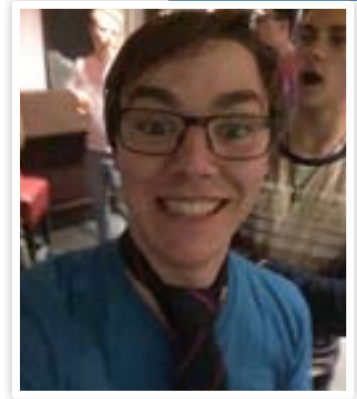
Moving out brings a lot of responsibilities that most of us hadn't come across before. Cooking is one of them. Most of the times, getting home at 18.45, I'm too lazy to cook so I find myself getting döner again. I live across the train station so that's only a 30 second walk for me, which might be a little too convenient. Another thing is cleaning. I used to only spend time in my room to sleep. Where I live now we don't have a living room, so my room is currently full of empty cans and bottles, plates with left overs on them and a lot of scattered around electronic components. Don't worry, I'll clean up eventually...

Maybe the biggest responsibility is money management. I guess you'll learn how to deal with that eventually, but for now I take the highest amount of money I can get from the government. It just feels so easy to get 'free' money and worry about it later.

The next big change going to university is the amount of freedom, which is really something to look out for. Since there are almost no mandatory classes, I find myself skipping a lot of them already, and let me remind you, we are only in the fourth week. Of course for some classes I have a good and valid reason, but for most I either just don't feel like it or they are in the morning and I happen to have a hangover or didn't set my

> *"Since I moved here my life just got so much better."*

alarm the night before. Nobody cares what you do (except maybe your parents but they won't know, right?...), but it is your responsibility to make sure you won't fail your module because of this. So far I haven't had trouble keeping up with the different subjects and my grades have been good, but I feel like things are exponentially getting more difficult.

Sometimes I wonder if I'm having too much fun instead of studying. During the Kick-In you get thrown in a group you never met before but they end up being the people you spend most of your time with. We have a lot of fun but we also help each other out when studying. If you follow me for a week, you'll find out I'm just trying to get the best out of my time here. I've been to all constitution drinks except for two and I'm joining all activities Scintilla puts on its website. I got a Bijzonder Bier Boekje at the vestingbar and we now have Special Beer Tuesdays to make sure we try them all before the end of this year. I even said yes to writing a column in this

> *"But I feel like things are exponentially getting more difficult."*

magazine while I felt like I had nothing interesting to talk about, I felt like I was a really boring person. And I was, but since I moved here my life just got so much better.

Puuzle

Author: Truusje

Dear sparkling friends, This time I have an awesome puuzle for all the digital enthusiasts out there, It is completely binary! Send a picture of the correct solution to vonk@scintilla.utwente.nl before the 10th of December. From all the correct solutions a random contestant will be drawn which we will be awarded a pie! Last editions puuzle was won by Hans Roelofs VP congratulations! The Vonk will soon contact you for your prize!

Take care and happy sparkling!

Truusje
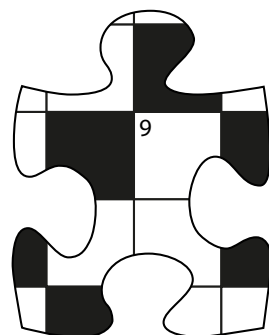
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Rules

Each binary puzzle should be solved according to the following rules:

1. Each box should contain a zero or a one.
2. No more than two similar numbers next to or below each other are allowed.
3. Each row and each column should contain an equal number of zeros and ones.
4. Each row is unique and each column is unique.

Each binary puzzle does only have one solution. You can always find this solution without guessing.