De Vonk

Periodical of E.T.S.V. Scintilla
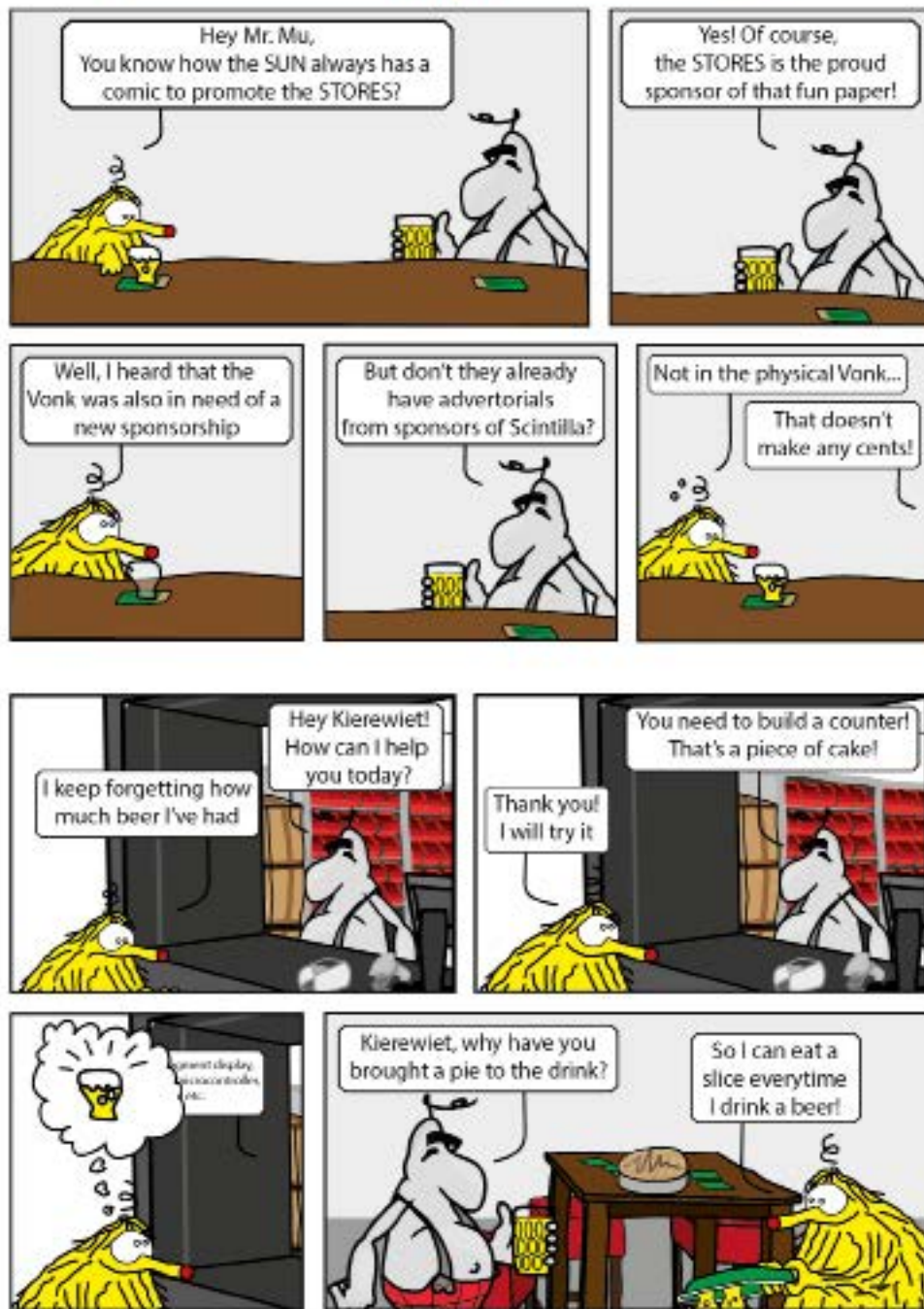
Presidential Note

Author: Pauline Lettinga

Dear physical Vonk reader,

I mean I guess you were always a physical entity, but this time, for the first time in a long time, the Vonk is physical as well! As we have learned from the past years during corona, everything is better when it's allowed to be physical. While the online Vonk is already amazing, that must mean this one will be legendary.

Speaking of legendary, let's look back at the past year. We as a board started with great enthusiasm, ready to get back into full swing now that corona seemed like a thing from the past. Sadly a constitution drink wasn't feasible in the first week, but we did celebrate the dies with a fancy dinner at Sensazia. Later on a camp for the first and second years could still be held since they didn't have one during their Kick-In. Scala organized a pubcrawl, the borrel a constipation drink and the 91st board still got a chance to thank their active members by taking them to Burger Zoo. Not too long after that corona cases rose again and into another lockdown we went. Committees still organized some nice online activities, but I think I can speak for everyone when I say we were happy when things opened up again. This time, it seemed for quite some time, let's hope it stays this way.

With the newfound freedom the EEMCS Oktoberfest could take place again, just like the scrapheap and the OPEL VAUXHALL TESLA Ceremony. SCALA even organized an physical Murder Mystery after the success of the online editions. For the first time in a while, it was even possible to have a cantus!

Scintilla was in full swing again and I was loving it. Not long after we could enjoy the first ever active member weekend, where we had a pubquiz, went to Hellendoorn, had another cantus, visited the Othmar brewery and ended with a barbeque on campus. As if that wasn't enough we finally were able to have our long awaited constitution drink.

The past year has had its ups and downs. It sort of went like the Scintilla sling. It's sad to see the year is already over, but I have full confidence that our lovely candidate board will not let Scintilla go bankrupt next year and that they will organize many more epic activities together with our amazing committees. For me and the rest of my board it's time to get back to studying, but we will definitely see you there.

Dames en Heren, op de koningin, op Scintilla!

Masthead

Main article

With the launch of the new website, also a launch into history was made.

Historic

They are hung around the necks of the brand new board members every change GMM, they are visible on every board photo.

Column

Understanding where the money comes from and goes to is key in understanding the strategy, policy, and politics of universities.

On location

Pretty much the only word of Dutch on which everyone agrees on that it cannot be translated into English, is the beautiful 'borrel'.

Editorial

Dear reader,

What the Vonk? What is this? The Vonk, but on paper? But I was told that this would never happen again? Evidently, that is not the case: we are releasing a new physical Vonk! Filled with the best content that was posted on the website in the last year as well as some original content only available in print, diliverd to your doorstep. From now on we hope to release a yearly edition of the Vonk starting with this first edition of the 40th year.

Of course, this Vonk contains some of the articles we all know and love: we have a Presidential Note, this Editoral, picture pages and of course the Puuzle. Next to that, you will be taken through time and see the various websites Scintilla has had. You can also follow the trail of an EE student by reading about the bachalor and master thesis and the afterlife of several Engineers. In this edition you can also read more about several of the student teams. Do not worry though, this physical Vonk comes as an addition to the Vonk website. We will still be publishing bi-weekly articles on the website in the next year, with advertorials coming up every other week. If this sounds like something you'd be interested in helping out with as well, don't be afraid to send us an email.

With out last edition being published almost three years ago most of you might not even recognize this piece of art you are holding in your hands right now. Not only you are unexperienced with physical Vonks, our editorial team is as well! But after some very late nights and a lot of frustations towards InDesign we were able to 'beun' this new version together. For now, it is time to enjoy this new physical edition, and we hope to see you soon on our website!

Roos

Meet the kandi's

The summer is almost coming to an end. That means that it is almost time for our lovely board to pass the baton. At the beginning of September, the current candidate board hopes to be next.

The candidate board for the 93rd board currently consists of four people. Usually, a board has five or six members, that means the coming year can be a bit busier for us than past years. However, we are a strong team and are excited for next year. We hope that we can have a great time with you and other members of our beautiful association.

There were eight functions to divide, that means that each of us got two functions. Aniek is the candidate President and Commissioner of Internal Affairs. She will keep an eye on the board and you can always ask her about activity related issues.

The candidate Secretary and STORES Administrator is Pieter. He likes pens and text without grammar mistakes. He will be responsible for the STORES finances.

Roos is the candidate Treasurer and Vice-President. She will be responsible for Scintilla's finances. If she becomes Vice-President, she will hopefully keep an eye on the President.

The candidate Commissioner of External Affairs and Commissioner of Educational Affairs is Timo. At moments when you cannot find him in the Scintilla room, he will probably be at a company. For study-related issues, you can always go to him next year. We hope to see you a lot in the Scintilla room and at the activities the coming year! Get some rest during the summer break. We wish you a lot of fun and come back fresh and well!

ToKREES with KlokEES

Party of Recognition

Scinterklaas

'19-'20

Evolution of the Scintilla website

Author: the 90th board of Scintilla

With the launch of the new website also a launch into history was made. Did Scintilla always have a website? What was included in the process of making a new website? How is this new website different from the old one? And what features are we missing that were implemented in earlier versions of our association's website?

Finally, it is here! After more than 10 years, Scintilla is getting a completely new website. As the old website has quite a 00's feel, DIGI (Scintilla's committees Webteam and SOT) and the board felt it was time for a modern looking website to better present herself digitally.

After the introduction of TOM, the amount of time DIGI-members could spend on the website and digital systems of Scintilla has decreased. While attempts have been made to create a new website from scratch, they have not succeeded so far, until now. Some time ago, the board heard about Congressus, a company that hosts member databases and websites for student and study associations. After some consideration and getting in contact with other associations who use Congressus, the (90th) board of E.T.S.V. Scintilla and DIGI decided to apply for a trial version.

With this trial version DIGI could poke around in the manager that comes with Congressus to see what functionality it had. After a couple of weeks, it was de-termined it had enough functionality to be able to replace most of the current website and the member database, called SMART3. With this in mind, the decision was made to make the move to Congressus and finally update the website after all these years.

The MoSCoW

Sadly, Scintilla won't be getting an "is-there-any-coffee-left-unit" on the website.

To make the move to the new website, a list of requirements had to be made. This was accomplished in a so-called Mo-SCoW. This is essentially a list of requirements and features, split up into four categories: Must, Should, Could and Won't. DIGI and the 90th board spent an evening brainstorming about all possible features a new website could have, and afterwards splitting them up in tho-se four categories. All items in the Must category had to be finished and working before the new site could launch; take for instance the company profiles that Scintilla is contractually obliged to have available, or the documents of the General Meetings which legally have to be available for members. The Should category encompasses all features that need to be completed as soon as possible af-ter launch, but are not instantly crucial for running the association effectively. Examples are the beloved quotelist, which (sadly) does not receive native support in Congressus and still has to be implemented and imported from the old site, and the also beloved exam database. As you might expect, the Could label is given to functionality that is nice to have, and possible to be realised at some point. Think about things like the lyrics to cantus songs, the birthdays of Scintilla members or the "Is-the-Scintil-la-Room-open?" tool which is yet to be implemented (if ever). The fourth category is Won't. This includes all features that came up during the brainstorm session, but are simply too difficult to implement or are not inside the scope of DIGI. Sadly, Scintilla won't be getting an "is-there-any-coffee-left-unit" on the website.

After months of hard work by DIGI and the board, all Musts have been checked off, and most of the Shoulds have been completed. Of course, not all Coulds are finished, so expect some functionality of the old website to not be complete just yet. Don't worry: DIGI is doing their best to have them ready as soon as possible (Soon™).

SCREW

Some things are not supported by Congressus, but very important for Scintilla to keep. For those things a new project was started. This project combined has been called SCREW: Scintilla's Congressus-based Responsive Epic Website. Up until this point SCREW's functionality can be split up into three parts. Firstly the website has to look stylish. Though the website looks decent on its own, some improvements had to be made on the Congressus styling. This is achieved using the Custom CSS option in the manager. Apart from small improvements, the biggest influence SCREW has is that anyplace on the site you see red, it is replaced by the beautiful Scintilla Red defined as #E4002B. The second task of SCREW is to elaborate on Congressus functions by improving the standard event viewer, or adding the birthdays field on the homepage to celebrate members on their birthday.

SOFA

Scintilla has to host some of its files, like GM documents, exams or photos on its own servers, protected behind a login wall so only members can have access. To achieve this, a new program was created: Scintilla's OAuth File Access or SOFA in short. As the availability of GM documents depends on SOFA, it was categorised as a Must for the new website.

This meant it had to be up and running properly before launching the new site. This turned out to be a bit of a challenge, as communicating with Congressus' database meant obtaining an API-key which is only possible by forcing a board member to send an email to "Folmer van Congressus" allowing Webteam to receive such a key. As the board claims to be very busy, the sending of this request took some time.

Having received this key, some more challenges were encountered. To handle authentication between SOFA and Congressus, an open standard called OAuth is used. Congressus claims to support this, yet part of their implementation is incorrect. They do not follow the OAuth specs, making the development of SOFA significantly harder. The Webteam members tasked with the development of SOFA had to manually re-verse-engineer the way Congressus im-

Congressus' OAuth implementation, by Johan Verzijden

OAuth works as follows: SOFA sends you to the login page of Congressus with a parameter to tell Congressus you came from SOFA. After you log in Congressus will send you back to a predefined URL with a code, validating that you logged in. This code is only valid for 60 seconds, so SOFA now sends a request to the Congressus API to request API access in your name. If the code is valid Congressus will respond with an access token. This token is valid for a long time, but not indefinitely: to know when the access token expires, the **specification** recommends a value called `expires_in` to be sent with the access token. This is the lifetime of the access token in seconds. Unfortunately, Congressus sends a value called `expires_at` instead which contains the expiration time. To make things worse this timestamp isn't following ISO8601, the international standard for date and time representations: ISO8601 specifies `19650909T09:30Z` while Congressus sends us `19650909 09:30`, replacing the `T` (between the date and the time) with a space and omitting the time zone marker `Z` (defining the time to be UTC) completely.
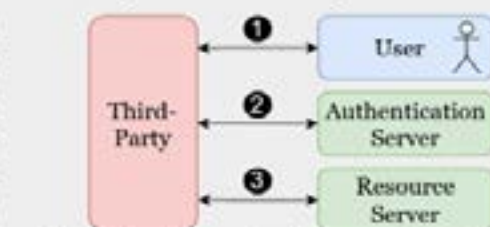
With OAuth, third-parties obtain an authorisation grant from the user (1), to retrieve an authentication token from an authentication server (2), with which the desired data can be retrieved from the resource server (3).

plements OAuth, to then compensate for the errors in their implementation.

The New Manager

Active Scintilla members are familiar with creating events on the old website. Of course, using a different back-end, this will change drastically. From now on, anyone who wants to create an event on the new site must not only have a member account, but also a so-called Congressus Manager User account. By asking the board for an invite link, you create an account, separate from your member account on the back-end of the website. Webteam or the board will then grant you Active Member rights, giving you the possibility to create events for your committee. This makes sure people who shouldn't have access to the member administration, don't have those rights.

Currently there is no documentation made for active members on how to create events, but do not worry: creating corresponding entries for the Scintilla Wiki is on DIGI's to-do list. (Of course, if you feel like helping, feel free to write up something!)

All in all DIGI is glad to have the new website up and running, and hopes you like it as well. In case you find an issue with the website, there is a bug report link in the menu, but hopefully you won't need it…

The reason to create a new website

Now it is time to look back to the now old website, which was launched in 2008. Before 2008, the website ran on the webserver called Roxen. Roxen is a free web server and is XML/XSLT-based with a small number of server-side scripting possibilities. Not a lot of active members understood how Roxen worked. Besides this, there were numeral reasons why E.T.S.V. Scintilla's members and the board wanted a new website. The integration with the activity calendar using the old software was rough, they wanted more possibilities to bring their partners under attention and active members wanted more access to change information about themselves and their committee on the website.

The process of building a new website

In 2008 a group of active members, who eventually all did a board year, worked on creating and launching an all-new website. The following active members worked together to get started on building the new website:

- Jethro Beekman VP, Development
- Hubert Flisijn VP, Development
- Laurens Fortgens VP, Graphics

> ## the well-known red colour was pinker than the colour used on the website

- Tom Vocke VP, Graphics
- Esther Dalhuisen VP, Database
- Olaf van Zandwijk VP, Database
- Henri de Jong VP, Sitemap
- Sjoerd op 't Land VP, Sitemap

They decided to make the new website in the PHP framework 'Symfony' because they had experience with this framework. The biggest obstacle was the amount of time in which the site had to be launched. Everybody wanted a new website, but not a lot of people wanted to put a lot of effort into making this site. As a consequence, various boards had to encourage the team to build the website.

Functions of the new website

There was a desire to implement a lot of fun SOT projects; the digital SWI-PED, the coke vending machine and the beautiful database into the new website. Besides this, a brand-new function was being able to subscribe to an activity. SOT and Webteam did not have the desire to be required to execute every small change on the website that was requested by the board and the committees, so a board member always had to be a member of the SOT. This board member then had the access to change these small matters and keep the focus of SOT and Webteam on more important work, such as the hardware and software.

Graphical interface of the new website

With the new website, the board wanted to implement the new corporate identity of E.T.S.V. Scintilla. This new corporate identity included a change in association colour from blue and red to only red with a white coat of arms. This red colour is now a pride of our association, however, on this website, a seemingly different shade of red was used:

the well-known red colour was pinker than the colour used on the website. After people sent proof that a different colour was used on the website, it was discovered that the red actually looks different on computer screens compared to its real-life equivalent, so no mistake was made at all.

Saying goodbye

After serving the association since 2008, this website has come to retire this year. New for its time, but aged too much for current times. Gladly and gratefully, we look back and go in with a new website that eventually has the same fate as this one. Special thanks go out to Tom Vocke VP, Laurens Fortgens VP and Hubert Flisijn VP for giving a lot of information about the website they built themselves.

2007 - 2003

With still a Roxen back-end but some parts already written in PHP, at the end of this timeline the changes were already coming. Going back in the years with
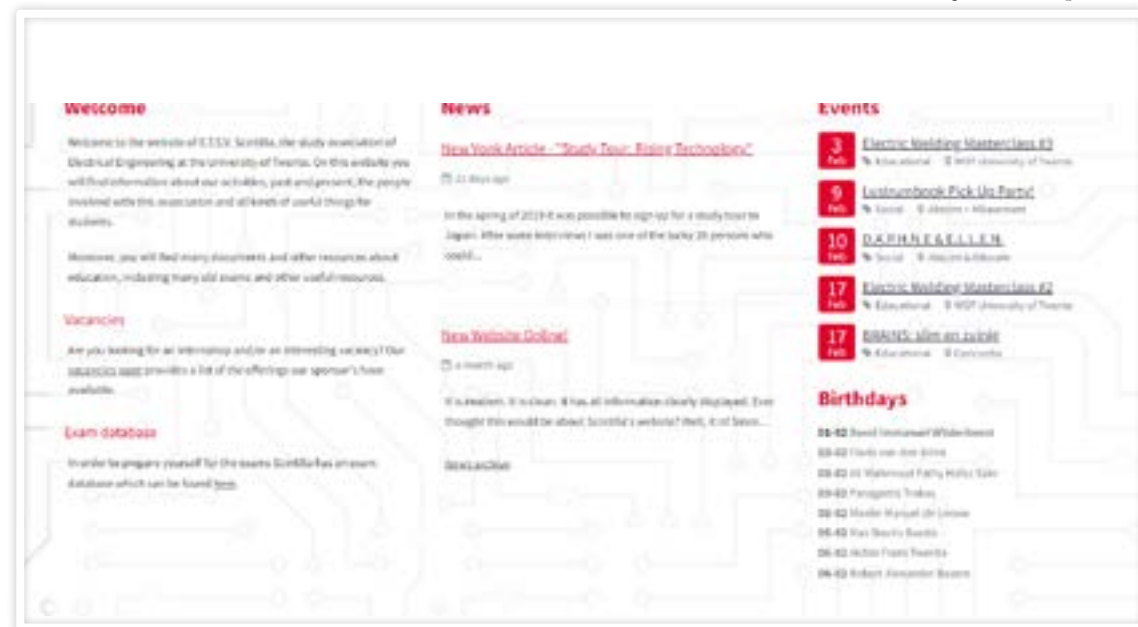
the internet archive this website did not have a lot of visual changes. Scintilla's style was a bit different than we are used to now, with a lot of blue and darker red. Sadly, due to not embedding every graphic on the site, not the full glory of this era can be admired. In this time however a lot of extra sponsors came around for which space had to be made available on the homepage which became longer with also a more expanded side menu. A nice feature that was added on this new website was a counter at the bottom logging the inbound and outgoing bandwidth utilization of the Scintilla network.

2002 - 1999

The change between 2002 and 2003 was mostly a visual one, in the period from 2002 to 1999 we can see a whole other design.
Final design concept of the Scintilla website from 1999 up to 2002 made by Jasper Jeroen Dik

Final design concept of the Scintilla website from 1999 up to 2002 made by Jasper Jeroen Dik
The first hints of the blue with the dar-

ker red were made back in this period. Maybe you'll recognise one very important part on this site, the elongated scintilla sling. The one we still use today specifically on association clothing with names on top of it, but also still in the 'huisstijl' on envelopes and stationery. Believe it or not, but this whole graphic design was made in Photoshop, yes it did already exist at that time, by Jasper Jeroen Dik. In 1999 the division of SoT and Webteam formed. Some people were working primarily on the website at Scintilla and others were mainly responsible for the computers and the network at Scintilla.

1999 - 1994

In this period not one website but 2 or 3 different ones quickly followed up one another. The first website that can still be visited with the internet archive is from 1997. To give you some perspective: not all machines could even play music, they were not powerful enough. Therefore, the Scintilla server streamed the music to every workstation in the Scintilla Room, it was called Soepkip radio.

You can see the big Scintilla sling in the middle with a little menu around it. One thing to mention is that this website had embedded fonts and did not use the normal web browser fonts like any other website at that time. The main attraction of this website though was a homepage for every active user and a 'koffieping'. This last one was ofcourse the most used. You could look up, before making the walk down to the Scintilla Room in the Hoogekamp, if there was coffee in the room and how old it was. A fun anecdote is that this piece of the website was also written as a WAP, a subset of HTML for wireless (low bandwidth) websites, that could be read on Siemens cellphones with a graphical screen that were distributed to people at the university by a provider as a sort of trial. On a small screen you could ping that specific part of the website and request on your phone if there was coffee, high-tech at that time. Because Scintilla was of course a study association, the exam database was also up and running and everyone could view old exams that were scanned to pdf. Since 1996 this website already ran Roxen and was made in such a way that it was also fully browsable in terminal, not everyone had

the luxury of having a full web browser.

Before 1996 the amount of websites and how they looked is sadly a bit faded. A couple of things are still very sure, in 1994 the first website of Scintilla was built and e-mail was setup for active Scintilla members. This was for a lot of people the first and only e-mail address they had. The website was a real 'uithangbord' and one of the first website at the university. First the website was hosted on its machine name utelscin.el.utwente.nl. With some savyness and contact with the then responsible person for the '.nl' domain we 'registered' scintilla.nl. But later because of the rise of more UT websites and the implied hierarchy that was desired by UTwente central IT administration it had to be changed to scintilla.utwente.nl with no redirect from the first name.

While the website was a nice to have and a team effort of our administrator-team (SOT), far more important was the network in the Scintilla room itself. With more than six computers, connected to the web, to work of this was a hub for downloading content on your own harddrives. To give you some perspective what the network was like I'd

like you to redirect to yearbook pieces of 1995 and 1997 (in Dutch). Because the Electrical Engineers of Scintilla had access and the know how to work with

the hardware the association was one of the pioneering organisations on the IT front.

Closing and thank you note

Since the establishment of Scintilla's Operator Team in 1988 there is a lot more to uncover about how the IT systems of Scintilla worked, were structured and changed over time. If you want to share your story about the old websites or IT systems, don't hesitate to contact The Vonk. I want to give my special thanks to Fred van Dijk VP, Sander Ruitenbeek, Martijn Damen VP, Jasper

Jeroen Dik VP, Eric Lammerts VP and Arjen Krabbendam for replying to my messages, the nice chats about the IT systems of Scintilla they worked on and the material for in this article.

A new challenge for Green Team Twente

For just over ten years Green Team Twente has been competing in the Shell Eco Marathon, a competition all about efficiency. This experience resulted in the team becoming World Champions in 2019, due to the pandemic this was the last year in which the race was held. This year we are making a change: We will participate one last time in the Shell Eco Marathon while making the shift to Formula Student, a competition more aimed at speed. Because this competition currently only allows ICE and battery powered cars, we will be the only team powered by hydrogen.

Author: Johan Verzijden

This makes our task really difficult, as we not only have to follow the rules set by the competition, but sometimes have to break a rule or even set our own rules (e.g. for the whole hydrogen system). We are in close contact with the organisations in both Germany and the Netherlands, to set up a hydrogen class for the years to come.

The car we will use for the Shell Eco Marathon has mostly been built by the last two teams, so I will not focus on that. Way more interesting is the new Formula Student race car, which we started designing in September. Let's take a closer look at its Electrical System.

The Electrical System
The car contains two electrical systems. First is the Tractive System, consisting of the Fuel Cell, a DCDC Converter, a capacitor stack as energy buffer, an air compressor and the motors. The 49kW Fuel Cell operates between 130V and 180V, which results in really high currents and therefore thick cables. To combat this, the power coming from the fuel cell goes through a DCDC converter, boosting the voltage to about 400V.
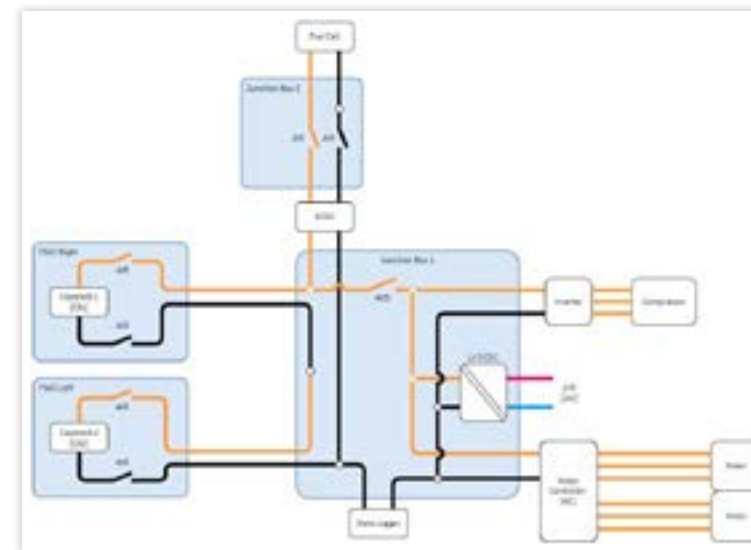

Figure 1: Render of Green Team Tentes latest car

Figure 2: A schematic drawing of our Tractive System

When accelerating, a lot more power is needed, but sudden and frequent changes in the power usage are bad for the fuel cell. That is why we have a bank of capacitors to provide extra power. These are then charged with regenerative braking during deceleration or by the fuel cell during standstill. All this power is then fed to the motor and compressor inverters. They both convert the power to 3-phase AC, which is used to power the air compressor and the two drive motors. A total of six high current relays (called AIR in the schematic) are able to interrupt power to shut the car down in case of an emergency.

Then there is the Low Voltage System. This is concerned with controlling the car by transferring the accelerator pedal signal to the motor controller and transmitting all important information realtime to our server. It also ensures the safety of the car by using a lot of sensors and a shutdown circuit, which is able to interrupt all power to the motors when needed.

Supplying the Low Voltage System
As the chief of the Electronics subteam I am tasked with keeping a good overview of the complete electrical system, but I also design and build parts myself, for example the Low Voltage Supply. This consists of a 400V to 24V galvanically isolated DCDC converter and a 24V battery in parallel. During normal operation the control, safety, and cooling components in the Low Voltage System are powered from the high voltage Tractive System. The battery is only used whenever the Tractive System is switched off, for example because of an insulation fault. This may sound quite straightforward, but choosing the DCDC converter and battery turned out to be quite a challenge. It was very 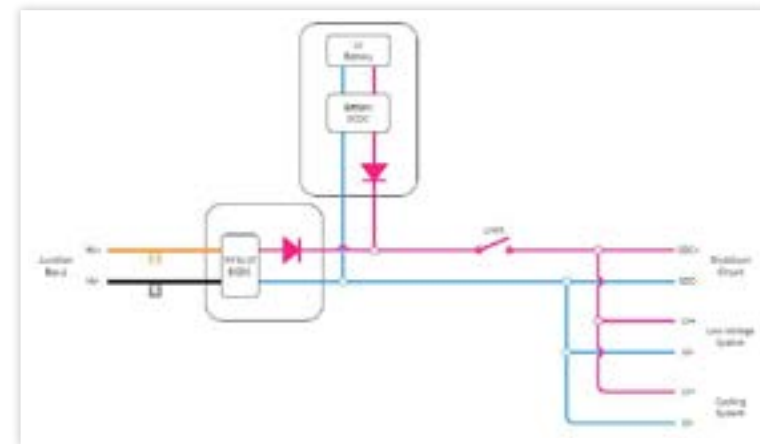hard to accurately predict the power draw of the cooling system, which will be drawing the most power. But in the end we were able to calculate how much all the pumps and ventilators would need and base our choices on that. The battery also had to be protected against the converter and vice versa, because they could damage each other by both imposing a different voltage. That is why I added diodes that prevent current from the battery flowing into the DCDC converter, or from the DCDC converter flowing into the battery.

Being part of a student team
I decided to join a student team because I saw an opportunity to work in a large multidisciplinary team. During the Bachelor you have quite some projects, but you do those in small groups and you never have a lot of time to finish them. A student team is the perfect place to get to know a lot of new people with different backgrounds and expand your practical knowledge of Electrical Engineering. I decided to take a gap year to be able to fully focus on the task at hand, but it's also possible to do a student team part-time, in every proportion imaginable: Some of my teammates follow their normal curriculum next to Green Team, others do just one course per module. As long as you have the motivation, it is possible.

Figure 3: Schematic drawing of the Low Voltage Supply

Electric Superbike Twente

Author: Tariq Kloezeman

Electric Superbike Twente has been an explorer of electric motorcycle racing since 2017. Our pursuit for speed was partially obstructed by the COVID-19 restrictions over the past two years. This resulted in two unfinished motorcycles with huge potentials. It is up to us, the fifth team, to extract this potential on the race track. With the knowledge gained in the previous years, during tests and on the race track, we have now set our sights on our race in Finland which starts on the 1st of July.

ELECTRIC SUPERBIKE TWENTE

Within Electric Superbike Twente there are four sub-teams. We have a Chassis team, the Powertrain team, the communications team and the management team. Each sub-team is responsible for a different task. The Chassis team works on the structural part of the bike, like the frame, electromotor and the bat-

partners. The Management team keeps a clear overview of the entire team and facilitates everyone in order to reach the team's goals.

The fourth sub-team is the Powertrain team. Our Powertrain engineers are responsible for all the electric components

modules, the battery pack including the Battery Management System (BMS), choosing the correct traction inverter but also the software development. As a powertrain engineer, you have to work very closely together with the chassis engineers to make sure every component is provided with our energy from the batteries and given the right directions. You also get the opportunity to work closely together with the engineers of our partners by for example improving the PCB's of our ECU at Prodrive, choosing the correct battery cells with our battery cell partner Melasta, stress testing the bike at the dynamometer from Ten Kate Racing Products or implementing the CCS protocol together Intech and Heliox.

The latest of the two bikes is called the Delta-XE. This bike is the furthest in development and hence I will give a detailed explanation on the electrical workings of the Delta-XE.

Figure 1: Render of Green Team Tentes latest car

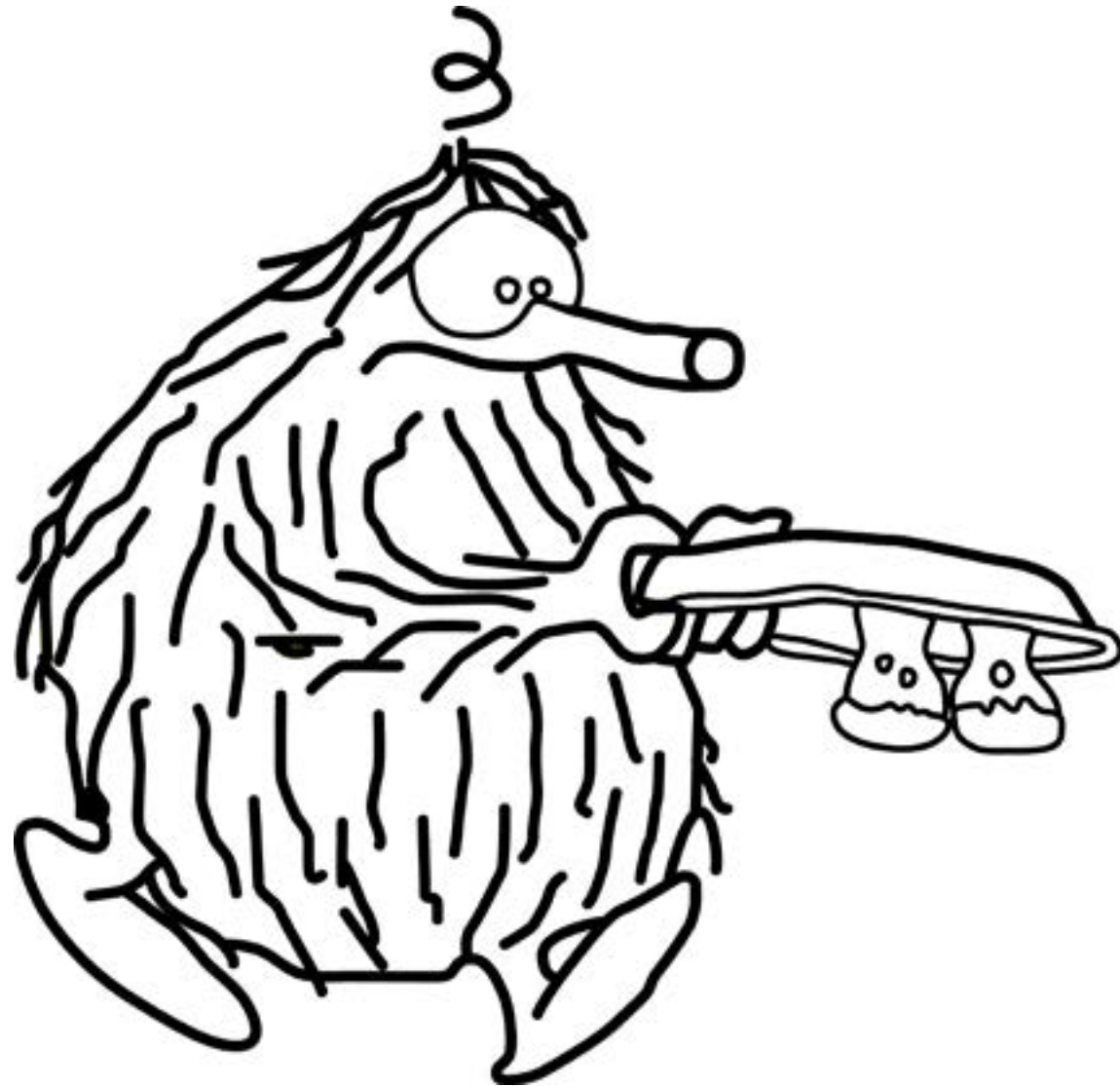*Figure 2: A schematic drawing of our Tractive System*

Low voltage system

You may want to know more about the power electronics in our bike immediately, but an equally important system in our bike is the low voltage system. The low voltage system monitors all the data from the sensors, such as all the coolant data and the throttle input given by the driver. The low voltage system also provides the instructions for the power electronics. The low voltage is still the brains of our bike.

The low voltage system runs on 12V. However, we don't use a conventional lead acid battery but lithium ion batteries in combination with a buck con-

verter. The reason being that with the li-ion batteries we have a higher energy density and can put the low voltage battery in every orientation desired.

The data in our bike is gathered using a Controller Area Network (CAN). In the previous bike all the analog sensors were read out by the ECU using long cables running to the ECU. This posed two problems, a lot of cables were necessary which made it hard to keep the bike organised and difficult to do repairs. Secondly, because these long wires running through our bike were prone to interference, these could influence the readings of the analog sensors. To solve both these problems, a CAN system was

implemented in the Delta-XE. Small microcontrollers were placed around the bike which read out the analog sensors with relatively short wires. After processing the data on the microcontroller, i.e. filtering or converting the data. Each microcontroller then puts the data on the central CAN bus. The data is available for all the other devices connected to the CAN bus and can take actions accordingly. The CAN bus is a robust decentralised system widely used in the automotive industry which has already proven its useability for a long time, hence the reason why we have chosen for the CAN system. Technologies such as the CAN network is one of the many technologies where you get experience on while developing the bike.

High voltage system

Now the low voltage system is functioning properly and has all the data to drive safely we can begin at the fun stuff, powering the motor with our battery pack of 800 VOLTS!! The battery pack uses lithium polymer pouch cells with high discharge ratings in order to let our bike accelerate as fast as possible without damaging the cells. The battery pack consist of 12 modules with each its own BMS chip. Each module has 16 cells in series and 3 in parallel, totalling in a capacity of 13.5 kWh for the whole battery pack. So, our battery pack has 576 lithium polymer pouch cells. The voltage and temperature of each tri-cell is monitored by our own designed BMS system. The BMS system disconnects the battery pack when a cell's voltage becomes too high while charging or too low while discharging or when the temperature of a cell becomes too high. The BMS also takes care that all the cell voltages are the same so that we will get the most capacity out of the battery pack.

With the battery pack delivering the 800VDC, we need a way of controlling the 3 phase motor. This conversion is

done with a traction inverter from Cascadia Motion. This is the only component in the powertrain which is bought off the shelf due to its complexity. In the future, however, it might be possible for us to make a custom inverter. The traction inverter can handle the 800V the battery pack is delivering and can deliver 170kW peak (30 seconds) to the motor at 15,000 rpm. The motor uses a IGBT power stage and is controlled by the CAN network.

The electromotor is a so called internal permanent magnet synchronous motor (IPMSM) which is made in collaboration with AE GROUP. We are using field-oriented control, also called "vector control" to send current commands to the three phases of the AC motor. The three phases are converted to a vector where one component defines the magnetic flux of the motor, the other the torque. To get the most efficiency

and torque out of an IPM style motor, you have to characterize the flux and inductance of the motor. When this is done, the motor can be operated with feedforward control using a lookup table, generated by the characterization tests. When operating at feedforward, a specific current is requested. A PI (proportional-integral) controller inside the traction inverter uses its feedback to follow the current command.

The motor controller requires positional feedback from the motor. Inside the motor a resolver is housed, a type of rotary electrical transformer. It exists out of 3 wire windings. The primary winding, fixed to the stator, is excited with a sine wave. The two two-phase windings, fixed at right (90°) angles to each other on the stator, produce a sine and cosine feedback current. This way it is possible to know the rotation of the stator inside of the electromotor.

Being part of a student team

Being a part of Electric Superbike Twente, you a get to know how it is to work on a large-scale project were all the facets of engineering come together including those of Electrical Engineering. Together with your enthusiastic colleagues, you will contribute in making the racing of tomorrow more sustainable, such that future generations can still experience the amazing world or racing. By doing so you will also meet businesses were you maybe end up working later, as well as see what the latest developments are in the electric vehicle industry. This can be done by going to expo's like the Battery show Europe in Stuttgart were all the big players in the world show off there latest innovation in Electric vehicles technologies by talking to the CEO's and CTO's of the companies. Next to going to expo's, there is also the opportunity to get guided tours at our partners to see their latest innovations.

Scintilla's Chains of Office (Penningen)

Author: Mathijn Becker

They are hung around the necks of the brand new board members every change GMM, they are visible on every board photo. Yet very little is known about them, despite the fact that when handed over to the new board members a story is told about why each one belongs to a specific board position. I'm talking, of course, about Scintilla's chains of office.

During my period as part of a candidate board it became clear that the chains of office were no longer insured. It was going to be my board's job to have them appraised, and to look into a new insurance policy. Now it has turned out that it is very difficult to appraise things, we were denied taxation on numerous occasions. One thing had become clear: secretly the chains of office are worth quite a bit, because they are (probably) made of amber and silver. These materials are certainly not cheap, but is that purely the reason why board members flaunt the chains of office so much?

Diving into the Archives

I went into the archives on a hot summer day, hoping to find answers to all my questions about the chains of office, and their history. But actually I found out that there is not much information to be found in the archive from the distant past. As real techies, only necessary things were stored, such as minutes and Vonk booklets. What I could find about the medals consisted of two things: a photo from 1969, and a program booklet of the first lustrum in 1970. In the program booklet you can see that there is a talk by the then Rector Magnificus, where a handing over of the chains of office is mentioned.

The story I've heard about this is that when Scintilla was founded, Thor and ETV came by with gifts, but the University of Twente itself had nothing. In order not to be left behind, they would come up with something, which happened during our first lustrum. The funny thing is, that a photo from a year earlier shows the board from then, in Berlin, with the chains of office on, a full year before Scintilla got them! So before the official gifting of the chains of office board members could already be seen flexing with them.

> *"There is a dent in one of them, and new amber on one of them as well. Of course, the one with the dent belongs to the Commissioner of Internal Affairs..."*

I even had contact with a member of that specific board, but it was too long ago for him to remember what was going on with the chains of office back then, unfortunately. He did say a drink or two

Figure 1: Close-up of a Chain of Office.

Figure 3: Dent in the chain and the bits on the back.

could bring back memories, but he is a busy man so a meeting has not happened yet. In the time since whenever we got them, some of the chains have had a rough time. There is a dent in one of them, and new amber on one of them as well. Of course, the one with the dent belongs to the Commissioner of Internal Affairs... Guess it is hard to take care of your chain of office when you are a few drinks in. As you can see, on the bottom side there are a bunch of numbers, grouped into bundles of five. Of course, this means something right? I found out that the numbers are in the International Te-legraph Alphabet No. 2, which was the foundation for the American Teletypewriter code, a code used for 5-bits typewriters. The assumption here is that 5-bit typewriters were used at the University of Twente in the early years. The code, translated to the latin alphabet, reads SCINTILLA!

Within the amber there are a bunch of components, and each change-GMM the board on its way out tells stories of how the components are arranged in a special manner, one that symbolises the board function related to that specific chain of office. If you want to hear these stories, definitely come to the next change-GMM!

If you ever find out more about the chains of office, or other interesting stories of Scintilla's past, don't hesitate to contact the Vonk committee! They usually are interested in stories such as this one. Maybe one day Scintilla will have a committee dedicated to the archives...

Figure 2: All the chains together in their suitcase.
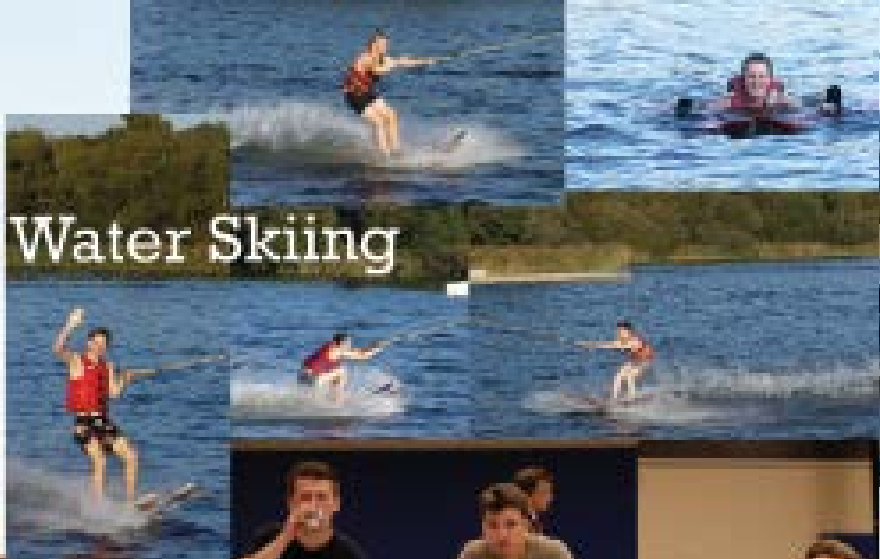
Water Skiing

Scrapheap Challenge

NoCoBo

Change GMA

Lustrumbook Hand-out

Active Member Outing

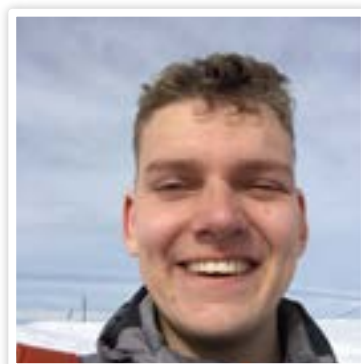'21-'22

BSc assignment

Author: Alexander Keizer

We live in a digital age in which more and more data is being stored every day. One popular way to store data digitally is through 'solid-state devices' such as SSDs, USB drives and SD cards. These devices have an advantage over traditional hard disk drives in that they have higher read and write capabilities.

However as these devices get smaller and smaller to store more data, they come with a downside; they become less reliable over time as their size decreases. During my bachelor assignment I investigated how these solid-state devices degrade over time, and how this degradation can be characterised over time.

To understand how flash cells (one single cell of flash memory) degrade, it is useful to look at the flash cell structure. Figure 1 shows a low level schematic of a single flash cell. To store data, charge is stored in the floating gate structure by applying a voltage to the word line, allowing charge from the word line to tunnel into the floating gate structure through a process known as Fowler-Nordheim tunnelling. Storing a charge on the floating gate structure also applies an electric field on the NPN structure below, affecting the threshold voltage of the transistor. If the charge increases on the floating gate structure, the threshold voltage increases to a value VT2>VT1, where VT1 is the threshold voltage if the floating gate structure is uncharged.

To read data stored on a flash cell, a voltage VT is applied on the word line, which is between VT1 and VT2. Then a voltage is applied on the bit line, which either allows a current to flow through the NPN structure depending on whether the flash cell is storing charge or not.

Solid-state devices have one drawback however; they are limited in program/erase (PE) cycles due to the mechanisms described above. Every time the floating gate structure is charged and dischar-

ged, the oxide layer insulating the floating gate structure becomes electrically stressed. In other words, defects and charge imperfections begin to

form in the oxide layer. If enough of these defects form, a phenomenon known as stress-induced leakage current (SILC) can be observed. SILC is bad news for solid-state devices such as SSDs, USB drives and SD cards because it limits the lifetimes of these devices. However, it is also known that the de-fects formed can be removed through
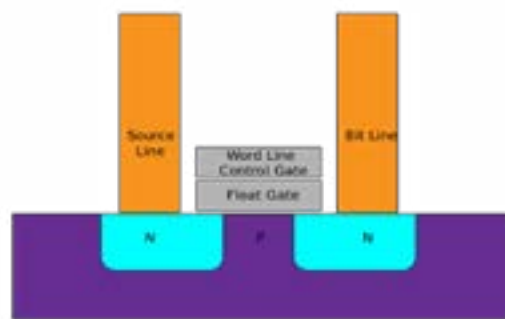

Figure 1: Flash cell structure. Degradation occurs between the floating gate structure and the gate structure [1]

the use of (thermal) annealing. What was not yet clear however, is exactly how the annealing process acts over time.

The goal of my bachelor assignment was to investigate SILC and the subsequent annealing process when annealing an electrically stressed chip at different temperatures. In order to study this, I was able to measure the leakage current present in electrically stressed MOS capacitors instead of flash cells themselves. This is because modern flash cells are small enough that it is not possible to measure a meaningful leakage current using traditional measuring techniques.

$$k = Ae^{-\frac{E_a}{k_s T}}$$

Equation 1 shows the Arrhenius equation, which was used to characterise the

rate of reaction of the thermal annealing process. The Arrhenius equation is used in chemistry to quantify and model the temperature dependence of the rate of reaction of a chemical process. Since the rate of annealing observed in the MOS structures is temperature dependent, it makes sense to use this model as a starting point to characterize the annealing process.

Over the course of several weeks, I was able to measure SILC and the subsequent annealing process in MOS capacitors at several temperatures between 110-230 degrees Celsius. Figure 2 shows one of the I-V curves that I measured whilst annealing a stressed MOS capacitor. Here it is also nicely illustrated that SILC is a more prominent issue at lower voltages.

In conclusion, we can state that the annealing process in MOS capacitors

closely follows the Arrhenius equation, whilst showing some second-order temperature dependence. However, extrapolating the measured data for lower temperatures makes annealing at lower temperatures currently unfeasible. Nevertheless, the measurements allows us to get a better understanding of the mechanisms at work behind thermal annealing.

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[1]   Cyferz, "Flash cell structure," Wikimedia Commons, July 2007
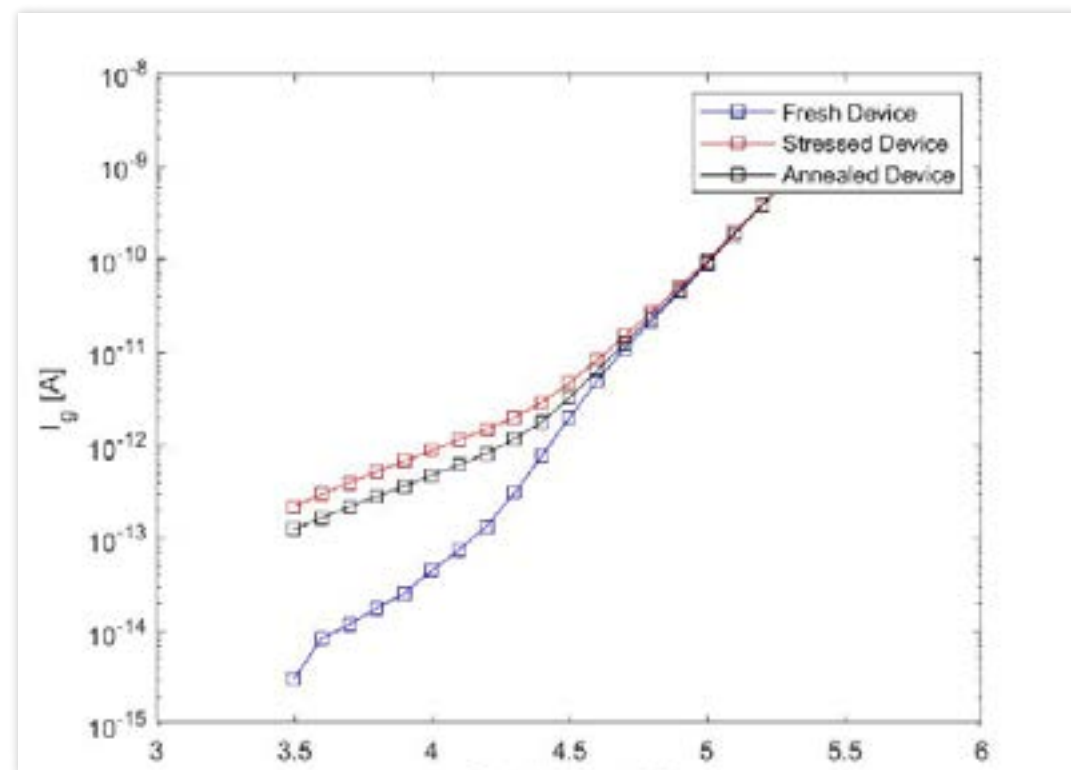[2]   Wikipedia, "Flash memory" (https://en.wikipedia.org/wiki/Flash_memory)

Figure 2 I-V curves showing the mechanism of electrical stressing and thermal annealing at 230 °C.

Multi-Frequency Electrical Impedance Myography as an alternative to Electro-Myography

Author: Ewout Baars

Imagine that one way or another you lose your hand. Various daily tasks which used to be an easy job might now be difficult to perform. Luckily in the 21st century it is possible to use a robotic prosthetic hand. At this moment multiple robotic prosthetic hands are already produced and used [1]. Most of these prosthetic hands make use of Electro-Myography (EMG) in combination

Electrical Impedance Myography

Electrical Impedance Myography focuses on the electrical impedance of a muscle or muscle group. Using a four points measurement and skin surface electrodes it is possible to calculate the impedance of a part of the human body. During this study, the electrodes are placed on the upper arm to measure the impedance of the bicep brachii, as shown in figure 1. EIM has a few benefits over EMG. EIM can be performed from 0Hz up to the Gigahertz range, while EMG has a bandwidth from 0 to 500 Hz. Besides, during one measurement instant multiple measurement frequencies can be used simultaneously. Therefore more information can be extracted from the state of the muscle per measurement.

Measurement frequencies

The measured muscle impedance is influenced by many factors, e.g. muscle length and width, amount of blood in the muscle and the (de-)polarization of the muscle axon's. [2, 3] When an isotonic contraction is performed the muscle

shortens due to the movement which is barely possible in an isometric contraction. However, in both cases the measurement should indicate that the muscle is contracted. This study showed that during an isometric and isotonic contraction the resistance decreases. The same holds for the reactance when the measurement frequency is lower than 50kHz. However, when the impedance is measured above 50kHz the reactance increases when a contraction is performed. Using 2 measurements below and 2 above 50 kHz it should be possible to distinguish a contracted muscle from a relaxed muscle in different situations.

Data processing

Even though using multiple frequencies it is possible to distinguish a contracted muscle from a relaxed muscle it is cumbersome to come to an equation that is not only able to distinguish muscle contraction but also to do this in different arm positions. Therefore a neural network is introduced to find a relation between the various measured impedances, muscle contraction and arm movement. The neural network is trained using 8 inputs, the resistance and reactance measured at 4 frequen-

cies. The training targets of the neural network are both the arm position and the amount of muscle contraction. The arm position is indicated by the angle of the elbow which is either 90 or 180 degrees. The amount of muscle contraction is indicated by an EMG signal
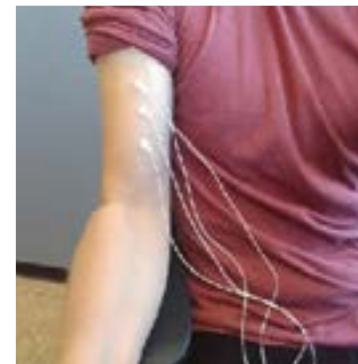

Figure 1: Placement of the 4 electrodes on the upper arm to measure the impedance of the bicep brachii.

the muscle impedance signals. Both target signals are normalized between 0 and 1. An example of a movement pattern including an isometric and isotonic contraction is given in figure 2. The corresponding measured resistance and reactance are given in the same figure.

Results

The movement pattern of figure 2 is performed multiple times, from "D" to "A" as well from "A" to "D". The neural network (NN) is trained using all the datasets of these measurements. One of the results of the trained neural network is given in Figure 3, together with the arm movement (bottom plot). The top plot shows the normalized EMG target signal and the output of the NN. As can be seen is have the target and the output of the NN a higher amplitude during contraction. The middle plot shows the movement of the arm. The arm is either in position "0" or "1". The NN is able to recreate the target very well.

Conclusion

Finally two conclusions can be drawn from the results shown in Figure 3. Using the impedance measurements measured at 4 different frequencies it is possible to distinguish a relaxed muscle from a contracted muscle even though the arm is in different arm positions. Secondly, it is possible to distinguish these different arm positions as well. Therefore EIM is a promising candidate for the control of a robotic hand.

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[2] L. T. L. Fiuza, "Feasibility of eit measurements of functional muscular activity as control signals for prosthetics," Master's thesis, University College London, k.aristovich@ucl.ac.uk, 8 2018. Department of Medical Physics and Biomedical Engineering.

[3] A. Liston, R. Bayford, and D. Holder, "A cable theory based biophysical model of resistance change in crab peripheral nerve and human cerebral cortex during neuronal depolarisation: implications for electrical impedance tomography of fast neural activity in the brain," Medical and Biological Engineering and Computing, vol. 50, pp. 425–37, 05 2012. Copyright - International Federation forMedical and Biological Engineering 2012.

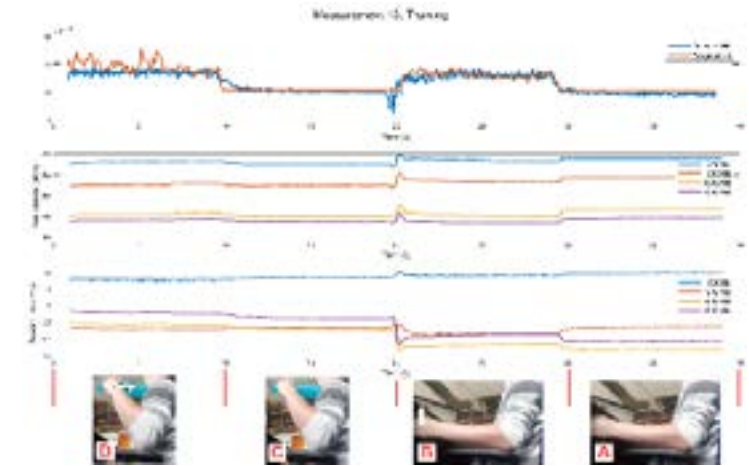Figure 2: The measured resistance and reactance during 4 different arm states. State "D" pushing towards the shoulder. "C" relaxing with the hand up. "B" pushing against table top. "A" arm relaxing on arm rest.
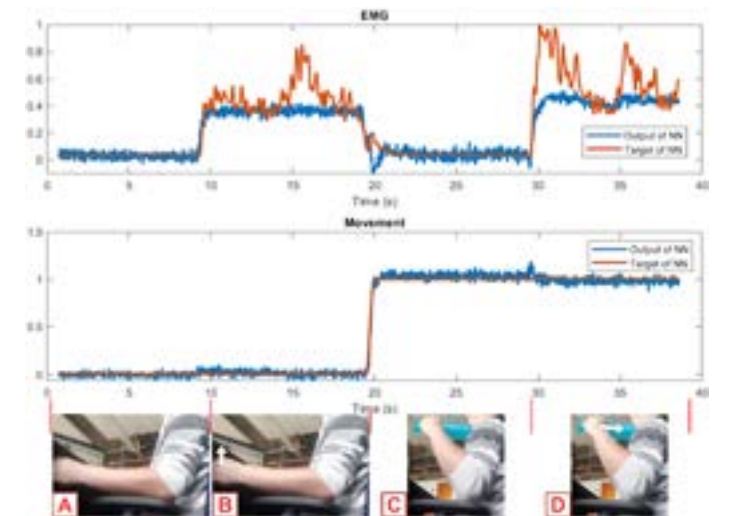

Figure 3: Bottom, the performed movement pattern with the 4 different states. Middle, the arm position target and output of the NN. Top, the normalized EMG target signal and the NN output.

Afterlife

Author: Olaf van der Meer

In the rubric 'Afterlife', Electrical Engineering alumni from the University of Twente look back at their time as a student. They take us along their study time and subsequent career path and share what defined their period at Scintilla and the University of Twente. In this edition: Olaf van der Meer.

Study years (2014-2020)

Studying Electrical engineering wasn't a clear choice for me, but Twente certainly was. When asking freshmen why they come to the east, most refer to some kind of 'atmosphere', although no one can really put it in words. I suppose it's the incredible amount of associations that make the UT what it is. On the downside, there's almost too much to choose from. Every 'clubje' will convince you that they are the place-to-be. I recall being unsure about what to do next to studying. As many people like to remind me of, I spent a considerable amount of time in my Kick-In with a certain pink hat. Luckily, I lived in a great house on the Campuslaan, full of older students, who were not in the least hesitant to point out why I was about to make a huge mistake. I ended up taking their advice to heart and joined a sports association, Phoenix Lacrosse, and Scintilla instead. Near the end of my first year, I was asked to take up the role of chairman in the bartending committee. This quickly launched me into more activism at Scintilla and would eventually lead up to doing a board year at Scintilla. I finished my bachelor thesis in 2017 at the Biomedical Signals and Systems (BSS) group. The topic was time-frequency analysis of pain signals in the brain using a MATLAB environment. Although the human biology aspect didn't speak to me as much as I'd hoped, I was convinced that the signal processing part was something for me. After my bachelor thesis, I wasn't sure what master direction to pick. Also, the prospect of working on non-technical skills appealed to me more than purely technical courses. In other words; time for a board year!

Doing a board year at Scintilla was a great experience, which I can highly recommend to anyone who's not sure if studying another year is the right choice for them. I was lucky to have a "full" group of 6 for our board year, meaning we had the luxury to pick up more work than only maintaining the association in its status quo. As commissioner of Internal Affairs, I focused mostly on committee business and member bonding, although general board member responsibilities take up a large part of the time. I won't go into detail into what a board year is or should be, I think people who are curious should find out for themselves! It's a time where you can develop yourself in a way that you feel suits you. In any case, I enjoyed working on soft skills and working with other people, in contrast to the individual studying.

During the board year, I also joined the study tour to China, meaning many weekends and lunch breaks were committed to raising funds and endlessly scrolling confusing websites to figure out how stuff works on the other side of the world. I can highly recommend taking the opportunity of going on a study tour when it presents itself. Having travelled China feels like a big bonus when working in an electronics company. Of course, it's also simply a fun experience that gives you a broader perspective on life and work in the Netherlands. After seeing the factory of the world and the heart of consumer electronics, I was more confident in what I wanted to do for my master's degree. I studied at the Integrated Circuit Design group, combined with a large number of embedded systems courses. I figured this would set me up nicely for a career in a consumer electronics company. I enjoy working on things that you interact with in daily life. I find it incredibly cool to see your own design end up in the local Mediamarkt. Luckily, I had an exciting internship at a consumer electronics chip design company already lined-up at Axign. For those that don't know the company, Axign is a fabless chip-design company that focusses on class-D amplifiers that offers high-end audio quality for consumer electronics prices. I followed the company for a while already and figured it would be a great mix of my music "hobby" and electronics "profession".
A company visit during the study tour to China.

I first walked through the doors at Axign in september 2018 and did a study on current-driven speakers. Unfortunately, an interesting assignment ended in a physical challenge when I ended up home with joint inflamations (tenniselleboog & golfarm) on both sides. Changing form a dynamic student life to a 9-to-5 desk job is quite a difference, and unfortunately quickly takes a toll on your body if you're not used to it.

> It's a time where you can develop yourself in a way that you feel suits you. [...] I enjoyed working on soft skills and working with other people

Anyone who ran into this as well will tell you it's an awfully long recovery. After several months of rest, I slowly got started on my thesis on high-resolution class-D amplifiers. After a slow and quiet thesis period due to a pandemic hitting the world, I graduated in the first week of September 2020. Writing the thesis is not only an anxious time for many students due to the pressure of generating results in their research, it's also the end of your student life rushing towards you that is confronting. I figured the best way to deal with the end of student life was to have an exciting job

prospect to have something to look forward to. Luckily, I was very confident in where I wanted to go; Axign made me an attractive offer several months before graduating. Remembering the advice to never take the first offer, I made a counterproposal which was happily accepted. I started my job as Application Engineer in October 2020.

Application Engineer at Axign (2020 – now)

I joined the Application Team, a team that I had never really noticed in my digital/analog view on chip design teams as a student. Our job is clear but diverse, use Axign's chips to design optimal products. Bridging the gap between very high system requirements and the limited available resources often proves quite the challenge, but it's a puzzle that I enjoy wrestling with. Living in a period of unprecedented component shortages makes the demand for creative problem-solving skills even bigger. Coming up with a new work-around or alternative to a suddenly unavailable

solution means everything in a business where time-to-market is key.

Since October 2021, Axign has moved to a bigger building, straight across the UT letters, to facilitate the rapid growth of our teams. In 7 years, the small startup has evolved into a more established player in audio chip-design. Despite the on-and-off corona measures, I work most days in the office to use the equipment in the lab. In general, the diversity of the work is what makes it great in my opinion. I roll from high-level schematic design and customer contact into firmware development and analog circuit design on a daily basis. It's great to be involved in all aspects of your product, it truly makes it feel yours.

An important aspect of my job in the application team that I did not foresee in my studies is the required soft skills to effectively communicate complex designs and solutions in a few lines of text over email. It especially does not help when the person on the receiving end speaks primarily Mandarin. As one might expect, China is the epicen-

tre of consumer electronics design and therefore is the home of many of my colleagues and customers. During my time at Axign, I've learned to enjoy the collaboration with Chinese colleagues. However, the occasional comically poor communication we receive back has led to a healthy dose of frustration as well. I feel like I enjoy working with my Chinese counterparts more than the average person, but I had no idea what this would bring on my path. After a year in the application team, Axign asked me if I would consider moving to China to help build-up Axign's Shenzhen office and lab. Needless to say, the following months were incredibly stressful. The prospect of flying to the other side of the world, together with my girlfriend, for an indefinite period of time is not something to decide over one night of sleep. After due consideration, I decided I was up for it, and started preparations.

Unfortunately, after living in anticipation for a few months, the exciting but scary prospect of living in Shenzhen got postponed indefinitely due to the pandemic. The outlook of strict qua-

rantines, unpredictrable travel rules and near-impossible visum applications simply results in too many downsides to weigh against the benefits. Nonetheless, I'm sure I will visit the region on many occasions in the future and encourage fellow young engineers to do the same. Getting more acquainted with the soon-to-be largest economy of the world is not a bad thing when working in a company that wants to stay relevant.

After deciding not to leave the Netherlands for the time being, mixed feelings arose. It was comforting to know that I did not have to leave my known life behind, but I was saddened to miss out on this opportunity to see more of the world and to further develop my professional skills. Luckily, a new opportunity quickly came across at Axign. From January 2022 onwards, I will take up the role of project leader. It's an exciting responsibility that combines deeper technical understanding of the design with the soft skills to keep everything on the tracks. As a student, I did not fully expect that the skills picked up during activism and a board year were on equal footing to the technical skills during the studies, but now I know better.

The project leadership is a function that I combine with my work as Application Engineer. In other words, I work with the current chips and the future generation of chips simultaneously. Personally, I think it's great to be involved in multiple projects at once. Perhaps this is a trait of smaller companies, where a limited number of people means that you can't afford to put a full-time employee on every little task. Due to this, I could also volunteer to pick up the task of working out a collaboration with Scintilla. Hopefully, at the time you're reading this, Scintilla is proud owner of two new JBL partyboxes that were designed right here in Enschede! Being able to share my work like this with friends and family is what initially drove me to consumer electronics and I'm proud to see

it become reality. I'm excited for the coming years of my career, and hope you are too. Life doesn't end after student life, it simply changes. I hope to see you all soon, perhaps even as colleague, in the afterlife...

Where To Find €1.1 Billion?

Author: Maarten Bonnema

Why do we see an increase in the student population? Who cares about the nominal study time? Who are the active students at Scintilla? Though these questions seem to be completely unrelated, the common denominator is – like almost everywhere in the world – money. Understanding where the money comes from and goes to is key in understanding the strategy, policy, and politics of universities. In this article I'll elaborate on the question how universities are funded, what type of allocation is used, and various phenomena that result from that method of allocation. Note that the exact allocation is much more complex than discussed here, but else no one will ever read this... Stay put, because comprehending the financial structure makes you understand why certain decisions are made: from alcohol policy to the collaborations of the UT with the Vrije Universiteit.

A brief overview of Dutch university funding and the power of allocation methodology.

Let's start with a brief overview of where the Dutch public universities get their money from. The total income of these universities can roughly be divided into three categories: almost 60% comes from the national government, about 30% comes from the students, and the remaining 10% is highly diverse. This 10% comes from governmental bonuses the university gets when students graduate, PhD's make their promotion, and external project funding, e.g. from the European Union or industry. However, I will mainly focus on the first two contributors.

Firstly, lets dive deeper into the funding from the Dutch national government. In 2022, the government spends a total of about €5.4 billion on universities. The UT receives – similar to Eindhoven and Wageningen – about €278 million, but Delft receives more than double. Do institutions closer to The Hague get more government aid and attention? No – unlike various other topics in politics – this is not the case for university funding. The allocation of funds is a complicated, historically-grown architecture. There are numerous fixed components in the funding that correspond to the numerous (sub-)tasks, like research and education, to provide a stable foundation. However, an important flexible component is the student-related budget. Annually, the national government sets a fixed budget for this component and it is divided proportional to the amount of students enrolled to a university [1]. Let's make it more concrete, what if next year all of a sudden the student population at the UT rises with +10% (usually this is about a few percent). Logically, the costs for the UT will rise significantly as well and the UT receives sufficient funds to cover the costs. However, what if all technical universities see a rise of +10% in their student population? Everyone, receives more funds, but often not sufficient, as the total amount of funds is fixed every year. Hence, for the government funding, we don't care about our own growth so much, but more about the relative growth in students. Naturally, this results in market forces and competition among universities – we currently live in a neo-liberal society after all.

Secondly, a more familiar component: the 30% contribution of the students. The first thing to understand here is that – by far – not every students pays the same tuition fee. A main distinction can be made between EER and non-EER students: student from the European Economic Region and outside. In essence, we stimulate the exchange of students within Europe. Table 1 shows a clear overview of the tuition fees, and a fun outlook for the coming academic year. health are forgotten. A problem which can be tackled by creating better work environment. Or just simply hire an extra physiotherapist or psychologist. However, we are sitting in a rollercoaster of technological advancement and innovation. It goes faster than we can adapt to and at a certain moment it will be too much for us. So maybe we should stand still sometimes and ask the question: "When is it too much?" and maybe take a small step back.

Apart from the extraordinary high tuition fees ATLAS students are willing to pay, we see that non-EER students pay more than €8,000 extra for a technical BSc and more than €14,000 extra for a technical master. Do universities get that much more money for non-EER student compared to an EER student? No. The government funding discussed earlier, only applies for the number of enrolled EER students. Basically, the difference in tuition fee is to cover for the missing subsidies, in order to break-even. So universities don't care – at least financially – whether they have EER or non-EER students? Definitely no, financially, there is a strong preference for non-EER students. This is due to another nice neo-liberal construction in the government funding: the funding only accounts for the nominal study time. Taking the example of a fourth year BSc EE student who participates in the full-time programme, this is seen as a financial burden of €8.500 a year.

> So maybe we should stand still sometimes and ask the question: "When is it too much?" and maybe take a small step back.

Even more interesting, the principle is institution independent: the nominal time is calculated from the starting date of the first enrolment. Taking the example of a fourth year BSc EE student whom studied already two years at Delft university, after the first year at the UT, the university receives no funding anymore. Hence, a burden for the UT of: 3*€8,500 = €25,500. Therefore, the universities have a strong preference – from a financial perspective – for non-EER students. Whether they studied for three years already in Delft or not, during their fifth year at the UT, they still pay the calculated break-even price

PROGRAMME	STUDY TYPE	EER STUDENTS [€]	NON-EER STUDENTS [€]
Bachelor	Technical	2,209	10,875
	Non-technical	2,209	9,375
	ATLAS	4,419	13,084
Master	Technical	2,209	16,500
	Non-technical	2,209	12,750

Table 1: National (for EER students) and institutional (for non-EER students) tuition fees for 2022-2023 at the UT. The definition of "technical" is accredited by the NVAO, but highly dubious nonetheless [2]…

of €10,875.

Overall, it is understandable that universities have financial struggles, if they want to uphold the quality of education and realise their ambitious research plans. Research from PwC estimates that universities in total lack about €1.1 billion this year [3], often resulting in reduced quality of education: higher student/staff ratio, cheaper academic staff (more PhD's and assistant professors that teach compared to full professors), fewer contact hours, etc.

This lack of income results in various strange phenomena. An intriguing consequence of the policy of government funding can be seen in the increasing amount of diverse technical programmes. Besides the incentive of growth, it is key that the programme can be referred to as technical, at least by the NVAO. This is because of another interesting aspect of the government funding: a distinction is made between three types of enrolled students: regular, technical, and medical. The funding per type of student is multiplied with factors 1:1.5:3. Medical students result in the most funding, this is mostly because their residencies (in Dutch: co-schappen) are very expensive. Technical students result in 1.5x the funding, intended to cover for the costs of lab work, materials/chemicals, physical projects, etc., those a law student for example doesn't make. This does sound rather fair, however, clever universities will always try to maximise this trade-off. In essence, what if we can set up a technical programme with minimum technical content (read: minimal costs)? The university receives their 1.5x funding and minimises the costs per student. Additionally, we know that non-technical studies are by far more popular than technical ones. Hence, a lesser intensive technical programme also alures more students, which fits perfectly in the goal of student growth discussed earlier.

To conclude, it's evident that the Dutch universities have a financial problem. However, what can (or should) they do about it? Well, first of all, we can say that the government funding is lacking. However, do we then resolve the root-cause, or just the symptoms? On the cost-side we see that universities are reducing expenses, leading to lower educational quality – or even abolishment of untenable programmes. I believe a lot could be gained in the student-side: encouraging nominal study time, but mainly optimising efficiency without affecting the quality of education (or even enhancing it). For example, a third of the funding can be gained by reducing the study delay of all students by a single year. Though these proposals are often controversial in the Netherlands, if we want to have resilient and sustainable universities, they are necessary to consider. The fixed, national tuition fees should become flexible. There is no way seriously competing with other universities if all fees are equal for all EER students. More diversity in the type of education: do you prefer no contact hours at all, full digital education (where possible)? Fine, enrol for a reduced fee for that programme. More socially aware, is your education more relevant for the economy and society? More government funding and hence significantly reduced fees, but also vice versa. Ideally, as a university you have maximum student-efficiency, those who enrol will graduate in three years for their BSc. One way to increase this efficiency, is to raise the Binding Study Advice, e.g. the ATLAS programme has a BSA of 60 EC. Other methods are to enhance matching and entrance criteria. In brief, I believe the government should step up its funding, however, this is only reasonable if the exploration of one or more – controversial – means is done, in order to uphold the great quality of education at the UT, and nation-wide.

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Active Member Weekend

Rento Hofstede Crull

Author: Tim Huggers

As the last edition of 'Icons of Electrical Engineering' crossed the Atlantic into London through the efforts of Sebastian Ziani de Ferranti, you might have a clue of where we're headed. Inspired by the Oyfo Technology Museum based in the old Hazemeijer factory in Hengelo I visited some time ago, it is time to discover the local engineers that were at the foundation of powering our dearest Twente.

Born in 1863, Rento Crull was a Dutchman contemporary to icons as Ferranti (1864). In his younger years, he was described as a stubborn kid, climbing on roofs if he could not have things his way. He was kicked out of high school for skipping school and insufficient marks and started working in metalworking, followed by a machine factory in Borne. He comes into contact with early electrical machines and his curiosity is sparked. He follows courses at the 'Technicum Mittweida', but had a hard time going after the money he needed for studying. His fathers inheritance, who had died shortly after Rento was born, seemed hard to claim. He stopped his study and instead attended the colleges by Wilhelm Kohlrausch, a renowned

professor at the technical university in Hannover. He did not have the money to officially get his degree but did learn a whole lot from following the courses.

Unfortunately, there is very little documentation on the following period of his life. He appeared in the reports to a minister written by Professor Snijders from the 'Polytechnic school' in Delft. Obviously, by the time of the 'International Electrical Engineering Exhibition' (1891), located in Frankfurt am Main, Snijders' interest in electrical engineering had already taken off. He attended a presentation from Hofstede Crull about the advances made by American company 'Thomson-Houston Electric Company' about which he reported

Figure 1: Hofstede Crull as of 1894.

to one of the governments ministers. Hofstede Crull must have worked at the Thomson-Houston branch in Hamburg. Soon enough, he moved to the United States.

General Electric Company, under the lead of Thomas Edison, fused with Thomson-Houston Electric Company. This gave access to a lot of experience and patents for Hofstede Crull to learn from. Most likely, he met with Edison as he describes him in a local newspaper:

"Edisons power was industrializing invention. He had a forward looking spirit: There is future in it, let me invent it. He would enable all his personnel to realize the invention he envisioned. "

Hofstede Crull returned to Europe in 1894. He started an electrical engineering office in Borne for the Körting brothers he had been introduced to in his time studying in Germany. The Kinderdijk in Alblasserdam was the very first place in the Netherlands where a public power plant was built in 1886 by

Figure 2: An advertisement in the Provinciale Overijsselsche en Zwolsche Courant, offering all the available goods they could supply. <No intersecting link>Figure 2: An advertisement in the Provinciale Overijsselsche en Zwolsche Courant, offering all the available goods they could supply.
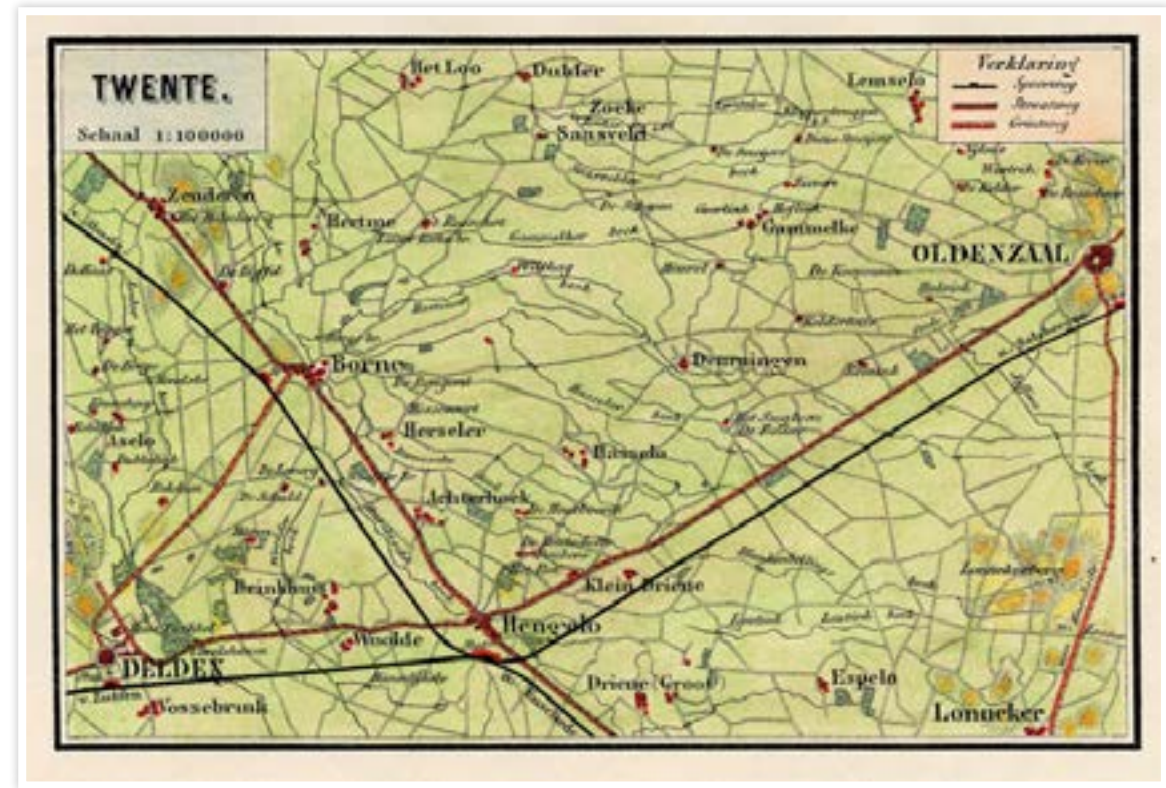

Figure 5: A map of Twente in 1884. Important for distance references: Borne, Delden and Hengelo can all be seen on this map.

Willem Benjamin Smit. In 1894, when the municipality of Borne signed with Hofstede Crull, it really was the first power plant that was built outside of a large city, which required a substantially different design.

The first electricity was supplied in

August of 1896. This plant featured a Cornwall boiler, built by Stork in Hengelo, a steam turbine from Gustav De Laval imported from Sweden that powered a German Lahmeyer DC dynamo of 2 x 110V.

This is why the international experience of Hofstede Crull was essential to the project; there was very little options in the Netherlands for the specific needs that the project required. Also, as the Current War was still raging on in 1896, it is obvious that Hofstede Crull took Edison's side as he worked for the General Electric Company during his time in the United States, although it could have made more sense to use an AC dynamo in the less urban surroundings of Borne.

When Hofstede Crull started a similar project in Terborg in 1898, he had to switch to AC as the plant would be located 2 km from the town the electricity was needed. As the majority of engineers around that time also recognised that it was most beneficial to have an as big as possible power delivery area through the use of AC plants, Hofstede Crull was quick to follow.
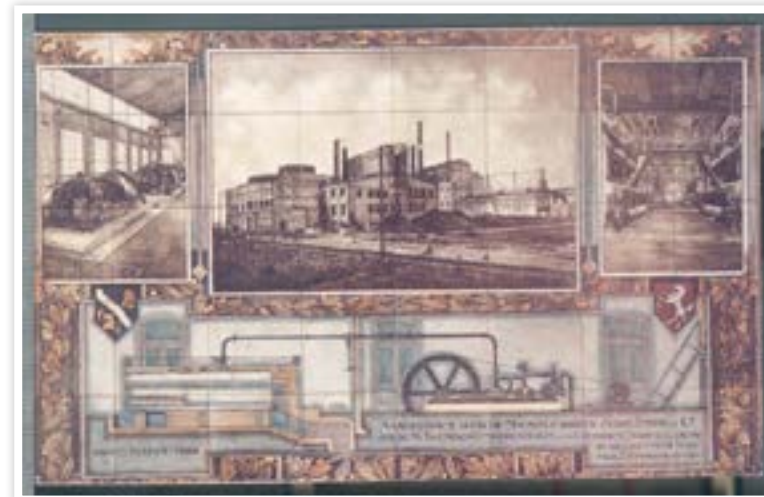

Figure 4: A tiling that shows the TCS, which can be seen at the Oyfo Techniekmuseum.

In 1899, the chief of the national railway service (called "Dufour" back then) asked Hofstede Crull if he could supply electricity from Borne to power the new train station in Hengelo. It would be another risk for the Bornish, unsuccessful plant, if they could not live up to this new contract.

He started gathering funds from all kinds of sources in order to start up completely from scratch. He dreamt of a power plant that would be central in the region of Twente (thus, in Hengelo) that would allow him to supply a much larger target area. Using Willink's contacts, he got the financials secured and started constructing a power plant that would first feature second-hand hardware. There was a strict deadline and the ordered piston steam machine would arrive too late. One of the first big contracts of the TCS would be a high-voltage line to Delden. As Hofstede Crull had returned to another exhibition in Frankfürt, he came to know of the possibility of a three-phase current technique that would allow a distance of six kilometers to Delden without a substantial amount of loss. He tried obtaining this contract before with his old DC company in Borne, but did not manage to close the deal. With his new AC plant in Hengelo, there opened up a lot of possibilities.

In 1910 our dearest Enschede got connected to the TCS network through the first 10kV connection in the Netherlands. It was the last piece of the puzzle as the whole of Twente already got connected to the TCS.

If you have been to Hengelo before and had a look at a couple of the old factories there, you might recognise the name HEEMAF. The origins lie with Hofstede Crull and an associate named Willem Willink. He was a mechanical engineer and was related to four renown textile entrepreneurs from the Twente and the 'Achterhoek' regions, which would be essential in getting the start-up capital and potential contracts. They started in 1897 under the name of "Hofstede Crull & Willink" in Borne but moved to Hengelo in 1900 as the Borne branch was getting too small. Hofstede Crull's ingenuity and Willinks stability made for a very successful balance in the company.

Figure 6: A Heemaf advertisement.

Eventually in 1908, the company was converted into a limited company which meant that the name be changed into 'Hengelosche Electrische En Mechanische Apparaten Fabriek' or Heemaf for short. It was done because it enabled for easier financial growth at the expense of having to set up an audit board that would have full disclosure.

Heemaf grew to be one of the biggest suppliers of electrical machines and devices for private use. They were one of the first developers of the vacuum cleaner, worked on efficient light bulbs and were the suppliers of the first Dutch traffic lights. In the 50s they were considered the biggest private energy company in the Netherlands. They eventually got merged into Essent which is an operational energy provider as of today.

When Heemaf started a new contract with the municipalities of North Brabant in 1916, a lot went wrong for Hofstede Crull. The communications with the municipalities caused issues, at its worst point having Hofstede Crull angrily assuring that he would get everything he could get out of the contract that he could, not agreeing to the terms that were set.

The audit board got word of this unfortunate cooperation that would be held accountable to the whole of the Heemaf enterprise. They concluded that Hofstede Crull had gotten overworked and as a result, having a hard time keeping his head cool. As a solution, they appointed two new directors next to Hofstede Crull and Willink. Hofstede Crull could not accept this and left the company in May of 1919, having been director for Heemaf for over 25 years since he and Willink started the company.

This was an interesting story to be included into the "Icons of EE" series. Hofstede Crull wasn't so much one of the prominent players in the Current War, he does provide us with perspective on how the view from the Netherlands would have been. Once again it may be clear that he lived in a very exciting time for electrical engineers and we should admire the contribution he had to the total Dutch energy supply.

His story finishes in 1938 when he is buried in Borne with a lot of media presence. He had been a renown man for his difficult character but inexhaustible diligence. In order to keep this article somewhat readable, there was made a selection of achievements of Hofstede Crull to be included. If you are curious for more accomplishments, such as "De Vereneeigde Yzerfabrieken (VYF)" in Doetichem, being President Chamber of Commerce in Arnhem, his obsession with 'Spyker' cars among other things, then make a visit to the holechistorie page on R.W.H. Hofstede Crull.

'Borrelen' for DUMMEES

Author: Tim Huggers

Pretty much the only word of Dutch on which everyone agrees on that it cannot be translated into English, is the beautiful 'borrel'. It is a mysterious term with which almost every (Dutch) student has a positive association. For fresh first-year students or our international students that want to learn the Dutch culture, there is a lot of unclarities and questions:

How the %&$* do I pronounce it?

'Borrel' can be described as in the International Phonetic Alphabet as [bˈɔɾəl], although I doubt that will be of much help to you. Easiest is to just go to one and ask a Dutch speaker at a borrel to pronounce it, and try to repeat it. He or she will gladly help, especially if you offer them a beer. You might get one back once you can pronounce it, as a reward!

It has some tough to pronounce consonants for non-Dutch speakers. The 'r' is widely used in Dutch without any other consonant preceding or ensuing it, where it is not pronounced as in 'bore', more so as in 'drug'. No English word really compares, but especially the Dutch 'bier' you might be familiar with by now, has the right pronunciation to the 'r' in 'borrel'.

Also important to be familiar with, is the term 'VriMiBo'. It is an abbreviation for 'Vrijdag Middag Borrel' which directly translates to 'Friday afternoon borrel'. Once every four weeks, one is organised by Scintilla on Friday from 16.00 o'clock onwards, a great way to enter your well-deserved weekend! Any other Friday, there is also a Vrimibo where you will be very much welcomed; its just not organised by your favourite study association <3. Inter-Actief organises borrels for Technical Computer Science, Abacus for Applied Mathematics and Proto for Creative Technology students.

It's just drinking beer, right?

Having a 'borrel' is much more than just having a beer. Generally, you always have an occasion for the 'borrel', for example you had a productive week, a module is finished, a new board must be constituted. You could invite your project group or do-group for the occasion, suggesting for example: 'Hey guys, we haven't spoken to each other in a while, we should celebrate that we made it through Module 1!'. It is a great way of staying up to date with your peers, getting to know your year and the entire association. Having the accompanying drink is just an option to smooth the process, allowing you to share your thoughts and feelings more easily. It can also be useful in finding the right project group for the next module, already having had a 'borrel' with them might give the cooperation a head start for the project.

> *"Once every four weeks, one is organised by Scintilla on Friday from 16.00 o'clock onwards"*

Where does the term come from? I don't see anything boiling?

Already in 1693, there were sightings recorded of signs of Dutch inn's saying ''Hier tapt men Borrel, uyt den treuren'' and "Hier gaat den Borrel, dag en nagt'', advertising the occasion of a borrel to bypassers with time and money to spend. The word 'borrel' originates from the medieval Dutch 'Borre' or 'Borne' which translates to 'spring' or 'source', and with the added '-el' functioning as a diminutive translating 'borrel' to 'a small drink'. By adding some adjectives, the exact substance can be filled in: a bitter borrel or a 'bittertje' can refer to gins such as Beerenburg. Therefore, 'borrel' is a very broad term and can be applied to a large assortment of beverages.

Who organizes borrel's?

Without de Borrel there wouldn't be any drinks! I asked Mathijn, the chair of de Borrel, to tell something about his beautifully named committee. An activity starts with an idea, either by one of de Borrel members, or by a different committee. The commissioner of internal affairs of Scintilla will schedule an appropriate date for the activity. Then, the person or committee sends a reservation through a form to both the BHV and de Borrel. The secretary of de Borrel will make sure there is a drinking room, and puts the drink on abscint.nl. Through this site the chairman can keep track of who is available for each drink, and select bartenders based on that. On the day of the activity, the bartenders will be there about thirty minutes early, to clean and prepare for the drink. Then, when the activity starts, immediately there will be fresh cold beers for you to enjoy! Afterwards, the bartenders and some of the attendants clean everything up, so that they can be treated on a nice afterdrink. Make sure to ask a bartender about his or her best afterdrink story, there's a lot of good ones!

Where do the drinks come from?

The Abscint and the MBasement, maybe you already know these places from a good evening with friends. These drinking rooms are stated in Educafé and six associations have the right to organise drinks here. There is one umbrella foundation responsible for these two drinking rooms. This is 'Stichting Borrelbeheer Zilverling'.

''Hier gaat den Borrel, dag en nagt''

It is important that the bar should be clean and drinks are in stock every day. Besides this it is not rare that equipment and furniture breaks. For this reason, there is a Daily Board that takes care of these tasks. They order beer, wine, soda and even shots. The Daily Board also takes care of hygiene and the content of the drinking rooms as well.

Every day from 4 P.M. an association from 'Stichting Borrelbeheer Zilverling' can organise a drink for their members. The main purpose of these drinks is student bonding and letting the students relax after a whole day of studying. Theme drinks, cantus and graduation drinks are organised on a regular base.

Do not forget to hop by sometimes and enjoy a drink with your fellow students for an exceptional price of €0.50!

What do I do?!

In general, joining a borrel is a very easy way of getting to know people from Scintilla. As you do the same study, there is a great chance you have something in common that you are interested in or if you want to ventilate about your frustrations and enjoyments that come with student life. If you ever find yourself without a subject to talk to, you can always pick up an edition of Scintilla's Universal News (SUN). A new edition is presented at every 'VriMiBo' (I hope you remember what this term means, otherwise I would refer you back to How the %&$* do I pronounce it?) organised by Scintilla. The SUN is a small (1 page) periodical with entertaining articles and a puzzle.

Congrats, you read through the whole article! Now you know everything about the concept of a 'borrel' and therefore you can consider yourself an official 'pilsbaas'. If aren't familiar with that last term, I recommend you ask one of pilsbazen at the next borrel ;)

Puuzle

Author: Truusje

After a long disruption in puuzles, Truusje is back with new puuzles. In order to compensate, and keep you occupied during this sparkingly hot summer you get two puuzles for the price of one.

The first one is binary puzzle, it has 3 rules:
1) Fill the grid, no more than two 1's or 0's next to each other in each column and row
2) Each row and column needs to contain the same amount of 1's and 0's
3) Each row and each column is unique

The second one is more challenging. It's for those fast puzzlers who solved the binary puzzle and need a bigger challenge. In order to solve it, you:

ELMEC ACELE DHKEL EMNDI TITHS ETTOP EOCRC TIODO NOMOS VOEWO

JOIN 'De Vonk' AND BECOME REPORTER FOR ETSV SCINTILLA!

send an email to: vonk@scintilla.utwente.nl

YOUR ASSOCIATION NEEDS YOU!

BartS - RoosM - JaimieJ - JasperV - RickR - TimoB - TimH - WouterN - AliS - JeongC