

# De Vonk

Periodical of  E.T.S.V. Scintilla

Year 36 | Edition 4 | November 2018

Main Article:  
Meet the Board!

Junction:  
The Dean of EEMCS

Committee:  
SHOCK



# IMPROVING THE QUALITY OF LIFE

Our vision has quickly become our passion; to improve the quality of life and be recognized as the best. When combined with our goals and values these statements provide the framework for our decision making and the development of our business strategy. We are working towards sustainable solutions for the natural and built environment. Big challenges like urbanization, scarcity of and water resources, and climate change are topics we are working on every day. Furthermore, Arcadis is thriving to be a premier employer who can make this expedition a fun journey!

For students and recent graduates we are organizing multiple inhouse days throughout the year.

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# Presidential Note

*Author: Ewout Baars*

Dear reader,

The first day of college is already a few weeks ago. By now, you start to understand what the student life means. Hard work, long days, but once in a while there is a fun activity. Maybe your body is able to get vitamins out of coffee and beer already, maybe you still have to adapt. For us, this year is also a new start just as it is for you. I'm still wondering about how the year will be, how I can make the best of it and what is wise to do.

You have spent a few weeks in different lecture rooms probably. Trying to find the next one and wondering how far it will be from your current room. I was used to that already, but now my situation changed again. Everyday you can find me in the Scintilla room, I drink a lot of coffee and talk with everybody who passes by. After a hard day of work and a lot of coffee I am tired and energized (from the caffeine) at the same time. Luckily there is a remedy available from 4 o'clock onwards.

Hopefully many of you have seen and enjoyed it as well. The constitution season, one of the most interesting seasons in the year. Your first reaction might be that it is strange to get so many free beers. After a while, you get used to it and you start to enjoy the whole happening there. For me, this year I learned how to fly, fall, push and pull through the whole room. This is simply because drinking free beer is not the only fun thing you can do at a constitution drink. "Brassen" is a ritual which is done and loved by many. You might have seen it and maybe you even want to try it. If

this is the case, train for a whole year, so you will be the best pedel for the next board. In this edition of 'De Vonk', you can even learn about the origins of the traditions that shape the constitution of new boards at the University of Twente.

Now that the season is over, your liver can rest a little bit, you can go to bed early again and maybe you will even be able to keep your eyes open during the lectures. If you have rested enough and you think you are strong enough to have a nice evening and get your credits at the same time, there is good news. Now the constitution season is over, the activities of Scintilla are going to start. Check the website, the little triangles in the edu-cafe and ask the board, because almost every day there is something fun to do.

Hopefully the board is still energized and has rested as well, hopefully we will be settled a little bit and hopefully we can indeed provide those activities for you. We are trying our best to make this year one of your best years and one of the best years for Scintilla!



Dames en Heren,

Op de koningin, op Scintilla!

Ewout Baars

President of the 89th board of E.T.S.V. Scintilla

# Masthead

## De Vonk

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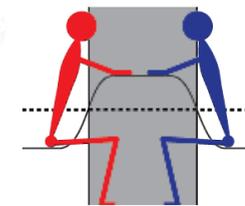
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Since February, Joost Kok is the new dean of the faculty of Electrical Engineering, Computer Science and Mathematics. We had a nice chat with him on his visions for the faculty of EEMCS.



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Several students have been working on concluding their Bachelor's degree with research into a topic on the cutting-edge of technology. Read all about their research in this article.



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# Editorial

Dear reader,

The academic year is well on its way by the time this new edition of 'De Vonk' will be delivered to your home or office. Most of you will be hard at work finishing that project or preparing for your next test. Good to know that you have found at least some time to relax by finding out what this edition of 'De Vonk' has to offer.

At the Editorial Office, we have been looking back at the successful start of this academic year. We have gotten to know the new board a little better and would like to offer this possibility to you as a reader as well. Not only will this edition present you with many interesting details on personal views of the board, it will also unravel their visions on the future of the association. As soon as you think you have been properly introduced to the new board, we challenge you to put your knowledge to the test in this edition's Puuzle.

In this edition you will also find another article on the rich traditions of the association. After the brief history that the Editorial Team presented to you last edition, we have now collected several historical facts on the tradition of the Constitution Drink. Matthijs has been diving into the origin of the phenomenon and added some personal experiences from this year's drink.

You will also find a junction with the new dean of the EEMCS faculty, Joost Kok, in which you will be able to get to know Joost better and learn about his visions on education within EEMCS.

Have fun reading!  
Stef

# News for the Electrical Engineer

Author: Maarten Thoonen

## Gradual Capacitance for Particle Position Detection in Microfluidic Channels

By Eiko Westerbeek  
BIOS Lab-on-a-chip Group

In this project carried out at the bios group, a new method to track particles or cells in microfluidic channels is presented. Particle position tracking in microfluidic systems is crucial to characterize sorting systems or to improve the analysis of cells in cytometry studies. By applying a gradual capacitance in a two parallel electrodes array the position of particles can be tracked in one axis by impedance analysis.

This method has the extra benefit of tracking the particle's position at lower frequencies and measure the dielectric properties at higher frequencies. A gradient in capacitance was obtained by manufacturing a gradient in surface area over the length of the electrode which resulted in a gradient in Electric double layer capacitance. A 3-D simulation was performed showing the particle position detection and dielectric properties analysis.

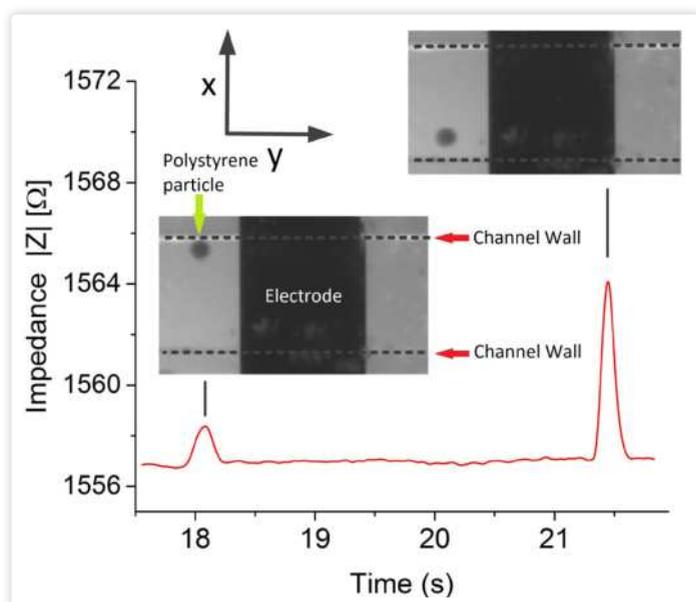


Figure 1: Measured impedance over the cell when two polystyrene particles passed at different positions, an electrolyte flow is applied from in positive y-direction. The height of the peaks is caused because of the different particle position in x-direction. The electrode which could be observed in the still are actually two parallel electrodes with a channel in between.

To experimentally validate the technique, a microfluidic chip with a gradient in capacitance was fabricated and used to detect the position of polystyrene particles in one axis and measure their dielectric properties at low and high frequencies respectively.

Figure 1 shows part of the measured impedance over time, when the two parti-

cles passed the electrode at different positions. The two particles have the same size and dielectric properties, but the difference in x-position results in a different change in impedance.

Figure 2 shows the change in impedance when a particle passes at different x-positions of the channel at low and high frequencies.

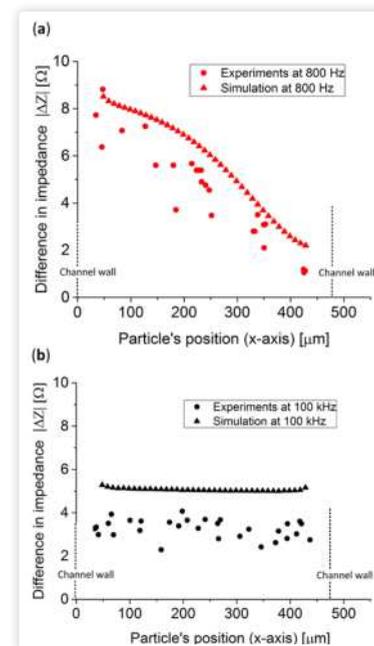


Figure 2: Figure 2a shows results from measurement as well as a numerical simulation at a frequency of 800Hz. The figure shows that the change in impedance, when a particle passes, is dependent on the x-position of the particle. Figure 2b shows the results of the experimental data and numerical simulation at 100kHz frequency, at this frequency the change in impedance is independent of the position.

## Competition for 7 nm Chips: Intel, AMD, and the Shift of Chip Manufacturing to TSMC

Intel is starting to outsource some of its production to TSMC, for example entry-level chipsets. Supply for its 14nm chipsets has fallen as much as 50 percent below capacity. TSMC is the world's largest foundry and has worked with intel before, including for iPhone microprocessors. TSMC was the first to produce 16nm FinFETs and has invested a lot into 14nm production. AMD is also planning to move its 7nm production to TSMC, giving it an advantage over intel's 10nm chips.

TSMC expects to profit from 7nm starting from third-quarter. However, cryptocurrency mining demand is weak. Therefore, the company revenue will grow with a high single-digit figure rather than 10 percent. Customer demand still was an ongoing challenge, according to the company.

Experts debate whether intel is using TSMC to help its own supply or to counter AMD. There is a shortage of intel CPU's. Production of the new Whiskey Lake platform should start third quarter, but they are forecasting a drop in notebook shipments due to weak supply. It could also be they are using TSMC capacity so AMD can't use it. Buyers are shifting to AMD due to intel security problems and intel has shown in the past they use such tactics and they can outspend AMD.

Written by David Jones

Retrieved from: <https://www.allaboutcircuits.com/news/competition-7-nm-chips-amd-intel-chip-manufacturing-tsmc/>

## 5G Specs Get Last-Minute Update

The 3GPP, a partnership governing mobile networks, has request a set of eight last-minute updates to the new 5G spec. they are not expected to delay the rollout of commercial 5G networks, but do show how much work is still being done in the background. The changes are not backwards compatible, so carriers and suppliers will have to agree on which spec to use, the current, the one from June or a hybrid. At this point, carriers are already deploying test equipment and handset makers are finishing up smartphones which supports the wide variety of bands, from 600 MHz to 39 GHz. They should be in use before April.

All the changes are marked as ASN.1, which means they are at the software layer. Of course no spec is bug free, so it is expected there will be more small corrections in the next version of the spec. an expert from Qualcomm is however reasonably confident there will not be any critical ones. Another expert said the changes can be handled in software or firmware. Carriers have extremely aggressive demands, all top four US carriers expect to have a network up by Q1 2019 or even the end of this year. Because of that, 3GPP might have tried to push the 5G spec to quickly. At this moment it depends on the manufacturer whether new phones will support all bands. It seems to be challenging to support both the very low and very high bands. This could lead to issues with roaming. The availability of bands is also still emerging. The FCC will auction spectrum for the 28 GHz band and a new 24 GHz band, requiring new RF front-end chips. At this point, the focus is at the 3.5 GHz band, although in the US only the portion from 3.55 GHz to 3.7 GHz is available. More availability is not expected before 2020 or even 2021. For carriers, the challenge is to set up small-cell base stations which are needed to support the mm wave frequencies in crowded urban environments.

Written by Rick Merrit

Retrieved from: [https://www.eetimes.com/document.asp?doc\\_id=1333787&page\\_number=1](https://www.eetimes.com/document.asp?doc_id=1333787&page_number=1)

L2s that correct features for EN-DC and SA with non-backwards compatible (NBC) ASN.1 change	
R2-1813082	PTRS-UplinkConfig NBC Correction (E010)
R2-1809976	CR on 38.331 for new RNTI and MCS table (RIL Q022, Q023, Q024, Q025 and Q026)
R2-1813272	Correction on reconfiguration of type 2 configured Grant and DL SPS H235, H236, H238
R2-1813385	Introduction of In-Device Coexistence solution for EN-DC
R2-1813440	Updated L2 capabilities (EN-DC related changes implemented as NBC change using author "R2-1813440")
Additional late change for EN-DC and SA with non-backwards compatible (NBC) ASN.1 change:	
-	Field measResultNeighCellListNR in MeasResultSCG-Failure -> MeasResults2NR is changed from being mandatory present to optional, and extension maker is added.
-	Field hoppingId in PUCCH-ConfigCommon, changed from "INTEGER (0..1024)" to "INTEGER (0..1023)".
-	Converted all corrections for EN-DC related UE capabilities in section 6.3.3 to Non-Backwards-Compatible (NBC) changes. Kept/Added version tags (-v15xy) where applicable. Used author "Raoorteur NBC-Capabilities".

Figure 3: Overview of specs.

# The 89th board of Scintilla

*Author: the 89th board of Scintilla*

**On the 4th of September, the 88th board handed over the scepter to the 89th board of E.T.S.V. Scintilla. We have asked them to introduce themselves by writing something about their history. Get to know the new board members a little better by reading their stories in this article and learn about what is driving them and what will be keeping them busy coming year.**

*From Ewout Baars  
President*

Hello, dear Scintilla member,

You might already know me for a few years, maybe only a few weeks or even a few hours. One thing for sure is that I'd like to meet you. One of the main reasons I started the board year is to get to know more people, but more about this later. Let me start with something about me.

My name is Ewout Baars and I am happy to tell that I am the president of E.T.S.V. Scintilla. This means you will see me a lot on activities, in the Scintilla room and many more placed connected with electrical engineering. I am always open for a short (if I am busy) or long talk.

If there is any problem, you can always come to me. I might not know the answer but I will always know someone who has the answer. This connecting role is one of my most important tasks. About 3 years ago I started full of ener-

gy and hope with electrical engineering and I could never have imagined how well that went. Right from the start, I felt at home among all other electrical engineering students and at Scintilla. Nevertheless, it took almost a year before I joined my first committee, the Borrel. After my first year, I had the urge to do more than only the Borrel, therefore I joined the SKIC (Scintilla's Kick-In Committee). Here I learned a lot about planning, organizing and distributing tasks.

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*“Right from the start, I felt at home among all other electrical engineering students and at Scintilla.”*

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After the Kick-In camp was done, I had no activity to organize anymore, which I really liked. Therefore, I became part of the Borrel board. We knew everything



about every Borrel organized, we made sure everything around the activity was taken care of and of course we joined the activities as well. I met many new people, people responsible for the bar, the building or even the O&O-square for example. Every activity which went successful gave new energy. I also had to lead the gatherings of the Borrel. I had a

hard time doing this in the beginning, but after a few meetings it got easier. In the end I even liked to lead the gatherings.

When the option came to become a board member, I did not have to think twice. I knew for sure that as a board member I would get to know many new people, learn new skills, organize even more activities and, most importantly, have an awesome year. After a long period of being a candidate board member, I can now finally proudly say I am a board member. Together with the 5 other board members, we run around, work every day and drink a lot of coffee in order to make your year as good as possible.

That's my Scintilla life, so to say, besides that I am just an ordinary guy. I love to do some sports and video or analog games. I have played; soccer, tennis and am still trying to see the gym sometimes (which is not going very well). My favorite video games are Rocket League and Viva Piñata Party Animals. My soldering iron is called Beau, simply because I like the name. The amount of coffee I drink is countable on two hands (if you count the cups of coffee I drank last hour). When I drink too much coffee you can clearly see it, since I'm bouncing up and down when this is the case. My favorite Scintilla snack is a nice Dutch snack: the stroopwafel. I can recommend it to everyone who does not know it. If you want to, you can try it with a cup of coffee and have a talk with me in the Scintilla room.

I hope you will have a great year and if I can do anything to make it better, contact me ;).

Greetings,  
Ewout Baars

P.S. I have lost until thus far a few pairs of sunglasses, but I don't know how many actually.

*From Matthijs van Minnen  
Secretary*

If you have been keeping up to date with Scintilla, you may have noticed that there is a new group of people constantly hanging around the Scintilla Room. They claim to be the new board and it appears I am one of them...

My name is Matthijs van Minnen, nice to meet you! I started my ventures at the University of Twente in 2015, but leaving this place is still far beyond the horizon. My hot-rod (soldering iron) is called Daphne. Perhaps I drink more coffee than is good for me and occasionally grab a Kitkat (Scintilla has several types, so there is room for some variation) as a snack to go along with it. The Kitkat is my favourite as it is a snack with chocolate which has some volume to it thanks to the layered biscuits inside. I will be consuming these snacks in/around the Scintilla room, so don't hesitate to come by and snack along!

As the 89th board of E.T.S.V. Scintilla we were initiated on the 4th of September. In this board, I will be fulfilling the Secretary function. As such, writing a short piece for the Vonk is no problem. The attentive reader may even have noticed that I have been writing some other articles for the Vonk too, over the past few years. Hence, for me, making the step to become the Secretary was only logical.

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*“Over the past few years I have actively been working for numerous committees. All of which were equally interesting and challenging.”*

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Taking a complete year off is not a small



feat, but in my eyes, this time is very well spent. Over the past few years I have actively been working for numerous committees. All of which were equally interesting and challenging. Nevertheless, I seek more challenge, which I hope to find in the upcoming year! Also, this year gives time for a well-deserved break from all the studying. Over the past three years I managed to obtain most of the study credits needed to complete the bachelor, but I would like to spend a little more time slowly taking in all of this material.

Besides executing all the board related activities and tasks I hope to improve many of my skills, such as improving my practical Electrical Engineering knowledge. Hopefully I will see you during one of Scintilla's Shock hobby evenings, were we can work on projects together!

Apart from the hardcore Electrical Engineering, I would like to improve my writing, which can be useful as the Secretary. Drafting emails and letters helps greatly, but there is only so much information one needs to put in an email. To publish larger pieces, I will continue writing for the Vonk. So, stay tuned for more interesting content written by yours truly.

Kind regards,  
Matthijs

*From Hessel den Hertog  
Treasurer*

Hello there,

My name is Hessel and I will be the treasurer for a full year, which means I should be able to control all the money that is going around within the association. As ABBA already stated in one of their songs:

Money, money, money  
Must be funny  
In the rich man's world

Unfortunately, we are students so being rich is not an option. But being a student for sure brings a lot of fun, so again: ABBA is always right.

“Being a student for sure brings a lot of fun.”

Furthermore being a Scintilla member also means that you have your own baby, which, when turned on, gets very hot. Of course I am talking about my soldering iron. I named her Tinna Turner.

Let's describe a normal day in the Scintilla room. A day can't begin without a good cup of black liquid gold, then I check some incoming mail whilst enjoying my coffee. Oops, I ran out of coffee let's take another cup.

Next up, declarations!! Things that people paid for Scintilla and who want their money back. Entering these declarations takes a lot of time since we are a very active study association, which is of course a very good thing.

Then after the break it is time for the action points acquired in the meetings with the committees. Finally, when the clock jumps to sixteenhundred I start to interchange my coffee mug for a beer



glass. But first, I need a little bodem so I turn towards the stripelist. First I check if my favourite snack, the suikerwafel, is still available. Otherwise I take a filled cookie. Then I go downstairs to, preferably, the Abscint, but the MBasement is also fine.

As Winter Is Coming and summer is going, the sunglasses can return to the wardrobe. But where did I leave them?

This is one big problem of mine. I think I can freely say that I am the biggest sponsor of Scintilla regarding the sunglasses.

I like both winter and summer. In the summer it is possible to drink a Grolsch Weizen in the sun on a terrace and in the winter it is authorized to sing Christmas and Frozen songs while building a snowman.

I ran out of words. You passed this part of the Vonk. You can now go to the next function. See you guys and girls (or, if preferred, other) in the Scintilla room.

Kind regards,  
Hessel

*From Melissa Tijink  
Commissioner of External Affairs*

My name is Melissa and 21 years ago (well, almost 22) I was born in Oldenzaal. Since Oldenzaal is close to Enschede, I still live there with my parents and our dog, my brother has moved to Groningen.

As you might already know, my function in the new board is the one of commissioner of external affairs. I will keep contact with the companies that we as electrical engineers are interested in and make sure that you have a good career orientation while you are studying. Now you might be wondering, how did I end up here?

At high school I enjoyed most of the subjects I had, but mostly mathematics and Latin. I did not enjoy physics, which may seem a bit odd for an electrical engineering student... Well, I never really imagined myself as an electrical engineering student. I used to think that I would study Medicine or some microbiological related topic. But everything changed, when I visited a Technical University.

“I did not choose Electrical Engineering, it chose me.”

From that moment I realised I needed some form of engineering and some form of mathematics in my study. And I liked everything I encountered. So the search began. I finally ended up doing a 'student for a day' thing here in Twente and I experienced something that can be described as: I did not choose the study, the study chose me. And from that moment I decided to do electrical engineering. Which was a surprising outcome for myself and everybody around me.

I still get some surprised faces when I



tell someone I study electrical engineering, but that has more to do with the fact that I'm a girl. People still believe that being a girl in a men's world is the toughest part about studying electrical engineering, that is at least what they usually ask me first.

I will not lie, it is hard sometimes. I did not really know what I was going to get myself into when I started the study. I remember the first weeks during the lunchbreaks. I expected to talk about our weekends and other things in those long 75 minutes, but we ended up watching Arnold Schwarzenegger quotes again and again. Luckily we started talking more as the year continued and I was less bothered watching silly YouTube videos, and these 75 minutes feel shorter and shorter.

In my first year, I joined the LEX (lunch lecture and excursion committee), because I wanted to expand my skills and get active in the student life. At the end of my first year I became chairman of this committee. I enjoyed being in a committee, so in my second year I joined the Gala committee, the Sun and Scala (activity committee). In my third year I expanded my list of committees even more, by joining the CursusCom-

mittee. I feel really at home within Scintilla and I want to work on some skills that we do not learn within the study for a year, that is why I am doing a board year.

In my free time I enjoy reading books, I love the Harry Potter books. I am also a fan of Scandinavian thrillers. The 'whodunits' genre intrigues me so much, I recently started Crimibox, which is a company who sends you a box with a (made up) murder case in it. Furthermore I enjoy watching movies and series and tv shows from the NPO (national broadcasting station). My other hobby is playing flute, which I do in an orchestra. Last year, I played basketball in Enschede and before that I used to swim. Basketball was a dream of mine, but because of my knees I never got the chance to play. I enjoyed it a lot last year, although I'm not really good at it.

I'm looking forward to this year, I am sure that I will learn a lot and, also quite important, have a lot of fun with my fellow board members and all the other Scintilla members!

Kind regards,  
Melissa

Favorite Scintilla Snack: Autodrop  
Scintilla sunglasses: 0 (my head is too small)

*From Romano Ferla  
Commissioner of Internal and Educational Affairs*

Dear readers of this piece about myself,

I'm the fifth board member you will read something about (at least if you read the Vonk from left to right). In constitutive order you would assume I'm the Commissioner of Internal affairs (CIA), which is totally correct! For 50%, as my second function is the Commissioner of Educational affairs (CEA). That doesn't mean, however, that my piece will be as twice as long as the others. I could, but I won't. That said, let's move on.

So as CEA, I will do numerous things, such as being a contact person for students if they have problems with their study. I will try to combine information out of all the things I come into contact with. These might be student complains, but also arguments with the lecturing staff and university-wide discussions about education. With this information, I will try to improve (read: make people improve) the study and the relation between Scintilla and its educational side. If the students feel good, the CEA feels good.

As CIA (I like this abbreviation), I use some knowledge of the CEA part to know when and which students have



time to participate in activities and make sure it fits in the planning. Activism is something I will promote, under the first years students, but also at the older years students. With this high number of activism already present in Scintilla, I will coordinate the committees on a higher level. If the members feel good, the CIA feels good.

That was a bit of what I ought to do next year, but that does not really inform you about who I am. If you have no idea who I am, I'm the guy with the 'kuif'. In the summer you see me with sunglasses, when winter is coming I trade it in for a scarf.

Within Scintilla, I always loved to participate in activities and eventually ended up organizing them. In my free time (some sort of section of time, extremely valuable but hard to find) I like to be with my girlfriend/friends/family, drinking 'just one beer' with others and going to bigger parties. Other things I like to do more often are for example reading a book for recreation and losing myself in the stories in it. I also enjoy traveling (at least 1000km, not just getting the train to my parents) with a good companion (or more) and explore other cultures and adventure into nature.

while exploring ruins and dungeons, an Electrical Engineer is just as worthless if the electronics are not made. Often that is also said with a student and coffee, but not in my case. I believe the number of coffee drunk last year (till the moment written) is countable on three hands. If I would extrapolate this data however, knowing that last two months I drank more than half of it, one finds an exponential curve. Though, with such a small data set, it's unclear whether I will become a caffeine addict or if it's just part of a sinc function and I will eventually stop drinking any more coffee. Time will tell. My favorite Scintilla snack is the 'speculaas torondo', it's cheap, it fills your stomach, it has a great kcal/€ ratio and has a better taste than the regular one. It's just the best.

Have a great year, don't forget to enjoy the great things in life!

Kind regards,  
Romano

Ps. Lost 1 pair of Scintilla sunglasses, but also acquired one, so that counts as even.

*From Sebastian Bunda  
STORES Administrator*

Hello everyone reading this!



If you started reading this article from the beginning, you've got to know the most part of the current board of E.T.S.V. Scintilla. I am the last piece of the puzzle as the administrator of the STORES.

My name is Sebastian Bunda and I recently turned 21 years old. I am originally from Arnhem and started studying here in 2015. If you come to the Scintilla room often, you'll notice that I am not always around. This is because I am trying to combine a part-time board function with working on a hydrogen car at the Green Team Twente.



**"Scintilla became like second home to me."**

As the Administrator of the STORES, I will be managing the financial aspect of the best electronics shop in the neighbourhood.

As a board member I am not only responsible for the STORES but together with the rest of the board I will make sure that the association runs properly.

At the Green Team Twente I am working on the electrical drive train of the car. At the moment we are trying to figure out what part of last year's car needs to be improved. This will likely include working on a new boost converter or a new motor controller.

You might think with all these tasks the-

re is little time left to study, and you'll be correct! Last year I finished the last part of my Bachelor. Since I haven't decided yet on what Master to continue with, I decided to take a gap year between my Bachelor and Master with the aim to develop myself.

Since I started my studies, I have been an active member participating in many committees and after a while Scintilla became like second home to me. When I got the chance of doing a part-time board year next to a part-time Green Team year, I could not refuse.

The Scintilla room offers a large quantity of snacks you can buy. So if you ask me what my favourite one is, I do not have a definitive answer. During my Bachelor assignment I spend a lot of time in the SK which meant that I tried out a lot of different snacks. But if I do have to select a few, I would choose the "roze

koek" and a Lion.

In my free time I enjoy making music on my guitar and jam together with some friends. When I am not playing the guitar, I also enjoy playing games with my friends and watching movies and series on Netflix. I still play tennis every week in my home town and I try to do some other sportive activities at the side, like jogging and the occasional visit to the gym.

I hope that I will see you around when you visit the Scintilla room. I will try to make the best of this year and I hope you will do to!

With kind regards,  
Sebastian

P.S. I still have the Scintilla sunglasses that I bought last year.



From left to right: Sebastian Bunda, Melissa Tijink, Matthijs van Minnen, Ewout Baars, Hessel den Hertog and Romano Ferla.

# Advertorial Witteveen & Bos

Electric Bus Transport, The Future or Reality?

Authors: ir. T. Ludlage, ir. C. Liem

**This article will focus on the implementation of a bus transport option which is fully electric to make it more sustainable. This requires a transition from the current diesel infrastructure and therefore the question: The future or reality?**



## Situation

Environment, health and sustainability are important issues on a national and local level. This is coupled to numerous initiatives and targets. For example, municipalities need to be CO2 neutral by 2025. To achieve this target, people are looking at car free zones or at making public bus transport more sustainable, because diesel buses and cars are a large source for local emissions of harmful gases such as CO2 and NOx.

Above-mentioned ambition is the reason for the zero emission agreement for bus transport. This agreement, made at a provincial level by the transport authorities, is a letter of intent to replace all diesel buses with zero emission buses (e.g. hydrogen/electric) by 2030. From 2025 onwards only zero emission buses are allowed to be purchased.

## Problem definition

Making bus transport sustainable is not just a simple action of replacing the current bus fleet. There are several factors that need to be accounted for. Figure 1 shows the relationships between the different factors.

Simplified it means that the next factors are important:

- Charging methodology;
- Delivering the required power;
- Maintaining the current timetable of the buses.

There are several solutions for these factors, but a solution for one factor can have a lot of implications for solutions of a different one. The following options are available for charging methodology:

- Opportunity charging / Overnight charging;
- Conductive charging by an overhead line / inductive charging with a coil in the ground.

For the delivery of the required power:

- Capacity of the charging units;
- A location is required for a distribution station with a transformer, low voltage distributor and available connections;
- Power loss in the cables versus location of station.

Maintaining the current timetable provides the following variables:

- Size of the battery
- Possible energy losses



Figure 1: New value chain electric buses.



Figure 2: Charging methodology: inductive / pantograph / power plug

## Trade-off considerations

To show what this means in practice, an example will be given. In this example, line 1 has a route length of 22 km. It is assumed that the energy consumption of the bus will be 1,5 kWh/km.

Choosing a method of charging is a bit easier. Although inductive charging seems very promising, the technology has not quite advanced enough to achieve the same efficiency and reliability of a “conventional” pantograph. Therefore charging via pantograph or by power plug is preferred. Power plugs are mainly used in case of charging at the bus depot. Figure 2 provides an overview.

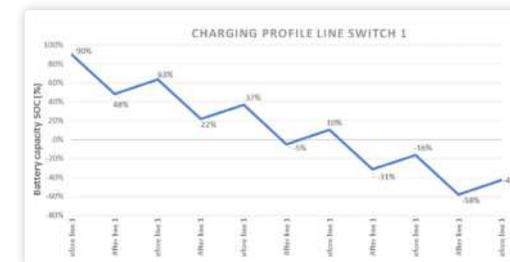


Figure 3: Scenario 1: Bus of line 1 with a battery capacity of 79 kWh and bus stop time of 2 minutes

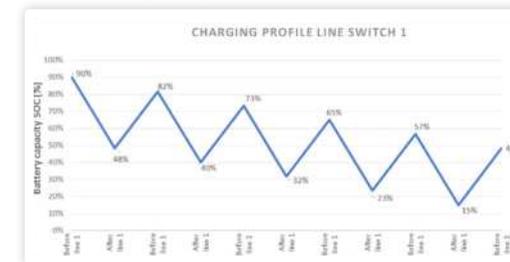


Figure 4: Scenario 2: Bus of line 1 with a battery capacity of 79 kWh and bus stop time of 4 minutes

After each round line 1 will arrive at a charging point and will have limited time to charge. For now the assumption is that the bus has a battery capacity of 79kWh. To determine the maximum charge capacity of a charging station, the following formula needs to be used:

$$\text{Minimal battery capacity} = \frac{\text{charge capacity}}{C\_factor}$$

C\_factor is the charging speed of a battery. For top-end batteries, the speed is currently 6C. When this value is entered in the formula, the required minimum charge capacity of 450kW is found.

Placement of the charging stations gives several practical issues that need to be addressed. One of them is the power loss when using long cables from the charging units to the charging points. Another one is when multiple charging points are used simultaneously; this amount is not naturally available in the grid. New installations are required such as distribution stations, with charging units, and need to be placed around the station where limited to no space is available.

But how much will a battery charge during a short stop? This can be calculated when assuming that a bus will stop for an average of two minutes at a bus stop. However some of this time cannot

be used because the coupling process of the pantograph also requires 30 seconds. Effectively this will leave 1,5 minute of charging time per full round.

Figure 3 shows a representation of the described situation. It shows that the charging time is insufficient to bring the State of Charge (SOC) to its starting point. This results in an extra challenge, which can be solved in different ways. For example, it is possible to increase the size of the battery, which will give the bus a larger range (but the graph will still have the same behaviour). Another option is to increase the stop time of the bus to 4 minutes, see Figure 4.

This graph shows that it is possible to perform the timetable for line 1 (if the amount of rounds are limited). Other possible solutions could be improving the energy consumption of the bus by increasing the efficiency of the air conditioning, optimize the driving behaviour of drivers for driving electrically or increasing the charging capacity of the charging units (and batteries).

## Conclusion

In the end... Electric bus transport; The future or reality? The example shows that electric bus transport could be implemented right now. New developments in the future could result in more robust and reliable scenarios, which would increase the speed of implementation. This makes this subject a very interesting field with a lot of developments, which provides lots of opportunities and possibilities.





Figure 3: The difference between the two export files shown graphically. Notice that the margins present on the left are absent on the right.

that goes to the printer. This file includes margins that allow for some deviation during the printing of the magazine, which is needed because it is eventually cut into the right size by hand.

The second export is the file that gets uploaded to the digital database on the website. This file is not physically printed and therefore does not need the margins.

As with every committee, the board is eventually responsible for everything we, as a committee, do. Therefore the board is tasked with the actual publication of the magazine. The board puts the final file on the servers of Scintilla and contacts the publisher that we have an export ready for printing. Every Scintilla members receives his copy of the Vonk at his postal address. This address is quite sensitive information as it usually corresponds to the place where someone lives. By letting

the board do the final steps of the publications, the committee does not need access to the entire database of addresses of all the members and effectively avoids any privacy concerns.

“When everything has been confirmed, we tell the publisher to start printing the magazines.”

The publisher downloads the required files and processes them in its own printing software. After this has been done, the publisher sends a final print preview to us. With this example, we can do a final check whether all the margins are correct and also whether the front cover and back cover align nicely with the print on the spine.

When this has all been confirmed, we tell the publisher to start printing the magazines. It usually takes ten days for the publisher to print all the copies and mail them to every individual member (the mailing is actually done by a different firm). The spare copies get shipped to Scintilla by the publisher directly. After those ten days all the readers can enjoy their new copy of our great magazine!

If you have made it all the way to the end of this article, you now know the entire process of creating an edition of the Vonk. In the next edition, I will explain how the layout of the Vonk is made and tell you about all the things that can go terribly wrong during this process.

Are you interested in joining the Vonk after reading this article? Don't hesitate to contact us at [vonk@scintilla.utwente.nl](mailto:vonk@scintilla.utwente.nl)!



SKIC

Beer Burger drink

Ladies kick-in

Pre-reunion drink

Wissel ALV

# Advertorial: Arcadis

Author: Erik Rietbergen, Arcadis



Solar panels are part of the design of building-related installations. When calculating and/or implementing a Photo-Voltaic (PV) system, several factors have to be countered and/or implemented to make the system safe and the design optimal. Not implementing these can result in a less effective or even dangerous (Health & Safety) PV system. In this advertorial, these factors/subjects are brought to (sun)light and provided with a solution.

## Intro

A PV panel consists of multiple solar cells which are electrical devices. These cells convert light into direct current (DC) electrical power which is transported via cables to an inverter which turns the DC energy into alternating current (AC) power, see Figure 1.

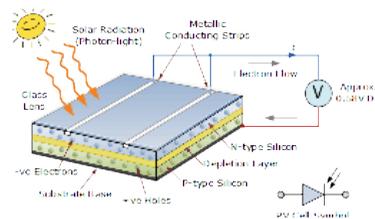


Figure 1: Solar Cell (source: Alternative Energy Tutorials)

## Shadow influence

Shading is one of the biggest influences on the performance of a PV system. An inch of shade on a panel will result in a decreasing output of the panel and if not designed effectively, the whole series of panels will decrease their output. An exhaust on the roof, a speck of dirt (lack of maintenance) or even another panel can create enough shade to the panel for it to

'restrict' the flow of the current through the cell string. For these reasons extra design calculations and research needs to be done, which is often forgotten. Implementing the equation in Figure 2 below we can counter the shadow cast by the panels on each other.

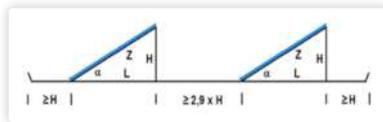


Figure 2: How to counter shadow influence.

A string of solar panels is usually connected in series. In which the current produced by the first panel is the maximum of the second panel, etc. This combined by a restriction of the current created by the shadow will have a chain reaction that can reduce the output of the whole string of panels.

By utilizing Direct Current optimizers, the influence of shade is countered by adjusting the output voltage and current and maintaining the maximum power of the system. These optimizers will boost the decreased current so it matches the current of the unshaded panels.

## Gradual Degradation

The next factor is the degradation (in percentage) of the panels, as soon as a panel is exposed to sunlight its cells start to degrade. This degradation reduces the output of the cells and thus the output of the whole system. The amount of the degradation varies from less than 1% to even 3% in the first year and 0.3 to even 1% in the years following. Causes of degradation are:

- Quality of the panel's materials;
- Weather conditions;
- Physical damage;
- Maintenance (panel cleaning).

When the degradation is sub 80% it's seen as the system has reached its end of its lifespan and will need to be replaced. This percentage is achieved faster with implementing low quality panels as seen in Figure 3.

Next to the lifespan, the degradation is important when the reason to implement a PV system is to counter the energy usage of an installation. If not implemented in the design there's a possibility that after a couple of years (or even after year 1) the output of the system is lower than the to be countered usage.

Example of Gradual Degradation			
LQ panel		HQ panel	
Year	Efficiency	Year	Efficiency
0	100%	0	100%
1	97%	1	98,5%
2	96,1%	2	98,2%
3	95,2%	3	97,9%
4	94,3%	4	97,6%
5	93,4%	5	97,3%
6	92,5%	6	97,0%
7	91,6%	7	96,7%
8	90,7%	8	96,4%
9	89,8%	9	96,1%
10	88,9%	10	95,8%
11	88,0%	11	95,5%
12	87,1%	12	95,2%
13	86,2%	13	94,9%
14	85,3%	14	94,6%
15	84,4%	15	94,3%
16	83,5%	16	94,0%
17	82,6%	17	93,7%
18	81,7%	18	93,4%
19	80,8%	19	93,1%
20	79,9%	20	92,8%
21	79,0%	21	92,5%
22	78,1%	22	92,2%
23	77,2%	23	91,9%
24	76,3%	24	91,6%
25	75,4%	25	91,3%

Figure 3: Gradual degradation (quality panel).

## Power outage (black-out)

What happens to a PV system when there is a power outage? Is it smart enough to

IEC voltage range	ACV (rms)	DCV	Risk
High voltage	> 1000	> 1500	Electrical arcing
Low voltage	50 to 1000	120 to 1500	Electrical shock
Extra-low voltage	< 50	< 120	Low risk

Figure 4: Electrocution risk.

power down or will it continue to produce power and thus create a dangerous situation?

Unfortunately most PV systems will continue to operate as if the grid or the connected distribution board is still active. This not only creates a fire hazard when the produced power is "piling up" in the distribution board, but it also creates an electrocution hazard, which is specified in Figure 4 according to the standard NEN-EN-IEC 60038/NEN 1010.

When an inverter is switched off, it will only interrupt the current of the system but the voltage will remain at a dangerous level (>120 DCV). The height of the voltage is dependant on the number of PV panels that are connected to the system, for example four panels will generate more than 120 DCV which will create a risk of electrical shock. Larger systems for residential or commercial projects have dozens or even hundreds of panels in which the voltage can go up to 1kV.

An effective solution to counter these risks is using the optimizers (explained in "Shadow influence") to lower the voltage per panel. These optimizers can be provi-

ded with a modus which switches off the panel and the string cables. This modus is activated when the connected inverter signals that the power supply from the grid or distribution board is gone.

The output from the panels while switched off is 1 DCV each. The capacity of the string cables has to be designed so that the output is lower than 120 DCV which equals to less than 120 panels per string.

## Outro

Erik Rietbergen is an electrical designer and PV specialist for Arcadis in the division Buildings department Building Services, where he designs and engineers a wide array of projects from offices to laboratories.

At Arcadis, Erik has many opportunities to develop himself personally with Arcadis Imagineers and a personal action and development plan. Next to his work and personal development he has multiple opportunities to develop his technical skills via the varied projects and his bachelor Engineering and Applied Science at which he is going to graduate in 2019.

# SHOCK

From Bus Pirate to Soldering Iron

You probably have heard of the committee and every now and then the activity pops up on the site again: the SHOCK hobby evening. It sounds epic, but what is it exactly? The SHOCK (“Scintilla’s hobby commissie voor knutselaars”) supports the Electronic hobbyist at Scintilla. We organize the occasional hobby evening in the Westzaal, where all the fancy equipment of the Westzaal is available for you. SHOCK activities last the entire evening, so you can prototype and solder to your heart’s desire!

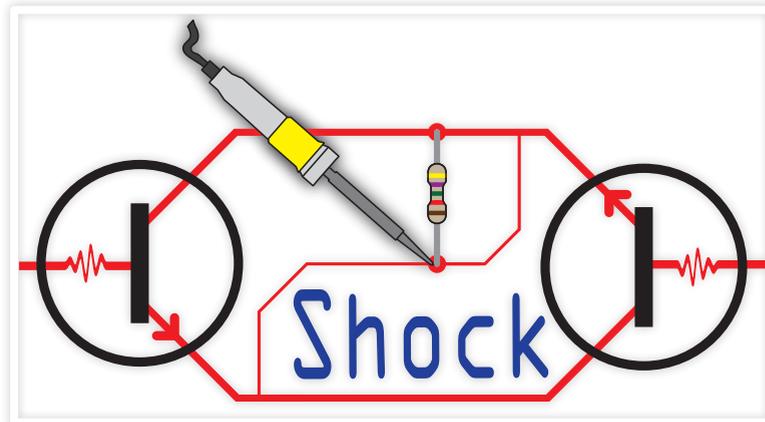
You can work on your own projects with fellow students around you and not be locked away in your small room suffocating from dangerous lead fumes because

“It raises the thought why the faculty still has the MyDAQ.”

it is too cold outside and you don’t want to open your window. In your room you also don’t have the awesome help fellow Electrical Engineers can give you. Maybe you need some insight in your class-D

amplifier design or your Arduino code is not working and you don’t know why. At such an evening you can also awe at the crazy projects others have, like somebody making a machine that can detect weeds with a camera and kill them with a strange taser system. And don’t you have all the components for your project or did you just blow up that import part of your circuit? No problem! Often there is a STORES representative present that can sell you the stuff you need.

And now you are thinking: I want to attend such an awesome evening, but I don’t know what to build... Well, you



Author: Wouter Nijenbuis

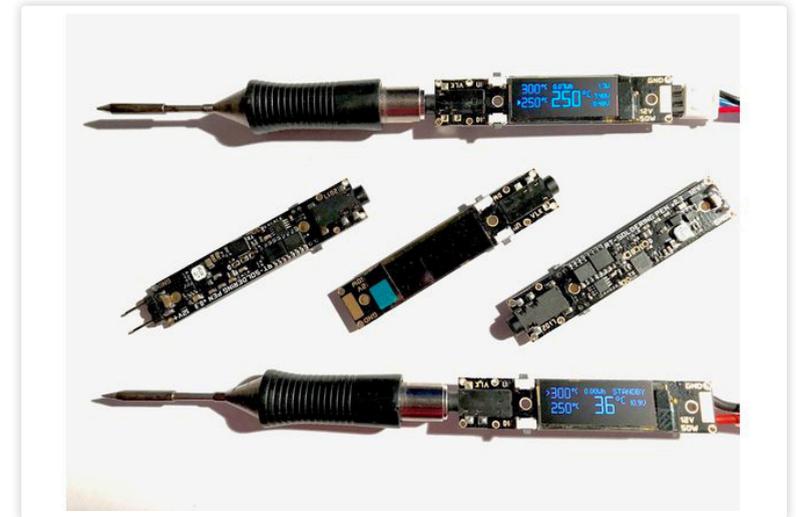


always have friends or the internet for ideas. But if the internet gives you a sensory overload from all the cool stuff that is presented there, SHOCK has you covered. Because this year, we will start selling project kits we developed! Two kits have already been finalized, the Bus Pirate and the portable soldering iron.

When you hear the name Bus Pirate you would probably think of some Johnny Depp dude riding a bus while singing shanty songs and drinking rum. Well sorry to disappoint you, but that’s not it. Maybe this piece of tech is not as weirdly interesting, but it is a nice piece of equipment every Electrical Engineer should have. A Bus Pirate is what some people call a hacker’s multi-tool that can talk to all sorts of electronic stuff. You can flash chips and talk to them with all sorts of protocols like I<sup>2</sup>C, SPI and UART. It has a measurement probe that can measure up to 6 Volts and it can measure frequencies up to 40 MHz. It even has a function generator and power supply on board. And everything is controllable via a serial terminal on your PC. It raises the thought why the faculty still has the MyDAQ. The best part of the Bus Pirate is a fully opensource design. This gives way

to a lot of custom firmware and code that can be used with the Bus Pirate.

The second project that will be available at the hobby evening is a portable soldering iron. Maybe you have heard of the TS100, a soldering iron that is fully user programmable and can either work with laptop power supplies or just run from a LiPo packs. As SHOCK we thought: we can do that! So some work later there was a beautiful design. We used Weller RT tips because they are very good quality and the heating element and sensor are very close to the tip, what makes for quick heating times (5 seconds!) and accurate tip temperature. The tips are low



Weller RT tips

“A Bus Pirate is what some people call a hacker’s multi-tool that can talk to all sorts of electronic stuff.”

energy, they already reach high temperatures at 40 Watt. And because these are very popular tips there are a lot of different types available. The soldering iron will be controlled with an attiny5 microcontroller, which can be easily programmed using a cable that is included with the kit. It was some challenge to figure out how to get to the attiny5

because it has a limited number of pins. But luckily the Weller tips connect with a 3 point 3.5mm jack, so with a 4 point 3.5mm connector on the PCB this can be used for programming and controlling the tip! The kit will be available at the STORES not too long from now for around €40 (while the original Weller soldering station for those tips costs €350). At a hobby evening these kits will even be available with a discount! And of course, there is help from the SHOCK when building one.

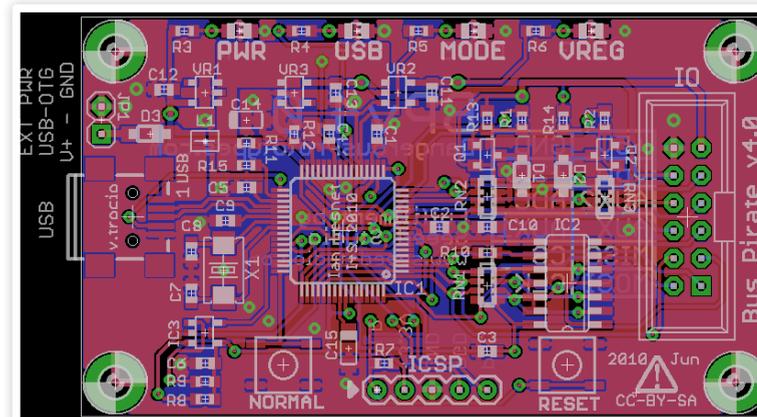
With every project we are bringing out we try to schedule a couple of evenings in which you can work on the project, so

you don’t have to plan that yourself and your cool new project is not going to end up as a nice bookshelf ornament collecting dust. This year we expect to have

“When you hear the name Bus Pirate you would probably think of some Johnny Depp dude riding a bus while singing shanty songs and drinking rum.”

three projects available with approximately 2 evenings per project. After the projects are launched at a hobby evening we hope to make them still available as soldering kits at the STORES.

We’ll see you soon at the hobby evening with your own awesome project or a nice kit that we have made for you!



The Bus Pirate V4

# Meet the Dean of EEMCS

Joost Kok

From a town on the outskirts of Amsterdam to the rural campus of Twente. Joost Kok has made many steps to lead up to his position as Dean at the EEMCS faculty of the University of Twente. We were able to ask him some questions to shed some light on his flourishing career and what is to come for the EEMCS faculty. Read all about the drive of the dean below.

After he is asked to give a small introduction, Joost Kok takes us back to his youth:

"I grew up in the small town of Muiderberg. It is on the outskirts of Amsterdam. It is the Dutch gateway to the polder of Flevoland. If you drive from Amsterdam to Almere, you will cross a bridge. On that corner you will find Muiderberg."

*In this small town which is right next to the IJmeer and the Gooimeer (two lakes), there was plenty of water for Joost Kok to work on his aquatic skills. He practised many water related sports from windsurfing to water polo.*

*The new Dean went to primary school here but went to high school in the larger town of Bussum. Here he went to the same*

*school as Dutch celebrities such as Ron Brandsteder. After this came a tough decision, namely which University to attend.*

*At this point, Twente has definitely crossed Kok's mind, "but then I had to visit Enschede to find a room, so then I thought lets live at home for a year and study in Amsterdam which is how I ended up at mathematics."*

So, mathematics in Amsterdam?

"Yes, Computer Science did not exist, so all you could do was Mathematics and a specialisation in Computer Science. The first time you could study Computer Science in Amsterdam was in 1981."

We hear you previously worked in Leiden,

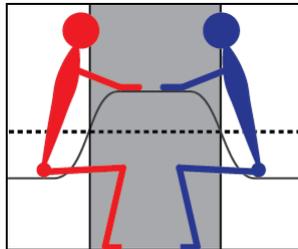
what did you do in the past?

"I have lived a year in Finland after which I moved to Utrecht. Before I moved to Twente I have worked for 23 years in Leiden."

You have worked for 23 years in Leiden and you have been working in Twente for half a year, are there large differences between the two universities?

"The University of Leiden is a diverse University, one with many different stu-

Author: Matthijs van Minnen



dies. So it is what you could call a comprehensive University. Twente is more technical although we cannot really give it that name. The scope is smaller here when compared to Leiden. In Leiden they educate 28.000 students whereas here in Twente there are 'only' 12.000 students. So Leiden is twice as large."

What is your opinion on the sizes of these Universities?

"In Twente, some things are definitely smaller, but you could also name it more transparent. In Leiden the University

"Twente has a true campus."

buildings are scattered around the city whereas Twente has a true campus."

What are the advantages of having a campus?

"Well, it is not that small. Although I have the feeling that you are more closely connected to what is going on. I have the feeling that this University plays a large role in the area of Twente. The University has much contact with companies in the region. Many of these companies largely depend on the University and it's students and staff. This connection is far less strong in the Randstad."

Could you elaborate on this?

"The University of Twente shows more



Joost Kok

Age

Study

Favourite Food

Favourite Drink

2018 - 1961 = 57

Mathematics (with specialisation in Computer Science)

Food filled with spices

(Premium) Pilsner

passion, they are still strongly connected to the region of Twente than they are in Leiden. Leiden focusses on the world. They have been sending students to China for the past 200 years."

"The University of Twente is still strongly connected to the region of Twente."

Does this 'local' vision clash with the vision the Executive Board of the University to become more international?

"I do not believe the Executive Board focusses on that. Internationalisation is an important focus point but if you look at the relation with German Universities, there is a large difference. The closest University to Twente is the University of Munster in Germany, which is significantly closer than any Dutch University. This creates interesting opportunities to work together. If the Brexit continues, the collaboration between the Netherlands and Germany becomes more important. Twente is on the border of both countries and can provide an interesting angle."

Would you say interesting developments are a brew, especially in the Twente and Ruhr regions?

"Yes, I believe collaborations will become more intensive. We will be working together on many things. Especially regarding energy, this does not stop at the border of a country. Being on the border it becomes interesting to create 'Energy test gardens.'"

Are there any plans in development yet?

"No, this is still something we have to

work out, but we are working on starting up these kind of projects. We are in a luxury position at this moment. The number of students is growing. There are sectorplans which allow us to invest in fundamental research. This combination provides a good vantage point as we are continuously growing and we can decide what we want to invest in."

So you have the freedom to work on these kind of projects?

"For us this is a major opportunity. Sometimes I compare our situation to Eindhoven, they set themselves up close to Philips. Here, companies are setting up around our University."

Hearing this answer it seems there are no worked out plans yet?

"Well, we are very much thinking about this. It is a two-sided affair. For these kind of projects research groups have to work together. This can be extended beyond faculty borders. It does not only involve Electrical Engineering, Mathematics and Computer Science. There are numerous topics such as energy and data science, which you cannot simply place with one research group but with the expertise of a number of research groups. It is demanding on the faculty to be able to complete such tasks."

*After looking closely at the similarities and differences of Leiden and Twente we were also interested in the difference between the new Dean, and the predecessor, Peter Apers. Apers was in charge until the 1st of February when he passed on the responsibilities to Joost Kok and could en-*

*joy his emeritus.*

Are there things in the past few months that have drawn your attention or were disappointing?

"I have developed a strong admiration for Peter Apers because he was able to manage things fantastically. The Natural Gas Revenues (Aardgasbaten) project is something that has given the whole Computer Science scene in Twente a boost which has been flourishing since.

After my appointment this new dynam-

**"We are able to meet goals a year before they are due."**

mic situation started in which we have a lot of freedom to invest. We are able to meet goals a year before they are due. It is the foundation Apers built which I can build upon. It is a special kind of situation that we ended up in."

*It became clear that the transition in the faculty provided a great platform for change and innovation. One could name many different examples as to what the faculty can improve upon. In the long run however, this continuing growth will cause problems because of the limited space. We were interested to see if the faculty is already anticipating these problems.*

Are there any plans to expend and make more room for the growing faculty?

"We are working on this and are looking at the future moves. Research groups will move from Carré and to the new Techmed Centre. This might be the perfect opportunity to claim more space for Electrical Engineering labs. At the same time we should look at improving the efficiency and utilisation of the already available labs. For this we need to cross faculty borders. An example would be data science, this is a growing field which needs to be tackled by multiple faculties."

How would you like to see these fading boundaries?

"You can already see a change with some chairs, they are already crossing the borders of research groups and even faculties."

It seems like TOM could play a role in this?

"This is part of the philosophy of TOM. It is a unique feature that we have here in Twente. Besides this there are some limitations to TOM. It is a discussion I follow closely."

*With this final piece of information we see that Joost Kok has great plans for the future. The boundaries between faculties should be removed to make way for the seemingly unstoppable growth that has currently taken hold of the EEMCS faculty. To conclude we asked him what role the students should play in this puzzle.*

What is a last piece of advice you would give to the students?

"The students must realise that Electrical Engineering has an enormous potential. The knowledge of your subject is exactly what the world needs now. Electrical Engineering has reality on the one hand and the limits of nature on the other. So-

**"Students must realise that Electrical Engineering has an enormous potential."**

omething you could call the 'Wisdom of Nature'. The combination is something very interesting. You should realise the power that is in your hands with Electrical Engineering."



Faculty Board of EEMCS with Joost Kok (centre) as dean.

# StudyTour to China

## Technology Road

Author: SRC

On the 22nd of July 2018, 22 members of Scintilla arrived in Beijing, China. The study tour 'Kē jì zhī lù' ('Technology Road') visited China for three weeks. In those three weeks, Beijing, Xi'an, Wuxi, Shanghai, Shenzhen and Hong Kong were visited. China was chosen to see the great advancements in innovative technological development in the big growing economy. During the study tour several companies and universities were visited to get an understanding of the newest technology.

### Beijing

The trip started in Beijing, which is of course the capital of China. On our first days in China the program was not that intensive as everyone was quite jetlagged. On our first official day, we planned to visit the forbidden city. Unfortunately, we were not allowed in. :(

Not that the city was forbidden – as in the dynasty era. But only 80,000 people were allowed to go in per day, so we had

to come back another day. Furthermore, we went to visit the Beijing Zoo to see great pandas. They were big but not that great, as they were sleeping all day. We also did a very nice but difficult hike up the Great Wall guided by a 63-year-old woman. Even though it was very warm, she did not look exhausted at all. Especially next to us, as it seemed like we ran a marathon. Besides all the sightseeing and culture, we visited two universities as well, Tsinghua University and Beihang University.



### Xi'an

While staying in a luxury hotel in Xi'an, we explored the city. The first thing we did was a tour on tandems over the old city wall, crossing over the wall, way faster than the Chinese. Luuk and Raymond even decided to do another round.

One of the main attractions of Xi'an is of course the Terracotta Army. Together with uncountable Chinese people we visited the halls with excavations. Our very enthusiastic guide, Stefanie, showed us around through the halls. Afterwards, we had to hurry to be on time for the Tang Dynasty Show, which ended up in driving through the city as you would do in GTA.

On Monday we visited Huawei and the Northwestern Polytechnical University (NPU), where we got a presentation about NPU and their prominent role in China's aerospace engineering program.

### Shanghai

In Shanghai we stayed in the well-known



hotel Hyatt on the Bund. From the rooftop bar on the 32nd floor of our hotel you had a great view of the river and the nicely lit skyline of Shanghai. Among many company visits, we had a nice and inspiring visit at Philips. The CEO told us a lot about the healthcare system in China and asked us how we managed healthcare in the Netherlands and how we would change the Chinese system.

Although we were in China, we ran into a German themed bar, so we drank some nice German (half)liters crafts beer served by Chinese bartenders dressed in Lederhosen and dirndl.

### Shenzhen

Our stay in Shenzhen started off with a visit to the Shenzhen Electronics market. Which isn't just your regular Dutch food and clothes market where sellers shout their reduced prizes all over the place. The difference starts even before entering. It was like taking a journey through Mario land with tunes every 50 meters cast by an intercom. Spontaneous dancing occurred very often when the LED strips and other electronics were spotted. Like enthusiastic children we swarmed over the first floor of one of the many skyscrapers that was packed with

electronics. It felt like a real-life Ali express. As Shenzhen is one of the major manufacturing capitals of China, we visited some really cool companies that showed us how they make semiconductor components (mainly diodes and other small stuff) and giant LED screens. This even included 2 clean room tours. During the last one it was even possible to get so close that you literally could put your nose in the bonding machine.

### Hong Kong

Directly after coming from the boat, we



had a warm welcome at the Dutch consulate where we had an insightful presentation about the 2 systems on country construction that the Chinese and Hong Kong government came up with after the British gave Hong Kong back to China. We also visited another university, PolyU. We got a tour through the Aviation Service Research Centre that's working with the university on commercially sponsored research, mainly to reduce wear and tear in the aviation industry.

When you are in Hong Kong it is almost a must to go to Macau, the gambling capital of Asia, or actually the world. Macau has 4 times the annual revenue of Las Vegas with half the number of casino's.

We ended the study tour with a private boat with an almost unlimited supply of drinks, plenty of food, nice music and lots of stuff to entertain ourselves. This included a slide into the water, a trampoline, a surfboard, kayak and some random other stuff.

Overall, we spent three amazing weeks in China, filled with lots of technology and culture. We would like to thank UFonds for their contribution to make this study tour possible.

# A true student tradition: The constitution drink

Author: Matthijs van Minnen

A new year of lectures has started which means busy streets, busy lectures halls. Busy everything. Moreover, the new academic year announces the change of most boards of the study associations. Scintilla is no exception in this. As I'm sure you have all read earlier in this edition of the Vonk, a new board has been constituted. Accompanying this constitution is a drink: the constitution drink. This is not your ordinary drink in the Abscint on the Thursday afternoon. Quite on the contrary; if you enter sometime after four, you will wander into a prime example of the craziness that is the student life and it is a tradition that might need some explanation for the inexperienced.



In the essence, the constitution drink allows boards of other associations to meet and congratulate the newly constituted board. They can do this by so called 'recipiëren' or meeting the new board. Since there are many different boards, some coordination is required. In charge of this process is the master-pedel. He/she is accompanied by a small army of 'pedellen' to maintain the peace. The term pedel is not something the students came up with, but it is something that originates from the academic world. Back in the 13th century, pedellen or pedels (the alternative plural form) oversaw most of the administrative tasks of the university. This could include the sales of books, the announcement of doctoral promotions and more.

In the current day and age the pedel has fewer tasks and is mainly devoted to the ceremonial tasks. He or she precedes the rector magnificus during official occasions. The more notable task of the pedel

however, is the ending of a doctoral ceremony. At most (Dutch) universities, the pedel would hit the floor with his/her staff and announce the words: "Hora est" (The time has come) which ends the Ph.D. examination. At the University of Twente, which originates from

*"Mijnheer de rector, de tijd is verstreken."*

1961 and is quite young and modern, the pedel uses the words: "Mijnheer de rector, de tijd is verstreken." (Mister rector, the time has run out). The pedellen also realised that the latin term describes that one hour has passed whereas a normal defence at the University of Twente takes exactly 45 minutes before the pedel announces his words. Apart from this announcement, the pedel has little influence on the ceremony as this is lead by a different chairman.

The student version of this ceremony is quite different (and includes more beer), but is a ceremony nonetheless. It is during this special occasion that Scintilla showcases some of its rare items. The board brings out their medals which contain electronic components cast in amber; they also wear their newly acquired board-tie and pin. This is also one of the rare occasions the Scintilla staff gets to leave the room.

In the friendly atmosphere that is present around the Abscint all boards make an extra effort to watch over these special objects as nobody would want these special items to fall into the wrong hands during something what is known as 'brassen'. As such, all board members are happy to assist in the safekeeping of these items.

As it turns out, the visiting boards not only want to meet personally with the new board members, but they also want



'Pedellen' from the University of Twente. (Photo from the UT Beeldbank)

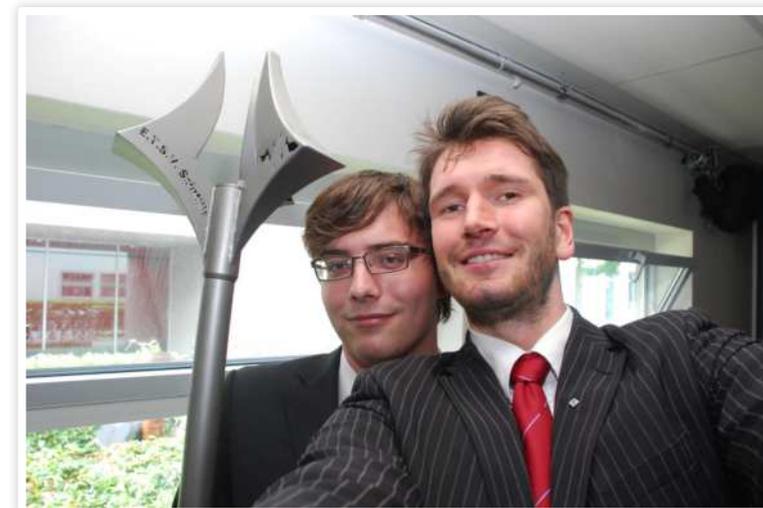
to meet very up close with Scintilla's most precious items. They sometimes take the phrase 'watching over the special items' too serious as instead of keeping them within the Abscint, they bring them outside to what they call 'safety' to have a closer look. This behaviour is something the pedellen cannot allow.

What results is a stand-off between the pedellen and the visiting boards. In anticipation of what is to come, the board is located behind a line of pedellen far out of harm's way at the start of the constitution drink. This might seem like a perfect solution to avoid that any of the board members is taken, but it is not fool proof.

The constitution drinks allow for great bonding between the different boards as they mischievously coordinate a raid together. The target of the raids is generally one of the board members or the Scintilla staff. At the start of their year, all board members are still 100% motivated, so stopping them and their ideas is not a simple feat. The conflicting interests of the board members and the pedellen usually results in a large clash, but without any violence. Brassen can only be performed by pushing and pulling people around.

it is possible to initiate a bout of brassen with someone else. This is a different action with the same name as mentioned before. That is why it is sometimes also referred to as 'zooien'. Brassen is initiated when one grabs hold of the other's lapel. It is best to grab hold in return, otherwise you will lose immediately. The person that touches the ground first loses, so the goal is to remain standing the longest. After a lot of pushing and pulling someone loses but the two people remain friends nonetheless. They help each other up and proceed to drink a beer together and take a rest. This type of brassen is an effective method to stop people from taking objects, the other type of brassen.

The brassen and the other type of brassen go on until all beer is gone, it turns 7 o'clock, or all the items of value have successfully been taken by the visiting boards. At the end of the day you can leave with the safe feeling that your clothing may be damaged, but you remain unharmed. The new board members however will receive several letters, brasbrieven, discussing the terms for the return of the items that were taken the day before, but those are a story for another time...



From left to right: Pedel staff, Wouter Pool VP (master-pedel) and Jippe Rossen VP (pedel)

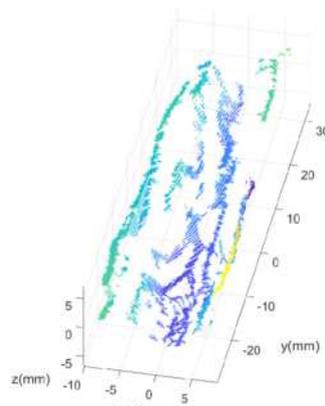
# BSc Thesis Abstracts

## 3D Point Cloud Reconstruction Based on the Finger Vascular Pattern

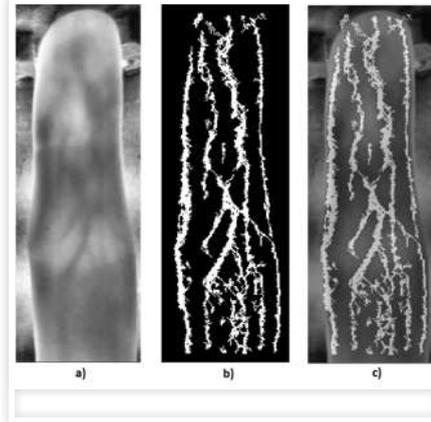
In a lot of consumer devices, such as phones and laptops, fingerprint recognition is a common authentication procedure. The drawback of using fingerprints is that it is relatively easy to replicate someone's fingerprint as they are easily left behind on smooth surfaces. As an alternative to fingerprint recognition, the vascular patterns in the finger could also be used. These patterns lie beneath the surface of the finger and can only be captured using infrared light. Unfortunately, this procedure is very sensitive to the orientation of the finger. At the Biometric Pattern Recognition

chair at the University of Twente a device has been designed to be able to capture three images of the finger veins. This research is the first attempt to try to solve this problem by creating a three-dimensional model of the vascular system of the finger using this device.

A 3D point cloud of the finger veins of an index finger has been created using stereo reconstruction. Utilizing the camera parameters obtained by camera calibration, the images captured by the acquisition device can be processed. The resulting images are then used to obtain a disparity map, which indicates the distance to cameras. The goal was to create a 3D point cloud of only the finger veins, so an algorithm that can extract the structure of the finger vein is used to isolate the finger veins.



The processed image and the vascular structure



a) Shows a processed image of the finger, b) shows the vascular pattern and c) is the combination of the two for visible purposes only

Author: Sebastian Bunda



Two known test models that simulated the finger vein structure were created to estimate the accuracy of the 3D model. By reconstructing the models, it is shown that there is still improvement possible for future research.

The method shown in this paper shows that it is in fact possible to get 3D models of the vascular system of the finger. The method still needs improvements in terms of speed and accuracy. The paper also provides several recommendations concerning the 3D model acquisition and recommendations for improving the finger vein scanner used in this research.

## Visual puppeteering using the Vizualeyez 3D motion capture system

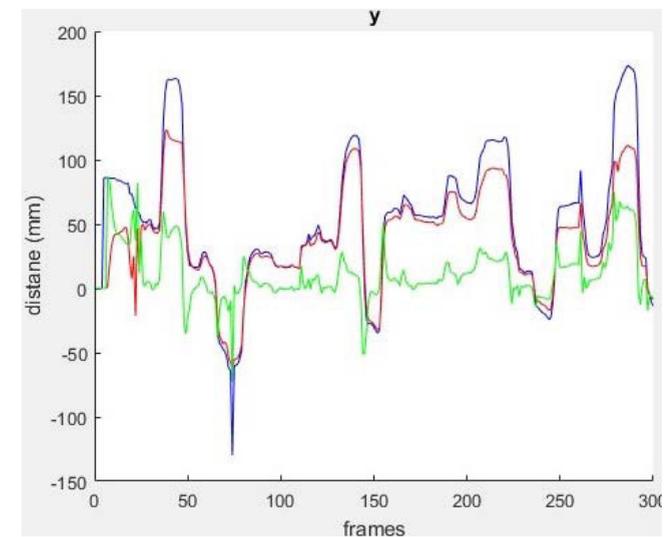
The goal of this report is to find a method which can be employed to puppeteer robots. The main thing that have to be kept in mind is that the movements made by the robot have to mimic the movement of the puppeteer.

To accomplish this goal two methods which should be able to do this are described and compared to each other. One of the methods involves kinematics and inverse kinematics. This method has the puppeteer hold a target which is measured and from which the necessary variables are determined, which are used to calculate the needed motor positions. The second method involves

measuring the angles of the movements of the puppeteer and use these to control the robot.

The puppeteer will be measured using the VZ4000 3D motion capture system. This system will communicate with MATLAB using the software provided. To test the methods, simulations will be done with the help of MATLAB. A robot desk light will be used as puppet and the methods will be used with this robot in mind. The robot will also be controlled real time by the puppeteer.

The method which had the puppeteer hold a target worked for the most part, it had the robot move to the desired point. The problem was however that that the orientation measurement of the target did not work completely as intended. The other method worked as intended for two of the four used



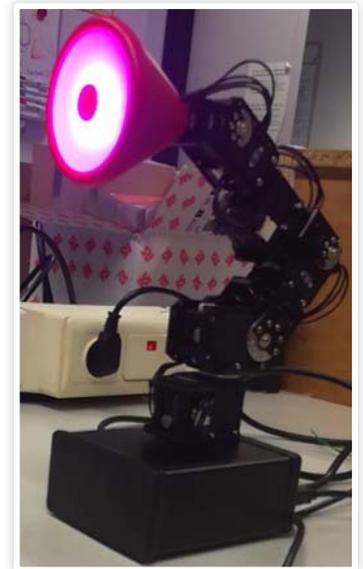
Left: Results of end effector method, in the y direction. Here the blue line is the target, the red is the end effector and the green line is the error between the two.

Right: the robot puppet used.

Author: Mark van Holland



angles. Out of the other two, one was influenced by two of the other angles, while the other angle of these two had problems in the definition of the positive and negative values. The results of both methods show that both methods have potential to achieve the goal of this paper. The method involving the angle measurements is better suited for robot with less degrees of freedom, while the other method is expected to work better for robots with more degrees of freedom.



## Realisation of a safety-cage with integrated force sensing for interactive aerial robots

Aerial robots are getting more advanced every year and their influence in daily life becomes more and more apparent. Most commonly however, these vehicles are not intended for physical interaction with their environment. Yet, the potential of interaction with these vehicles is large. Examples of situations are wind turbines being cleaned by drones or safety operations on hard-to-reach places. Even though safe encased drones do exist, these systems do not allow physical interaction as sensing and control technologies are not implemented. The area of physical interaction between aerial vehicles and their environment is thus a very active and interesting research topic. For these reasons, force sensors have been designed that can be integrated with a safety cage in order to enhance the interaction aspects of drones.

In the presented research, force sensors have been designed by means of strain gauges. A safety cage is realized where these force sensors are integrated, being able to provide useful information regarding interaction forces acting on the entire drone.

By first analyzing different layouts of strain gauges and strain gauge characteristics, a final design for a force sensor is proposed. Different designs regarding the placement of these sensors

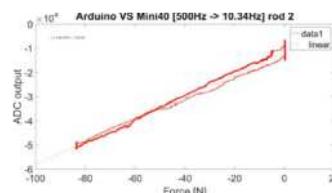
have been analyzed in order to propose a final set-up of sensors. With this final set-up in mind, a

3D-design of a safety cage is realized in where these sensors are implemented. Tests with the designed force sensors have been performed and analyzed by comparing the results to a commercial 6D force/torque sensor. Results propose a potentially accurate and sensitive system, yet noise, temperature effects and hysteresis are apparent and significantly reduce the accuracy of the sensors.



Realisation and implementation of force sensors in a safety cage (without rotors/electronics).

Author: Thomas van Zonneveld



The output of the ADC of 1 rod while different known forces are applied to the rod.

## The recognition of hand gestures by evaluating micro-vibrations using a single wrist-worn highly sampled IMU

Author: Camilla Spaan

After an incidence of stroke, the motor activity of the patient can be affected. This is perceivable by the inability to complete simple hand movements. By using wearables, which are suitable for ambulatory measurements, home revalidation becomes an option. By using a highly sampled IMU implemented in a wearable device, it becomes possible to detect specific vibrations corresponding to certain hand movements. This paper is a preliminary study focused on gesture recognition and presents the answer if the information obtained by a highly sampled IMU is adequate to classify different gestures made by human subjects

The IMU measures the acceleration of a set of gestures for each subject, which are analyzed using signal processing techniques like Fast Fourier Transform and power spectrum. To be able to classify these gestures, features are extracted from the power spectrum

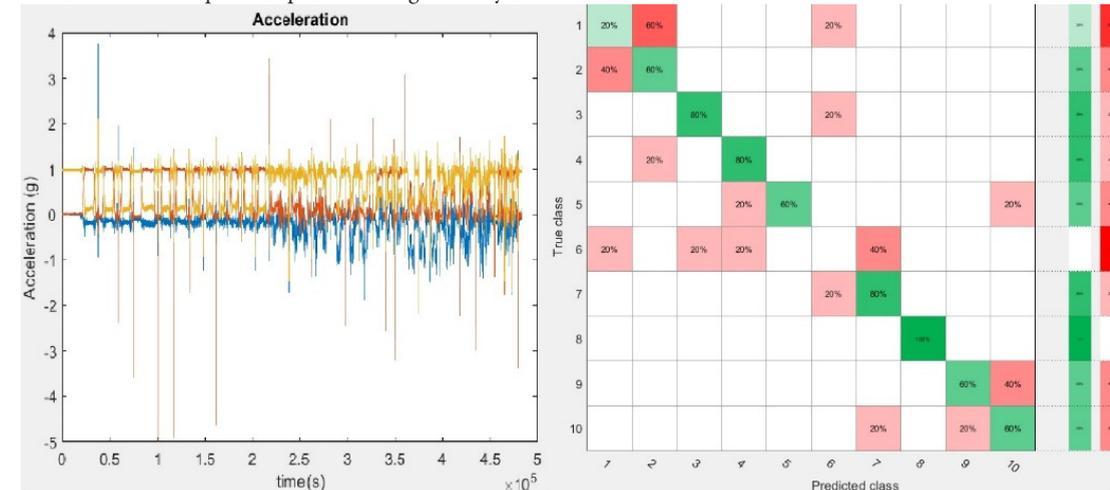
to indicate the characteristics corresponding to each specific movement. Using the classification learner Support Vector Machines, subject specific models and generic models are generated. The gestures will be implemented individually and grouped based on corresponding movements. These models are created using the feature sets obtained of both the individually and grouped gestures as input. One data set is used to test the model. The results of the tested model are shown in a confusion matrix to indicate the accuracy of correctly classified gestures.

It was found that for subject specific models individually arranged gestures an average accuracy of 53% was obtained and for grouped gestures 68%. While the generic models generated an accuracy of 35% individually and 62% grouped. The accuracy of the individually based generic model is significantly smaller than the other mo-



del as it did not have enough input to create a representative model that takes variations of movements into account. While the accuracy of the subject specific models could be increase if more measurements were conducted per subject.

It can be concluded that as for now this highly sampled IMU is not adequate to classify gestures or be used in home revalidation. This can be improved using a different IMU, more measurements and further research in implementing this method in home revalidation.



Conversion of acceleration to gestures recognition

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# Link the baby!

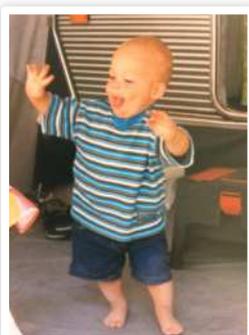
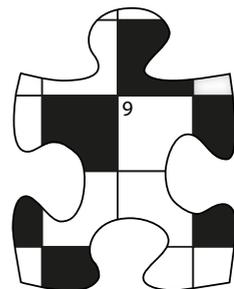
*Author: Truusje*

Sometimes you just like a bit of nostalgia, that's why every now and then I like to look at baby photos of board members. Luckily I was able to find photos of the new board.

Unfortunately, the board members have changed quite a lot since these pictures were taken. Therefore I cannot keep them apart. Since it is a shame to not know who is who I ask you to link each

baby photo to their respective board member.

Do you think you know the answer? Please send your solution to [vonk@scintilla.utwente.nl](mailto:vonk@scintilla.utwente.nl)



1



2



3



4



*From left to right: Sebastian, Melissa, Matthijs, Ewout, Hessel and Romano*



5



6



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