

# INTRO 2016

A STEADY INFLUX OF NEW STUDENTS



InMotion | **PhD** research | Icons of EE | Viking facts  
| Introducing **candidate Board** Thor | **Column**

**Connecthor**

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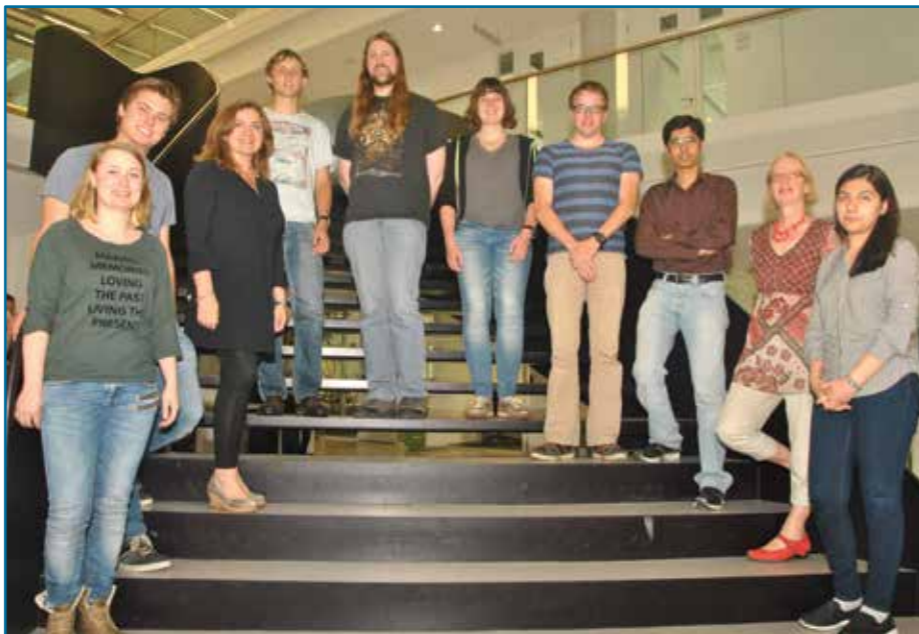
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My first editorial as the Connecthor editor in chief! I am proud to have been a member of the Connecthor team since the very beginning of the magazine. I have seen many members joining and leaving. However, every time we have managed to get an enthusiastic team together. My ambition is to keep on doing what we are good at: making sure that every quartile a new, interesting and fun to read magazine lies in the shelves (near the reception area and the one near the Eurest cafeteria on the first floor), drops into your mailbox or on your desk.

As the new academic year has started, our dean, Bart Smolders, has written an article about the results and ambitions of our Department for now and the near future, and about re-thinking our long-term strategy.

A September issue would not be the same without our study association presenting its new board members, a goodbye from the leaving Commissioner of Education and Vice-President of Thor, Thomas van der Werff, and the yearly update on the introduction week of first year's national and international students.

The SPS-VCA research group, headed by Peter de With, has had success with their research on Barrett's Esophagus cancer. Fons van der Sommen wrote about his research on detecting this form of cancer in an early stage.

We think we have managed to deliver again a magazine to be proud of. We hope you will enjoy reading this new edition of the Connecthor as much as we have had making it!

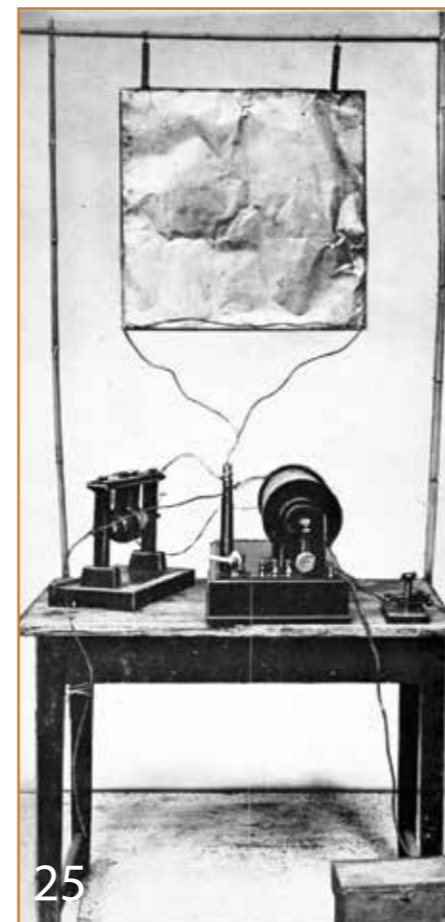
As always, the editorial board will be glad to receive your suggestions and ideas via [connecthor@tue.nl](mailto:connecthor@tue.nl).

Pauline Hoen ■



**Introducing candidate Board Thor**

The members of the candidate Board of Thor introduce themselves, read all about these 'kandies' on page 18!



**Icons of EE: Guglielmo Marconi**

Read about Electrical Engineering legend Marconi on page 25.



**Viking facts**

Thor has a lot to do with the Vikings. Jump to page 22 for some surprising facts!



**My BEP at the Electromagnetics group**

Anouk Hubrechen tells about her Bachelor End Project at the Electromagnetics group. Read all about it on page 29.

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# Electrical Engineering in 2050

By: prof. dr. ir. Bart Smolders



Our department has developed itself in a very positive way in the past years. First of all, we have seen an enormous growth in the number of students: an increase from 65 first-year students in 2010 to 285 last year. Secondly, each year we manage to acquire more national, European and industrial research projects, despite the increasing competition in acquiring research funding. We now have more than 200 PhD and PDEng students in our department. And

hoped for in 2010 and is a result of our policy, such as the introduction of the Bachelor College and new majors. In addition, we put quite some effort in promoting our study programs. Some departments with a limited research budget will probably have to limit the maximum number of first-year students, simply because they do not have enough scientific staff or budget to accommodate more students. Our maximum capacity at Electrical Engineering is around 350 first-year

(MP), we discussed these scenarios with the chairs of the capacity groups. It was decided to choose a long-term scenario that will result in 100% coverage of our permanent staff cost from the yearly budget that we get from our University (in Dutch: "eerste geldstroom"). In the past years, we only had coverage of about 70%, meaning that the remaining 30% of the permanent costs had to be earned from research projects. With our change in financial policy, the pressure to score financially interesting projects will be reduced. As a result, I expect that our staff can spend more time on teaching and on expanding our long-term fundamental research activities. The main challenge in the upcoming period is to find young and talented new scientific staff members. We need more staff to reduce the educational load in some of the capacity groups. Next to this, several senior scientific staff members will retire in the next years. I expect that in five years from now, more than 30% of our permanent scientific staff will be new. Therefore, it is of utmost importance to re-think our long-term strategy. What will Electrical Engineering look like in 2050? What is our intended position? Which talent do we want to hire to achieve this long-term vision? In order to answer these questions, we will organize a special symposium in the second half of 2016 with the central theme "Electrical Engineering in 2050". I would like to invite you all to participate in these discussions, it is about our and your future! ■

last but not least, we moved to our new and spacious Flux building with state-of-the-art lab facilities. As a result, we are now one of the largest and well-balanced departments of our university with a solid financial outlook for the upcoming years. At university level, most of the departments are facing a growing interest among young VWO students. As a consequence, the total number of students at the TU/e is expected to grow from about 7000 in 2010 to more than 12000 students in 2020. This strong growth is something that we

students (250 Electrical Engineering students and 100 Automotive students). I would be very happy if we can maintain an influx level between 250-300 students in the upcoming years.

Our growth in education and research does have consequences. On the positive side, our overall budget will increase in the upcoming years. In the past months, we have investigated several financial scenarios for our department towards 2020. In the management platform

**We have seen an enormous growth in the number of students: an increase from 65 first-year students in 2010 to 285 last year**

# From the Vice-President

By: Thomas van der Werff



It's 9 o'clock in the morning on a standard weekday in the middle of another quartile. It's a moment which most people would assume to be a moment of quietness, peacefulness, and, above all, an opportunity to concentrate on your work or study. However, this is the study association Thor, and thus this is often not the case. There are already several members entertaining themselves on the sixth floor of the green glass building called Flux. The Board room where I've worked all year with my fellow Board members contains a few of these early birds. They don't need anything to enjoy their time here, except maybe a few ballpoint pens to throw with and a Board member to talk to. Loud laughter and frolicsome voices fill that specific part of the building, it's a scenario that you'll get to know fast enough during your time spent at Thor. A pro and a con is what it is, depending on what your intentions were for that morning. But most of all, it is one of the features that makes this study association such an awesome group to be part of.

It's the first, last and thus only time I'll write this specific column. An opportunity I've been given by our President who unfortunately was not able to actively participate during the last quartile of this year. So I've been given the task to conclude the past academic year and introduce the new one. It has been a blast of a year. Activities organized by our active members where present in large quantities. The new generation has brought us many new and motivated faces that have entertained our large group of members. But also the older students were once again willingly waiting to support Thor with their organizational, technical or creative skills. It's something that I want to thank them much for, because without them we would be only a fraction of what we are now. And with them we have made this year once again a great success.

For the new students I would like to take the opportunity to invite you to the great period that's in front of you. And with this, steer you in the direction which will give you a great experience of your time as a student here at the TU/e. Thor is an open, friendly, helpful and

above all an awesome association that is very well worth spending some time at. So when your schedule allows it, come take a look in Het Walhalla on floor 6 in Flux or maybe just drop by at the Board room on that same floor to have a chat with one of the many people that are so often available there.

This article, my Board year, and the interference of old Board members in our association, I know for sure that at least two of these three will have come to an end. It has come to the point that I have to say goodbye to the ups and downs of the last year. From Commissioner of Education to presiding a GMM, from 'brassing' kandies to members that are being 'brassed', from breakups to a (school)trip to the Efteling, this year certainly has had his moments. And now, with the last quartile being my favorite one, I will most certainly leave my functions as Commissioner of Education and Vice-President with suitable satisfaction and memorable memories behind me.

Geen Gedonder! ■

# We measure external and internal quality

There is a big chance you've recently bought fruit or vegetables. Did you realize these have been thoroughly inspected using vision technology? And that this vision technology may have come from Ellips?

Produce grown by nature vary in size, color and weight. There are differences in quality as produce may suffer from diseases or insects. As a consumer, you buy produce you find attractive. Produce with the right size and color and without defects are more attractive and thus more valuable. Decay in bad produce spreads to good produce during transportation and storage. So you want to remove bad produce after harvest. Farmers and packaging houses use grading machines for this task.

Fruits are transported on lanes through these machines. Each fruit is measured. The fruit is

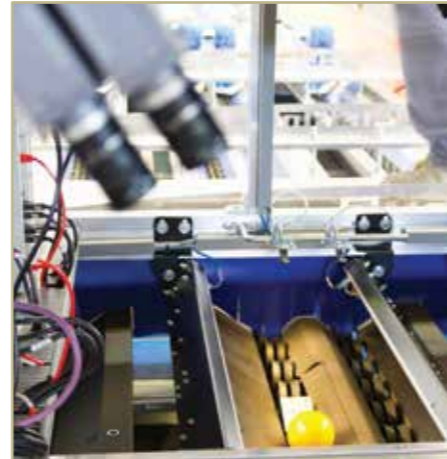
**Produce with the right size and color and without defects are more attractive and thus more valuable**

sent to an exit based on the measurement values. Each year 150 machines are built with TrueSort as the engine of the grading process. TrueSort is a combination of cameras, computers, I/O devices and of course a lot of software to implement the grading process on a machine.

The TrueSort system is developed and sold by Ellips. Ellips is a company with 30 employees and a strong commitment to stay ahead of the competition. Hence 20 employees work



in research and development. Among them are graduates from Electrical Engineering, Software Sciences and Mathematics. They work in one of the scrum teams.



Currently, there are three scrum teams. The GUI team specializes in user experience design and implementation. The vision team is mainly occupied with machine vision. It implements the algorithms to convert the images from each produce in a series of measurement values. The 3<sup>rd</sup> team has a broad knowledge in the real-time operating system, gigE and USB camera interfaces and packaging algorithms. Due to their track record in solving problems, they are called the A-team. Often one feature requires cooperation between two or three teams to get the job done.

## Scrum Development Strategy

Ellips uses the scrum development strategy. This means that the 'Product Owner' keeps a list of new features for TrueSort. The list is called the backlog and it is prioritized so the most important features can be delivered first. Every two weeks a meeting is held. During this meeting, each of the development teams takes two weeks worth of work from the backlog. This way each job tends to get done by the right person.

Ellips offers its employees a lot of room to do their work according to their personal preferences. The product owner specifies what features he wants. The development teams decide how these are best implemented. Some team members become in-depth specialists, other members prefer to work on a broad range of different topics. Some employees enjoy implementing code, others spend a lot of time in consultation with customers to get the desired specifications clear. Some employees always work in Eindhoven, others fly all over the world to assist customers in person.

Students looking for a graduation project, job or simply more information are welcome to contact [hans.kester@ellips.com](mailto:hans.kester@ellips.com). Or keep an eye on [www.thor.edu](http://www.thor.edu) and register for a company visit to Ellips. ■



## IEEE Photonics Society Graduate Student Award

Wang Miao received the 2016 IEEE Photonics Society Graduate Student Award, which is granted to only ten students worldwide every year. Wang designed, built and tested optical switching modules using fast semiconductor optical gates, and included fast optical flow control. Based on these modules, he designed novel flat network architectures for data centers, with strongly reduced latency and increased throughput. Wang also received the IEEE Photonics Society Japan Young Scientist Award Paper at the OECC/PS 2016 conference.



## Veder Award

On Wednesday May 18<sup>th</sup>, dr. ir. Elbert Bechthum received the Veder award for his PhD research in the field of high-performance Mixing-DACs. Elbert works for the MsM group. His promotor was prof. dr. ir. Arthur van Roermund and his supervisor was dr. Georgi Radulov, PDEng.

Photo: Françoise Kusters (Madam Chairman of the Vederfonds), Elbert Bechthum, and Erik Fledderus (who pronounced the consideration).

## TU Eindhoven's soccer robots third time World Champions at WC RoboCup 2016

The soccer robots of TechUnited have won the World Championships RoboCup 2016 held in Leipzig. It is the third time that our soccer robots have won the world title. During their ninth World Championship in a row, Eindhoven's robots beat their opponents only after kicking penalties against China's soccer robot team, named Water, of the University of Beijing.

Our care robot did well as well. It won the silver medal at the @Home-League.



## PPJ Bachelor Prize

On the Education Day, which was held on June 8<sup>th</sup>, 2016 the yearly PPJ Bachelor Prize for the best lecturers in years 1, 2 and 3, was awarded to three scientific staff members.

Marion Matters was elected by the students for the 1<sup>st</sup> year course 'Circuits'. According to the students Rob Mestrom deserved the prize for the 2<sup>nd</sup> year course 'Electromagnetics I'. The award for the 3<sup>rd</sup> year was given to Paul van den Hof and Mircea Lazar, for their course 'Control Systems'. Paul (P.P.J.) van den Bosch, being the initiator of this prize, handed over the awards to the winners.



Rob Mestrom (left picture) and Paul van den Hof (right picture) receiving their price.



## Evacuation Drill June 7<sup>th</sup>

Tuesday June 7 there was an evacuation drill in Flux. In general, the drill went well; the building was evacuated within 9 minutes and people made good use of the 'safe' stairs and emergency exits. Flux was evacuated because of a (fake) bomb threat near the footbridge between Flux and Gemini. Many people lingered next to or around the Flux building, which is a matter of concern. In case of a real bomb threat or other serious calamity this is highly undesirable behavior. Please go to the appointed meeting area: the Markthal (official name: the Forum) in Metaforum or the indicated area by CSA.

# Automotive Technology InMotion

By: Johan van Uden and Vinay Srigopal

Student racing team InMotion develops and builds two highly innovative race cars. These will help the team, consisting of more than 50 students from Eindhoven University of Technology and Fontys University of Applied Sciences, to reach their ultimate goal: participating in the 24 hours of Le Mans.

## KP&T IM/e: Innovative development platform

To help develop the IM01, the future race car that will compete in the most prestigious endurance race in the world, InMotion is currently preparing the KP&T IM/e for the track. The goal of the KP&T IM/e is to test and develop certain technologies for the IM01. The KP&T IM/e features a fully electric powertrain, active aerodynamics and suspension parts 3D printed in titanium. By implementing two YASA 750-series electric motors powering the rear wheels, the KP&T IM/e is equipped with approximately 550 bhp. This amount of power combined with a total weight of just 650 kilograms results in unique specifications for any student team: a top speed of 285 km/h and an acceleration from 0-100 km/h in less than 3 seconds!

The KP&T IM/e has been designed to break national and international track records for electric cars. InMotion will visit for example



Circuit Park Zandvoort during the coming months, to show the world what students are capable of with the technology of tomorrow! By pushing boundaries with the KP&T IM/e, InMotion aims at both gaining racing experience and attracting new partners. The students involved are convinced of the KP&T IM/e's abilities and are eager to measure

themselves against the most legendary racing benchmark in 2017: the Nürburgring Nordschleife. Toyota Motorsport currently holds its track record for electric cars, meaning InMotion will soon compete against one of the largest automobile manufacturers in the world!



## IM01: The future of Le Mans

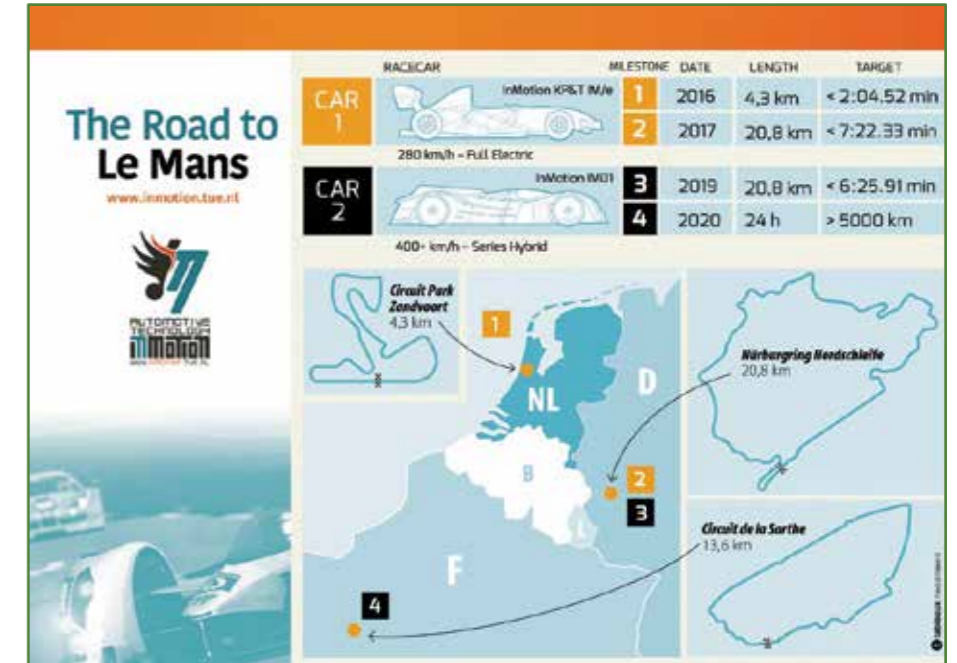
The gain of knowledge, skills and experience greatly helps InMotion engineering its future Le Mans racer: the IM01. By extensively testing with the KP&T IM/e's powertrain, it will be optimized for the IM01. Major evolutions of this powertrain are for example the amount of electric motors featured (one for each four wheels) and the addition of a petrol range extender for the IM01. After all, the IM01 will be a 1000+ bhp four-wheel drive race car, designed to last for at least 24 hours.

By implementing innovative technologies in the IM01, InMotion can qualify itself for the 24 hours of Le Mans through the Garage 56 entry. This class yearly provides one innovative project to present itself among major participants like Audi and Porsche, with the great advantage of being exempted of all regulations (except for safety rules). This provides InMotion an outstanding position to show the extraordinary technical achievements of the students involved!

InMotion aims at participating to the spectacular Le Mans endurance race with the IM01 already in 2020. The InMotion roadmap shows all objectives, race cars and record attempts at a glance.

## Electronic Control Units

Both the KP&T IM/e and the IM01 are controlled by a limited number of electronic control units containing advanced hardware and software. These ECUs are the brains of the car. Research conducted by InMotion in an early development stage, has led to a proposed integrated automotive architecture using only five ECUs for the IM01: a single central vehicle state controller combined with four satellite controllers to which the sensors and actuators will be connected. The main advantage of this setup is the possibility to perform low-level control locally (in the satellite ECUs) and the entire high-level vehicle state control centrally (in the main ECU). This reduces the required processing power at the different nodes (compared to



a fully integrated single-ECU architecture) as well as the network load (compared to a federated architecture).

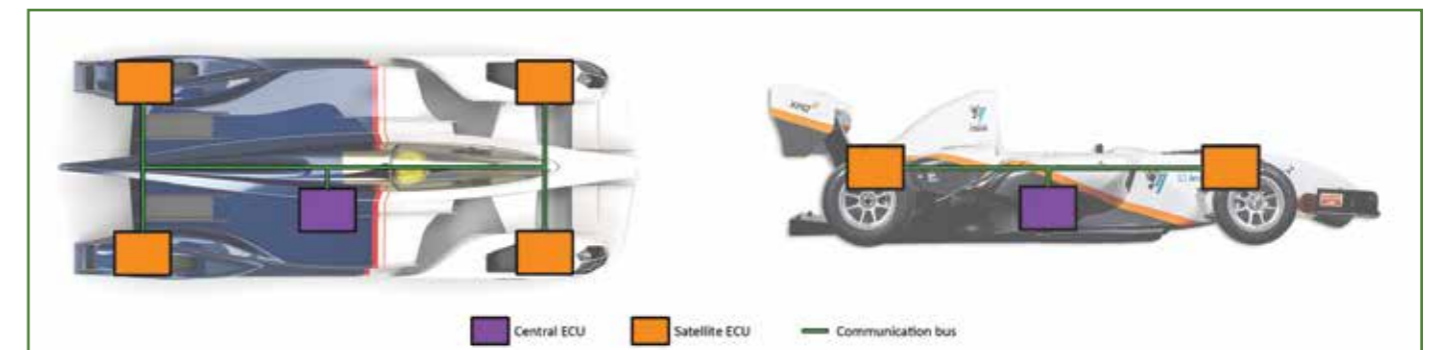
For the KP&T IM/e, InMotion has simplified this architecture. As this vehicle has a smaller amount of sensors and actuators, the number of satellite ECUs has been reduced to two, one in the front and one in the rear. The main principles and advantages of the architecture still hold.

ECU development for the KP&T IM/e is an enormous challenge. One of the main reasons is exactly this limited number of electronic control units (three including the central unit); the average passenger car has over a hundred ECUs to control every aspect of the vehicle. InMotion has chosen to limit the number because the fewer ECUs, the smaller the likelihood of technical problems during system integration. Extra challenging is the fact that the ECUs have to keep operating under very harsh conditions – 24 hours at full capacity. With a battery pack that can supply 800 volts and 300 amperes, fire or electrocution must be prevented at all costs.

## Code generation

The ECU software is usually coded manually based on mathematical control models. These graphically represented calculations control the adjustment of electronic components such as traction control (for optimal grip) and active aerodynamics. Together with partner ICT Group, InMotion is able to develop and deploy the ECU software using the Motar platform. With this platform InMotion can translate the graphical control models into software fully automatically – without the need for any manual coding or integration. This speeds up the development process of the vehicle, while reducing the likelihood of programming errors. All this increases the reliability of the ECUs.

The Motar software development process starts from a MATLAB/Simulink model representing the application behaviour. This model contains configuration blocks from the Motar block library, which can be used to configure the AUTOSAR-based basic software from within the MATLAB/Simulink environment. ▶



Motor input and output blocks can be connected to input and outputs of the model.

Once connected, the model can be used to generate code for the target. The code generation process is triggered by a single button click from within the MATLAB/Simulink environment. This action leads to an executable that can be flashed to the dedicated target fully automatically.

During the execution of the Simulink model on the hardware target, the External Mode connection can be used to monitor and change parameters on the target in real time without the need of re-flashing it. This can be useful for hardware-in-the-loop testing and verification. The External Mode can also provide feedback to enhance the model. This enables the InMotion developers to apply a round-trip engineering methodology.

**Board members, student engineers and internships**

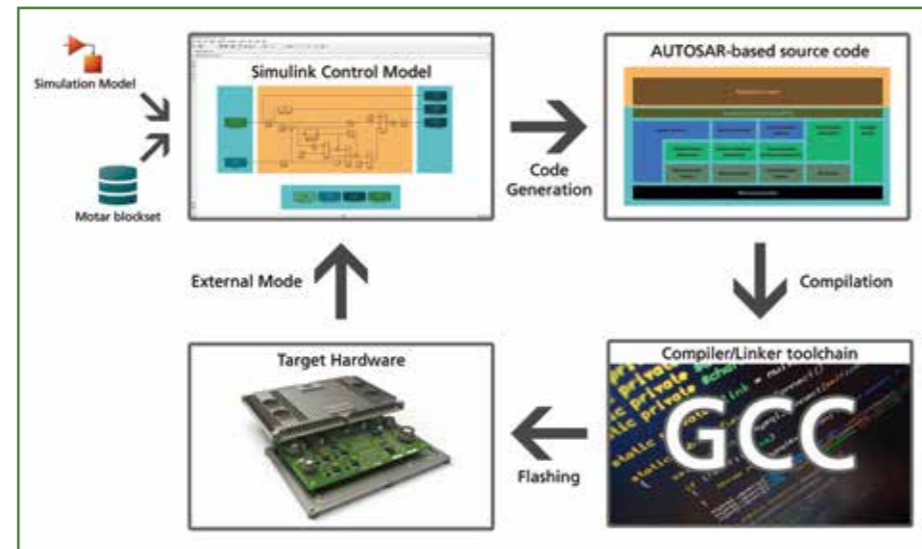
InMotion is always looking for motivated students who are interested in contributing to the future of technology! Students of ranging disciplines at different levels (HBO or WO) can

develop themselves on engineering, assembly or in a management function. Internships and end projects are also possible to be carried out within the student racing team.

Do you have what it takes to join an ambitious team? Are you willing to gain relevant

practical experience and eager to boost your CV? Then please have a look at [www.inmotion.tue.nl](http://www.inmotion.tue.nl) or contact us via [HR@inmotion.tue.nl](mailto:HR@inmotion.tue.nl).

Like InMotion on Facebook and stay up to date of the latest developments: [facebook.com/TUeInMotion](https://www.facebook.com/TUeInMotion).



# Whose desk is this?

By: Rainier van Dommele

For more than eight years I am working as a technician in the Electrical Engineering department. I started in the ECR/EM groups, and currently I work for the Mixed-signal Microelectronics (MsM) group. Being technician is a diverse job. For starters I order new PC's and help students and staff of MsM with their PC issues before they go to ICT services. I also manage the external and internal website of MsM. Next to that, I order and manage the servers MsM has to do IC (integrated circuits) design on. Those servers I manage using my PC. For each student that needs access to technology data from IC foundries I create an account and sign a NDA. All that paperwork is enough to get my desk drawer filled.

for testing equipment. When equipment is broken, new parts or equipment has to be ordered which I do in my office on the 7<sup>th</sup> floor of Flux. Thus, the paper trays on my drawers contain mostly packaging slips.

The labs are mainly closed Faraday cages which have no cell reception and are not easy to look into. In order to keep an overview of the labs which I manage and monitor the well-being of the people working inside, I installed cameras in the labs which stream the video to a screen on my desk using a BananaPi. Also there are a lot of Post-It notes and note blocks on my desk to write down things I have to remember or sketches when discussing measurements with students.

There are two mugs on my desk, one for coffee and one for tea. The coffee mug I got in March which has pictures of my (at that time) seven-months-young daughter. Currently I have a picture on my desktop with my daughter and refresh the picture often. Furthermore there are lots of tools on my desk like a label-writer, tape, USB card reader, USB microscope, USB sticks etc. There are also some worn out mills which I have to order.



In the cabinet I keep order forms from years before I stored them digitally, batteries and extra PC adapters for when someone has to present but does not have the right port on their PC. A first aid kit is near my desk as well, as I'm part of the BHV (emergency response) team. Behind my desk there are some paintings which bring colour into the office.

I share my office with Margot, the secretary of the group. We are the come-to persons in the group for questions, technical or non-technical. And we are always in for a casual chat.

Apart from these 'ICT' tasks I'm laboratory manager of several laboratories; one solely in use by MsM, others shared with EM. Being lab manager means organizing and keeping everything organized in the lab, as well as explaining how equipment works to students (BEP/MSc/PDEng/PhD) and helping them with their measurements. Therefore I'm one of the few people within this department with two desks: one in my office for the ICT and organisational tasks and one in the lab

# Excursion to Vanderlande

By: Alexandros Rikos

On the 10<sup>th</sup> of May we visited Vanderlande with a group of Electrical Engineering and Automotive students. It was one of the many company visits that Thor organizes every year. Vanderlande is a Dutch company active in the material handling and logistics automation industries. They are best known for their airport baggage handling systems, which are currently used in 17 of the world's 25 largest airports.

After a short bus ride we arrived at the company's headquarters in Veghel. The area was huge and included many different buildings. We first headed to a welcome area where we were offered some coffee and listened to a small presentation about the company.

The afternoon continued with another presentation from a Vanderlande engineer. He introduced us to the more technical aspects of the company, answered questions

and gave a lot of information on the different technologies that Vanderlande is currently working on.

After these presentations it was time for the exciting stuff. We split in small groups and headed to the innovation center. This is the place where Vanderlande test their new technologies before introducing them to the market. Each group got a tour of the building and the different technologies were explained in detail by the employees. These included belts that can weigh, screen and sort luggage, warehouse automation systems and some really cool robot arms used for sorting products.

Finally, we headed back to the bus stop to return to Eindhoven. Visiting companies with Thor is always a nice experience. It helps to locate your interests and to narrow down the field of electrical engineering you want to pursue. If you are interested in control systems and system integration, you should definitely check out this company.



# Excursion to Prysmian

By: Yuk Hang Yuen

On a very rainy day a small group of students gathered near the entrance of Flux at the end of the lunch break. Although the excursion was promoted by the Telecommunication Systems course, we were only with a group of twelve enthusiastic students. We wanted to be on time, so even though there was an incredible rainfall, we decided to head out towards Strijp-S. Conquering the rain and headwind we finally arrived at Prysmian with soaked pants.

Then the more technical part of the presentation began. They explained what kinds of methods there exist to create multimode optical fibers and how they work. There are two commonly used methods, and they use only one of them in this factory.

After the presentation we went to have a look inside. We divided in two groups, put on some coats, safety goggles and the typical blue shoe covers, and went inside. They showed us the different machines corresponding to the different processes explained earlier. We were already impressed by the first machine, especially by the heat radiating from it, but then we found out they had a lot more of them running parallel in order to increase production. What was really interesting was that some of the machines were really old, some dating back to the 80s, but were constantly improved to maintain the high quality.

In the second part of the tour we visited the testing labs where they showed us methods to detect imperfections and how they graded fibers to guarantee their quality. Here they used expensive measurement equipment and some of them used free space optics. An interesting fact is that the employees can listen to the radio and somehow they actually all agreed to listen to the same channel.

The Prysmian excursion was a very clear, simple and memorable excursion. First they explained us the theory behind the methods and in the end they simply showed us how it is done in practice. Now we know how multimode optical fibers are made, and that they are made here in Eindhoven.

# Computer vision for cancer detection

By: Fons van der Sommen

Approximately five years ago, gastroenterologist Erik Schoon from the Catharina Hospital in Eindhoven called Eindhoven University of Technology with a simple question: "If my new phone can recognize the faces of my children when I take pictures of them, would my endoscopy system also be able to recognize early stage cancer?". This question landed in the SPS-VCA research group of the Electrical Engineering department, headed by prof. Peter de With, who has extensive experience with video content analysis and computer vision. Together with dr. Sveta Zinger he visited the hospital to assess the image quality and complexity of the task at hand and concluded that the problem was definitely worth investigating. Five years later, the breakthrough results of the research that followed are published in medical journal Endoscopy. The developed image analysis algorithm that produced these results scans endoscopic images for signs of early esophageal cancer. In particular, esophageal cancers that arise in people with a medical condition called Barrett's esophagus.

## Barrett's esophagus

People suffering from gastric reflux over a prolonged period of time, can develop a so-called Barrett's Esophagus (BE). This is a condition in which the body has replaced the cells of the esophageal wall in the lower part of the esophagus with an acid-resistant cell type, that is not inherent to the organ, to counter the acidic fluids from the stomach. This defense mechanism, however, comes at a cost: an over thirty-fold increased chance of developing esophageal cancer. Hence, this patient group is closely monitored and periodically receives endoscopic surveillance.

The incidence of Barrett's cancer has increased dramatically over the past decades. Especially in the Western world, the number of cases per year is rising rapidly. This growth is predominantly explained by Western lifestyle and diet, as overweight is a major risk factor for the development of BE, and, consequently, for the development of cancer. At an early stage, Barrett's cancer can be treated endoscopically,

showing cure rates approaching 100%. However, if it is not halted early in its development, only 15% of the patients survive the first five years after diagnosis. Therefore, early detection is of crucial importance.

## A new biopsy protocol

Until recently, medical protocol dictated to take "four-quadrant, 1-cm endoscopic biopsies performed at closely timed intervals", in order to detect the presence of developing cancer cells in BE. However, recent studies have shown that early cancers are regularly missed when this biopsy protocol is employed. Therefore, experts on Barrett's cancer have called for a paradigm shift, moving from blind biopsies to targeted biopsies, based on visual inspection of the tissue. This change in biopsy protocol has been enabled by the developments in CCD/CMOS technology, allowing for endoscopes equipped with High-Definition (HD) cameras. Using HD endoscopy, medical experts have shown a correlation between histology and visual representation of the tissue, where generally, deviating color and texture patterns in the tissue are associated with developing cancer.

## The need for computer-aided detection

Finding early cancer in BE endoscopically is a very challenging task. First of all, the esophagus is constantly moving during surveillance, attempting to swallow the endoscope. Second, imaging conditions inside the body -- such as intestinal juices, poor lighting and specular reflections -- impede the visual detection even further. On top of that, most gastroenterologists typically encounter these early cancers only a couple of times a year, severely steepening the learning curve for recognition. As a result, a considerable portion of developing cancers is overlooked during endoscopic screening and is detected at a later stage, when local endoscopic treatment is no longer an option.

Given the above-mentioned issues, a computer-aided detection system offers a very attractive solution. Such a system can

analyze all pixels of every video frame and never gets tired. Furthermore, the involved machine learning methods allow for training a model based on expert knowledge, very fast and efficiently. The advantage of a computer-aided detection system that helps the gastroenterologist during endoscopic surveillance works in two ways: (1) serving as an extra pair of expert eyes, more cancers will be detected at an early stage and (2) providing live feedback to endoscopists, this improves the learning rate for recognition of these early cancers.

## Endoscopic image analysis

In computer vision, the problem of segmentation deals with dividing a certain image into meaningful regions. The definition of a meaningful region all depends on the goal of the segmentation algorithm. For example, for autonomous vehicles objects such as cars, pedestrians and traffic signs can be meaningful objects in an image. Typically, objects in an image can be segmented based on properties such as shape, color or texture. These qualitative properties are quantified using image features, which can be histograms of the color, output of specific filters or basically any mathematical operator that works on an image and produces a vector. As the variation in objects is usually too large to capture them with a set of heuristic rules based on those features, machine learning can be applied to estimate a model for the objects of interest.

Given the clinical context of Barrett cancer detection, the region in an endoscopic image that displays cancerous tissue is of interest. At the SPS-VCA research group, we have developed a unique method to find and tune a system for segmenting this cancerous image region. Based on medical literature and expert knowledge, we have devised image features that are capable of capturing the deviating color and texture patterns of early cancer in BE. Fig. 1 shows an example of specifically tuned filters that we employ to quantify the texture properties of the tissue. These filters are a modification of well-known Gabor filters, which have been shown to correlate

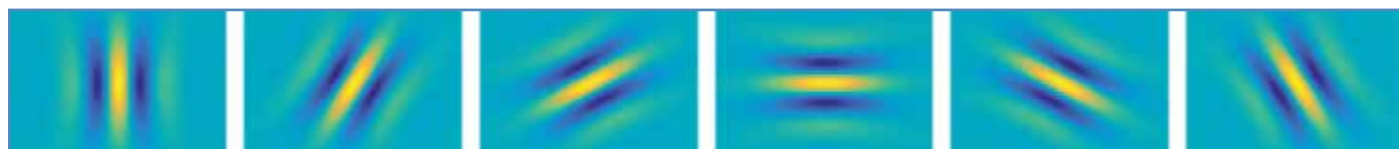


Figure 1: Log-Gabor filter kernels, corresponding to neuronal firing patterns in the mammalian visual cortex.

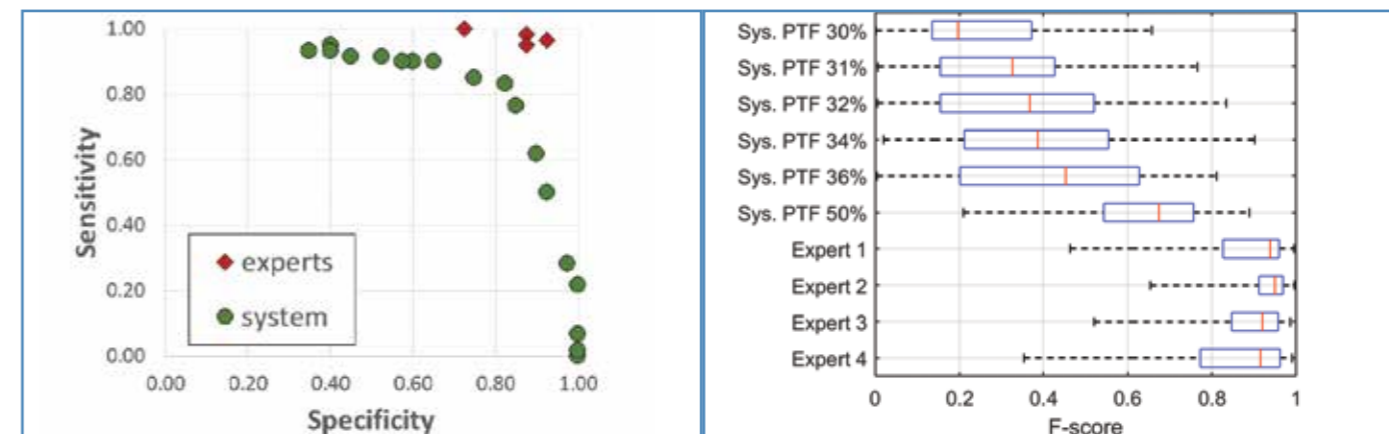


Figure 2: The patient based detection performance for the system for different fractions of positive training samples (PTF) compared to the performance of experts (left) and the corresponding annotation performance (right).

with spatial firing patterns of neurons in the visual cortex of the mammalian brain. In addition we have shown the benefit of including color information, as it quantifies the increased red hue associated with neo-angiogenesis or tissue that is more white due to necrosis.

After investigating the most discriminative features, we have developed a framework that uses those image features for endoscopic image analysis. The first step in our framework extracts the part of the image that is suitable for analysis, i.e. the Region Of Interest (ROI). Next, the image features are computed and a machine learning model is trained based on examples of expert annotations. Once trained, the model can predict, for every position in the image, whether or not cancerous tissue is present.

## Clinical validation

For validation of the proposed detection system, we have invited four experts on Barrett's cancer to delineate the malignant tissue in a set of 100 images. Pathological data was available for all the images, including delineations of the gastroenterologist that treated these patients, serving as a gold standard. We compared both the detection results of the four medical experts as well as the detection performance of our system to the gold standard. The leftmost graph in Fig. 2 shows the detection performance of the system for several training options. The sensitivity of the system increases with the fraction of the training examples that contain cancer (PTF). However, as it finds more cancers, the number of false positives also increase, resulting in a lower specificity. The figure shows that once a good trade-off is established, expert detection performance can be matched. This means that the system can predict whether or not an endoscopic image shows early cancer with similar accuracy as experts on Barrett cancer.

If we compare the exact tissue delineations of the system to those of the four experts, the annotations of the experts show a much closer resemblance to the gold standard (see Fig. 2, right graph). This can be explained by our design choices, in which we prefer detection accuracy over delineation similarity. When the system accurately detects suspicious tissue, the gastroenterologist can determine the boundaries tissue segment he wants to resect. Hence, our system is optimized for a low number of false positives, resulting in slightly more conservative system annotations.

## What's next?

With these results, we have shown that supportive automated analysis in endoscopy is feasible and it can match detection rates of experts. We want to bring our system to the clinic, where it can help physicians live during endoscopic screening, however, the current algorithm is designed for still images and not suitable for video yet. The step to analysis of real-time endoscopic video offers a lot of challenges, but also a number of interesting

options to investigate, such as the availability of several frames of the same tissue and temporal consistency of detections.

To make the next steps necessary to prepare the system for clinical practice, Dutch cancer society KWF and technology foundation STW have awarded funding to a recently submitted project proposal of our group. This project, called ARGOS (Automatic Recognition of iRregularities in the esOphaguS), is a joint effort in collaboration with the Catharina Hospital Eindhoven, the Academic Medical Center (AMC) Amsterdam, endoscope manufacturer FUJIFILM and local SME ViNotion.

In order to make the problem more accessible, our group has organized a Grand Challenge at the MICCAI 2015 conference in Munich. For this ongoing challenge, we have shared our data with the image analysis community and invited other researchers in the field to propose new algorithms for Barrett's cancer detection. For more information on this challenge, please visit the challenge website, we are looking forward to your submissions! ■

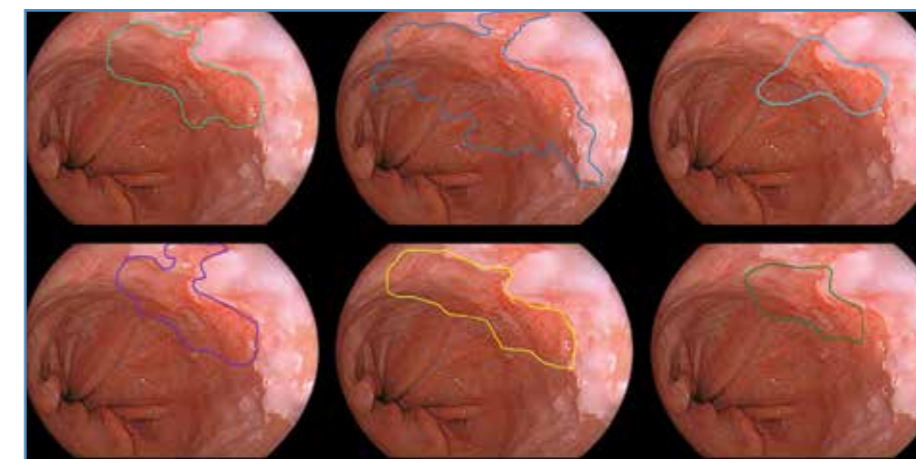


Figure 3: An endoscopic image of an early cancerous lesion annotated by the proposed detection system (top right) compared to the gold standard (top left) and the delineations of four expert gastroenterologist (bottom row and top middle image).

# Associations in general

By: Elwin Hameleers, Steven Beumer, Sjoerd van der Heide and Stefan Molenschot

The department of Electrical Engineering has several associations to aid the students of Electrical Engineering and Automotive in different ways. There is the Study Association Thor for all Bachelor and Master students and it's two Master Associations especially for the master students. Next to that there is the IEEE Student Branch Eindhoven. Read below what each association does!



## e.t.s.v. Thor

Thor is the study association for all students, both bachelor and master, studying Electrical Engineering or Automotive at the Eindhoven University of Technology, and focusses on the enrichment of those students. To achieve this, the members of Thor organize a lot of activities, aiding in the relaxation and fun outside of the study hours as well as helping the students with their study or prepare for the career of the students after graduation. It is clear that the activities of Thor mostly revolve around three themes: education, development and recreation.

All activities are organized by students and for students. It is possible for each student to join a committee to organize various things. For example, the ACCI organizes a lot of different fun activities throughout the year, the ReisCo organizes a study tour to a country outside of Europe to get acquainted with other companies, business structures and cultures, and Kvasir organizes several excursions to and lunch lectures by Electrical Engineering and Automotive companies. There is also a first year committee, called Ivaldi, for freshmen to learn what it is to organize a few events a year and to get to know Thor. Next to this, also exam trainings and inside looks in the different parts of our department are organized. It is also important to party from time to time, so there are several parties throughout the year, some are on Stratumseind and some are in Het Walhalla. Het Walhalla is Thor's pub located on the sixth floor of Flux and is staffed

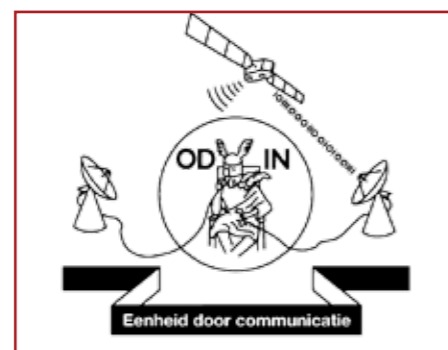
by the Tappers to provide thirsty students and staff with a drink from 16:30h to 19:00h every weekday.

For more information on what Thor does or if you are interested in becoming a part of Thor, feel free to visit the Board in Flux 6.184, visit our website [www.thor.edu](http://www.thor.edu) or send an email to [Board@thor.edu](mailto:Board@thor.edu).



## IEEE SBE

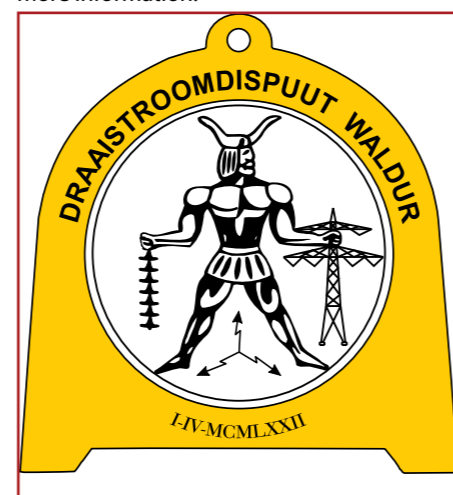
IEEE Student Branch Eindhoven is a local branch of the IEEE organization and we focus on master and PhD students in all directions. We organize activities ranging from fun workshops like a wine tasting or lock picking to more serious activities like lunch lectures and company visits. So if you are at the end of your bachelor and want to do more besides studying, then walk by the board room (Flux 6.184). We are almost always present and interested in what you would like to do and try to make that possible. See our site: [www.ieee.tue.nl](http://www.ieee.tue.nl) for more info!



## Masterdispuut ODIN

'Masterdispuut ODIN' is a master association for students interested in the research profile 'The Connected World'. We organize company visits, lunch lectures and various other activities to allow students to come into contact with companies in their field of interest. Make sure to join one of our ac-

tivities if you are doing courses within 'The Connected World' as it is a valuable addition to your study. Also, if you are a third year bachelor student, joining our activities is a great way to discover your interests to make an informed choice for your master track. We are in the board room (Flux 6.184) on Monday mornings or in Het Walhalla (Flux 6.152) on Monday evenings to give you more information.



## DSD Waldur

DSD Waldur, which means 'Draaistroomdispuut Waldur' in Dutch, is a study association for Master students of the department of Electrical Engineering that specialize in power engineering, sustainability, smart grids, electric actuators and motors, automotive, and power conversion. As you might already know, these specializations are directly linked to the capacity groups of Electrical Energy Systems (EES) and Electromechanics and Power Electronics (EPE). Waldur has been founded in 1972 and its purpose is to link students to the capacity groups and companies in this unique field of specialization. The main goal of Waldur is to organize excursions, (lunch) lectures, drinks, study tours, and network events. To achieve this goal we organize a 'Waldur Wednesday' every quartile, and a biweekly coffee hour. Furthermore, Waldur has its own magazine 'Gjallar', which is published twice a year. More information about Waldur and how to join them can be found on [www.waldur.nl](http://www.waldur.nl).

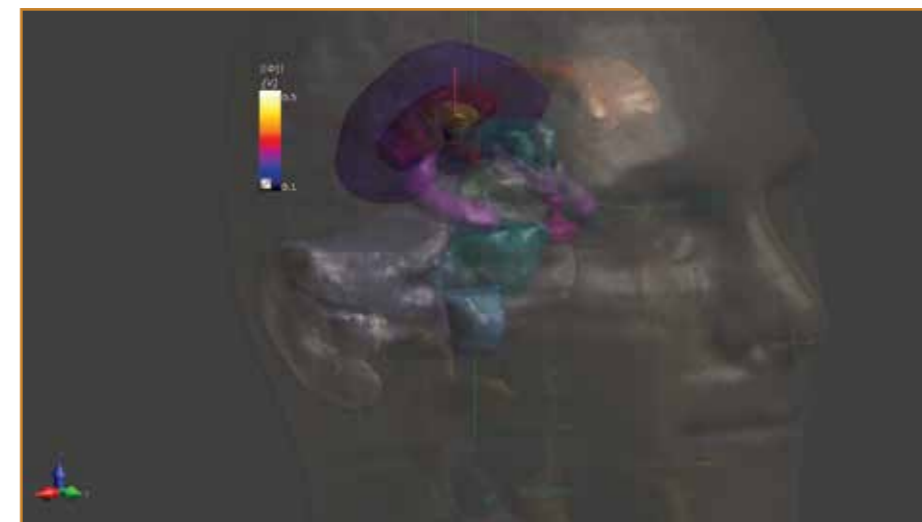
# Modeling Deep Brain Stimulation

By: Rob Sanders

In the fourth quartile of last year I did my internship at Medtronic. The neuroengineering field has got my interest me since the course neuromonitoring in the second quartile of the same year and therefore I wanted to do my internship in the same field. The department of Electrical Engineering recently got in contact with Medtronic and they had an amazing assignment about deep brain stimulation which immediately interested me. Doing an internship outside the university also attracted me, since this gave me the possibility to gain some experience with working at a company.

First some background about the company. Medtronic Eindhoven Design Center (MEDC) is a global research and development center of the Medtronic Neuromodulation business, located on the High Tech Campus in Eindhoven. It was founded in 2011 as a spin-out of Royal Philips and previously known as Sapiens Steering Brain Stimulation. Specifically, Medtronic is working on deep brain stimulation (DBS), which is an effective and well accepted surgical treatment involving the implantation of a 'brain pacemaker', which sends electrical impulses to specific parts of the brain. The initial ambition of MEDC is to improve the therapeutic efficacy of DBS, to shorten and simplify the clinical procedure, and to improve patient comfort. For this purpose, MEDC developed SureStim, a unique high-accuracy DBS system consisting of an advanced, MRI-conditionally safe DBS lead with 40 stimulation points and an integrated, image-based solution for planning and programming of an optimal DBS treatment.

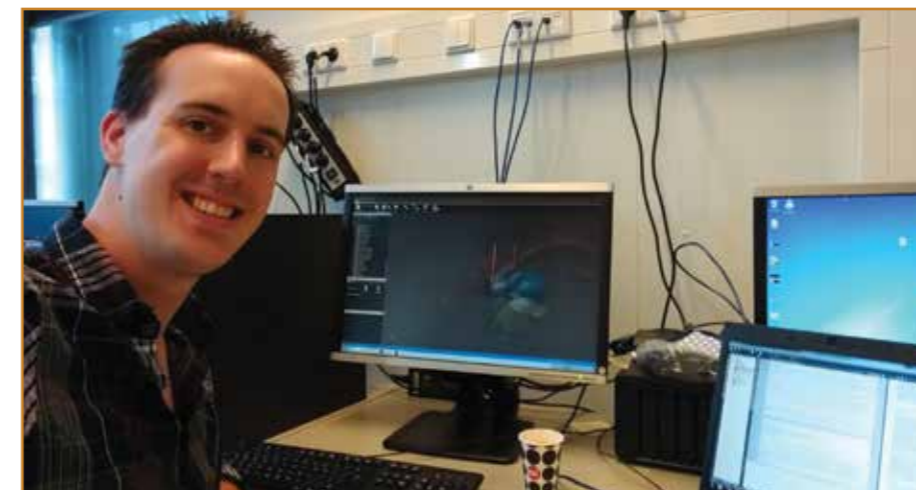
The largest difference between SureStim and the commonly used stimulation lead is that the SureStim has 40 small electrodes instead of 4 cylindrical electrodes. This makes the new lead capable of steering and thus reducing side effects of the procedure. This has been modeled and tested by Medtronic with the



lead in a saline solution, concluding that it indeed was capable of producing a steered field. The human brain, however, is not like a saline solution at all. And that is where I am stepping in. My assignment was to do some research about modeling the heterogeneity and anisotropy of the human brain and more important, if this has significant influence on the DBS procedure.

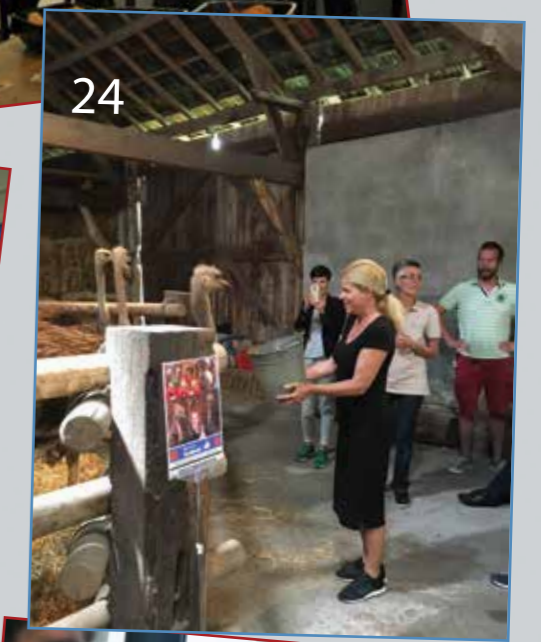
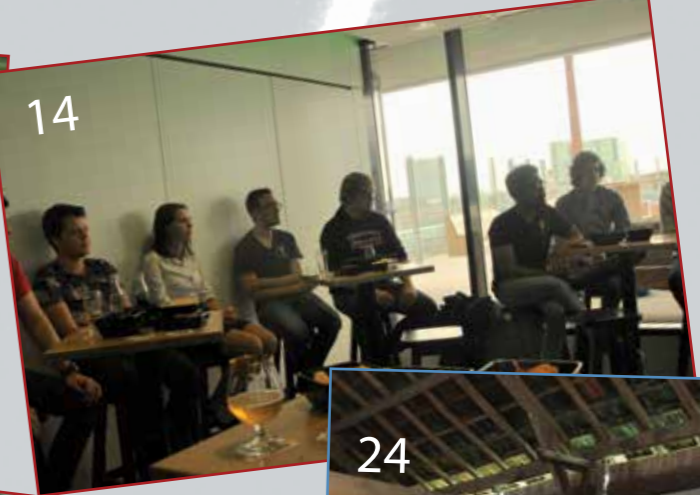
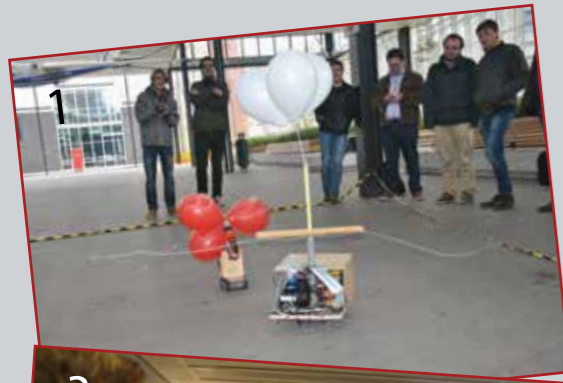
So I started with reading a lot of papers and some easy modeling in Sim4Life, which is a simulation platform combining computable human phantoms with physics solvers and advanced tissue models. I also had to fresh

up my knowledge of electromagnetics, but luckily my two supervisors were experts in this. And as the modeling continued, I learned a lot about the human brain and its anatomy. The figure above shows such a model of the DBS lead in the human brain and the induced potential field. I made these models with different setups and different stimulating fields, and the results were imported into MATLAB for post-processing. Ten weeks later, I got more nice images and a beautiful report which concludes that heterogeneity has a significant influence on the electric and potential field of the DBS lead, but this influence is much less when steering.



During this internship I worked two days a week at Medtronic, on Tuesday and on Wednesday. This doesn't seem much, but it was enough to get to know the company and some of the employees. I worked together with a student from Rome, who was doing an internship about the scripting of the modeling in Python. There were some nice talks during the lunches and afterwards there was always a table soccer match. It was a short internship, but it was really nice to see such a company from the inside. I know a lot of people go abroad for an internship, but I am glad I could just ride my bike to the High Tech Campus and did not have to move somewhere else. ■





- 1 & 2. VolunDr Balloon Battle
- 3 & 4. Excursion Vanderlande
- 5 & 6. VolunDr Foxhunt
- 7 & 8. TNO Drone workshop
- 9. ACCI Bowlen
- 10 - 12. ACCI Project X party
- 13 & 14. Accenture publecture
- 15 - 17. ACCI Weekend
- 18. Partysub
- 19. ASML lunchlecture
- 20 & 21. Tappersopdracht Lester
- 22. Borrel with Van der Waals
- 23 & 24. Departmental office trip

# Introducing candidate Board Thor

**H**ello everybody, my name is Lester Manders and I hope to be the next President of the best study association of Eindhoven: e.t.s.v. Thor. I turned 20 last February and I live in Eindhoven. I grew up in Gemert, a small town not far away from Eindhoven, where I went to the 'Commanderij College' for my VWO.

friends for life, I started talking and I even started to take the upper hand in life. I discovered the joy of leading things.

In two years I learned a lot within Thor. I organized parties, weekends and all kinds of other great activities. I learned that Thor is a great association that I want to take part in. I did lvaldi in my first year and in my second year

## I would like to help Thor to the next level!

In my younger years I was not the person I am today. In primary school I was a shy little boy that did not have many friends. But I was a happy little fellow. In secondary school I started to get more out of my shell, I made

I joined the ACCI. In the second half of my second year I became Tapper in Het Walhalla. In my third year I would like to become the next President to help Thor to the next level!

Geen gedonder! ■



**D**ear readers, my name is Rutger van Anrooij and I want to become the next Secretary of the study association

Thor. I grew up in a town called Goes in Zeeland and I went to 'Pontes', a comprehensive school in Goes.

The choice of studying Electrical Engineering was not hard for me, because at a young age I was already taking apart a lot of devices and wanted to learn how they work. At the

## At the age of 15 I had already built a LED Cube

age of 15 I had already built a LED Cube. I chose the TU/e for the small scale education and for the atmosphere in Eindhoven.

I got to know Thor at an orientation day, after following a lecture there was an lvaldi party. In the introduction week I was inspired by my intro parents (two of them are currently in the

board of Thor) to become an active member of Thor. I joined the first-year committee lvaldi and organized the open house day. In my second year I joined the activity committee ACCI and also Volundr, the committee that promotes the practical side of Electrical Engineering.

I am certain next year will be a great year. There is a lot I want to learn and do as a Board member to enrich Thor and myself as much as possible. I am really looking forward to the coming year!

Geen gedonder! ■

**D**ear readers, I am Jim Beckers and coming year I want to be the Treasurer of Thor. I grew up in Valburg, a small village between Arnhem and Nijmegen. Since

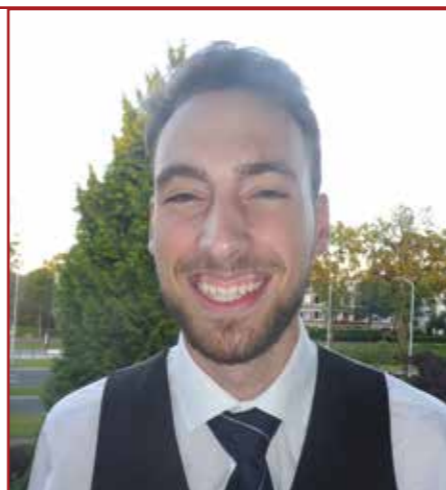
Later on we did a research on coils. All of this led me to choosing electrical engineering as my next education.

## ...and I wanted to do some more

I was little I was interested in electronics. I played with science kits, that let you build your own circuit to light up a lamp. I took apart almost all electronic devices.

After participating in the ACCI this year and also getting involved with the coming lustrum book and study trip, I really got enthusiastic for the association and I wanted to do some more. A lot of things have happened this past year which I really enjoyed and for next year I want to make sure everybody else from Thor can experience the same.

Geen Gedonder! ■



**H**ello, I am Dirk Buijvoets and I introduce myself as candidate Vice-President and candidate Commissioner of Public Relations. In September 1996, I was born in Enschede and since then I lived most of my

reading or gaming. Having studied at the TU/e for two years and having participated in multiple Thor activities I decided I would like to spend a year in the Board. In this year in the Board I hope to learn things like taking

## make sure we as Thor members have a year to remember

live in Hengelo. From a young age on I have been interested in the more technical aspects of live, so when the time came to pick a study, I could not choose between Electrical and Mechanical Engineering and because both studies seemed interesting, I chose to do both. I have joined the student fencing club and during the time I have left I can be found

responsibility, how to organize and plan. Besides the personal development, I hope we will be able to organize some fun and interesting activities, which will make sure we as Thor members have a year to remember.

Geen Gedonder! ■



**H**ello, I am Robin Steenbakkers, the candidate Commissioner of Education of e.t.s.v. Thor. I am 21 years old and I

live in Eindhoven. I grew up in a small town called Schijndel. Here I went to secondary school and after HAVO I went to VWO at the Elde College. In my fifth year I first came in

started looking for people who wanted to organize the 12<sup>th</sup> lustrum and make a lustrum book, I immediately joined these committees as well.

## I first came in contact with Electrical Engineering and Thor when I did a masterclass



contact with Electrical Engineering and Thor when I did a masterclass. After this masterclass and an orientation day I decided that Electrical Engineering was the study for me.

During the introduction week I came to know a lot of people and our great study association. Because of this I joined lvaldi in my first year and the FotoCo and ACCI in my second year. When at the end of my second year they

So much has changed since secondary school and I already learned very much. I want to learn much more and that is why I decided that I wanted to be in the Board of our study association. I am looking forward to next year, for I know that it will be an amazing experience and that it will lead to great memories.

Geen gedonder! ■

**H**i, my name is Rick Voogt and I am the candidate Commissioner of Het Walhalla. I come from a little town just south of Rotterdam, called Zuid-Beijerland. After finishing my education at the local secondary school I decided to study at the TU/e instead of Delft, where most of my

with the lvaldi and afterwards joining the ACCI and the Tappersgilde. I really enjoyed doing this as I learned a lot of skills which you do not learn by sitting in a lecture. This is what drives me most to become a Board member of Thor next year.

## In the beginning of my first year, I used to do little more than studying

friends study and which is a lot closer to my home than the TU/e. I found the TU/e more welcoming than Delft.

Together with my fellow candidate Board members I hope to have an awesome year in which we accomplish a lot and, not to forget, have a lot of fun!

In the beginning of my first year, I used to do little more than studying. However, as time progressed, I started to do more and more aside from my study. Since then I also got more and more involved with Thor. Starting

Of course I hope to see you in Het Walhalla or at the study association.

Op Het Walhalla en Geen Gedonder! ■



# Active members day

By: Ralph Roetman

*The Board thanks its members who participated in organizing the numerous activities throughout the year by organizing an 'Active Members Day'. This year, the Board thought it would be fun to mask it as a field trip of an elementary school.*

Once a year we go on a school trip with our 'school', 'Basisschool de Blije bok', to thank the students (or as some call them: active members) for their dedication during the past year. It is a challenge to find something all students like. Eventually we found a nice trip to the Efteling, so the bus was ready in front of Flux on the 23<sup>th</sup> of May around 9 o'clock. Luckily, teacher

Thomas could get all of the students in line, because of his newly purchased megaphone.

Naturally not every student had thought of his lunch, therefore we made a little packet with some drinks, a Sultana and a coloring page. This was necessary to entertain all the students in the bus.

At the Efteling it was a bit rainy, but this couldn't spoil the fun. After the cash desks, some already ran to their favorite attraction. A few thought that as it was raining, it didn't matter any more to get wet, so they went to the Piraña, while others went to the Vogel Rok to stay dry. It was very quiet in the park, therefore people didn't even want to wait a few minutes but skipped the ride when there was a queue of more than five minutes.

Sadly, everything has an end. A whole day of walking was a bit exhausting for some, but luckily they could sleep in the bus. Everyone was also hungry, but fortunately a few enthusiastic teachers were already barbecuing at Flux and gave everybody some food upon arriving. On behalf of the teachers of 'Basisschool de Blije Bok' all students are thanked for their great efforts during the past year. ■



# Sioux. Where knowledge meets pizza

**Sioux is an innovative technology company with 450 dedicated engineers working on Technical Software, Mechatronics, Electronics, Industrial Mathematics and Remote Solutions. We support leading high-tech companies in the Brainport region and far beyond with the development and manufacturing of their products.**

## Sioux Pizza budget

We also love to support the ideas and development of our own employees in our so called expertise groups. Over 60% of our engineers acquire knowledge and share their expertise in one or more groups.

They work on their latest innovative study projects like Industrial application of System on Chip technology, Cynara (a microcontroller and FPGA based, modular prototyping platform), Oculus Rift and many more. Sioux provides the tools and the food for thought. We call this the Sioux Pizza Budget, as pizza is the most popular choice of food for those meetings.

At Sioux, every employee has a personal development budget of € 6,000 per year, meant for training of their professional and personal skills. This special Pizza Budget is an extra topping on top of this development budget.

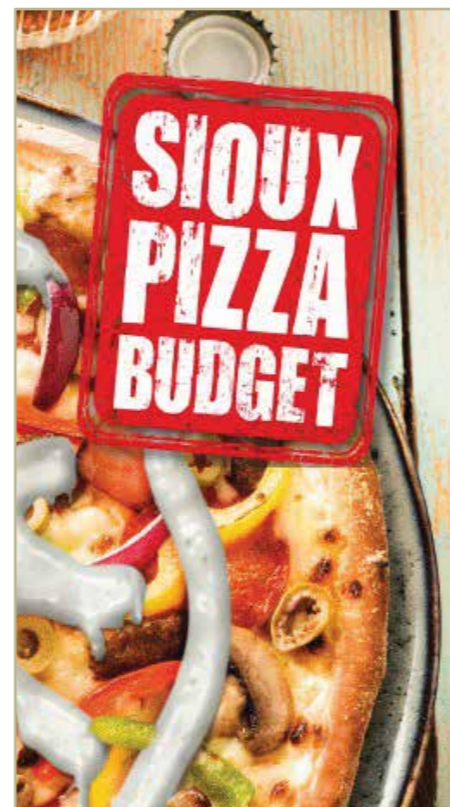
## Meet and eat

We would like to invite you to attend our Thor lunch lecture on the 5<sup>th</sup> of October by our Senior System Architect Kees Kooijman. There is also a Sioux company visit scheduled for the 15<sup>th</sup> of December. Details will follow at a later time but the pizza will definitely be there. In March next year you can find us at the TU/e Wervingsdagen and again with pizza of course. ☺

Already interested in attending a meeting of one of our expertise groups and enjoying delicious pizza?

Send an e-mail with your name, phone number and interests to [pizza@sioux.eu](mailto:pizza@sioux.eu).

We are looking forward to meet you! ■



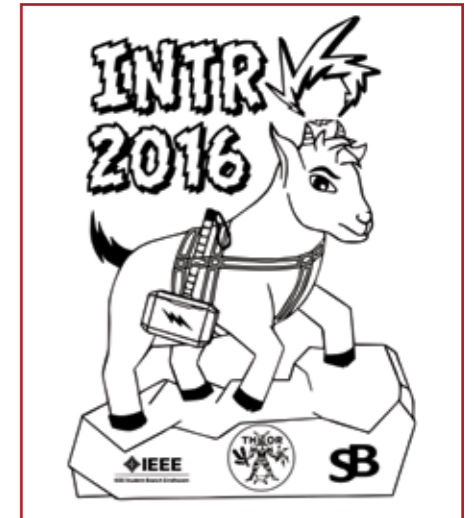
# Introduction week

By: Martijn de Kok

Every year in August, upcoming first year students are introduced to Eindhoven University of Technology and Eindhoven's student life. This year, these so-called 'kiddos' spent the week of the 15<sup>th</sup> of August exploring the campus, celebrating parties and getting to know the many student associations Eindhoven has to offer. Many Electrical Engineering and Automotive students have great memories of their own introduction week and were anxious to join this year's edition as parents. A pair of parents guides a group of around eight kiddos during the entire week, showing them around and making sure they have a great time.

Covered with stickers and flyers from the Limbopad, the kiddos were welcomed in the Auditorium by Bart Smolders, the dean of the department of Electrical Engineering. Here, they were also united with their introduction families and given gadgets that would make them unique and recognizable groups. Some kiddos would spend the rest of the week wearing iron man outfits, others would be dressed as dwarves and partying together with Snow White and her loving prince.

Each group worked on an engineering case with small self-driving vehicles, played water games and had their pictures made for the face book. The groups got to know each other and did several bonding activities. Speaking of bonding activities: there are none better than chasing a candidate board member and working together to relieve the unfortunate soul of their stifling neck garment.



Yes, kandi's were present this year as well, along with all their undignified incompetence. Aspiring to become fully fledged board members of Thor in the upcoming year, they set out to let their faces be known to all potential new members. They did this by entertaining the kiddos whenever and wherever they could, by making breakfast and by showing off their dance moves at every party. Truth be told, they have been a great help in making this introduction week as memorable as it was.

During the faculty tour, the upcoming freshmen were guided through the Flux building, getting to know the layout of the building, exploring several labs and becoming acquainted with Thor. After the Green Strip Market, where Thor orchestrated an activity



together with Lucid, the kandi's proved their incapability yet again by losing all the important General Members Meeting artefacts they were supposed to take care of. Luckily, with the help of parents and kiddos, the kandi's were able to retrieve the artefacts and put everything in place before the board arrived.

During the barbecue that followed, the new 'Tapauto' had its time to shine. Traditionally, a beer tap car was made every year by the sitting board before the introduction week. This year, the car was a combined effort of several board members and a group of enthusiastic first year students.

There had been plenty of opportunities to party. Thor had held a party in the Topsy Duck, the Central Intro Committee had organized a pub crawl on Wednesday and of course there was the Compositum party. After a week of drinking and dancing, the kandi's had prepared a hangover breakfast to prepare everyone for the All TU/egether festival, which concluded a spectacular week.

I have participated in introduction weeks as a kiddo, as a parent and now as a member of the Thor Intro Committee. Each year came with a little more responsibility, but I have great memories from every single one and I'm already looking forward to next year's introduction week. On behalf of the committee, I'd like to thank all participants and volunteers for making this a fantastic week. We hope all kiddos and parents enjoyed it as much as we did, and we would like to see all of them back at the after-intro party in Het Walhalla! ■

# Viking facts

By: Fer Radstake

Besides being named after the Norse god of thunder, e.t.s.v. Thor has much more to do with the Vikings. The names of committees like Ivaldi and Kvasir, our fileserv Mjollnir and our pub Het Walhalla all come from Norse mythology. Our members like to behave like a bunch of Vikings too, loudly chanting the Thor song on every occasion and cheerfully raiding the 'constitutieborrels' of the other associations, never returning without some kind of loot. In short, we're a real Viking association. But who were these Vikings? Find out with these surprising facts.

## First attack

Although the famous 793 raid on Lindisfarne is generally taken as the beginning of the Viking Age, the first documented attack took place some four years earlier. When three, possibly lost, Viking ships landed on the Isle of Portland in southern England, the local sheriff mistook them for simple merchants and demanded they'd pay taxes on the goods they were carrying. The Vikings didn't quite agree with the sheriff's reasoning, and killed the poor man instead.

## Egtved Girl

What's the difference between modern girls and girls from the Nordic Bronze Age? Not much apparently, judging from a Danish grave from 1370 BCE. The 16- to 18-year-old girl inside was wearing a miniskirt and crop top, and was buried with a good supply of beer. Isotope analysis shows she was originally from the German Schwarzwald, and had travelled a lot in the last year of her life. Perhaps she died from binge drinking on holiday with her friends?



The Egtved Girl's clothing caused some uproar when she was unearthed in 1921. (By: Nationalmuseets Samlinger, <http://samlinger.natmus.dk/DO/4368>, CC BY-SA 2.5)

## Women

Viking women were quite powerful compared to their southern counterparts. Whereas the Romano-Christians saw them as inherently evil due to Eve's sin in tasting the apple, the Pagan Scandinavians didn't have such prejudice. Instead, the Vikings considered women to have something sacred, and female priests and 'witches' could reach a high social status. Also at home, women were in charge of much of the household, and were expected to run the entire farm when their husbands were away at war or on business. Although there's no reliable evidence female warriors ever existed, they often feature in the sagas and there are a number of anecdotes about women fighting when the need arose.

In marriage husband and wife were equal partners. Although a marriage was usually arranged between father and groom, the girl's wishes were almost always taken into account. If the marriage nevertheless didn't work out, she had the right to divorce.

## The Dorestad kingdom

Although most people know the Vikings once raided the Dutch coast, fewer know they once had a kingdom here. In 850, the Danish Hrørrek conquered the cities of Dorestad (near modern-day Wijk bij Duurstede, lit. "settlement near Dorestad") and Utrecht. He ruled much of the Netherlands north of the Waal for some 30 years, ostensibly under the East-Frankish emperor Lothar, but in practice independently. He died sometime before 882, after which his lands were given to the viking Guðfrið, to pay him off from ravaging the Belgian coast. Guðfrið's murder in 885 brought the area into Frankish hands again.

## The Sack of Luna

Although Viking attacks are mostly known for their ferocity, they didn't shy away from using subterfuge if necessary. When the Viking chieftain Hastein had plundered his way along the coasts of Spain and France, he came to the Italian town of Luna. Looking at its high walls, he knew he couldn't take the town by force. He pretended to be dying, and sent some of his men to the local bishop



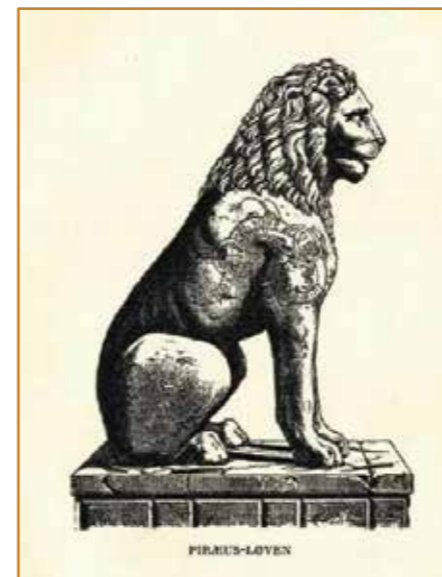
A testament to the extent of the Viking trade network is the find of a 6th century Buddha statue on Helgö island near Stockholm.

(By: The Swedish history museum, [kulturarvsdata.se/shm/object/html/108115](http://kulturarvsdata.se/shm/object/html/108115), CC BY-NC-ND 2.0)

to have him baptised, so that he could die a Christian. The bishop christened him, and returned to town. The next day some Vikings arrived at the city gates with the news their "good Christian" leader had died. The bishop allowed their funeral procession into town, so that Hastein could be buried on consecrated ground. Of course, as soon as the coffin reached the church, Hastein jumped out alive and well and sacked the whole town.

## World travellers

The Vikings travelled and traded further than any contemporary peoples. Their ships famously reached Newfoundland in the west, sailed to the coast of North Africa in the south and reached the Caspian Sea to the east. The Vikings also went down the Dnieper, where they founded the predecessor of modern Russia in Kiev. Further south, the Byzantine emperor had a Viking contingent as his elite guard for hundreds of years. These were taken to battle in places as far away as Syria and Sicily, the latter of which was conquered



This lion statue in Piraeus near Athens is carved with runic Viking graffiti.

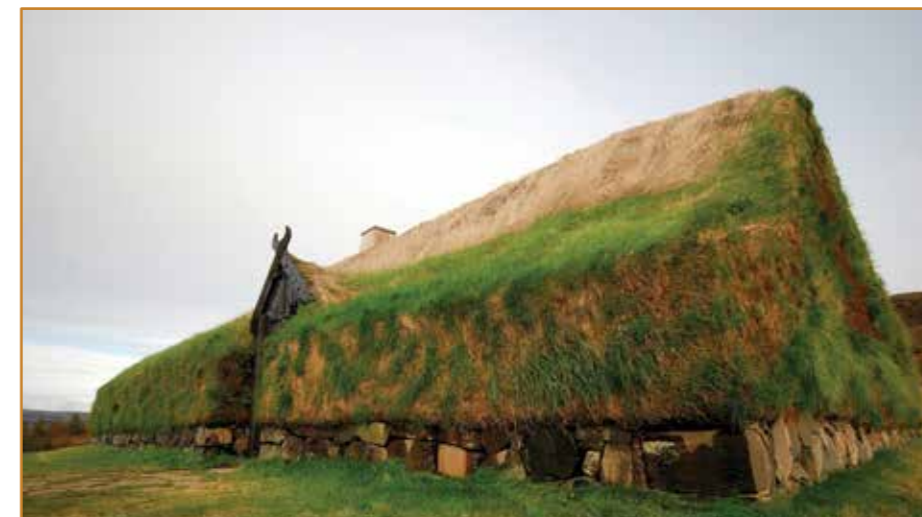
by the Normans around 1070. The Normans in their turn descend from Vikings that had settled in Normandy in the 900s.

## Danegeld

When faced with a Viking invasion, the English and French kings often paid off the Vikings, rather than fight them and risk the destruction of a town. The amount of money transferred to Viking hands was huge: in 1012 for example, a Viking fleet was bought off with 18,000 kg of silver. On the Baltic island of Gotland alone, 40,000 Arabic, 38,000 Frankish and 21,000 Anglo-Saxon coins from this period have been found.



Although there's no evidence they ever existed, female warriors feature in many sagas.



Vikings lived in small, isolated settlements.

(By Thomas Ormston (Ormstont) - Own Work (On Flickr at: [http://www.flickr.com/photos/thomas\\_ormston/1504523170/in/set-72157602296157786/](http://www.flickr.com/photos/thomas_ormston/1504523170/in/set-72157602296157786/)), CC BY-SA 3.0)

With so many coins flowing into Scandinavia, it's remarkable that the Vikings didn't use them, except for foreign trade. To them, coins had no special value other than the metal in them, and they were often hacked into smaller pieces when negotiating small transactions.

## Viking towns

Urbanisation in Scandinavia came remarkably slow. At a time when their Frankish and Anglo-Saxon brethren had long since embraced the urban culture of the Romans, the Vikings held on to the rural lifestyle they had led since the Bronze Age. "Settlements" generally consisted of far-apart farms and rarely numbered more than a few dozen buildings. Only in the late 8th century, towns in the modern sense of the word started to appear. Even then, they were

quite small: Heiðabýr near Schleswig, in the 9th century the largest town of Denmark, only had a population of 1000-1500. Although the pace of urbanisation increased around 1000 CE, it remained quite slow. By 1100, there were still less than 30 towns in all of Scandinavia.

## Law

Quite contrary to the Vikings' vicious image, their law was actually pretty lenient and modern. Where Romano-Christian law often aimed for vengeance and punishment, Germanic laws were based on the principle of compensation. Almost every crime was punished by a fine, its height based on the monetary damage to the victim or his property. Even murders were punished this way.

Again in contrast to Romano-Christian law, torture, corporal punishment and the death penalty didn't exist. The heaviest punishment was outlawry, which placed a criminal outside of the protection of the law. Although in theory this meant the convicted could be killed "for free", in practice this most often meant a banishment. Such was the case with the famous Erik the Red when he left Iceland to settle Greenland in 982.

## The last Viking

Svein Ásleifarson was arguably the last great Viking pirate. From his Orkney farmstead, he raided the coasts of Scotland, Ireland, Wales and south-western England from the early 1140s onwards. He made a habit of going on raids twice a year: after sowing his farmland he went on his "spring-trip" until midsummer, when he returned for harvest. Then he set off on his "autumn-trip" until midwinter. He continued this for some 30 years, until he was finally killed in a raid on Dublin in 1171. ■

# Multi-Gigabit Infrared Optical Wireless Indoor Networks

By: Joanne Oh

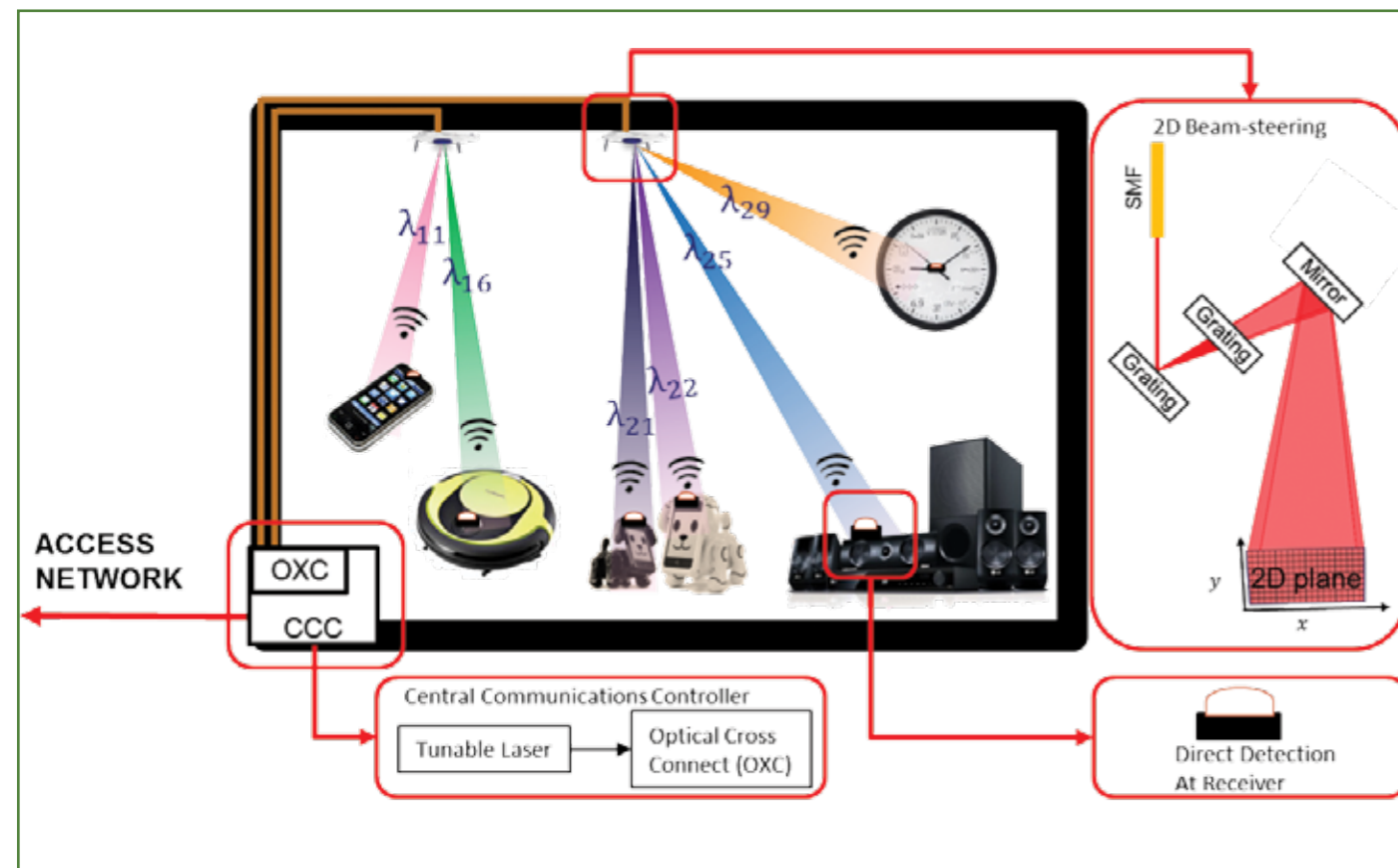
The continuously growing numbers of wireless devices ('Internet-of-Things') and bandwidth-demanding applications have pushed the available bandwidth in the radio spectrum close to full exhaustion. Radio wireless systems start to face the problems of poor link performance due to insufficient bandwidth, signal interference among devices, radio signal power increasing to possibly unhealthy levels and, inevitably, costly network efforts by internet service providers.

The Electro-optical Communication System (ECO) group in Electrical Engineering is working on a future-proof technological solution that is potentially cost-effective, energy-efficient, scalable, dynamic, secure and health-safe. In ECO, we proposed a narrow infrared beam for wireless communication. The target of our proposal is to harvest the giant capacity in the optical domain in an energy-efficient way, and to dynamically tailor it to actual service needs at varying locations. The advantages are that these infrared optical links are invisible, are inherently immune to electromagnetic interference, use unregulated spectrum and are physically secure. Moreover, eye-safe power levels of infrared light (beyond 1.4µm: according to ANZI Z-136 and IEC 60825) are double than that of visible light, which together with the high directivity

of the narrow optical beams allows a higher received signal-to-noise ratio. All this makes the system very suitable for indoor communications, whether at home or in an electromagnetic-sensitive professional environment such as a hospital.

Then, the big challenge is in the implementation of a beam-steering module which can steer many beams, each into an individually 2D-tunable direction. This module preferably does not require local powering nor mechanical intervention, should respond rapidly, and should be of high efficiency. In this regard, we propose the use of remotely-wavelength-controlled cascaded diffractive optical elements (DOEs). For initial test, we have integrated free-space optics into a fiber-optic communication system. The free-space

system has been designed such that the communication channels under test propagate wirelessly at a distance of at least 2.5m, in a path-folded testbed, to model an actual distance between the optical access point and mobile devices in an indoor scenario. These beams are then carefully steered in 2D by using a pair of crossed passive echelle gratings to direct each of the wavelength-controlled beams toward the location of an optical-wireless receiving device. Initial studies have shown the feasibility of having a channel capacity up to 42.8Gbps, over 2.5m distance, using low-cost 10GHz 1.5µm telecom band devices with adaptive multi-carrier modulation format known as discrete multi-tone (DMT) modulation. ■



An innovation for the future of high-speed optical wireless indoor communication (optical free-space downlink in hybrid with radio uplink), a vision of the project, "Beam-steered Reconfigurable Optical-Wireless System for Energy-efficient communication (BROWSE)".

# Icons of EE: Guglielmo Marconi

By: Stefan Molenschot

As Electrical Engineers we have all heard of Nobel Prize winner Guglielmo Marconi. As an engineer he did groundbreaking work in the field of radio transmissions, and as an entrepreneur he managed to build a business around it.

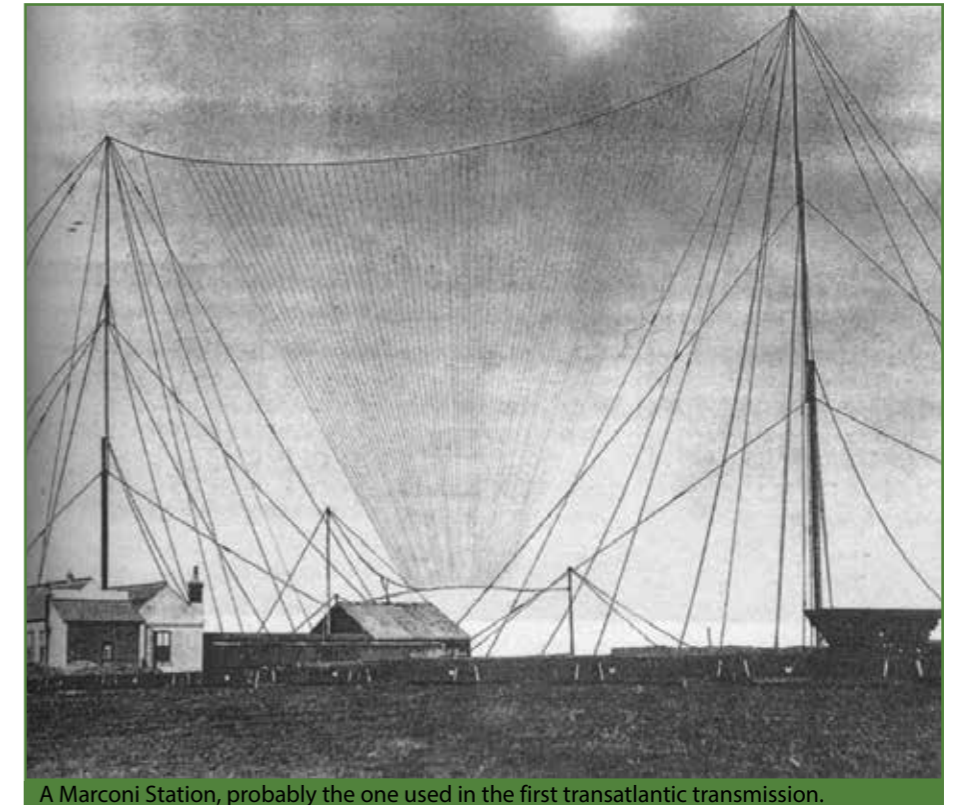
Guglielmo was the son of a powerful Italian land owner, Giuseppe Marconi, and Annie Marconi. Annie was the daughter of Andrew Jameson, owner of a well-known Irish whisky distillery. Guglielmo spent his childhood living with his mother in England. After returning to Italy at the age of 18, he was not admitted to university, but he was allowed to follow some lectures.

He quickly developed an interest in the work of Heinrich Hertz, and started to build test setups in his attic. Marconi was by no means a scientist, and wasn't much of an inventor either. Because of this he saw the new inventions and research by Hertz and other scientists in a very different light. Instead of trying to understand the physics and phenomena behind electromagnetic radiation, he tried to put it to practical use.

He mostly used existing components from radio experiments, and combined them with telegraph equipment. He added his own invention to this: the all-important monopole



Marconi's first radio transmitter.



A Marconi Station, probably the one used in the first transatlantic transmission.

antenna. This resulted in a usable system which eventually had a range of about 2 kilometers. Marconi saw the commercial value of his invention; he used his father's network of influential people to get funding for the project and obtain worldwide patents. He set up his company in 1897 and obtained his first (British) patent.

In London Marconi met William Henry Preece, chief engineer of the British General Post Office. He was already running his own experiments on wireless telegraphy, his setup already had a range of one mile. Suddenly, the budget and expertise of the Post Office was at Marconi's disposal. In the next couple of years he achieved ever-increasing distances without changing his equipment much; he just kept adding power. Of course this setup only produced broadband radio noise, without any tuning.

It came Oliver Lodge: he came up with the basic theories and inventions of adding tuning to radio systems, allowing for the communications between a transmitter and receiver over specific frequencies. Marconi improved on this invention and began adding this to his own radio systems. He incorporated

this into his most important patent of all time, British patent No. 7,777 "Improvements in Apparatus for Wireless Telegraphy" in 1900.

The next big milestone in Marconi's career is his transatlantic broadcast. Marconi had the very controversial belief that radio waves would bend with the curvature of the earth, enabling broadcast between locations without a direct 'line of sight'. We now know that this is false; the radio waves simply bounce off of the ionosphere and back to ground. Marconi's transatlantic broadcast worked nonetheless, he sent the first signal on the 12<sup>th</sup> of December 1901, from Cornwall to Newfoundland.

A lot of controversy still surrounds Marconi, though. He had several disputes with Oliver Lodge, who claimed to have sent wireless transmissions across a distance a year before Marconi filed for his patent. In Russia, Marconi still receives little credit for his inventions in the field of radio. Alexander Stepanovich Popov delivered a lecture on radio themes before the Russian Physical and Chemical Society 13 months before Marconi's first patent filing. ■

# A French guy in Eindhoven

By: Jonas Marie

**As part of my engineering courses at ENAC (French Civil Aviation School), and because I am really curious, I wanted to do an internship in a university lab rather than in a private society which doesn't let the curious spirit of trainees in. That is why I have chosen to turn to TU/e. It is a very good university, teaching courses in a very wide sector of sciences and technologies.**

## A little bit of history

Before engineering school, I followed technological courses specialized in electrotechnical fields called Industrial Sciences and Technologies. I obtained my "Baccalauréat" (equivalent to VWO-diploma according to Internet) with honors in 2010. Afterwards, I continued in CPGE (Preparatory class for high schools) and integrated the ENAC in 2013. There are intensive courses in mathematics, physics and industrial sciences in my specialty. I spent three years instead of two years in CPGE because I wanted to continue playing soccer. I have played soccer in 'Division d'Honneur', the sixth division in France. Furthermore before moving to Toulouse we were champions and going up in 'CFA2', the fifth division.

## First step in the Netherlands

To go back to the internship, it was around the 10th of May that I started to take some information about the Netherlands, and Eindhoven in particular. As I am a soccer fan of the best team in Europe, 'Olympique de Marseille', I already knew the institution of the city, the PSV and its Philips Stadium. By the way, it is the first thing that I went to see arriving in Eindhoven, after searching a market in order to buy an umbrella, the object that a good Dutchman has to own.



Strangely, when I went with the aim to rent an apartment, the weather was very good and the temperature was close to 30 degrees, so I thought that a short and T-shirt would be my main friend during this summer. Unfortunately, the reality was absolutely different. The two or three first weeks after, it was raining and the sky was grey every day. It will change for the coming weeks, sunshine and blue sky will come.

Days went by and I had never looked for a place to go running in Eindhoven. My first run was from Pastoor van Arsplein, where I am living, to TU/e, but it was a bad idea. There are a lot of crossroads and traffic lights so it is impossible to run continuously. So I decided to go back to my home and turned on Google

Maps for identifying the nearest park, which is Philips de Jonghpark. From this day on, it is my best runner partnership.

## Lunch time!

Before anything, I had to find meat. Together with my girlfriend, who came with me for two weeks before her end of study traineeship in a bank, I have searched for a commercial area to fill the fridge. On our way to Eindhoven, we had seen an area with IKEA, so we took the road and drove to IKEA's area. Once arriving there, we found no supermarket, so we decided to ask the first person in front of us. This person pointed out the biggest supermarket in Eindhoven, the Jumbo Winkelcentrum Woensel, so we went for a new trip to Woensel. After arriving there, we expected a big supermarket, but this was not the case. It was like a simple district market in France. But in fact it is not so bad because there are less people, less products and we spent less time to do shopping.

## My future

Lastly, I am going back to serious matters and I am going to tell you about my future. At the beginning of October, I will take the road to Toulouse in order to start my third and last year of engineer curriculum at the ENAC. In the same time I will start a second course in the field of Aeronautical, Space and Terrestrial Telecommunications Network allowing me to obtain a double degree.

Finally, I hereby thank the entire EM department profusely for their kindness, their welcome, their birthday cake and for lending us their red card for the coffee. ■



# 14 weeks in Eindhoven

By: T. Bonnafont

## Why Eindhoven?

As part of my scholarship I had to do 14 weeks of internship in another country. You may wonder why I chose Eindhoven in summer instead of a sunny and warm country like Spain. First of all it is because of the university. But mostly because since I live near Spain, I wanted to try to go north and see another country. I come from Pau, a small city in the South of France, and live in Toulouse, the pink city, since four years. In Toulouse I study Aeronautical Telecommunications and am specialized in Electromagnetism. Next year I will also do a master in optimization. I like science and it's why I chose to do an internship in a laboratory. One of my teachers has worked at TU/e and helped me to find this internship.

## Discover Eindhoven and the Netherlands

I came by plane and landed in Amsterdam, where I was very impressed by the size of the airport. After landing it took like 15 minutes to go park and then another 15 minutes by bus to go to the airport. Since I arrived I was quite impressed by the weather that is mostly not



sunny for a summer. I took a few days to go in the city center and to get acquainted with Eindhoven a bit. Quickly I discovered French guys that were also here for an internship and now I do most of the things with them. I went to the Extrema Outdoor, which was quite impressive, and also went to Tilburg to discover the La Trappe factory. This weekend I will go to Amsterdam. I have also visited the DAF museum, which is quite nice.

## Bike!

When I arrived in the Netherlands I also noticed that most of the people have a bike and that in the Netherlands bicycle roads are huge, so I bought a bike a few days after I arrived. It's quite enjoyable to ride a bike in this country since you can go anywhere: there is a bicycle road and there are no mountains. However, I do miss the mountains a little. I

found the city quite enjoyable with lots of beer places and quite a nice city center, and people are very helpful when you are lost.

## TU/e

I was also impressed by the size of the department building; in Toulouse you can find one the biggest department buildings of France, but it's nothing compared to this one. Besides, there is a bar in the building and that's one thing that is impossible in France. The building is also amazing with open space to work, and also impressive laboratories with faraday cages. Also, the view is beautiful when it's sunny.

I would like to thank Rob Mestrom for his help, and also the EM group to welcome me, help me with everything, and also for lending the red card to have coffee. ■



# Advertorial Witteveen + Bos

By: Anjo Peeters

**Anjo Peeters graduated from Eindhoven University of Technology in 2015 with a master's degree in Electrical Engineering. During his study he has been active in several committees within Thor and he was member of the Board of Thor during 2010-2011. Since March 2016 he is working at Witteveen+Bos at their office in Breda. Witteveen+Bos is part of the Dutch top 10 engineering and consultancy firms, with six offices in the Netherlands and several abroad. There is a great variety of projects in the fields of infrastructure, water, the environment, spatial development and construction.**



## Why did you choose for Witteveen+Bos?

I've performed my graduation project at Philips and during that time, I found out what aspects of the way of working there did and didn't suit me. So when I started looking for a job, I knew what was important to me. Although this might sound a bit cliché, I was looking for a company with a really good atmosphere and nice colleagues with whom you can really work together on a project. Regarding the work itself, I liked to work on projects for an external customer. With these types of projects, you have to make a connection between what the customer says he wants and what the technical implications of this are and how this can be realised. Furthermore, working for a customer triggers even more to work in a pragmatic manner and to always keep the goal of the customer in mind for the work you're doing.

After looking around at different companies, I received several job offers and it was time to make a decision. After some consideration I decided to choose for Witteveen+Bos since they best met my requirements. Especially the atmosphere was really nice; even in the job

interview I didn't feel nervous or anything, it felt way more informal and was a nice and comfortable conversation.

Although I've only started working several months ago, I already feel very much at home within Witteveen+Bos. The company is filled with enthusiastic people who are really interested in what you're working on and are very willing to help if you don't manage to figure something out on your own.

## What do you do at Witteveen+Bos?

In the last few months I've been working on several different projects alongside each other. The benefit of this way of working compared to focussing on one project at a time is that it is more interactive, regarding both the subject of a project and the people with whom you work together. To give you a better idea of the type of projects that I'm involved in, let me tell you more about one of them.

One of the projects I've been working on is for a water company ('waterschap' in Dutch). Amongst other things, they pump water from the municipalities towards the sewage treatment plant where water will be cleaned for reuse. In this transport system, a limited amount of sensors is present which are used for the control mechanism to operate the water pumps correctly. This sensor data is



possibly a huge information source about the performance of the system; Witteveen+Bos has been asked to investigate possible methods to use data for this purpose. With a better, real-time overview of the performance of the water transportation system, the company can gain better control of their assets. Using this information, maintenance and daily operations can be adapted to achieve a higher efficiency and cost reduction. Challenging in this project is to find a balance between on the one hand enough in-depth analysis of the sensor data and its relation to the physical system, and on the other hand a simple presentation of the data such that people with little knowledge about the system are still able to act upon this information.

## What is your advice for job-seekers?

Get in touch with several companies. I've participated in multiple business courses and inhouse days and I really enjoyed that. It is a very nice way to get a better idea about the possibilities that are out there, and is also helps you to determine what type of company suits you. And if you're looking for a company with a good atmosphere, nice colleagues and interesting projects, Witteveen+Bos is definitely worth a visit ;-). ■



# My BEP at the Electromagnetics group

By: Anouk Hubrechtsen

I am Anouk Hubrechtsen, a fourth-year student at Electrical Engineering, so it was time for the Bachelor End Project (BEP). I did not plan to start my BEP this year, but because of a series of surprising conditions I did.

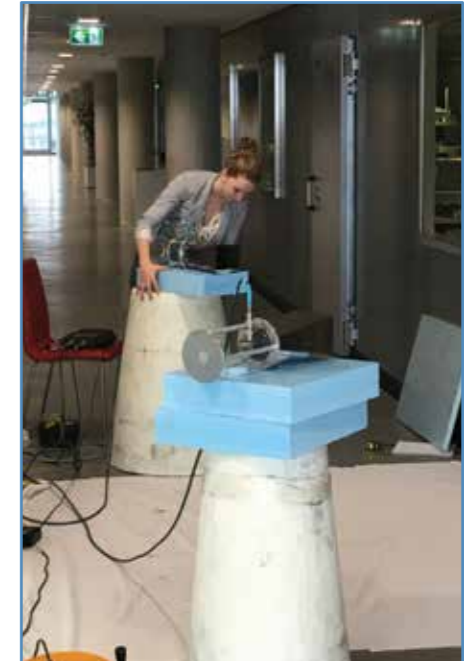
I have been familiar with the 'Center of Wireless Technology' lab of the Electromagnetics group located at floor 8 in Flux, because of my work at the promotion team of Electrical Engineering. Many high-school students visit Flux to get an idea of what it's like as an EE-student. A part of these information days, is a tour around the CWT/e lab, where I tell the students about the many possibilities of the lab. A lot of students found that the most interesting part of this tour was the anechoic chamber, a shielded room where antenna measurements are performed. Besides the high-school students, I was also highly interested in this topic which was noted by Ad Reniers, the lab manager of the CWT/e lab.

Ad Reniers told me about a BEP proposal regarding the anechoic chamber and he asked if I was interested. As I mentioned before, I had no intention of starting my BEP this year and I was not even sure which subject I wanted to pursue, but when I heard about the proposal I changed my entire planning to start with this BEP. So, a little out of the ordinary, I had a BEP before the official kick-off

meeting. My project regarded performing an error analysis on the anechoic chamber. It is of high importance that antenna measurements are not disturbed by extraneous signals or non-idealities within the chamber. My goal was to find these non-idealities to improve antenna measurements.

In the first quartile of the project I performed a literature study to obtain some more information about the chamber. As I had only taken one electromagnetics course, it was a bit of a struggle to read some of the papers. Thankfully, my supervisors helped me a lot on this subject. After reading many articles about the anechoic chamber, I found some techniques on how to perform an error analysis on the chamber. With a little creativity and some help from my supervisors, I combined a few and started measuring.

I performed two measurements inside the chamber and one outside the chamber on solely the pyramidal absorbers. I was interested in the cause, the direction and the magnitude of the reflections inside the chamber, as these are non-idealities. With a technique called time-gating, I could distinguish most of the unwanted reflections in the chamber to find their direction and magnitude. I performed a measurement on the hallway of floor 8 to measure the pyramidal absorbers, as shown in the picture

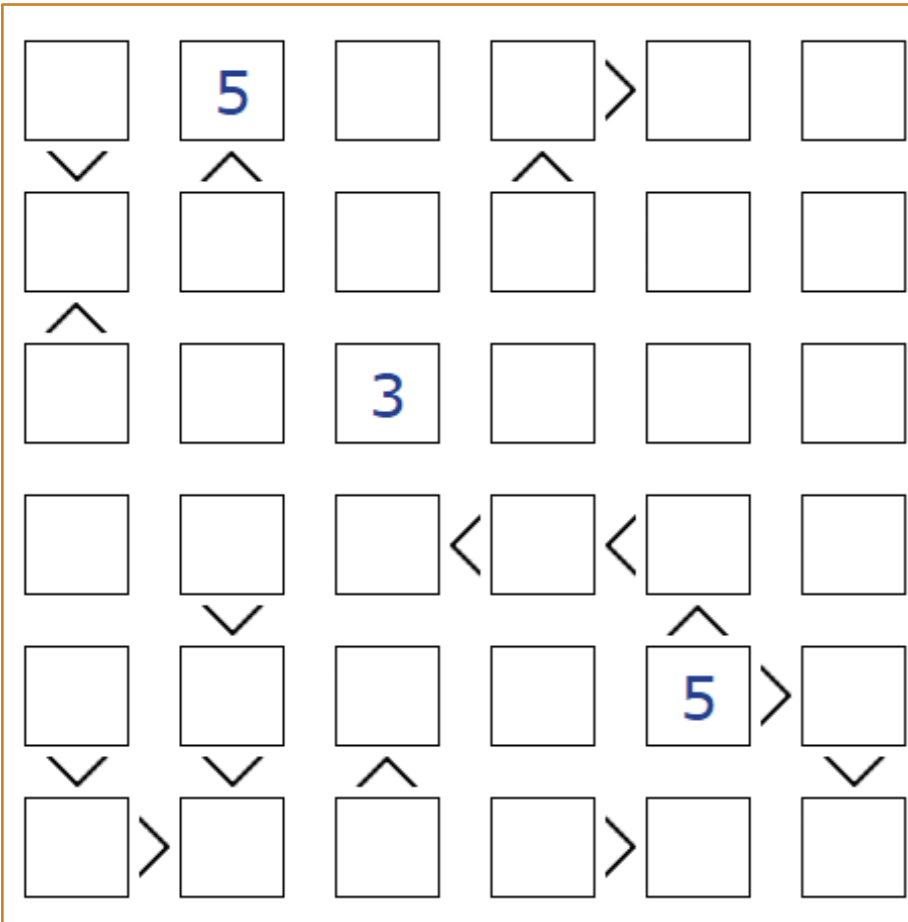


below. This looked a little funny to people studying on floor 7, so many people came by this day questioning what I was doing. After this measurement, I performed two measurements inside the chamber to distinguish all non-idealities. In the results, the reflections caused by the absorbers were clearly seen. I also noted a few other factors causing reflections, like a scanner inside the room, the rails on which the antennas move and the lamps. This way, I could distinguish the reflection levels of each of these factors.

In the end, I am very pleased with the obtained results. I feel like I have acquired a lot of new knowledge on the topic of electromagnetics and I am quite sure I want to pursue this subject. I felt a bit sad when the BEP was finished, as I really enjoyed doing the project. I would have liked to accomplish even more because I have a lot of new ideas to pursue the measurement even further, but I believe that is what every student thinks afterwards, and it was time to finish it up. I am very thankful to my supervisors Ad Reniers and Sander Geluk, who have taken a lot of their time to guide me through the project, and because of them, I have acquired much more insight in the topic. The thing that I am most pleased with is that my obtained results will be used in further measurements, so I really feel that I have accomplished something useful, and I hope to obtain many more useful findings in the future. ■



# Puzzle



### Objective / Rules

- Complete the grid such that every row and column contains the numbers 1 to the size of the grid.
- The arrows on the grid are less-than and greater-than signs. E.g.  $1 < 4$ ,  $3 < 5$ ,  $2 > 1$ .



### Winner previous puzzle

The winner of the previous puzzle is Simon de Vegt. He wrote a C program to solve the puzzle, see the screenshot below.

1	0	0	1	0	1	1	0	1	0	0	1	1	0
0	1	0	0	1	0	1	0	0	1	1	0	1	1
1	0	1	1	0	1	0	1	0	0	1	1	0	0
0	0	1	0	1	1	0	0	1	1	0	0	1	1
1	1	0	1	0	0	1	1	0	1	0	0	1	0
1	0	1	0	0	1	1	0	1	0	1	1	0	0
0	1	1	0	1	0	0	1	1	0	1	0	0	1
0	1	0	1	1	0	0	1	0	1	0	1	1	0
1	0	0	1	0	1	1	0	1	0	1	0	0	1
0	1	1	0	1	0	0	1	0	1	0	0	1	1
0	1	1	0	1	0	1	1	0	0	1	1	0	0
1	0	0	1	0	1	0	0	1	1	0	1	1	0
1	0	0	1	1	0	1	0	0	1	1	0	0	1
0	1	1	0	0	1	0	1	1	0	0	1	0	1

Puzzle solution June edition (Connecthor 34)

```
binArray = (int**)malloc(size*sizeof(int*));
binArrayCheck = (int**)malloc(size*sizeof(int*));

for(int i = 0; i < size; i++) {
    binArray[i] = (int*)malloc(size*sizeof(int));
    binArrayCheck[i] = (int*)malloc(size*sizeof(int));
}

//bininput(size, input, fp);
THORinput();
printf("Input\n\n");
printArray(size);
tees = twoCounter(size);

if(binsolver(tees, size)) {
    //system("cls");
    printf("\n\nThe answer is: \n\n");
    for(int i = 0; i < size; i++) {
        for(int j = 0; j < size; j++) {
            printf("%d ", binArrayCheck[i][j]);
        } printf("\n");
    }
} else {
    //system("cls");
    printf("\n\nThere is no solution!");
}
```

A part of the code that Simon used to solve the previous puzzle

# Marihuana contains alien DNA, NASA confirms

By: Tom van Nunen

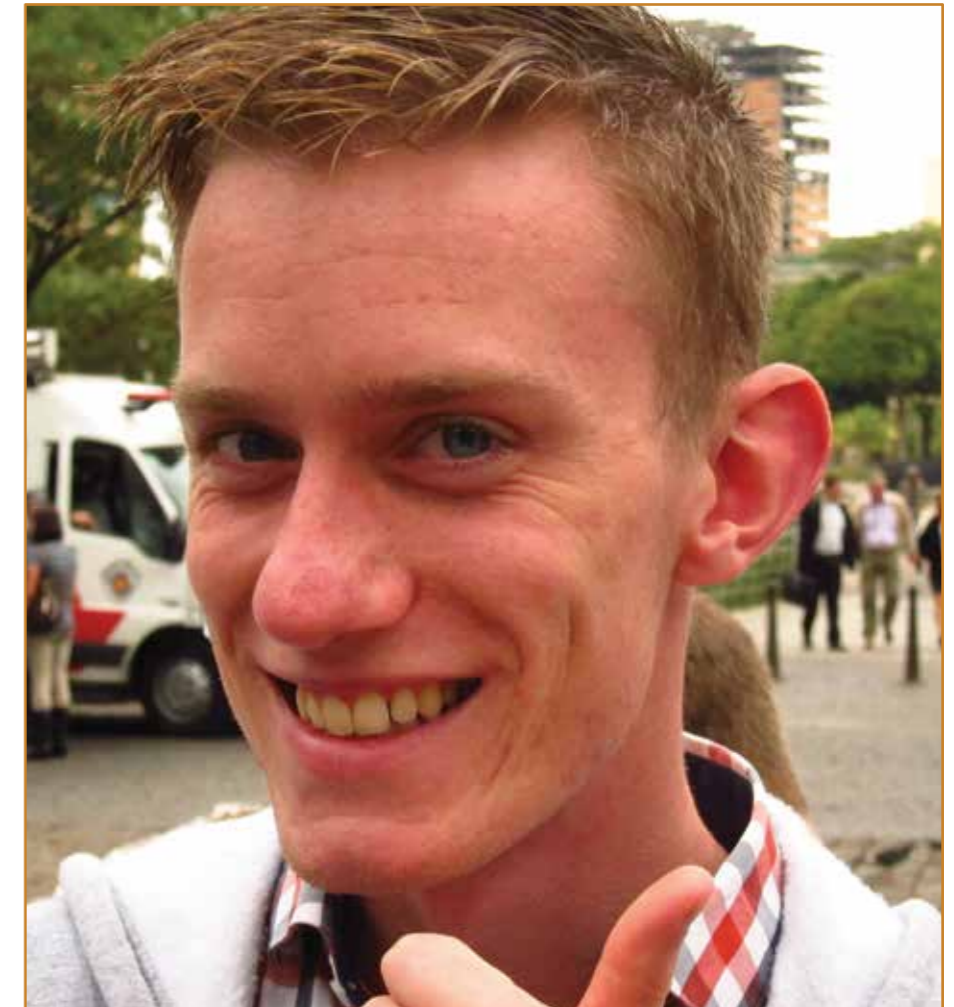
The results were recently published by a group of NASA researchers who claim they discovered multiple genomes that can't in any way be linked to any existing gene in any other plant species through the evolution theory. This will revolutionarily change our view on the world.

Okay, I must be honest with you, none of the things described above is actually true. The title of the article is meant to prove an effect that I notice quite often: people read just the title of an article and then pretend that they know what the article is about and what the conclusion is, without actually reading the full article. Many times conclusions are also based on their made-up version of the story, based solely on the title.

The last four months I spent in Australia, living closely together with a Dutch student from Twente University. Quite often, he mentioned to me an article he just read on Facebook and showed the behavior described above. For example, an article would be called 'politician A is going to do plan B': He spoke to me about how ridiculous plan B sounded and thus how incompetent politician A was. Had he actually read the complete article, like I often did a couple of minutes earlier, he would have realized that the article was about a problem that had to be solved, and the only thing the politician said was that he did not rule out plan B, but that it was way too early to jump to conclusions. The journalist spiced up the title a bit. A completely different conclusion, if you ask me.

In 2014, US radio station NPR noticed this effect and decided to pull off a joke. They posted a link on Facebook, titled "Why doesn't America read anymore". They hoped for people to comment on the link without having actually clicked on it, and they didn't have to wait long. Reactions ranged from claims that the general US public is "fat & stupid" to people stating that they actually do read often and writing complete monologues to defend themselves. If they had just opened the link, they would have realized that the article was actually empty.

IFLScience posted a link to an article about capuchin monkeys entering the Stone Age. Many commenters pointed out that the monkeys have been doing this for hundreds of years, despite the fact that was actually



the first thing in the article. Even if they had just read the first paragraph, instead of the full article, they still wouldn't have made that useless comment.

Media know that a catchy title will attract a bigger audience and therefore sometimes come up with a title that requires explanation. I have the feeling that more and more people base their opinion on article titles and out-of-context quotes, not caring about essential details and context. This leaves them with nothing but their own made-up arguments for the opinion based on nothing. Good luck using that as a basis for a decent debate.

Multiple universities and institutes, amongst which the Columbia University and the French National Institute, investigated the mentioned phenomenon. They found that almost 60% of all links shared on Twitter have actually never been clicked on before

sharing. "This is typical of modern information consumption. People form an opinion based on a summary, or a summary of summaries, without making the effort to go deeper."

Participants to the study were questioned about their actions. Many said that they share specific things to reinforce their image. They will only share things that fit the image they want to present to the people around them: intellectual, passionate, caring. Only the title matters.

As for my roommate in Australia, I was able to correct him most of the time. I hope he realizes that titles and first lines are not enough for someone to base a decent opinion on, although I'm pretty sure he'll just keep turning made-up nonsense into pseudo-facts.

This column is based on a similarly titled article on [www.iflscience.com](http://www.iflscience.com).





## AME

AME is an independent developer and manufacturer of high quality electronic products located in the top technological region of the world (Brainport Eindhoven). Our goal is to create innovative products that exceed customer expectations. We accomplish this by integrating product development and manufacturing and keeping a clear focus on the product and its function. Driven by technology, we strive for the best solution combining the disciplines of electrical, mechanical, software and industrial engineering. Through creativity, passion, ambition, motivation and a highly educated level of our employees AME secures its goal of being a profitable company.

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Driven to exceed expectations and to excel in creating innovative solutions, our team of experts is continuously looking for future best-in-class colleagues within the technological disciplines of applied physics, electrical, mechanical, software and industrial engineering.

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