2020

Innovative technological solutions designed by PDEng trainees

TU Delft Delft University of Technology

TU/e Eindhoven University of Technology

University of Twente.

Wageningen University & Research

A selection of projects

4TU. School for Technological Design STAN ACKERMANS INSTITUTE

The GEM-tower is a green energy solution for festivals to replace fossil fuels and will help festivals to be more sustainable.

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What do a clinical dashboard for prostate cancer, cooling without corrosion and a digital product platform for construction industry have in common? They were all designed for organisations by PDEng trainees of 4TU.School for Technological Design, Stan Ackermans Institute.
A collaboration between the universities of technology of Delft, Eindhoven, Twente and Wageningen. Is your company facing a challenging technological design issue that needs unraveling? Our trainees may be an attractive option.

Introduction

Our best MSc students are trained to become a technological designer, during a full time two year traineeship. After successfully completing the programme they are entitled to use the academic degree Professional Doctorate in Engineering (PDEng). The different PDEng programmes all fall within the 3rd cycle of higher education, as do the doctorate PhD programmes.

Putting theory into practice

The trainees spend their first year following a dedicated curriculum, which involves courses, interactive workshops and group and practical assignments. Often in close cooperation with industrial and health care partners. In the second year the trainees carry out an in-company design assignment. University experts act as supervisors, providing state-of-the-art technology, advising on the structure and execution of the project and monitoring that the goals of the project are realised. During the design project, the trainees demonstrate their skills in being able to turn knowledge into innovative business solutions for the high-tech industry or health care sector. In some programmes courses and design project run parallel.

Selection of interesting design projects

To demonstrate the value of the outcome of the PDEng design projects, we've made a selection of the latest design projects for you and combined them in this publication. We hope you enjoy reading about the projects produced by our talented PDEng trainees. For more information about our programmes please visit www.4tu.nl/sai.

With best regards,

Prof.dr. Paul Koenraad
Director 4TU.School for Technological Design,
Stan Ackermans Institute (4TU.SAI)

Company: Eindhoven Medical Robotics
Project: Design of an experimental setup to validate ROP Laser Surgery Device
PDEng trainee: Siddharth Khalate MSc PDEng, TU/e

Automotive Systems Design

Retinopathy of Prematurity (ROP) is a disease associated with the vision loss of premature babies and is a major cause of childhood blindness globally. Unfortunately, the severity of ROP not only depends on the neonatal care but also on the socioeconomic status of the country.

As a result, 60% of the premature babies born each year belong to the developing countries; naturally, these babies have a higher risk of developing severe ROP. In India there are approximately 100 surgeons for 3.5 million premature babies born per year, hence a vast majority of infants remain untreated.

To perform ROP treatment the surgeon delivers laser through a pupil of diameter less than 4 mm while rejecting the disturbances due to his head rotation, hand held lens motion, and eyeball motion of the baby. Hence the existing process affects the treatment accuracy, causes high fatigue on the surgeon and the patient, and eventually less number of patients can be treated.

To perform pre-clinical trials for ROP treatment a novel experimental setup was designed and developed to replicate the disturbances created due to the eye movements, the realized eyeball motions. Additionally, significant improvement has been achieved in the performance of the visual servo feedback system for laser delivery.

Company: Janssen Vaccines & Prevention B.V.
Project: Modelling and Optimizing a UFDF downstream unit operation in the Advac® manufacturing platform
PDEng trainee: Paula Gonzalvez Querol MSc PDEng, TU Delft

Bioprocess Engineering

It is widely known that vaccines are an indispensable tool to fight against infectious diseases, which are the leading cause of death worldwide. The current vaccine industry needs to supply enough vaccines with a high quality. To do so, a robust process, in which the critical parameters and materials are well-known and assessed, is of upmost importance. This task might be challenging, especially in the downstream section of the process, since it is when the impurities need to be separated from the product, while keeping the product quality profile.

At Janssen Vaccines & Prevention it is believed that to assure process robustness and product high quality it is indispensable to have a deep understanding of the different process steps and the mechanisms behind them. In this project, the focus has been set on the ultrafiltration/diafiltration unit operation at the downstream part of the process.

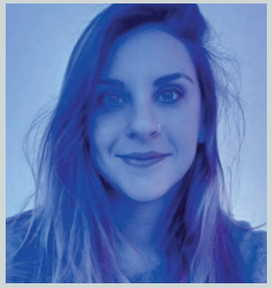
The challenge was to fully understand the removal of impurities in this ultrafiltration/diafiltration operation unit, creating a thorough understanding of the transport mechanism and phenomena and process performance at different scales. For this project, an in-depth study of the UFDF unit operation has been carried out, based on literature research and on internal information from the company. In addition, existing data has been gathered and/or generated in the lab. With this data, all

the characteristic parameters of this unit operation have been evaluated to describe the behavior of impurities at various operational conditions and scales.

The main goal of the project was the obtention of a mechanistic model based on the phenomena described in literature and adapted to the current process. The model is used to compare data from experiments to the theoretical outcome of the process, and hence, its performance can be assessed on basis of the parameters considered to be critical for the process.

Company: Koninklijk Nederlands Lucht- en Ruimtevaartcentrum
Project: Design of a corrosion monitoring system for aerospace applications - an Eddy current corrosion sensor for condition-based maintenance of the helicopters and aircrafts of the Dutch Air Force.
PDEng trainee: Kleopatra Papamichou MSc PDEng, TU Delft

Chemical Product Design



Corrosion is one of the most expensive and common issues in the aerospace industry that can use up to 25% of the total maintenance budget. Often, severe corrosion appears in locations that are impossible to be inspected without partially dismantling the aircraft, a process that is time consuming, expensive and often performed either too early or too late. The goal of this project is to design an in-situ corrosion monitoring sensor that will allow condition-based maintenance concepts to be implemented by the Royal Netherlands Navy and Air Force.

The result of this design project is a thin flexible PCB Eddy current sensor, that can be adhered to the high-risk areas of aircraft that are prone to corrosion attacks, such as the underfloor area of the NHIndustries NH90 military helicopter, that is widely used by the Royal Netherlands Navy and Air Force. The principle of the Eddy current technique is based on the interaction between a magnetic field source and the test material. This interaction induces circular Eddy currents in the test piece and the presence of very small corroded area can be detected by monitoring changes in the Eddy current flow.

Applying such a sensor and its implementation in the maintenance operations and schedule of the military engineers can be quite advantageous in many ways: prevent operational service failure due to severe corrosion on critical parts, reduce the cost of maintenance and the downtime of an aircraft for inspection and maintenance. The sensor is small, able to fit in difficult to access areas, lightweight, requires minimal auxiliary equipment and the data acquisition is quick, in the order of a few minutes and can be performed by non-specialists. The costs of the sensor are low and the production method is easy in small and big batches.

Further development of the sensor design can lead to tools required for a new condition-based maintenance concept and the sensor can be used potentially in a wider variety of applications, both in the military and the civil sector, such as civil aerospace, commercial ships and infrastructure.

Company: Emergo
Project: Developing a digital product platform for construction industry
PDEng trainee: Tim van Ee MSc, University of Twente

Civil Engineering

The demand for renovation projects is drastically increasing due an increase of the world population and sustainability requirements. Currently, around a thousand houses are retrofitted every year to become energy neutral. Yet, as part of the energy transition planned for 2050 a thousand houses should be retrofitted on a daily base. A huge challenge that offers me the unique opportunity to contribute in a practical way via this PDEng.

The excessive demand for retrofitting requires a new way of construction as current practices are found to be inefficient due to fragmentation of information between process phases, parties, and projects. To facilitate simultaneously the integration at all three levels, the renovation industry needs to be supported by tools, methodologies and workflows that aim to standardize communication and information exchange. This new way of building is found in the industrialization of the construction industry by introducing modular building concepts and digitalization. In this approach, standardized modules are being used to develop a project based solution. After that, prefabricated components are constructed off-site using industrial product lines and then assembled at the construction site. In the context of industrialized production, this is commonly done by using product platforms which have long been applied by other industries, examples are the platform for Kodak cameras, Volkswagen, and Sony.

The Design Project
Propelled by the above-mentioned ambition, the company Emergo recently developed the modular construction system Premodu to be applied in the context of “vernieuwbouw” (renewal in which new houses are constructed on the existing foundation). A digital product platform is developed in this PDEng to support this concept and to provide for the information requirements of Emergo and their stakeholders in delivering houses as products.

Motivation to do a PDEng
Considering the current changes in society and the current challenges for the construction industry, it is the practical application that appeals to me in this PDEng. I believe that this trajectory can help in the transition towards modular construction and hopefully allows me to contribute in a practical manner in this field also after finishing my PDEng.

Company: Ziekenhuisgroep Twente
Project: Clinical dashboard
PDEng trainee: Lars van der A MSc PDEng, TU/e

Clinical Informatics

Digitization of healthcare results in a large amount of digital (medical) data. This data can be reused to gain insights in the quality of care and therefore meet the growing information needs of healthcare professionals.

A clinical dashboard for prostate cancer was developed iteratively and incrementally. Data was collected through smart computer algorithms such as text mining. Data from free texts such as results, letters, documents and files (unstructured data) and from lab results, operations and admissions (structured data) were collected. Data collected has been turned into information and visualized in a way that encourages healthcare professionals to improve the quality of care.

As a second result of this project, the experiences (lessons learned) during this case study have been translated into a step-by-step plan that serves as an aid in the future development of clinical dashboards within and outside the Ziekenhuisgroep Twente.

Company: Fire Department Amsterdam-Amstelland
Project: The Data-Driven Fire Department
PDEng trainee: Joep van den Bogaert MSc PDEng, TU/e

Data Science

In case of fires or other incidents, a quick response of the fire department is often paramount to reduce the risk of severe damage or injury. We enabled Fire Department Amsterdam-Amstelland to make data-driven decisions to reduce response times, by providing three decision-support tools.

To facilitate strategic and tactical decisions, we developed simulation software. It allows the user to change, for example, fire station locations, vehicle and staff allocations, and incident rates to see the effect on response times.

We verified and validated the software through several tests and statistical experiments and applied it to real-life cases. We also prepared a dataset with demographics information of different locations in the region and used it to train Machine Learning models to predict incidents at those locations. We showed that this reduces potentially dangerous underestimation of incident rates in certain areas compared to the current practice of using historic incidents as indication of future incidents.

Finally, major incidents require a response of several fire trucks that are deployed from nearby stations, leaving the surrounding region uncovered for potential future incidents. We developed several approaches based on Deep Learning and Reinforcement Learning to suggest relocations of the remaining vehicles that minimize the response times. The most practical result provides decision makers with multiple alternatives and unique insights

Company: Medintec BV
Project: fVision - Virtual reality (VR) headset for healthcare
PDEng trainee: Edwin Nam Chun Mui MSc PDEng, TU/e

Design of Electrical Engineering Systems

Virtual reality (VR) is a computer-generated environment in which users interact through visual, audio and body gestures. VR is typically implemented in the form of a wearable headset consisting of an LCD/LED display and headphones. With a growing number of users each year, VR has found uses in various industries, including the medical sector.

This PDEng project is hosted by Medintec, a startup based in both the Netherlands and Germany. The founders of the company aspire to create a VR headset which can provide an immersive experience to subjects undergoing medical procedures such as MRI scans, surgeries and radiotherapies. This VR headset is called the fVision.

As a system architect, Edwin Mui oversees the design and implementation of both the embedded hardware and software of the fVision. Various design methodologies are also applied to ensure quality attributes like simplicity, manufacturability, scalability and testability are imbued into the product.

The fVision runs on the Android operating system. As an Android device, VR contents can easily be installed on the headset as apps. This allows the fVision to cover a large number of medical use-cases. At the end of the project, a prototype of the fVision was successfully realized and demonstrated to the stakeholders.

Company: HoSt
Project: Numerical modelling Anaerobic Digestion Processes by Computational Fluid Dynamics (CFD)
PDEng trainee: Hossein Norouzi Firouz MSC PDEng, University of Twente

Energy & Process Technology

The global warming and constantly increasing energy consumption, demand an environmentally friendly solution from the fuel and power generation sector. Anaerobic digestion is a main instance of this kind. Anaerobic digestion is a series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen. One of the end products is biogas, which is combusted to generate electricity and heat, or can be processed into renewable natural gas and transportation fuels.

A range of anaerobic digestion technologies are converting livestock manure, municipal wastewater solids, food waste, high strength industrial wastewater and residuals, fats, oils and grease (FOG), and various other organic waste streams into biogas, 24 hours a day, 7 days a week. Separated digested solids can be composted, utilized for dairy bedding, directly applied to cropland or converted into other products. Nutrients in the liquid stream are used in agriculture as fertilizer.

However, this is a complicated and complex process including chemical, physical and biological reactions; also mixing and pumping are involved. The experimental investigations are very costly in terms of time and money. They are also limited by safety issues and experimental techniques which can be applied in the real scale reactors. That is why, the computational techniques for modelling of the bioreactors are very desired.

The main task and mission of this PDEng project is to design and optimize biogas output from an anaerobic digester by the means of computational fluid dynamic model which is developed to be a tool for analyzing the interacting phenomena which affect the biogas production. After validation, the model is applied for parametric study of biogas yield. In brief, this model helps to analyze and optimize an industrial anaerobic digester process in order to achieve an improved design of this process which result in more efficient biogas production.

Company: DAF
Project: Design of a Cam/Roller-follower Interface Tribotester
PDEng trainee: Pedro Amoroso MSc, University of Twente

Maintenance

Reliability and availability are crucial aspects that must be considered in the pursuit of high fuel efficiency. In valvetrain systems and fuel injection systems of truck diesel engines, the cam/roller-follower pair is a critical contact that requires special attention. Many parameters affect the tribological conditions at the interface of this highly dynamic contact. One of the most critical aspects is roller slippage. From a reliability and fuel efficiency perspective, roller slippage is undesirable as it increases wear and energy losses. To reduce slippage, the tractive properties of the contacting surfaces play an essential role. Unfortunately, such properties tend to gradually decrease during the wear process eventually leading to increased slippage. To evaluate the tribological performance of this interface, a testing method and a test set-up are highly desired. An important factor is that testing time is shorter than the lifetime of a diesel engine. Thus, accelerating testing aspects should be taken into account.

PDEng Project
The subject of this PDEng project is the design of a testing method and a test set-up to evaluate the tribological performance of the cam/roller-follower interface. Throughout testing, it is expected to identify the effect of different parameters such as surface finish and lubricant viscosity on the interface behavior. During the design process, several challenges are expected. One of them is to properly imitate the cam/roller-follower interface behavior while allowing control over parameters such as the contact pressure and velocity. Another one is to attain accelerated testing while remaining within realistic interface conditions.

Personal Experience
With a background in Automotive Mechanical Engineering and a MSc in Tribology of Surfaces and Interfaces, this PDEng project offered me the opportunity to apply theoretical knowledge and practical experience to eventually deliver a pragmatic and tangible product. These characteristics combined with the option to tailor our educational plan make PDEng programmes unique and attractive.

Company: Ioniqa Technologies B.V.
Project: Conceptual Design of Large-Scale Ioniqa's Infinite PET Recycling Process
PDEng trainee: Ricardo Galvão Baltazar MSc PDEng, TU Delft

Process and Equipment Design

The climate change increasing impact and lack of suitable answers lead to an increasing social pressure on this topic. Hence, governments and companies are forced to change their policies and incorporate sustainability as their priority. Nonetheless, with increasing population and even higher increase in wealth, demand for non-essential products is continuously growing. Thus, drastic measures must be implemented to reduce CO2 emissions.

Ioniqa has developed a catalyst for the depolymerization of plastics, which enables the formation of the monomer. The current focus of Ioniqa is polyethylene terephthalate (PET) chemical recycling. Since it produces the monomer required for virgin PET production, the main advantages of Ioniqa's chemical recycling process are the flexibility to process any kind of PET-based material, independent of source or colour. Thus, PET products can be recycled an infinite number of times. Currently, Ioniqa develops PET recycling technology at 3 stages: R&D centre in Eindhoven; Pilot plant in Rotterdam; Demonstration plant in Geleen, with a capacity of 10 kta BHET.

The objective of this project is the conceptual design of a larger-scale plant, with respect to the existing demonstration plant. First, the process cost drivers are determined. The generated concepts were analysed based on these drivers to ensure the maximum cost reduction of the final process. Afterwards, the process was modelled to test the effects of all concepts in the whole process. The final step in this project was the economical and life cycle analyses.

One key conclusion from this work is that economics are the most influential factor behind the success of any process: independently from technical and environ-mental performance, the process must be convincing from the economic perspective. Furthermore, the designed process brings a significant reduction on the CO2 emissions compared to conventional PET production.

Company: ASML
Project: Cooling without corrosion
PDEng trainee: Milena Jovanovic MSc PDEng, TU/e

Process and Product Design

Worldwide ASML is currently the leading supplier to the semiconductor industry, driving the innovation of lithography systems to make chips smaller, faster and greener. Due to the complexity of such photolithographic systems, there is a strong requirement for cooling systems inside the machine which keep the temperature stable. Cleanliness is an important parameter at all system levels and only specific coolants are allowed to run through the system.

The common risk appearing inside the cooling systems is corrosion. This can lead to the leakage coolant in different parts of the machine and cause serious damage such as long system downtime impacting the customer production cycle. The objective of this project is to find a solution, preferably to eliminate or at least to reduce the occurrence of corrosion.

Within this project a detailed analysis of the system was completed. In order to understand the fundamental corrosion mechanisms and to verify whether the selected solution against the corrosion problem works an extended experimental plan has been proposed and performed. In addition, the conceptual design of the implementation of the tested solution in the cooling system has been developed.

The cooling without corrosion project has found a way to reduce the corrosion rate which was confirmed with experiments. The conceptual design showed that the proposed idea can be implemented in the cooling systems.

Company: Leiden University Medical Center
Project: The design of an automatic tactile stimulation device to treat Apnea of Prematurity - the BreatheBuddy
PDEng trainee: Sophie Cramer MSc PDEng, TU/e

Qualified Medical Engineer

Very preterm born infants are not yet fully developed and need intensive medical care for a long period to survive. Due to the immaturity of the respiratory center in their brains, most of these infants forget to breathe frequently; a phenomenon that is called apnea of prematurity. Adequate response to these apnea's it vital as frequent or prolonged episodes can cause permanent damage to the brain, which has a negative effect on the neuro-developmental outcome. Nurses act on apnea by gently touching or rubbing the skin of the infant to stimulate breathing. However, high workload on the ward can influence the response time of the nurse and prolong the duration of apnea.

We hypothesized that automated mechanical tactile stimulation can improve the treatment of apnea by enabling a direct response. After reviewing the literature and conducting interviews, focus group sessions, experimental studies and clinical studies an automated tactile stimulator is developed. The innovative working principle of our 'BreatheBuddy' has been successfully evaluated in a pre-clinical trial and a patent has been filed. Clinical evaluation of the BreatheBuddy in preterm infants is now planned in the Neonatal Intensive Care Unit of Leiden University Medical Center.

Company: TPRC ThermoPlastic composites Research Center
Project: Thermoplastic Composite Automated T-Joints
PDEng trainee: Sam Benou MSc PDEng, University of Twente

Robotics

The goal of this project is to weld thermoplastic composite T-joints using a local heat input. A T-joint is nothing more than perpendicular plates that get connected by inserting additional material (thermoplastic polymer in this case) between them. As a starting point, the current manufacturing of these joints out of non-reinforced plastics is used. The manual local welding of non-reinforced plastics is using the matured technique of hot gas heating. This research project is the first attempt to automate the hot gas welding process for composite plates.

This research identifies, measures and controls parameters that influence the weld strength. All these parameters relate to the basic welding parameters of heat, pressure and time. The challenge lies in the selection of the correct parameters and the ability to design a way of measuring and controlling them. During this PDEng, three set-ups are build that follow incremental development steps to gain control over identified welding parameters. These parameters came out of literature or self-conducted research. The final set-up is not perfect, but significant progress was made in the last two years. The set-up is now able to produce constant geometry welds with controlled temperatures and material feed rates. Next to those features, it is also able actually measuring all selected, relevant process parameters.

The set-up will enable future research to optimize the T-Joint by selecting different set-points for the controlled parameters. These joints will then be used to compare the new joining technique against available joining methods.

Motivation
My main motivation for doing this PDEng was the ability to prove myself in a multi-disciplinary environment. The project touched upon fields where most of my skills were self-taught (electronics and control engineering). All the efforts resulted in an official degree that improved and recognized these skills.

Company: Stichting KIEN
Project: The Guiding Environment - The design of a supporting and stimulating environment for older adults with early-stage dementia
PDEng trainee: Anne Grave MSc PDEng, TU/e

Smart Buildings & Cities

Dementia has a severe impact on quality of life of not only older adults diagnosed with this condition, but also their family. Every year there are 10 million new cases of dementia worldwide.

In this PDEng-project, as a part of the research program Empathic Environments, an early prototype of an interactive home system has been developed to enable older adults with early-stage dementia to live longer independently at their homes. The prototype of the Guiding Environment has been developed in co-creation with several companies, care organizations, and universities. Using sensor and projection technologies, this product guides older adults with early-stage dementia to perform their daily activities and helps them maintain their circadian rhythm. Through close collaboration with healthcare professionals, this study made a start with mapping the needs of different user groups (older adults with dementia, healthcare professionals and informal caregivers) who have been involved throughout the entire design process. In this way, the user needs are identified and incorporated into the design of this prototype. This has been translated into a practical tool for designers and electrical installation technicians to provide them insights into the actual needs of this target group.

Company: ASML Netherlands BV
Project: From informal TWINSCAN machine diagnostics data to reliable formal customer interface
PDEng trainee: Ani Megerdoumian MSc PDEng, TU/e

Software Technology

As the complexity of any system grows, the need for diagnostics becomes essential. In this sense, the data produced as an input for any complex system, like the high-tech machine of ASML is critical. During the wafer production cycle in TWINSCAN, the measurement, modeling, and applied corrections are logged to a diagnostic file called MDL (Machine Diagnostic Log). MDL contains essential data that helps designers (as well as support engineers) to understand the behavior of the machine. Over the years, customers have started using informal MDL data as well. By design, MDL does not protect itself from incompatible changes.

This project is initiated to analyze the possibility of converting all needed data to official XML-based files at low cost. As a roadmap, the current intention is to provide formal data to the customers. This, however, comes at a high cost if conversion is done manually.

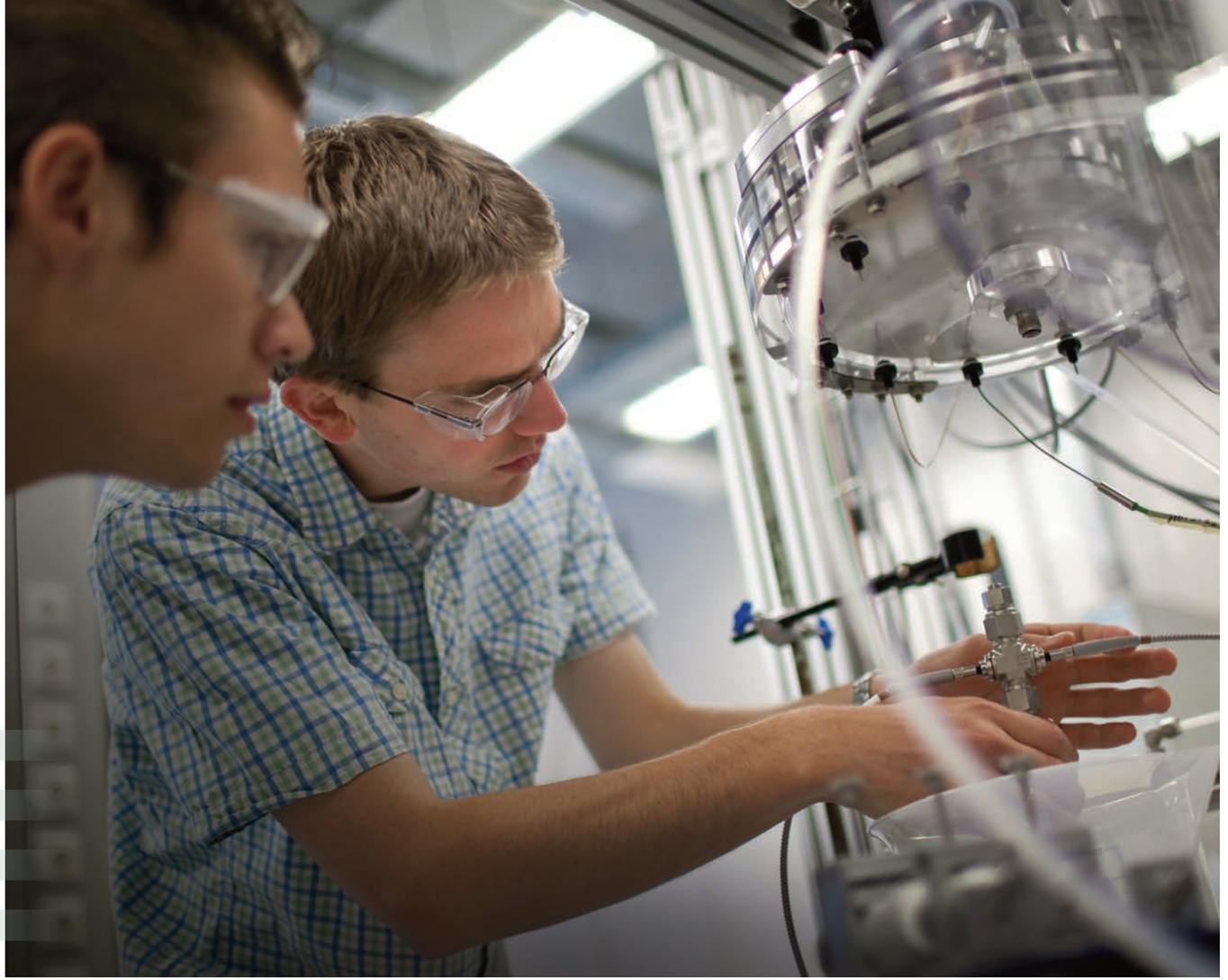
As a result of this project, a support tool, with mappings of the log file content to XML-based file is delivered. Besides, an iterable pipeline and corresponding prototype for producing the grouping of the tags is delivered, based on application of artificial intelligence. Finally, a prototype which provides an XML-based report for aiding the human resources in designing the XML-based formal reports is submitted.

Company: Philips Research China
Project: Motivation and adherence in self-management of chronic diseases
PDEng trainee: Xinying Zhao Med PDEng, TU/e

User System Interaction

Patient engagement has long been a problem in health care for chronic diseases. To tackle this problem, new engaging tactics are needed to continuously motivate and involve patients in their daily health tasks and follow-up checkups. One possible solution is to personalize health communication contents according to their distinctive characteristics and unique needs in health communication. Thus, they might be more likely to elaborate on the health information and behave accordingly. Therefore, this project aims to explore a personalized health communication approach and evaluated patients' reactions to this solution under chronic disease management scenarios in e-health settings. At Philips Research China, we co-created the personalized health messages with field experts during workshops and evaluated the representative messages with chronic disease patients via in-depth interviews and a survey.

The research findings resulted in a framework for understanding the content constructs and personalization method for composing the personalized health messages, which could also be utilized for determining future personalized health message contents. Moreover, we found a common tendency that, all the patient groups, regardless of their personality type, would prefer the virtual avatar with caring and rational characteristics as the communicator in a digital health management solution. They would also like to be treated as a person who is kind, caring, and reasonable in interpersonal interactions when receiving health information from the virtual avatar.



The Professional Doctorate in Engineering (PDEng) programmes in brief

Programme	Founded	Graduates 1988-2019	Location
Industrial Engineering*	1988	362	TU/e
Design of Electrical Engineering Systems (Track Information & Communication Technology, Track Healthcare Systems Design)	1988	272	TU/e
Process and Product Design	1989	484	TU/e
Software Technology	1990	472	TU/e
Design and Technology of Instrumentation*	1991	179	TU/e
Process and Equipment Design	1991	218	TUD
Bioprocess Engineering	1994	153	TUD
User System Interaction	1998	332	TU/e
Automotive Systems Design	2011	77	TU/e
Smart Buildings & Cities**	2011	50	TU/e
Energy & Process Technology	2011	25	UT
Robotics	2011	13	UT
Civil Engineering	2011	23	UT
Clinical Informatics	2012	75	TU/e
Chemical Product Design	2012	29	TUD
Maintenance	2014	11	UT
Qualified Medical Engineer	2014	22	TU/e
Data Science	2016	25	TU/e

** These programmes are being built down. The current trainees will be supported during their finalisation of the programme in order to receive the PDEng degree. / ** Before Smart Energy Buildings & Cities*

The 4TU.School for Technological Design, Stan Ackermans Institute offers two-year post-master technological designer programmes.

The institute is a joint initiative of the four universities of technology in the Netherlands: Delft University of Technology, Eindhoven University of Technology, University of Twente and Wageningen University.

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