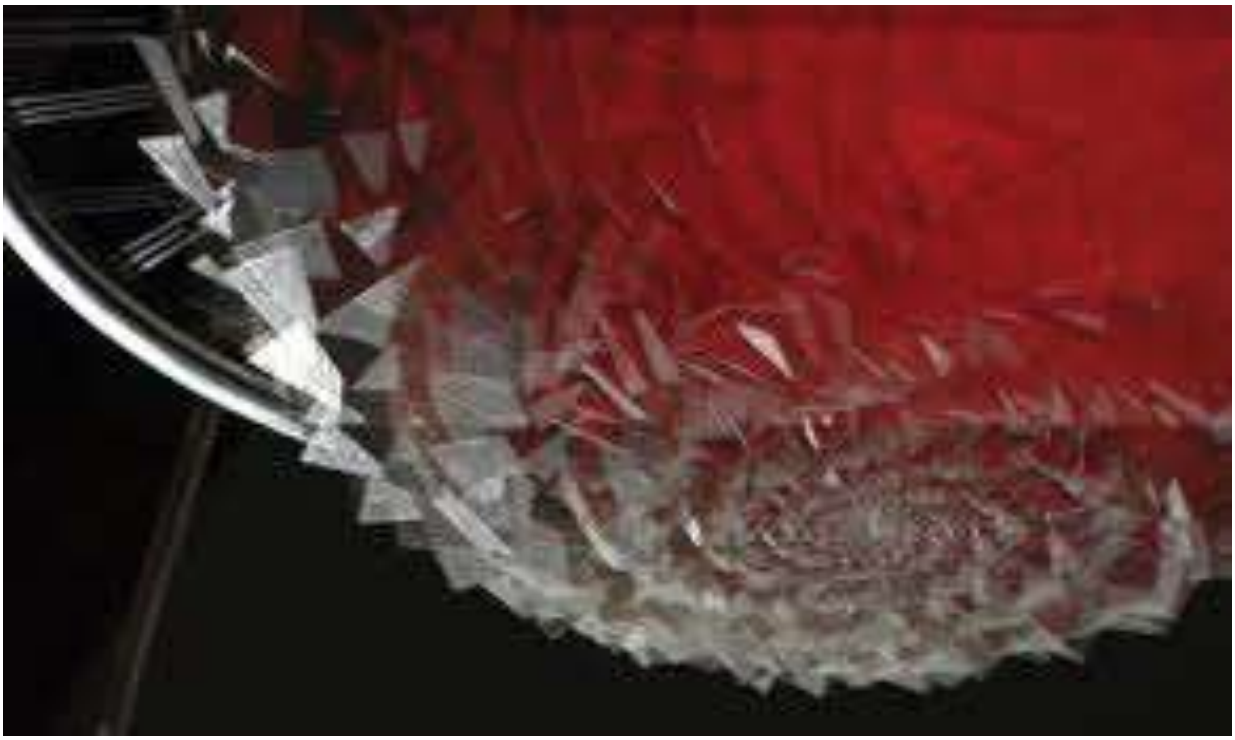
Fontys University of Applied Sciences
Symposium
Integrated Product Development IPD / ASIA
January 28th, 2016



Fontys University of Applied Sciences
Building: Rachelsmolen (R5)
Address: Rachelsmolen 1
5612 MA Eindhoven
The Netherlands

***For information please contact*:**
Fontys University of Applied Sciences
Herbert Veenstra
Phone 08850 75 515
E-mail H.Veenstra@fontys.nl or engineeringeindhoven@fontys.nl
Website www.fontys.nl/ipd

Fontys
University of Applied Sciences

KIVI
Engineering Society

Key note speaker: . Ing. Erik van de Vrugt; Chief Technology Officer / Owner TCPM

Developing production equipment for inexpert customers

Today's market for developing production equipment is international, demanding and competitive.
Focus in the development has shifted from mainly technical aspects in the past to a far more complex set of conditions today. This creates a very challenging environment for the engineers that have to provide the solutions.

But what if your customer appears to be inexpert in developing production equipment? How does this affect the developing process and its outcome? In my speech I will give insight in this circumstance occurring in a turn-key delivery of production equipment to a customer that is part of the international supply chain from an OEM in the automotive industry.

Non-technical "complex conditions" demand the development team to deal with globalization in relation to compliancy to various standards or the lack of standards, diverting development risks to the supply chain by OEM's, increased demands concerning safety regulations, cost control in operation, maintainability and serviceability, extreme shortening of lead times, et cetera.

On the technical side of development complexity has also increased. From a functional point of view overall equipment effectiveness has to be at a high level, energy consumption / noise production at low level (green economy). Or think of dealing with often contradicting demands on speed and quality, reduction of waste material.

Using information technology enables close monitoring of output and creates management information, but is also key in modular (re-)use of production equipment for other purposes (less dedicated equipment – flexible production).
Smart Industry will push these possibilities even further in the near future.

All this leads to a new level of complexity in the development process. Intensive communication within the development team (disciplines) and with all stakeholders is needed to create a successful solution.
Ing. Erik van de Vrugt
Chief Technology Officer / Owner
TCPM

Biography
Erik van de Vrugt is Owner and Chief Technology Officer of TCPM Engineers and Consultants. After finishing HTS Zwolle and fulfilling military service, Erik started out as a mechanical engineer at TCPM in 1992. At TCPM he participated in various assignments in the industrial field: both detached at customer location as well as in-house projects. Through the years he fulfilled several positions at TCPM, leading to his current position as owner / CTO by means of a management buy-out in 2008. At 49 years of age he now looks back at an extensive network and wide experience in the field of industrial product development / production equipment. Looking forward he is excited about leading TCPM through the challenges and opportunities of the future.

The KIVI Nomination for the AWARD

KIVI wants to congratulate all the students who have successfully completed their project today. KIVI is the Dutch association for engineers and engineering students. With 20.000 members KIVI is the largest engineering association in the Netherlands. All engineering disciplines are organized within KIVI.

KIVI is a must for every Young Professional to find his or her way in the world of Engineering.
As such we are also very interested in what the future engineers of Fontys University are achieving in their projects. We are proud and enjoy that we can be present today during the presentations of your projects.
This year KIVI will make the KIVI 2016 prize available for the best project. A jury consisting of KIVI engineers will review the projects and select the best project(s) from the symposium of the 28th of January 2016. A student group will then be nominated for the KIVI award 2016.
On the 1st of July there will be a second IPD/ASIA symposium. Student groups will also be nominated on that symposium. From the nominated projects the winning project will be chosen. The team members of the chosen winning project will be rewarded on the 1th of July 2016 with the KIVI AWARD 2016.

As the network body for engineers and other highly educated technical professionals in the Netherlands, KIVI's primary objective is to promote the importance of the role of engineers in technology within our society. This ensures continuity in adequate investment in education, research and innovation. To meet this objective, KIVI conducts the following core activities:

• **Technical promotion** – to promote the role of technology and engineers in general
• **Network** – to stimulate contacts and exchange of knowledge between engineers
• **Member services** – to provide services that assist members with the development of their professional careers

KIVI provides professional services to its members all over the world and organizes a large number of activities throughout the year. Of course this also counts for engineers from abroad who wish to work or study in the Netherlands.

From KIVI South

dr.ir. J.M. (Jan) Vleeshouwers
dr.ir. E. (Eric) Persoon

www.kivi.nl

Programme IPD/ASIA Symposium
Thursday January 28th , 2016
Fontys University of Applied Sciences

Rachelsmolen 1
Building R5
5612 MA Eindhoven

12.30 hrs **Registration and coffee** **Foyer R5**

13.00 hrs **Welcome Herbert Veenstra, chairman of the day** **Aula R5**

13.05 hrs **Key note speaker:** ***Erik van de Vrugt.*** **Aula R5**

Split up to parallel sessions

	Side room 0.22	**Aula R5**	**Side room 0.23**	**R1 101**
13.30 hrs	***IPD(M) 7*** *Robot Safety*	***IPD (W)13*** *Catharina Hospital Weighting Drainage Bags*	***IPD (E) 15*** *High Linearity Class-D Amplifier*	***IPD (W) 10*** *Self winding dog lash*
14.00 hrs	***IPD(M)1*** *System identification Device control*	***IPD (W)12*** *Biodegradable Disposal Container Organic waste*	***IPD (E) 16*** *Advanced Embedded System lab*	***IPD (E) 18*** *Tesla Coil Demonstrator*
14.30 hrs	***IPD(M)2*** *System identification Device Integration*	***IPD (W)11*** *Subcoal Demonstrator*	***IPD (E) 17*** *Cheap Laboratory Power Supply*	***IPD (E) 19*** *Floating Point processor*
15.00 hrs	**Break:**			**Foyer R5**
15.00 hrs	**Side room 0.22** ***IPD (W) 14*** *Medical printing*			**.**

	Side room 0.22	**Aula R5**	**Side room 0.23**	**R5 136**
15.30 hrs	***IPD (M)4*** *Delta robot Picking*	***IPD (E) 23*** *Wireless internet Gambia schools TV WHITE Space*	***IPD(M) 3*** *KuKa You bot*	***IPD (E) 20*** *HIFI Sound FPGA Platform*
16.00 hrs	***IPD (M)5*** *Robotic pick and Place from Conveyor*	***IPD (E)25*** *3 D printing pickup system*	***IPD (M)8*** *B.O.B Bottle*	***IPD (E) 21*** *Hardware prototype mobile USB audio*
16.30 hrs	***IPD (M)6*** *3 D Vision for Robotic bin picking*	***IPD (E) 24*** *Glow next object Water Fountain*	***IPD(M) 9*** *B.O.B. Positioning System redesign*	***IPD (E)22*** *Spherical Scanner 3D scanner*
17.00 hrs	**End of presentations and "collaborative" drink**			**Foyer R5**
17.15 hrs	**KIVI NOMINATION AWARD**		.	**Aula R5**
	After award party			**Foyer R5**
18.00 hrs	**The end**			

Project IPD1: System identification Course Device Control

Company: **ASML & Fontys**
Company contact: **Roel Merry**
Coach: **Nelis van Lierop**

Team members:

Students:	Institute	Department
Zeb Hendrickx	Fontys School of Engineering	Mechatronics Engineering
Joep Koolen	Fontys School of Engineering	Mechatronics Engineering
Floris Bruinessen	Fontys School of Engineering	Mechatronics Engineering
Laurens Kusters	Fontys School of Engineering	Mechatronics Engineering
Daniel Bos	Fontys School of Engineering	Mechatronics Engineering

Project Description:
ASML is one of the leading high-tech companies in the Eindhoven region and has a lot of experience in developing high-tech and precision equipment. It is constantly searching for qualified engineers. Fontys Engineering Eindhoven is interested in the cooperation with industry to update/develop courses with regards to High-Tech and precision systems, system engineering and system and control engineering that are relevant for students as well as industry. Thus, ASML and Fontys Engineering have agreed to mutually develop a system identification course for the engineering minor.

The goal of this project is to develop a practical use case where students experience the practical aspects of system identification using ASML hardware. For this purpose ASML provided a Reticle Masking (REMA) unit. However, the REMA unit is not directly suitable as demonstrator for system identification purposes. The REMA unit delivered contains mechanical hardware and linear motors with feedback from encoders.

REMA unit inside a lithography machine

Project IPD 2: Reticle masking Demonstrator Unit

Company: **ASML & Fontys**
Company contact: **Roel Merry**
Coach: **Peter Jacobs, Nelis van Lierop**

Team members:

Students:	Institute	Department:
Paul Beintema	Fontys School of Engineering	Mechatronics Engineering
Patrick van Sambeek	Fontys School of Engineering	Mechatronics Engineering
Jelmer Mahieu	Fontys School of Engineering	Mechatronics Engineering
Jim Veerkamp	Fontys School of Engineering	Mechatronics Engineering
Peter Duisters	Fontys School of Engineering	Mechatronics Engineering

Project Description:
The aim is to develop a stand-alone demonstrator based on the ASML reticle masking (REMA) unit. This REMA unit is a kind of diaphragm that is part of light beam manipulation stage of the ASML machines. In cooperation with ASML and the Mechatronics and Robotics lectureship of Fontys Engineering, the subsystems must be build, integrated and tested. And the full demonstrator system must be assembled.

The REMA unit normally is a part of a lithography machine. The REMA unit does not operate without the rest of the machine as it is. To make it suitable for the intended purpose it is of utmost importance to develop a system which allows using the REMA unit as a standalone device. This is the primary goal of the project.

This project is in cooperation with Fontys University of Applied Science, Department of Engineering, Eindhoven in cooperation with ASML and will be performed by Fontys University of Applied Science.

REMA unit inside a lithography machine


REMA Demonstrator unit – stand alone

Project IPD 3: KuKa YouBot

Organization: **Fontys University of Applied Sciences**
Logo:

Company contact: **Alexander Floor**
Coach: **Peter Jacobs**

Team members:

Students	Institute	Department
Willem Roefs	Fontys School of Engineering	Mechatronic Engineering
Michael Geers	Fontys School of Engineering	Mechatronic Engineering
Joris Laurenssen	Fontys School of Engineering	Mechatronic Engineering
Tom Clarke	Fontys School of Engineering	Mechatronic Engineering
Yorick van der Ende	Fontys School of Engineering	Mechatronic Engineering
Perry Verstappen	Fontys School of Engineering	Mechatronic Engineering

Project description:
Fontys Engineering is an alliance partner with National Instruments. National Instruments offers a full suite of tools for system identification, control design, simulation, and controller implementation. Take advantage of custom algorithm development, analysis, and visualization as well as integration with NI hardware for rapid control prototyping.

The KuKa YouBot became a learning platform to understand and control robotics with NI hardware and software.

Project IPD 4: Delta robot picking

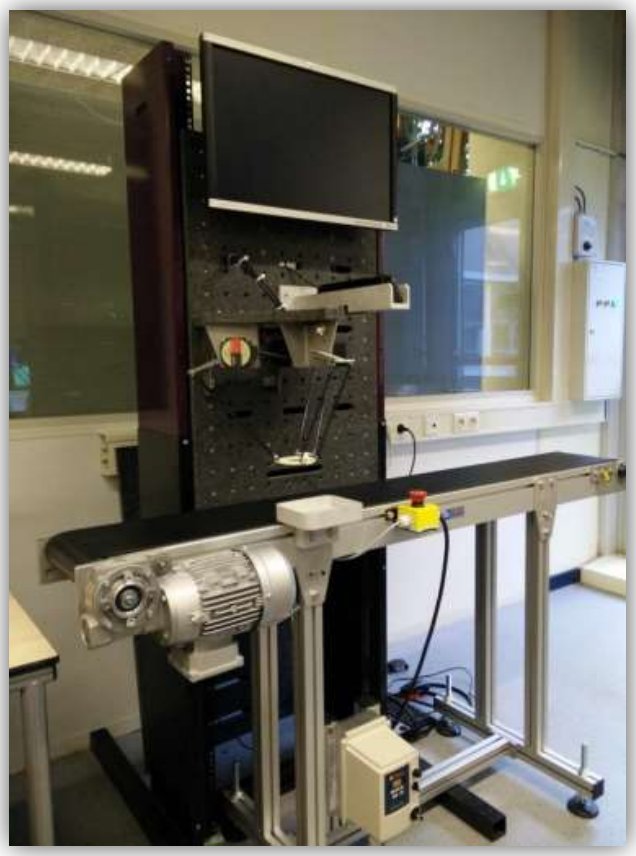
Organization **Fontys University of Applied Sciences**
Logo

Company contact: **Lectoraat Robotics & High Tech Mechatronics**
Coach **Peter Jacobs**

Team members

Students	Institute	Department
Ivo Bovendeerd	Fontys school of engineering	Mechatronic Engineering
Loïc Luijkx	Fontys school of engineering	Mechatronic Engineering
Nikki Gorissen	Fontys school of engineering	Mechatronic Engineering
Jeroen Rikken	Fontys school of engineering	Mechatronic Engineering
Milan Haverlag	Fontys school of engineering	Mechatronic Engineering

Project description
Our goal is to use the Deltarobot setup (as depicted in the image below) to pick up metal objects from a conveyor belt. Vision hardware and software have to be implemented to detect the objects on the conveyor belt, and the Deltarobot has to be programmed to move to the object, pick it up while still moving, and then deposit the object in a small container. The robot will be able to detect and pick up multiple shapes of objects. The current gripper also has to be improved.
These robots are used in High Mix, Low Volume High Complexity binpicking applications.



Project IPD 5: Robotic pick & place from conveyor

Organisation: **Fontys University of Applied Sciences**
Logo:

Client: **Randy Kerstjens**
Coach: **Peter Jacobs**

Team Members:

Students	Institute	Department
Niek van Duifhuizen	Fontys school of engineering	Mechatronic Engineering
Ferd Strous	Fontys school of engineering	Mechatronic Engineering
Max Litjens	Fontys school of engineering	Mechatronic Engineering
Kevin Siebers	Fontys school of engineering	Mechatronic Engineering
Peder Geurts	Fontys school of engineering	Mechatronic Engineering

Project description:

At some areas of application single products are sorted from a conveyor. These products are recognized by a vision system that coordinates the robotic pick and placement of these products.
The current set-up of the ABB Robot uses a 2D-camera to recognise products and pick & place the products on the right place. This system needs to become more stable and usable for a wider range of products. It is also desirable that the robot uses 3D-vision (to make it easier to recognize a wider range of products). With 3D-vision the robot can also recognize depth. Which makes it easier to recognize different products.

For this project it is intended to adjust the current ABB robot cell with conveyor and make it so that it can detect a wider variety of products and more stable than it is now. It should also be expanded with faster reconfiguration for the vision system. A framework should be designed where vision and robotics are fast and easily combined.
Next to all these statements it is also desirable to add a form of 3D-vision to the robot. This is for the robot to also recognize depth of objects.

Project IPD 6: 3D Vision for bin picking applications

Organisation: **Fontys University of Applied Sciences**

Logo

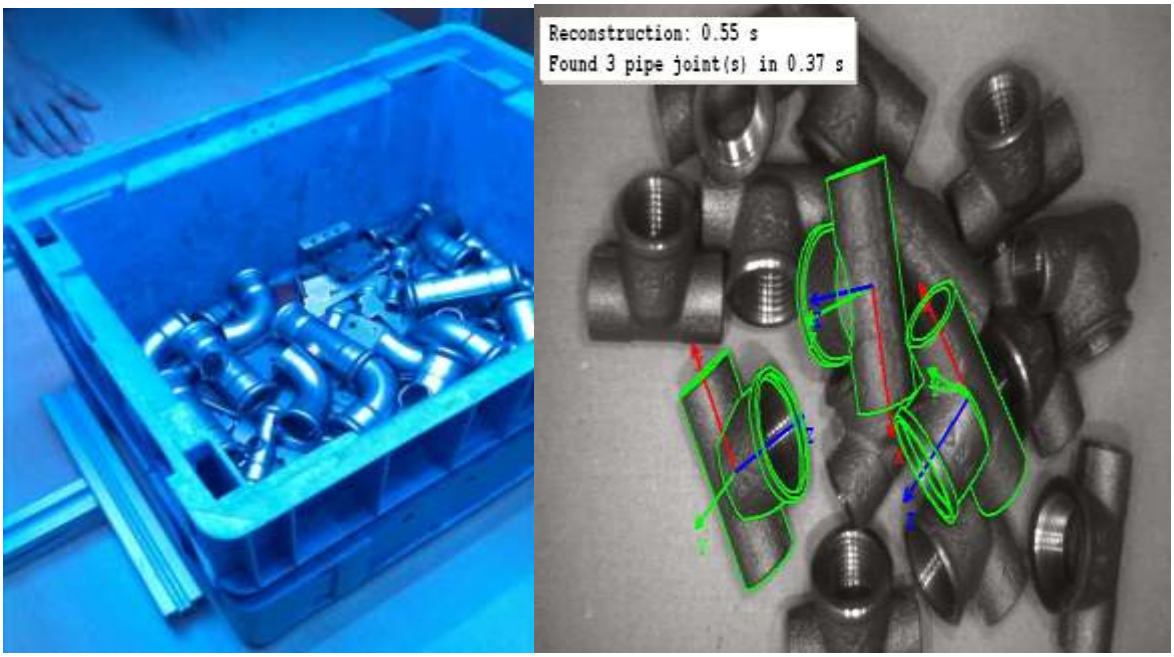
Company contact **Randy Kerstjens**
Coach: **Chris Remmers**

Team members:

Students	Institute	Department
Willem Sterken	Fontys school of engineering	Mechatronic Engineering
Niel van Sambeek	Fontys school of engineering	Mechatronic Engineering
Roy Schriek	Fontys school of engineering	Mechatronic Engineering
Stijn Spanjaard	Fontys school of engineering	Mechatronic Engineering
Willem Keeris	Fontys school of engineering	Mechatronic Engineering

Project description:

3D-vision for bin picking applications is one of the crucial things to get a good working application. This project is focused on getting the 3D information (coordinates) into a digital system. In order to get some information from the outside world into a digital system cameras are used. From the information from these camera (pictures) data extraction is needed. To extract data from these images many different algorithms already exist. To know which algorithm provides the best information to get the coordinates into a digital system further research has to be done. This specific 3D-vision project will make a combination of many different algorithms. Firstly, object recognition algorithms secondly depth mapping algorithms and finally rotation recognition algorithms. With the best combination of those algorithms the coordinates can be extracted and used by further robotic applications.



Project IPD 7: Robot safety

Organization **Fontys University**

Logo:

Company contact: **Falke Hendriks**
Coach: **Chris Remmers**

Team members:

Students	Institute	Department
Rick Lewis	Fontys School of Engineering	Mechatronic engineering
Bram van Horen	Fontys School of Engineering	Mechatronic engineering
Matthieu Ruijmbeek	Fontys School of Engineering	Mechatronic engineering
David Frieling	Fontys School of Engineering	Mechatronic engineering
Chris van Houts	Fontys School of Engineering	Mechatronic engineering

Project description.
Nowadays technology is used in every aspect of our life. Both in the industry as in our personal life. The way we interact with technology has changed over the years. Interaction becomes more and more personal. This personal interaction with technology comes with great safety responsibilities for the producing company.
These safety responsibilities give us a broader view on how to approach interaction between humans and robots or technologic products. How far can we go with this interaction. What rules are already established and are these rules enough to guarantee a safe environment

Currently our team is working with the Xbox Kinect one together with Labview running on Windows. This gives us the opportunity to read out the coordinates of the human skeleton. The joints e.g. hand palm, elbow and shoulder are converted into coordinates which are send to the Labview software. The software then creates a forbidden zone around the coordinates of the arm and the robot. When these two zones interact the robot must stop executing its current program. This is done by sending a command to the UR5 robot via a TCP/IP connection.

Future IPD projects can further develop this to make the robot more intelligent. Meaning it will create an alternate path from A to B when a human hand is in the robot's path.

Project IPD 8: B.O.B. bottle pickup redesign

Organization: **Fontys University of Applied Sciences**

Logo:

Company contact: **Max Bogers**
Coach: **Pavel Samalík**

Team members:

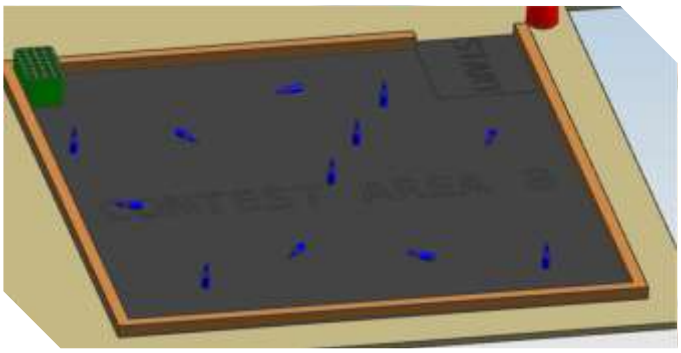
Students	Institute	Department
Koen van den Elsen	Fontys School of Engineering	Mechatronic Engineering
Thijs van Etten	Fontys School of Engineering	Mechatronic Engineering
Tom van der Schoot	Fontys School of Engineering	Mechatronic Engineering
Joeri Roelofs	Fontys School of Engineering	Mechatronic Engineering
Nick Schmitz	Fontys School of Engineering	Mechatronic Engineering

Project Description:
In 2014 there was a mechatronics contest for students. The assignment was to build a robot that has to pick up empty beer bottles in an area of 4x4 and place the empty bottles at the empty positions in a beer crate. B.O.B. (Bier Opruim Bot) was build but never performed completely as it should, so the goal of this IPD project was to make a functional robot for demonstration purposes.

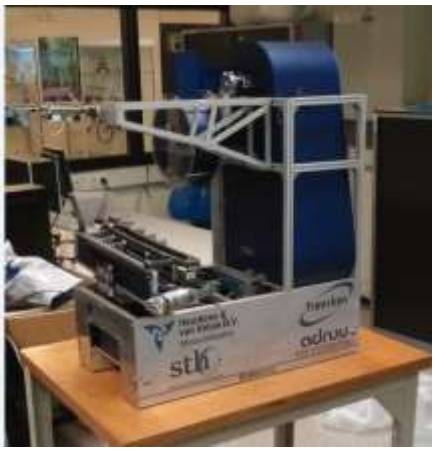
The controller that handled the vision tasks had an under capacity for what the application required which resulted in only able to run for short times. The other tasks of the robot where separated between two microcontrollers. Because of this under capacity was decided to place a new controller on the robot which can handle all the tasks. Besides these problems where there several improvements for smaller problems that has to be redesigned and repaired.

This project consist of implementing the required functionality with the new controller and improving the hardware and electronics. This consists of:

- A new vision application to detect beer bottles in an area of 4x4 meters.
- A new vision application to detect a beer crate in the same area.
- An autonomous program that uses the coordinates of the vision application and picks up the bottles using a mechanum drive.
- Reprogramming the internal bottle handling after picking the bottle up.
- Redesigning and making a new PCB.
- Rewire the robot with the new PCB's and controllers in a understandable and transparent way.



Operating area with random beer bottles.



B.O.B.

Project IPD 9: B.O.B. Positioning System redesign

Organization: **Fontys University**
Logo:

Company contacts: **Max Bogers**
Coach: **Pavel Samalík**

Team members:

Students	Institute	Department
Niels van den Elsen	Fontys School of Engineering	Mechatronic engineering
Roel Verschuuren	Fontys School of Engineering	Mechatronic engineering
Nick Verstegen	Fontys School of Engineering	Mechatronic engineering
Mark Vissers	Fontys School of Engineering	Mechatronic engineering
Thomas Wijffels	Fontys School of Engineering	Mechatronic engineering

Project description
CCM Mechatronics Trophy 2014 Redesign –B.O.B.
In 2014 there was a mechatronics contest for students. The assignment was to design and build a robot that has an electro-mechanical and mechatronic character.

The contest for 2013-2014 was a robot-race, called "C.H.A.P.": Clean House After Party. Each participating student team had to design and build a "C.H.A.P" that can "cleanup" the contest area.

A Group of Fontys students designed the "Bier Opruim Bot" (B.O.B.) as solution to this assignment. But as with most machines it isn't perfect yet and has room for improvements.

A part of this robot is the Positioning System which places the empty beer bottles in a crate. This old system was not accurate enough to place the bottles in the correct spots in the crate. Also the Arduino controllers didn't have enough computing power to steer the positioning system to the empty spots.

To tackle the first problem all the modules of the old system has been reviewed and major problems have been mapped. These problems have been tackled first before other problems that the old system has. The solution to the major problems are another choice of actuator, sensors, transmissions and some mechanical improvements.

To tackle the last problem a NI MyRio has been introduced to the project. This is a controller fitted with a FPGA which has a lot more computing power. The downside of this is that all the software, including the vision system to detect the empty spots in the crate, has to be rewritten.

Project IPD 10: Selfwinding dog leash

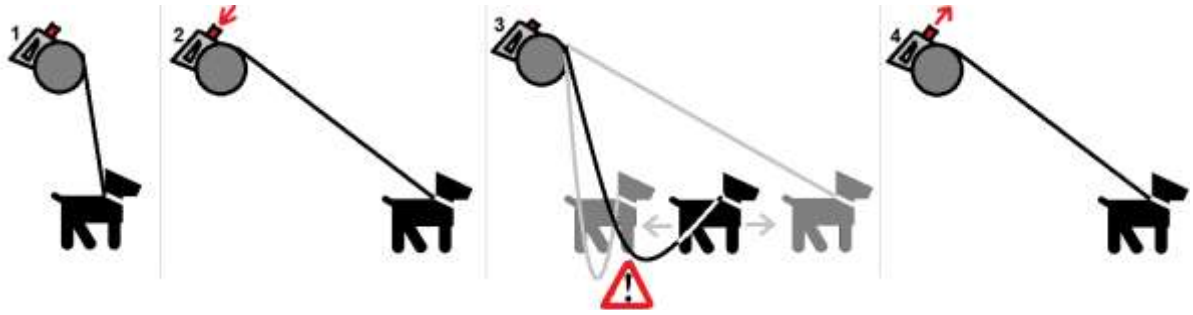
Organization: **Handelsonderneming Delahay Heeze**
Logo:

Company Contact: **Eric Delahay**
Coach: **Wim Broekman**

Team members:

Students	Institute	Department
Rick Corsten	Fontys School of Engineering	Mechanical Engineering
Bob Geelhoed	Fontys School of Engineering	Mechanical Engineering
Rob Martens	Fontys School of Engineering	Mechanical Engineering
Daan Neutkens	Fontys School of Engineering	Mechanical Engineering
Sander Raaijmakers	Fontys School of Engineering	Mechanical Engineering
Rob Martens	Fontys School of Engineering	Mechanical Engineering

Project description:
The aim of this project is to develop a retractable dog leash. The problem of many dog owners is shown in the picture below:



When the line is stopped the dog will still be able to move within the stopped length of the line. Because the line dangles behind the dog it can get stuck between the legs of the dog, and thus create problems for the owner or for the dog. This project is dedicated to a mechanical solution to this problem.

Project IPD 11: Subcoal demo machine

Organization: **N+P Group**
Logo:

Company contacts: **Jens Jennissen**
Coach: **Wim Broekman**

Team members:

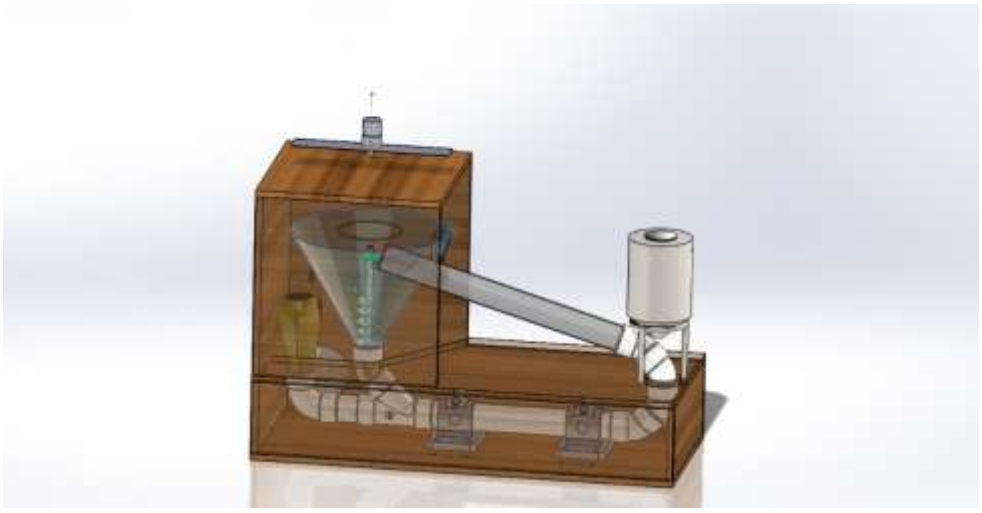
Students	Institute	Department
Mick Swemers	Fontys School of Engineering	Mechanical Engineering
Gijs Haans	Fontys School of Engineering	Mechanical Engineering
Marten Sterken	Fontys School of Engineering	Mechanical Engineering
Marco Teeuwen	Fontys School of Engineering	Mechanical Engineering
Martijn Pruijn	Fontys School of Engineering	Mechanical Engineering
Joris Meulenbroeks	Fontys School of Engineering	Mechanical Engineering
Jordy Wouters	Fontys School of Engineering	Mechanical Engineering

The project

The Subcoal® concept is a patented technology developed by DSM.

Subcoal© pellets are produced from various waste streams, such as reject from the paper industry and RDF fractions from sorting plants. Chemically speaking, coal is very closely approximated by the Subcoal® pellets. In addition, the pellet can be crushed in the same way as is currently often done with coal (pulverized coal). The concept can be implemented on site, thus realising a strong reduction in costs.

To show that Subcoal® has the same behavior as coal, IPD 11 has made a demo model of a rotary kiln, where Subcoal® is used.



Project IPD 12: Biodegradable Disposal Container For Organic Waste

Organization: **Fontys University of Applied Sciences**
Logo:

Company contacts: **Reinoud van de Wiel**
Coach: **Remco Hutten**

Team members:

Students	Institute	Department
Rick Bonants	Fontys School of Engineering	Mechanical Engineering
Enrique Perdok	Fontys School of Engineering	Mechanical Engineering
Marc Uyttenboogaard	Fontys School of Engineering	Mechanical Engineering
Arjen Schoustra	Fontys School of Engineering	Mechanical Engineering

Project description:
The assignment is very simple: Design a biodegradable disposal container for organic waste. Also reinvent the process of collecting and using organic waste in order to fully use the advantages of the idea. Use the latest technologies to enable future people to produce and use your design effectively considered the environmental and health issues. Also issues with energy, transportation and costs have to be considered.

The design has to be feasible considering economical, technical, social and environmental issues. The design may be produced by any manufacturing process possible, preferably using the latest technologies. Customers have to be able to use these technologies within 10 to 20 years to easily obtain your design. The design and processes combined have to be as cheap as possible, so choose for the BEST option available.

According to you, which of these concepts is the BEST option?

Project IPD 13: Automatic urine volume monitoring device

Organization: **Catharina Hospital**
Logo:

Company contacts: **Vera Lagerburg**
Coach: **Remco Hutten**

Team members:

Students	Institute	Department
Lorenz Janssen	Fontys School of Engineering	Mechanical Engineering
Rave Al-Chamary	Fontys School of Engineering	Mechanical Engineering
Koen Harthoorn	Fontys School of Engineering	Mechanical Engineering
Sjors Bakx	Fontys School of Engineering	Mechanical Engineering
Matthijs v.d. Hoven	Fontys School of Engineering	Mechanical Engineering
Bram Somers	Fontys School of Engineering	Mechanical Engineering

Project description:
The Catharina hospital, located in Eindhoven, is specialized in heart- and vascular diseases, kidney disorders and obesity. The hospital has a technical department for innovative solutions for technical problems in the hospital. This department has approached Fontys to develop and engineer their idea for a device that measures the urine output of catheterized patients, and stores the data on a central computer in the hospital.

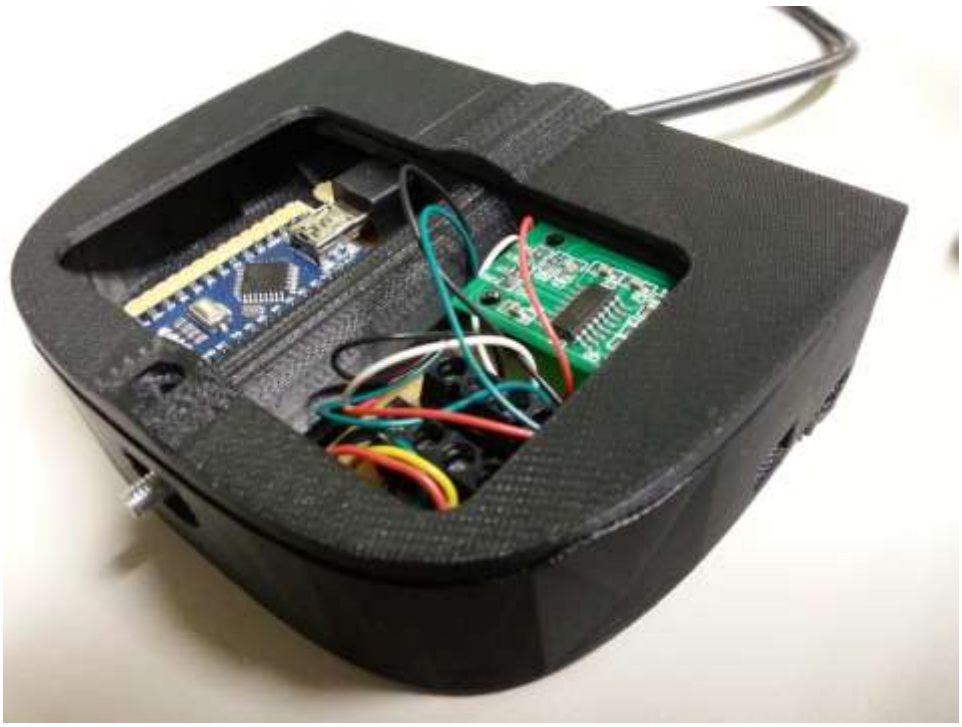


figure 1, prototype nr. 2

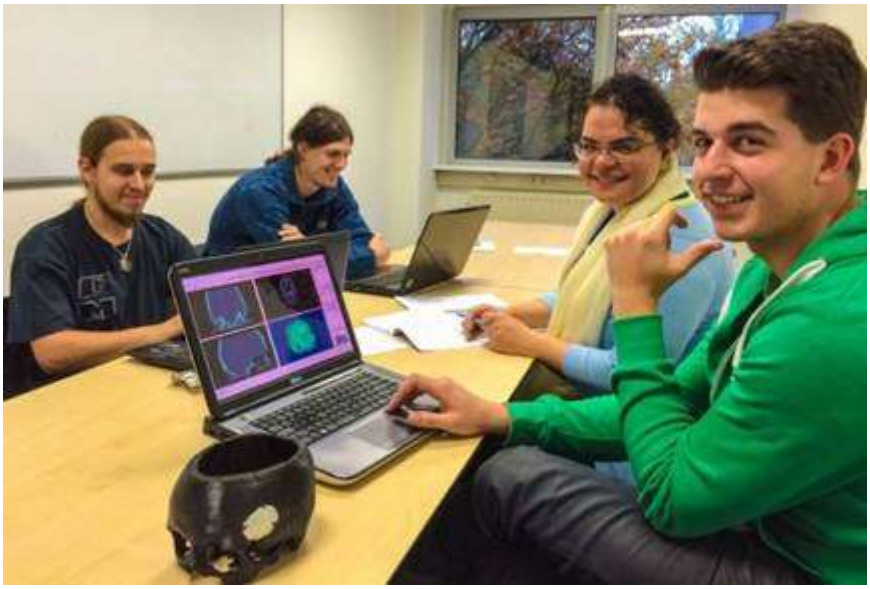
Project IPD 14: Medical printing

Organization: **Fontys University of Applied Sciences**
Logo:

Company contact: **Lambert Baken -Fontys MBRT**
Coach: **Hein van deVrande**

Team members:

Students	Institute	Department
Florent Versteeg	Fontys School of Engineering	Mechanical Engineering
Job van Bentum	Fontys School of Engineering	Mechanical Engineering
Vigilius van Oostenbrugge	Fontys School of Engineering	Mechanical Engineering
Parisa Rezaii	Fontys School of Engineering	Mechanical Engineering



Project description:
Exploration of Medical Printing focussed on the possibilities that could be applied in hospitals nowadays. The project consists of two parts.
Part 1: A literature study combined with testing Open Source and professional commercial software (Materialise Mimics) to create a 3D-printed patient-specific implant (PSI). The team created a demo skull with a PSI (see picture). Furthermore, knowledge has been gained about materials, design process of custom hip implants, and the interaction between human tissue (bone) and the implant.
Part 2: Working together with Fontys department of Medical Imaging and Radiation Therapy (MBRT). In the Minor Advanced Radiological Technology (ART) four projectgroups designed 3D-printed custom phantoms for MRI and CT scanners. These phantoms are tested in a hospital in MRI and CT. Studying the design process and the results from the scanner gained knowledge and insights about the behaviour of different geometries and materials in imaging equipment.

Project IPD 15: Linearity Class D audio amplifier

Organization **Fontys University**

Logo:

Company contacts **Jeedella Jeedella**
Coach: **Jeedella Jeedella**

Team members:

Students	Institute	Department
Merijn Verschuren	Fontys School of Engineering	Electrical Engineering
Lars Krammer	Fontys School of Engineering	Electrical Engineering
Martijn Lith	Fontys School of Engineering	Electrical Engineering
Tek Raj Dhami	Fontys School of Engineering	Electrical Engineering
Kanyu Tang	Fontys School of Engineering	Electrical Engineering
Ulemu Phiri,	Fontys School of Engineering	Electrical Engineering

Project description:
High efficiency audio power amplifier are required in many products. Class-D topology is becoming very popular in many device because of its high efficiency in comparison with other topologies.

This is a continuation project of last year project where last year students succeeded to demonstrate a class-D amplifier and they won the KIVI NIRIA award. The results of the previous project will be used to improve the performance of the class-D amplifier further. Using Class-D amplifiers for your speakers has a number of advantages over the commonly used Class-AB amplifiers. Some of these advantages are increased efficiency, typically high power density (output power [Watt] per physical volume of the amplifier [dm^3]), lightweight and low bill of materials cost. The most significant disadvantage is the decreased linearity (harmonic distortion) of the amplifier, especially when using an open loop Class-D amplifier.

The goal of this project is to investigate the possibilities of improving the performace of class-D amplifiers. Specifically to make a (simulated as well as physical) proof of concept of a brand new Class-D topology. The Extra L Opposed Current Converter (ELOCC) is proposed as current amplifier [1]. The ELOCC topology has been developed in recent years at Prodrive Technologies and Eindhoven University of Technology as a high linearity, current controlled Class-D motor driver. This idea can/may be used to improve the linearity of the Class-D amplifier.

The answers of these questions will be investigated during this project:

- Investigate possibilities to improve class-D linearity.
- Can the ELOCC topology be used as an open loop voltage source to drive a loudspeaker?
- Is the linearity increased compared to the conventional Class-D topologies?

A Class D amplifier need to be developed. This amplifier should accept both analog stereo audio inputs and an S/PDIF digital audio stream

This project will be executed as cooperate project with the Eindhoven university of technology accordingly the results will be available to both parties.

Furthermore, some investigation should be done to see what are consequences of using ELOCC topology in case there is a patent related to this topology.

Project IPD 16: Advanced Embedded Systems Lab

Organization	**Fontys University**	**Company contacts:**	**Jeedella Jeedella**
Company logo:	Fontys University of Applied Sciences	**Coach:**	**Jeedella Jeedella**

Team members

Students	Student Number	Institute	Department
Luigi Ferruccio Parisini	2209693	Fontys School of Engineering	Electrical Engineering
Natalia Szymanska	2197630	Fontys School of Engineering	Electrical Engineering
Giovanni Pizzarotti	2209964	Fontys School of Engineering	Electrical Engineering
Mehran Firoozbakhtan	2308436	Fontys School of Engineering	Electrical Engineering
Boyan Nikolov	2203754	Fontys School of Engineering	Electrical Engineering
Bozhidar Uzunov	2200817	Fontys School of Engineering	Electrical Engineering

The project

The goal is to develop an entertaining yet educational 10ECs-worthed embedded system course for future students, focusing on the practical programming aspects of real-time applications using ZYBO, a demo-board from Xilinx based on the powerful Xilinx Zynq7000 System-on-Chip.

To satisfy this challenging task, the team decided to build the course around a Self-driving Car project. The deliveries consist of practical assignments for a total of 12 classes, a project description, and the functioning hardware and software: 2 Autonomous Cars prototypes and a graphic interface application for remote monitoring and control.

An example of the autonomous car prototype and graphic interface

The self-driving cars consist of highly customized designs built from available off-the-shelf components. Each car is equipped with 4 distance sensors for avoiding obstacles, accelerometers and 4 independent wheel-drives for a high degree of control, a USB HD camera for online video-streaming and target recognition, a Wi-Fi communication module, and a long-lasting rechargeable battery pack.

The practical assignments are divided in two Quarters: Q1, and Q2. The first 6 assignments – Q1, will introduce the students to the programming and development environment needed to use the ZYBO board – Vivado, SDK, Petalinux, Linux basics, and will provide learning material for basic real-time SoC programming. During Q2 the students are provided with fewer guidelines, and the challenging task of realizing a Self-driving Car, starting from the principles learned by doing Q1 assignments.

Project IPD 17: Cheap Laboratory Power Supply

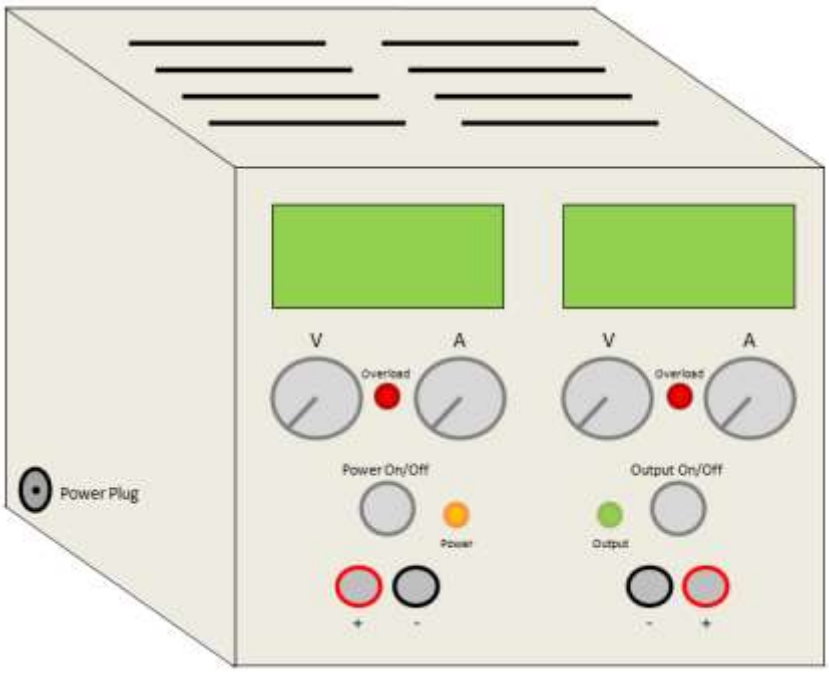
Organization **Fontys University of Applied Sciences**
Logo:

Company contacts: **Marc Hendriks**
Coach: **Marc Hendriks**

Team members:

Students	Institute	Department
Kars Roberts	Fontys School of Engineering	Electrical & Electronic Engineering
Clemens Mazee	Fontys School of Engineering	Electrical & Electronic Engineering
Nawal Raj Gajmer	Fontys School of Engineering	Electrical & Electronic Engineering
Pim Swinkels	Fontys School of Engineering	Electrical & Electronic Engineering
Kartic Krishnan	Fontys School of Engineering	Electrical & Electronic Engineering
Jeffrey Leijten	Fontys School of Engineering	Electrical & Electronic Engineering
Bruno Camargos	Fontys School of Engineering	Electrical & Electronic Engineering
Camelia Nacheva	Fontys School of Engineering	Electrical & Electronic Engineering

Project description:
The general design of the cheap power supply is as follows: The 19 volts of the laptop are transformed to 36V by a boost converter. After that the positive buck converter transform respectively the +36V to whatever voltage the user desires between 0…±30V. This voltage is set by potentiometers. The current that the load can draw is also limited, the user can set the max voltage between 0…2A with potentiometers. Furthermore the will be a microcontroller to control an LCD which displays the voltages and currents. The microcontroller will also control (some of) the power electronics.



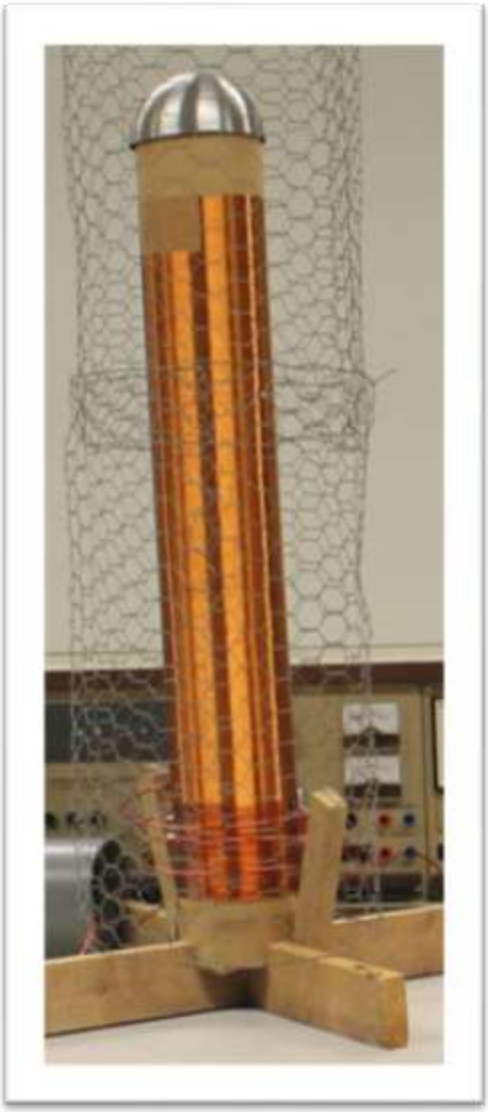
Project IPD 18: Tesla Coil

Organization **Fontys University of Applied Sciences**
Logo:

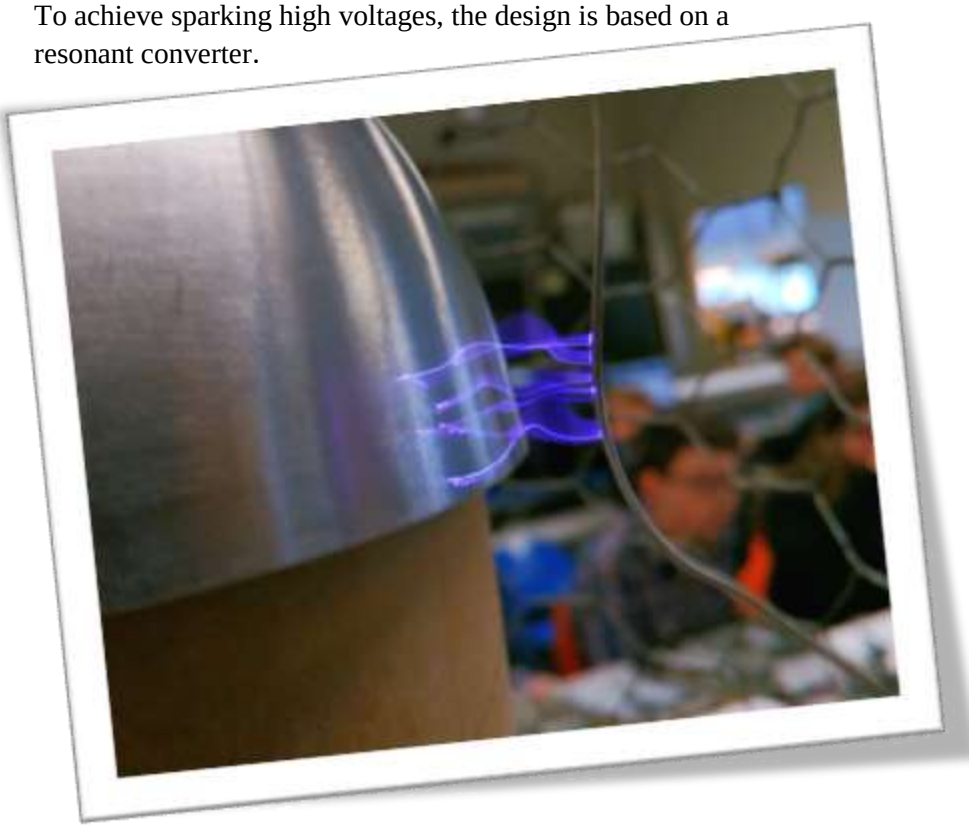
Company contacts: **Marc Hendriks**
Coach: **Marc Hendriks**

Team members:

Students	Institute	Department
Pim Kahlert	Fontys School of Engineering	Electrical Engineering
Niels Klemans	Fontys School of Engineering	Electrical Engineering
Robin van Dijk	Fontys School of Engineering	Electrical Engineering
Tonnie Bax	Fontys School of Engineering	Electrical Engineering
Remco Smulders	Fontys School of Engineering	Electrical Engineering
Ruben Verstegen	Fontys School of Engineering	Electrical Engineering



Project description:
The goal of our project is to create a demonstrating unit of a tesla coil for Fontys to get new students excited about electrical engineering, because of this purpose it has to be extra safe.
We power the tesla coil unit using a school lab supply with a maximum output of 30 volt and 3 ampère. By using contemporary technology it is possible to make the tesla work. To achieve sparking high voltages, the design is based on a resonant converter.



Project IPD 19: Floating Point Processor

Organization: **Fontys University**
Logo:

Company contact: **Wim de Valk**
Coach: **Wim de Valk**

Team members:

Students	Institute	Department
Daan de Bont	Fontys School of Engineering	Electrical Engineering
Maarten Leeters	Fontys School of Engineering	Electrical Engineering
Martijn van Duijnhoven	Fontys School of Engineering	Electrical Engineering
Lars Feijen	Fontys School of Engineering	Electrical Engineering
Ilja Ivanovs	Fontys School of Engineering	Electrical Engineering
Borislav Bliznashki	Fontys School of Engineering	Electrical Engineering

Project description:
This project is made so the students can learn how to work on a digital problem in the real world. For this project a floating point processor has to be made. The floating point processor should be able to do calculations with floating point numbers.

In the beginning some vague requirements are given by the costumer. The project group has to figure out the meaning of these requirements by brainstorming and asking questions to the client. This way the total specifications of the floating point processor have to become clear. Half the project period is used for this phase.

After this phase the floating point processor has to be designed and implemented into VHDL. The floating point processor needs to be simulated and tested. At the end the client uses a acceptance test and when this test is passed the project is finished. Otherwise changes have to be made in order to pass the acceptance test

Project IPD 20: HIFI Sound FPGA Platform

Organization **Fontys University**
Logo:

Company contact **Wim de Valk**
Coach: **Wim de Valk**

Team members:

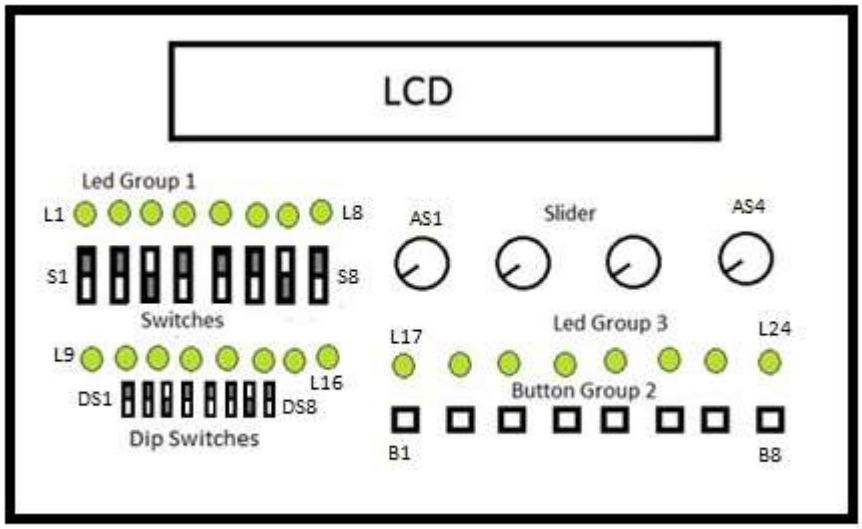
Students	Institute	Department
Tabrez Sarwaddin	Fontys School of Engineering	Electrical Engineering
Radiktya Zulkarnain	Fontys School of Engineering	Electrical Engineering

Project description:
There are many ways of doing signal processing using an FPGA, however since the FPGA is handling all the signal processing work, another board needs to be setup as the slave of the FPGA to perform additional tasks such as changing the volume, displaying information on an LCD, and other functionality that comes with an audio HIFI system.

The task of this project is to develop such a slave micro-controller board which consists of all the peripherals which are required for audio manipulation, with the following features;

- LCD display to show messages (Volume level, pan, etc)
- 4 Knobs
- 4 Slider switches
- 8-bit DIP switch
- 8 Push buttons
- 24 LEDs
- Headers to communicate with FPGA

These hardware features have to be programmed into the system in a way which allows the customer to easily change the code of them to suit his needs. A diagram showing the layout of the micro-controller board is shown below;



Project IPD 21: Hardware Prototype for a Mobile Audio USB Device

Organization: **Fontys University of Applied Sciences**

Logo: Videtur

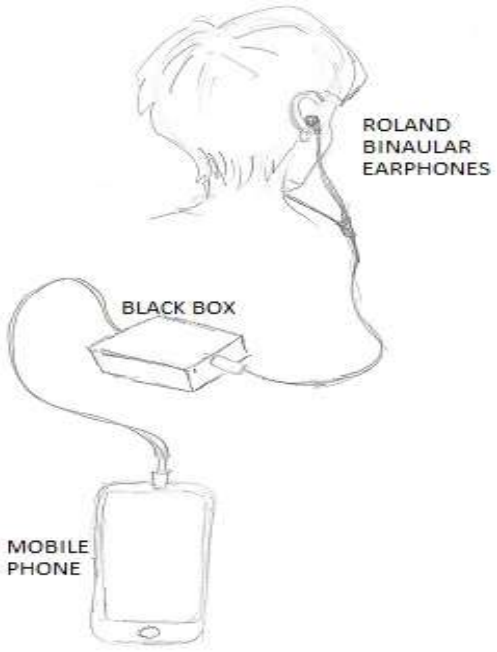
Company contact: **Geert Schoenmakers**
Coach: **Wiely van Groningen**

Team members:

Students	Institute	Department
Alex Vesselinov	Fontys School of Engineering	Electrical Engineering
Charles-Emmanuel Albufera	Fontys School of Engineering	Electrical Engineering
Jim van der Heiden	Fontys School of Engineering	Electrical Engineering
Muhammad Zarrar Khan	Fontys School of Engineering	Electrical Engineering
Nader Jamal Ali Al Zadjali	Fontys School of Engineering	Electrical Engineering
Warith Hilal Yahya Al Sheibany	Fontys School of Engineering	Electrical Engineering

Project description:

As part of IPD, we work for an assignment given to us by Videtur B.V. which is a startup comapny that desires to help patients or people with hearing problems. Videtur wants to make a hearing aid in the form of a smartphone accessory.



The problem is that opportunities are expected but not proven; as it is not an existing product, so there is little reference to compare with, and therefore there are increased risks. A second aspect is that the proposed concept has several risks e.g. delay, battery lifetime, etc. The challenge lies within hearing aid prototype with all of the customer requirements.

Nowadays, smart phones have a lot of capacity for making calculations and particularly to improve the functionality of an hearing aid. Therefore it is good to investigate the possibilities.

Project IPD 22: 3D Spherical Scanner

Organization: **EMCMCC**

Logo:

Company contact: **Mart Coenen**
Coach: **Theo Huberts**

Team members:

Students	Institute	Department
Aditya Kenia	Fontys School of Engineering	Electrical Engineering
Audric Nathan Wilhelmus	Fontys School of Engineering	Electrical Engineering
Dhanya Adista Girana	Fontys School of Engineering	Electrical Engineering
Ismet Molaahmed	Fontys School of Engineering	Electrical Engineering
Ivelin Lyahtov	Fontys School of Engineering	Electrical Engineering
Mochou Liao	Fontys School of Engineering	Electrical Engineering

Project description:
From the company EMCMCC the idea arose to develop a spherical scanner to collect 3-D information of certain objects. The project is a part mechanics, mechatronics, the necessary computer program and signal analysis or information processing.

The project has run earlier from Fontys Mechatronics and this has resulted in an arrangement where the control and data processing has now become operational. The following stage is directed to the integration of one or more sensors, e.g. optical or electro-magnetically, coupled with the signal processing equipment in conjunction with this spherical system and then to create a 3-D visual representation thereof. The ultimate goal is to provide a working spherical scanner.

The idea is to use one or possibly orthogonal sensors (x / y / z) at a selectable fixed distance to the centre, to establish a certain physical parameter. Examples include light intensity, heat; IR measurement, RF radiation diagrams of examples RF-ID readers, noise; sound, shape; ultrasonic, optical, colour; optical, etc.

Labview is used as the main program and 2 separate programs are being used. One program is to run the table and the arm and the other is to collect data. Colour analyser is used as the sensor to collect the light data and the data from it will be transferred to Labview automatically and the program will make the 3D plot out of it.

The specifications for the measurement and setup are arranged in the previous project in consultation with the client. On the basis of these specifications, there has been designed and constructed in a formation.

Project IPD 23: Wi-Fi Connection Using TV White Space for Gambia

Organization: **Fontys University**
Logo:

Company contact: **Jan van Eck**
Coach: **Duncan van Meeteren**
Team members:

Students	Institute	Department
Kamal Mokhtar	Fontys School of Engineering	Electrical & Electronic Engineering
Ali Al-Tubi	Fontys School of Engineering	Electrical & Electronic Engineering
Xheni Meda	Fontys School of Engineering	Electrical & Electronic Engineering
Bruno Campos	Fontys School of Engineering	Electrical & Electronic Engineering
Caio Plazas	Fontys School of Engineering	Electrical & Electronic Engineering
Jeremy Labrado	Fontys School of Engineering	Electrical & Electronic Engineering
Victor Muijieje	Fontys School of Engineering	Electrical & Electronic Engineering
Florian Nandiska	Fontys School of Engineering	Electrical & Electronic Engineering

Project description:

As it becomes faster with internet, the usage of television frequency is decreasing. Watching movies, TV-series and news can now be done through internet. The demand for broadcast channels is also decreasing because of that. TV White Space becomes larger. TV White Space refers to the unused TV channels between the active ones in the VHF and UHF spectrum. These are typically referred to as the "buffer" channels. In the past, these buffers were placed between active TV channels to protect broadcasting interference.

Companies are now looking for opportunities in TV White Space. Some projects (commercial and pilot) are already published to have a Wi-Fi access through TV White Space. The downside of these projects that are commercially-intended however lays on the maintenance cost or post-production cost for the user. This project, aims to provide the advantage of such technology in the highly needed circumstances. The opportunity was possible for Gambia by agreeing with the ministry. The project aims to connect three schools in Brufut, Gambia with internet, by having as low-cost maintenance as possible.

In Gambia, the internet is provided by a ministry building which then can be shared to the three schools. The ministry building is located in Banjul, 20 km away from Brufut, the town where the three chosen schools are located. Following is an overall diagram of the system:

Project IPD 24: Glow Next water fountain

Organization: **Foundation Glow / Glow Next**

Logo: GLOW > NEXT

Company contact: **GLOW next**
Coach: **Herbert Veenstra**

Team members:

Students	Institute	Department
Rob Reijs	Fontys School of Engineering	Electrical Engineering (EE)
Stefan Ketelaars	Fontys School of Engineering	Electrical Engineering (EE)
Aleix Morte Sanchez	Fontys School of Engineering	Electrical Engineering (exchange)
Jon Santiso	Fontys School of Engineering	Electrical Engineering (exchange)
Kundan Chalise	Fontys School of Engineering	Electrical Engineering (EEE)
Kiran Belbase	Fontys School of Engineering	Electrical Engineering (EEE)
Marius Ursu	Fontys School of Engineering	Electrical Engineering (EEE)

Project description:

This IPD project is a follow up of two former EXPO projects. One of them is eligible for GLOW-NEXT. Therefore, our project starts with finalizing/optimizing the former installation that uses a rotating hardware object with stroboscopic light. But next we have to show the feasibility of an extra surprising light phenomenon, where the solid object is replaced by falling water droplets. The concept consists of a water droplet dispenser that can eject water droplets at very predictive intervals. This system is connected to a speaker, as a result the droplets can be visually frozen, flowing downwards or upwards in a spiral by changing the frequency of the stroboscopic light.

Project IPD 25: 3D Printer Controller Module

Organization: **Adriaans Besturingstechniek**
Logo: **Adriaans Besturingstechniek**
Company contact: **n.adriaans@student.fontys.nl**
Coach: **Rob van Eldijk**

Team members:

Students	Institute	Department
Tess Peters	Fontys School of Engineering	Electrical Engineering
Roël Wiggers	Fontys School of Engineering	Electrical Engineering
Martijn Meeuwessen	Fontys School of Engineering	Electrical Engineering
Maarten Klompmakers	Fontys School of Engineering	Electrical Engineering
Niels Adriaans	Fontys School of Engineering	Electrical Engineering

Project description:
Most printers have a pre-installed controller module which controls the 3D printer. Unfortunately, electronics are not, yet, printable. Therefore, when building or buying the mechanics only, a separate control module is needed. However, most modules on the market are either expensive or mediocre.

The goal of this project is to develop and produce a prototype controller module for a 3D printer. This includes the hardware, embedded software and a demo PC application.

Though some specification is given beforehand, the majority is to be discussed with the customer. The base requirements are as following:

- Driver for at least 4 stepper motors.
- Driver and sensor feedback for at least 2 heating elements (extruder and heatbed).
- Compatible with common host software (Repetier, Cura).

An additional note to the requirements could be transparency. Each subsystem should be developed with scalability in mind. This allows for further expansion / improvement of functionality. The following list summarizes possible additions:

- 3rd order acceleration on the motor drivers.
- Transparent firmware. Teaching the controller how to use available hardware in runtime.
- Support for multiple extruders (scalability in axis and heating controls).
- Support for multiple methods of communication (Mass storage, Ethernet, Wi-Fi, etc.).