Institut for Human Centered Engineering HuCE
BFH Centre for Technologies in Sports and Medicine

Presentations of Seminars, Projects and Master Thesis

Master of Science in Engineering MRU

Date:	27.01.2017
Projects:	12.45 – 15.00
Apero:	16.00 – 17.00
Place:	BFH-TI, Quellgasse 21 Biel, room HG 408 for presentations, HG 433 / HuCE microLab for apero
Program:	
12.45 – 13.05	Thibaud Allaman, project 1, presentation (public)
13.05 – 13.25	Jan Lochmatter, project 1, presentation (public)
13.25 – 13.45	Adrian Maag, project 2, presentation (public)
	Break
14.00 – 14.30	Dominik Robellaz, Master Thesis, presentation (public)
14.30 – 15.00	Christoph Zimmermann, Master Thesis, presentation (public)
	Break
15.15 – 15.45	Thesis Defences, Master Thesis students (none public – HG 434)
15.30 – 16.00	Assessment (none public – HG 433)
16.00 – 17.00	Apero

The master students enrolled at the research group HuCE (Institute of Human Centered Engineering) will present their seminar work of their master course „Human Interface Technology“ as well as their project and master thesis work. Interested staff and bachelor students from division EKT, F and I are welcome to join the presentations and have an insight of the MSE master program. The subjects are in the following 3 areas:

- hardware algorithms
- biometry and authentication
- computer perception and virtual reality

Each project presentation takes 20 to 30 minutes, leaving enough additional time for discussions and questions. Short breaks between the presentation/discussion blocks allow bachelor students to select their favorite subjects by joining or leaving the presentations (be sure not to miss the free sandwich lunch at the end). All presentation slides will be in English, the presentation languages will be in German or in English, dependent on the master students choice and the audience.

The presentations will be concluded by an apero.
Registration until January 27th, 2017 on **ti.bfh.ch/public_defense**

Master Course: Human Interface Technology
Autumn Semester 2016
Project and Master Thesis Abstracts

Thibaud Allaman : "Total Process Control (TPC)"
Abstract: L'objectif du travail est d'équiper une machine du partenaire industriel avec des capteurs afin de détecter certains défauts qui peuvent survenir lors du traitement de poudre. Les 3 domaines suivants seront traités :

- **Détection des outillages :** permettra d'éviter toute interversion, tout remplacement par une contrefaçon et toute combinaison non-compatible avec la recette choisie par l'opérateur.
- **Détection corps étrangers et détection contact rotor-stator :** La distance rotor-stator sera contrôlée afin de prévenir tout contact. Les pièces tournant jusqu'à 5000t/min, tout contact peut être fatal pour la machine. La casse mécanique, le danger d'explosion et la pollution du produit sera ainsi réduite ou évitée.
- **Mesure de débit de production en ligne :** permet de contrôler la stabilité du process.

Dans ce travail, il faudra tenir compte des exigences liées aux produits alimentaires et de l'environnement ATEX (ATmosphères Explosives) 1/21 voire 0/20 dans lequel se trouvent les machines, qui limite grandement les principes de mesures ainsi que les puissances à disposition. Dans le cadre de ce premier projet, il s'agira de faire un premier état de l'art et de proposer les solutions les plus appropriées pour les trois domaines ci-dessus.

Jan Lochmatter: "Machine Vision Aided Laser Processing for Stent Manufacturing"
Abstract: The LWM (laser welding machine) from BWTec (an industry partner of the institute HuCE) and the new designed firmware core, which is based on OOD (object oriented design) methods, will be the design and research environment of project 1. The OOD based firmware has been designed by a bachelor student at BFH.
The current implementation cuts circular segments based on line-cuts. Each line segment is a single G-Code instruction (G0, G1). The blob of line-cut instructions should be replaced by G2, G3 instructions. The G2 and G3 instructions are used for circular line-cutting. In a target application to cut-off some rounded shape of a PTFE coated metal stent. The cutting process will be managed by a vision system. The vision system evaluation and some initial implementation for contour detection is also part of project 1. Due to economical reasons an expensive vision system is not an option. The algorithms used for image processing must be implemented in C++ by using OpenCV as library. Taking into account, real-time image processing is crucial to guarantee both low process cycle time and high quality.
By the end of project 1, a vision system has been evaluated. The G-Code interpreter supports G2 and G3 instructions. Sample implementation to count and characterize markers on a cylindrical object are possible. The LWM should be able to search the objects surface automatically. Therefore the vision demo application generates G-Code and sends it over IP to the SPS to control the LWM system.

Adrian Maag: "Lightshield Project: Design Evaluation of a preliminary Prototype"
Abstract: Bi-dimensional (RGB) and tri-dimensional (Depth) imaging are perceived as fundamentally different (and somewhat incompatible) technologies. The vastest majority of computer vision algorithms in use today are designed to operate on 2D images, and most of them cannot easily be ported or adapted to a 3D point cloud. Conversely, processing algorithms for depth maps operate primarily on the geometry of the scene, as they make poor use of additional information carried by the reflectivity, or the color of the voxels. In reality, a correct mix of 2D and 3D techniques can greatly improve the efficiency and accuracy of computer vision devices and algorithms, and open the way to truly intelligent vision systems.

The goal of this semester project is to define the architecture of a combined 2D/3D sensor on a standard CMOS process. Taking the results of semester project 1 into account this project will continue the sensor properties and identifying the prototype system variables. The result of this semester project will include a detailed block-diagram containing the minimum set of required blocks for an operating sensor (Sensor Area, Readout and Control circuits, Timing, Voltage supply and Interface). Additional, some critical points need to be evaluated like the influence of Infrared pulses (required for aquiring the 3D information) onto RGB pixel signal or handling high voltage required to operate the 3D-sensors. Finally, the results of this semester project should guide the direction of the master thesis.

Dominik Robellaz: "Compression and Reconstruction Algorithms for Non-equidistantly Sampled Esophagus Signals"

Abstract: In an ongoing research project a long-term esophagus electro-cardiogram (eECG) device is being developed. One of the challenges of the eECG project is the highly limited space in the catheter and thus the memory size in and the power source for the device. Data reduction and compaction is thus a key element to drastically reduce the memory needs, but this data reduction must not be realized in an energy-hungry fashion, so standard sampling with subsequent data compression is not an option. In several previous projects at HuCE-microLab, a new sub-Nyquist sampling method for our eECG device has been developed and the needed analog and digital processing blocks of the new sub-Nyquist sampling ADC have been integrated in ASICs. This current masters' thesis deals with the data path of this ECG signals, starting at the binary ADC output on an ASIC level, then storing the data in a highly compressed format on a FLASH memory, and final de-compressing the content of the FLASH memory and reconstructing the original ECG signal on a PC platform. The key points of this work are therefore: a close-to memoryless and low-power compression algorithm, qualified for ASIC implementation, a corresponding reference de-compression algorithm on a standard PC environment and finally, a new efficient interpolation algorithm, working directly on non-uniformly sampled data.

Christoph Zimmermann: "Long time archive for audio works"

Abstract: The Swiss Foundation Public Domain is responsible for the long time data archive of the volunteer driven Public Domain Project. The volunteers are collecting, digitizing and capturing metadata of old audio records, mainly 78 rpms, that are out of copyright. In this master thesis a data model was developed to represent the metadata as Open Linked Data. Also a trustworthy archival storage according to OAIS was evaluated and first migration steps were undertaken. Following the semantic web (Web 3.0) standards the Metadata (title, creator, publication date, images etc.) is modeled as triples (subject, predicate, object) using the ontologies Dublin Core, Schema.org, Music Ontology, Creative Commons and Logistics Core. The new data model is accessible via a web API that delivers RDF/XML or turtle. This fosters the reuse of this metadata on other websites and projects, which increases the overall value of the metadata and the work of the Public Domain Project itself.
This model is implemented as a set of new templates and forms using Semantic MediaWiki (SMW). SMW allows the value of a data field to be shown on other wiki pages with a semantic query. A data field may have data validation or can have only a limited set of values. These features simplify data entry and reduce errors significantly. A trustworthy storage system for the digitized audio files must fulfill digital preservation requirements defined by the OAIS model. A new system structure was evaluated and a migration strategy was defined. As a first step the operating system of the file server was replaced by Gentoo GNU/Linux because it stores the source code of every installed software. The source code together with file format specifications etc. is called representation information and which needs to be preserved together with the audio files to guarantee the understandability of the bits on the storage media.
A document management system (DMS) for the internal document handling of the foundation was evaluated and the selected NextCloud was implemented on a new virtual machine (VM) secured with TLS and certificates from Let's encrypt. The full report can be downloaded from: https://publicdomainproject.org (cc-by)