

# Biomedical Engineering

## Project Exchange

## Proceedings

Since WS2014

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## Scope & Introduction

Within the study programs BIOMEDICAL ENGINEERING (BACHELOR) and BIOMEDICAL ENGINEERING SCIENCES (MASTER) a series of courses was established that use elements of project based learning in groups. We see a clear benefit in these formats, as knowledge only generates progress if it is used in practice.

Our experience is remarkable in that many projects exceeded our expectations by far. We saw students show off their results at international conferences, workshops and publish articles in journals. Fresh forces approaching real world challenges generate a strong innovation drive. This has impressed even longstanding veterans from research and industry.

In the past years we spent a lot of effort in the process of finding project topics and then linking them to groups of students in the courses. It then occurred to us that the projects and individuals better speak for themselves. The Project Exchange will therefore enable direct contact between all involved and serve as a platform for connecting external partners, lecturers and students at different stages of their career.

## What exactly is the PROJECT EXCHANGE?

The Project Exchange provides information on several levels:

- Which courses are engaging, what are the specific goals, procedures and timelines
- Which results were generated by ongoing and finalized projects
- Which new ideas are *on the market* and open for cooperation

Based on this information we can then discuss and make decisions for our future:

- Choose a topic for your team project
- Assemble a team around your idea
- Know more about the specific area where you want to be an expert in the future

The Project Exchange therefore starts with presentations from existing projects and courses in the study programs. It further highlights new ideas to be elaborated in the future. Finally discussions will take place in small groups on the projects, ideas and teams that are represented.

# Biomedical Project Exchange – Program

## Venue

Fachhochschule Technikum Wien  
 Höchstädtplatz 6, 1200 Wien  
 Lecture room F0.02

Detailed travel instructions are available at

<http://www.technikum-wien.at/standorte-kontakt/der-hauptstandort-der-fh-technikum-wien-am-hoechstaedtplatz/>

## Date, time, schedule

Thursday, 18<sup>th</sup> February 2016

TIME	TOPIC	WHO
16:55	Welcome, setting up	Technikum Wien, lecturers
17:15	Introduction on all of us, on courses and projects.	Technikum Wien, lecturers
17:30	Poster presentations from finalized student projects. Ideas for further work.	Students of BBE, 6 <sup>th</sup> Semester
18:15	Presentations from ongoing work in student projects.	Students of MBE, 2 <sup>nd</sup> Semester
19:00	Presentations of new incoming ideas.	Partner institutions from research and industry, Technikum Wien lecturers
19:45	Project puzzle: People meet projects. Discussion according to individual interests.	Students of BBE, 4 <sup>th</sup> Semester, Supervisors
20:15	Final round, summary.	Technikum Wien lecturers

## Contact

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# Benefits

## For MBE and BBE students

- Students will strengthen their networks to companies and research partners already closely related to Technikum Wien.
- They will make contact to students in other courses and programs. Students may join existing teams. Existing teams will find new talented team members, adding strength to their own projects.
- Receive inspiration and ideas to kick start the individual bachelor's and master's thesis.

## For all students

- Approaching graduation and the job market students will strengthen their networks to companies and research partners already closely related to Technikum Wien.
- Towards their individual bachelors and master's thesis students receive inspiration, contacts and ideas to kick start their work.
- At any time students will make contact to students in other courses and programs. Students may join existing teams. Existing teams will find new talented team members, adding strength to their own projects.
- Students in the early semesters will get a clearer idea where a career in the fields of medical devices and software may lead.

## For research institutions and companies

- Make contacts to students, lecturers and study programs in the biomedical engineering fields, right in the region of Vienna, close to your home base.
- Learn about windows of opportunity for cooperation. What is underway in the university, where can we expect new developments, . . . .
- Provide input to study programs, so that future graduates will be even more productive in your company.

## Programs and courses involved

Courses from two programs are part of the activity:

- Biomedical Engineering (BBE, Bachelor)
- Biomedical Engineering Sciences (MBE, Master)

### Biomedical Engineering (BBE, Bachelor)

#### Becoming familiar (3<sup>rd</sup> Semester)

In this semester students decide which specialization they will choose. The BBE program offers four specializations. The Project Exchange covers two of them. Students from the 3<sup>rd</sup> semester are invited to the Project Exchange in order to get a clear idea of the topics that they might encounter in the future. This is part of the following courses::

- Introduction to Medical and Hospital Technology
- Introduction to Medical Imaging and Data Engineering

#### Conducting group projects in the 4<sup>th</sup> and 5<sup>th</sup> Semester

In these semesters within the BBE program consecutive group projects take place focusing on two areas:

- Software development: *Medical Data Engineering, Medical Imaging and Analysis, and Safety and Communication in Medical Data Engineering.*
- Medical devices: *Biological Signals and Medical Sensors 1, Bioelectrical Signals and Medical Sensors 2.*

### Biomedical Engineering Sciences (MBE, Master)

#### Conducting group projects in the 1<sup>st</sup> and 2<sup>nd</sup> semester

- *Project-Related Teamwork 1, Project-Related Teamwork 2*, covering topics on both software as well as medical devices



# Peer Review Process

## In the Summer Semester

DATE	ACTION	ACTORS
20 <sup>th</sup> April	Upload 1 <sup>st</sup> version of Group Paper (2 pages) into Documentation system of the course. Students will give feedback on papers of other groups	Students
1 <sup>st</sup> May	Upload 1 <sup>st</sup> revised version of Group Paper into Documentation system of the course.	Students
7 <sup>th</sup> May	Feedback by course lecturers during course units in plenum for all groups.	Course lecturers
20 <sup>th</sup> May	Upload 2 <sup>nd</sup> version of Group Paper into Documentation system of the course. Scientific jury will give feedback for further revision.	Students, Scientific board
7 <sup>th</sup> June	Feedback by scientific board via email to student groups for final revision.	Scientific board
20 <sup>th</sup> June	Upload 3 <sup>rd</sup> and FINAL version of Group Paper into Documentation system of the course. This is the <i>camera ready</i> contribution, which will be used for grading and publication in the <i>Project Exchange-Proceedings</i> .	Students

## In the Winter Semester

DATE	ACTION	ACTORS
6 <sup>th</sup> November	Upload 1 <sup>st</sup> version of Group Paper (2 pages) into Documentation system of the course. Students will give feedback on papers of other groups	Students
13 <sup>th</sup> November	Upload 1 <sup>st</sup> revised version of Group Paper into Documentation system of the course.	Students
20 <sup>th</sup> November	Feedback by course lecturers during course units in plenum for all groups.	Course lecturers
6 <sup>th</sup> December	Upload 2 <sup>nd</sup> version of Group Paper into Documentation system of the course. Scientific jury will give feedback for further revision.	Students, Scientific board
20 <sup>th</sup> December	Feedback by scientific board via email to student groups for final revision.	Scientific board
12 <sup>th</sup> January	Upload 3 <sup>rd</sup> and FINAL version of Group Paper into Documentation system of the course. This is the <i>camera ready</i> contribution, which will be used for grading and publication in the <i>Project Exchange-Proceedings</i> .	Students

## Deadlines & organization details

This event targets to enhance the cooperation on innovative topics in the fields of device and software development for medicine. We want to prepare for the event and capture what has happened. A basic organizational structure will help us to get the most out of the limited time we all have.

### Submission of new project topics

Persons who intend to start a new team project submit a one page project outline using the provided template available from the organizers.

Deadline: July 15<sup>th</sup>, 2016 to [mathias.forjan@technikum-wien.at](mailto:mathias.forjan@technikum-wien.at).

### Submission of project result extended abstracts

Ongoing and finalized projects submit a 2 page paper using the provided template of their lectures.

Deadline: according to review process.

### Submission of project result poster

Ongoing and finalized projects submit a scientific poster using the provided template available in the course system.

Deadline: announced by lecturers.

## Proceedings

At the event a proceedings booklet will be available in hardcopy and electronic form [www.technikum-wien.at\MBE](http://www.technikum-wien.at\MBE).

## Organisers

The Project Exchange is brought to you as a cooperation of departments at the University of Applied Sciences Technikum Wien:

### Department of Biomedical, Health & Sports Engineering

The DEPARTMENT OF BIOMEDICAL, HEALTH & SPORTS ENGINEERING coordinates the courses in the study programs that are represented in the Project Exchange. These courses also initiated this activity.

## Research Focus eHealth

The RESEARCH FOCUS EHEALTH at UAS TECHNIKUM WIEN performs research in the field of eHealth, linking information and processes in systems such as the electronic health records (EHR) and telemedicine. Several departments are involved: INFORMATION ENGINEERING & SECURITY, DEPARTMENT OF BIOMEDICAL, HEALTH & SPORTS ENGINEERING as well as COMPUTER SCIENCE AND INFORMATION SYSTEMS MANAGEMENT. UAS TECHNIKUM WIEN has become a significant and renowned source of know-how in this area. The staff is at the forefront, actively managing the further development – both in terms of the subject and the contents – of the topic in Austria and to a certain degree also at the international level.



**Contributions**  
**Bachelor Biomedical Engineering**



# Temperature Control for a Mechanical Eye Model

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**Abstract**— The task of this project is to develop a temperature control for heating the aqueous humor in the mechanical Eye Model to physiological temperature. For that a temperature measurement circuit has to be designed for an accuracy of 0.1 K. The signal has to be digitalized in order to process it with a microcontroller ( $\mu\text{C}$ ). This  $\mu\text{C}$  does the tasks of controlling and sending a pulse-width modulated signal depending on the measured temperature. The chosen method for heating the mechanical Eye model was using a small heating element inside the model. A sensor and a heating element were selected and a circuit for measurements and data analysis with the  $\mu\text{C}$  was designed, which was realized on a PCB. In order to increase the thermal conductivity within the eye model a metal plate was designed to fit inside the mechanical Eye Model.

## I. INTRODUCTION

Cataract is a clouding of the eye-lens that leads to a decrease in vision and even to blindness. A common treatment of cataract is replacing the clouded eye-lens with an artificial intraocular lens (IOL). These IOLs will be tested in a mechanical Eye Model, which was developed during the LOALis project. There is already a standard for testing IOLs, the ISO-11979-2, but the LOALis-model represents the human physiology better than the ISO-model.

## II. MATERIALS & METHODS

### A. Measurement circuit

For measuring the temperature with an accuracy of 0.1 K, a measurement circuit was designed, which is based around the AD7795[1], a high resolution 6-Channel, Low Noise, Low Power 16-Bit Sigma Delta ADC. A precise resistor with a tolerance of 0.05% was placed in series to the RTD. Four-terminal sensing was used to connect the precise resistor and the RTD with the AD7795. The AD7795 uses the voltage drop over the precise resistor as a reference for measuring the voltage drop over the RTD and therefore the need of a long-term stable current source is eliminated. This is called ratio-metric measurement technique.

### B. Control

The PIC24FJ64GB004 [2] 16-bit  $\mu\text{C}$  was used for communication with the AD7795 via SPI interface

and temperature control. The characteristics of a PID controller were implemented in C.

### C. PCB design

Eagle 7.4 was used to design the PCB according to the requirements of the circuit.

### D. Temperature sensor

For the temperature sensor for measurements inside the Eye Model a Pt100 platinum resistive temperature detector was chosen. Because of the asked accuracy a Pt100 within the tolerance class 1/3 DIN B was necessary.



**Figure 1:** The sensor (green part) and heating element (red part) placement on the designed stainless steel plate.

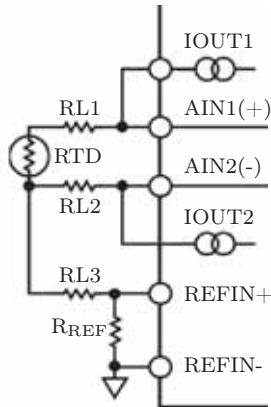
### E. Heating

A 20 W heating cartridge with  $\frac{1}{4}$  inch diameter and 1.5 inch length was selected. In order to make heating more efficient, a piece of stainless steel, which fits inside of the eye model and covers the bottom and sides, was designed. Additionally the sensor and heating element should be mounted on the designed part. The part was drawn using the PTC Creo software.

### III. RESULTS

#### A. Measurement circuit

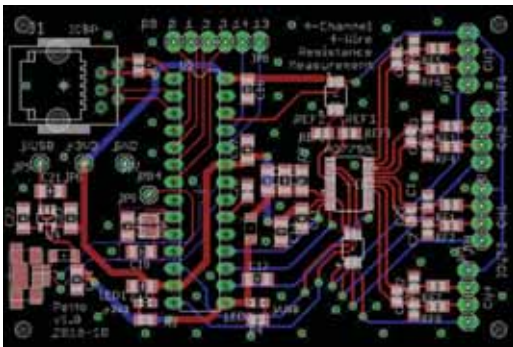
The four-terminal configuration of the AD7795 used for measuring the resistance of an RTD is shown in Figure 1. The resulting circuit provides four, low pass filtered measurement channels and the possibility to switch between two reference resistors.



**Figure 2:** The used configuration of the AD7795 for four-terminal measurement of an RTD, taken from [3].

#### B. PCB design

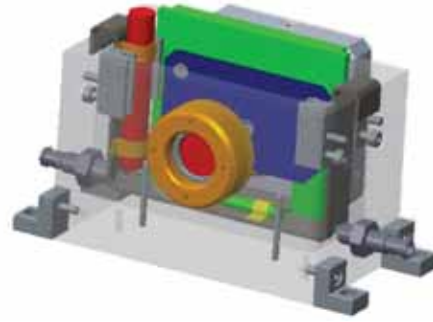
The PCB shown in Figure 2 was specifically designed for the AD7795 and the PIC24FJ64GB004. An ethernet bus for programming the  $\mu$ C and a micro USB bus for the power supply were built in.



**Figure 3:** The PCB designed for four-channel, four-terminal resistance measurements.

#### B. Heating

With its bent shape the designed heating plate shown in Figure 1 can be inserted in the model and hold in place without the need to screw it in. The temperature sensor (green part in Figure 1) and the heating element (red part in Figure 1) were attached on the heating plate.



**Figure 4:** The designed heating plate including the temperature sensor (green part) and the heating element (red part) positioned inside the eye model. In terms of better visibility the tilt/shift unit of the eye model was hidden.

### IV. DISCUSSION

#### A. Measurement circuit

Compared to conventional analog measurement circuits, the measurement method itself is a cheap way of measuring temperature with high accuracy, because a precise current source is not needed. The complexity of the final measurement circuit is small, because the AD7795 provides all the needed functions. Further tests will show whether the asked accuracy of 0.1K can be met.

#### A. Heating

The main challenge for the project was the lack of space inside the eye model. The mentioned placement of the sensor, the heating cartridge and the designed part leaves almost no space in between. This could be an issue if the additional part is slightly bigger than expected as it can interfere with the mechanics of the eye model.

### REFERENCES

- [1] Analog Devices. *AD7794/AD7795*. [online available] [http://www.analog.com/media/en/technical-documentation/data-sheets/AD7794\\_7795.pdf](http://www.analog.com/media/en/technical-documentation/data-sheets/AD7794_7795.pdf). December 21, 2015
- [2] Microchip Technology. *PIC24FJ64GB004 Family Data Sheet*. [online available] <http://ww1.microchip.com/downloads/en/DeviceDoc/39940d.pdf>. 2010. December 21, 2015
- [3] Analog Devices. *AD7792/AD7793*. [online available] [http://www.analog.com/media/en/technical-documentation/data-sheets/AD7792\\_7793.pdf](http://www.analog.com/media/en/technical-documentation/data-sheets/AD7792_7793.pdf) 2007. December 21, 2015



# Controllable Two Degree of Freedom for a Computer-Generated Hologram Projector

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*Abstract*— This paper reports an improvement of a rotating mini planetarium, where the hologram system is already given. Our stepper motors, which are working with 2.8 V and 1.33 A, are supposed to simulate a so called *platonian year*, which is around 25800 years, and the day-night cycle. The main goal of this project is to develop a stable construction, which is able to rotate and contain the electronic devices. Additionally the temperature inside the dome on the construction has to be measured in order to prevent possible overheating due to the laser. The main challenges in this projects are to find a stable construction allowing us to attach two  $\mu$ C-board, two stepper motors and a temperature sensor without impairing the rotation of the plate and to solve the energy supply problem within a rotating plate.

## I. INTRODUCTION

The objective of this project is to build a stepper motor driven construction, which consists of big plate simulating the so called *platonian year* and laser simulating the day night cycle. The big plate has to complete a full rotation in a certain period of time, which is around two weeks.[1]

Another requirement is that users should be able to set their own date for the hologram projector. In order to provide this functionality and represent the starlit sky at that date. The body of the construction needs to be very stable, but also light. Therefore it was decided that the best choice would be Plexiglas.

Accuracy is another goal of this project as the plan is to reach a minimum precision of 70 years. Therefore stepper motors with a high number of steps per revolution were the preferred choice. The benefits of them are the discrete steps as we can define every single step in any direction. Additionally, the stepper motors are not swinging, which is relevant for this project. If there was any noticeable swinging the moros might lose steps and the accuracy criteria would not be fulfilled.

The chosen stepper motors have a step range of  $0.19^\circ$ , which equals 400 steps per revolution and is the minimum of the product line. Stepper motor drivers are utilized to amplify the output current of both Arduino boards, which allows us to reach required current to power the motors without any further self-made hardware.

A big obstacle is the implementation of the power supply for both the laser and the stepper motor

driving it. Conventional wiring is not an option due to the fact that the construction is in motion and the wires would twist and break eventually. Currently, an inductive power supply is the preferred solution.

## II. MATERIALS & METHODS

### A. Construction & Placement

For the final construction Plexiglas was chosen, because it is light and stable.

A bevel gear is used to transform the power from the stepper motor to the optical element. It was chosen because of its low space requirements and its good energy transfer. A 1:1 proportion is given. The second engine is placed on the ground plate. A gearing is used to gain a high resolution and decrease the degree per step. The accuracy is improving by 2500.

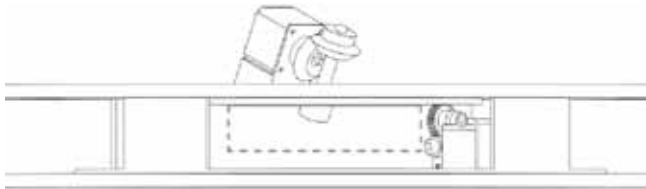
The whole plate will rotate on a rail system from a model railway.

### B. Software

The code for the motor control was written in C++ utilizing the Arduino (IDE) Integrated Development Environment and the integrated libraries. The goal to enable speed (steps-per-minute) control was accomplished but refining and user-friendly design are still required. Being able to set a certain date which is then displayed and a proper zeroing techniques are planned but not finished yet.

Initial plans to only use a single Arduino Uno for the control of both motors and the temperature sensor were discarded due to the fact that one Arduino

Uno is only able to control one (4-wire) stepper motor independently at the same time. A possible alternative to having basically the same code run on two Arduinos would have been to implement an alternating control. However, the latter solution was ditched owing to implementation difficulties.



**Figure 1:** Construction without dome, both stepper motors (on top of the plate and under the plate) and planned lowered center (dotted lines) are seen.

### C. Motors

The motors utilized in order to drive both the big plate (platic year) and the laser (day night cycle) are 4-wire bipolar stepper motors requiring 2.8 V and 1.33 A and 400 steps per revolution. They were chosen based on their high number of steps per revolution and relatively low wattage compared to similarly priced stepper motors.

The L293D stepper motor driver was used to supply the required current. It was planned to power them using a dedicated power supply due to the fact that the Arduino Uno was expected to not be able to properly power both motors at the same time. This plan was discarded following the first tests.

These tests showed that both stepper motors could be powered by the Arduino, which itself was powered by a USB connection. The only real problem with the stepper motors was the dropping of steps, which was quickly identified to be the fault of a damaged wire.

### D. Inductive Energy Transfer

To improve the systems quality the power supply for the components on the rotating plate is done via inductivity.

Coils are the best way to get the power from a static object onto a rotating one. Two coils are needed, one for the transmitter and another one for the receiver. The transmitter coil is positioned in the middle of the ground plate. The other one is placed on the bottom side of the rotating object.

As circuitry a royer converter [2] is used to get the coils running. Two transistors are driven in push

and pull mode and constantly charging one side of the coil. The circuit is self-oscillating which means the circuitry is always oscillating in ideal reverberation.

Our project uses a 24  $\mu\text{F}$  transmitter- and a 5.4  $\mu\text{F}$  receiver coil. By usage of 12 V DC input voltage the circuit offers 2 V and 1 A for driving components on the rotating plate (only a weak stepper motor in this case)

## III. RESULTS

The motor control is working as intended but still requires the date input and zeroing method. The power draw of both the motors and the associated possible requirement of an independent power supply for them was a concern initially but has been resolved. No real results have been gathered yet for the plate construction as it still needs to be assembled. However, further development was done in order to optimize it and provide more space inside the construction for the circuitry. The inductive energy transfer still needs to be built and tested as well.

## IV. DISCUSSION

The tests of the motor control yielded satisfying results. The plate was lowered at the center which provides a lot of space for the motor and the pipe. The energy supply problem was resolved and the circuitry for the inductive energy transfer is ready to be built and tested. Due to inductive coupling no wires will twist (or even be needed for the energy supply). The circuit board for the temperature sensor was produced but still needs to be fitted with components.

Further development will include the assembly of the construction and the finalization of a transmission, which will allow an accuracy of half a month. In comparison, the goal is to reach around 70 years. Additionally, the signals for the motors might be forwarded via optical signals. An option here would be an optical coupler. However, further research is still necessary.

## REFERENCES

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- [2] Mikrocontroller.net. *Royer Converter*. [online available] [http://www.mikrocontroller.net/articles/Royer\\_Converter](http://www.mikrocontroller.net/articles/Royer_Converter), December 20, 2015

# Generating CDA Documents Using eCard Services

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**Abstract**— eCard services have become an integral part of the Austrian healthcare system. With the electronic health record ELGA currently being rolled out, the combination of eCard and ELGA CDA technologies will be highly demanded. In this project we developed a client application that utilizes eCard services for the creation of a template ELGA report in CDA Version 2 format. The program was developed in C# and with help from the official eCard and ELGA CDA guidelines. The implementation of the eCard services was highly successful. Due to limitations, the guidelines for Level 2 CDA documents were not fully implemented. The program should be further developed to fulfil the CDA requirements.

## I. INTRODUCTION

The eCard has been used successfully for more than 10 years [1] as personal key to the electronic healthcare system. The next step is to implement an electronic health record, the ELGA, which is used in some parts of Austria since the 9th of December 2015.

As a result, patients will be able to view and manage their medical record online. ELGA uses the Clinical Document Architecture (CDA) standard as a core standard for the exchange and storage of medical data. Therefore, the technical combination of the eCard services with CDA documents will be of great demand in the close future.

This project issues the creation and management of CDA documents utilizing the eCard environment to automatically insert relevant patient data.

## II. MATERIALS & METHODS

### A. Hardware

The main client software can be run on any personal computer running a Windows operating system supporting the .NET framework. The client must be connected to a local network that a GINA box is connected to. The GINA box manages the connection to the *Gesundheits Informations Netz* (GIN). To read information from an eCard a card reader built by Kapsch AG is used.

### B. Software

The software was developed in C# using Microsoft Visual Studio as IDE. The eCard Simple Object Access Protocol (SOAP) services were retrieved from the GINA box via a Web Services Description Language (WSDL) URL. The services were implemented according to the official guidelines available at [2].

After a dialog with the GINA box was created, it was possible to read the data from any eCard inserted into a card reader. The resulting card object contains all data stored on the card and can be used for dialog authentication (in case it is an *O* card) or further processing. As soon as a dialog is open, its ID is logged in a file. When the application is closed, the file is read and the dialogs referenced by the IDs are properly closed. This way, the persisting of open dialogs after the applications crashes is avoided.

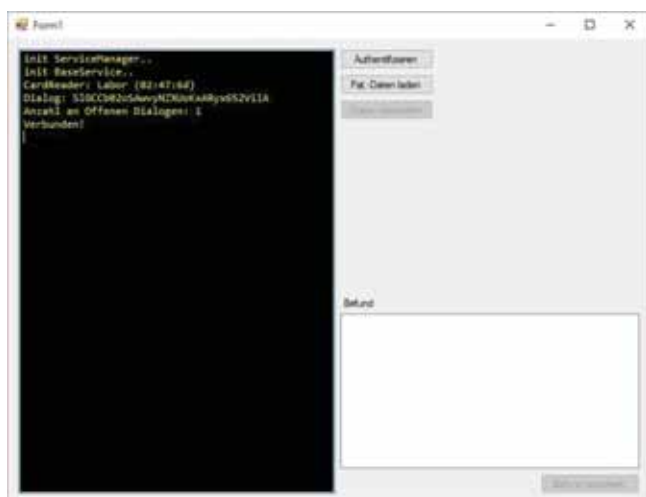
The patient information was then used to create a CDA document template. The document's XML structure follows the ELGA guidelines available at [3]. Additional report data may be entered by the user (i.e. medical professional).

## III. RESULTS

The implementation of the SOAP services works highly successful. Possible SOAP exceptions that may occur due to a network error or wrong handling by the user are caught and presented human readable to the user in a text field (Figure 1).

To test the reliability of the software developed in the scope of this project multiple scenarios of bad human handling were simulated. Different (*wrong*) cards were used for authenticating the GIN dialog and card data was requested with no card inserted into the card reader.

It turned out that the software worked highly reliable. Under no circumstances the program crashed. All SOAP errors were understandably displayed in the status log field (See Figure 1). Since it is part of the software design that control buttons are only enabled if the respective action would make sense at the current state of the dialog. Therefore, the possibilities for bad user input via the GUI are actually very limited.



**Figure 1:** User interface. Left side: Status log. Right side: Control buttons and text field for custom report text.

The mechanic that was implemented to close existing dialogs when the application is closed worked, although it should be mentioned that it was only tested with open dialogs that persisted after a forced crash. The application did not crash under normal use, so the mechanic was not actually needed.

Due to time limitations, the requirements for CDA Level 2 documents were not fully implemented. Nevertheless, the generated XML files are W3C [4] conform and can be accurately displayed in a common web browser.

#### IV. DISCUSSION

The comprehensive documentation and the WSDL

service encourages a short development effort. Especially the generated flow charts give a good overview about what is necessary to implement specific processes (e.g. functions of the base service). A major problem of the project was to get helpful information from caught exceptions. After some debugging it was discovered, that the type of the exception is `System.Web.Services.Protocols.SoapException` and a helpful description of the error is stored in `SoapException.Detail.InnerText`.

Without any further help except the ELGA guidelines the effort to generate a CDA Level 2 conform XML file is very high. Future projects should use additional help in from of external resources (e.g. libraries or frameworks) to simplify the generation process to achieve more advanced results.

Further steps are necessary to expand the project to more comprehensive software like it is necessary for medical professionals. To generate CDA Level 3 documents and to connect the software with the parallel project *CDA-Reader* could be the next steps to achieve this vision.

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- [2] Sozialversicherungs-Chipkarten Betriebs- und Errichtungsgesellschaft m.b.H. *Technische Informationen*. [online available] <http://www.chipkarte.at/portal27/portal/ecardportal/content/contentWindow?contentid=10007.678631&action=2&viewmode=content>. December 18, 2015.
- [3] ELGA GmbH. *Technische ELGA-Leitfäden*. [online available] <http://www.elga.gv.at/technischer-hintergrund/technische-elga-leitfaeden/>. December 18, 2015
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## CDA–Reader

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*Abstract*— Since Western health care systems will face a demographic shift towards more elderly and inactive citizens, new solutions to increase cost efficiency are needed. The Austrian electronic health record *ELGA* is a first step towards a faster and less expensive system, enabling health care professionals and citizens to share medical data stored as CDAs. This project combines two domains namely CDAs as used in *ELGA* and the Austrian eCard. A new service for the eCard was programmed enabling the user to retrieve blood lab report values from CDAs with a matching social insurance number of a given eCard. The implementation was guided through the javadoc implementation flow chart provided by Sozialversicherungs–Chipkarten Betriebs- und Errichtungsgesellschaft m.b.H. – SVC. The service was successfully implemented with Microsoft Visual Studio (C#) and displayed blood lab reports correctly.

---

### I. INTRODUCTION

Widespread chronic diseases such as Diabetes Mellitus Type 2 are challenging today's and future healthcare systems. Such diseases occurring predominantly in Western civilizations are economically stressing today's healthcare systems, forcing them to focus on future cost reduction and improvement of effectivity.

Electronic health records like *ELGA* are believed to help to face this challenge by improving data availability to increase treatment efficiency.

To communicate medical data *ELGA* uses the *Clinical Document Architecture* (CDA) format as defined by HL7. The aim is to improve interoperability of shared data between health care professionals.

The goal of our project is to create a new service for the Austrian eCard system combining two domains both the eCard and CDA documents, as found in the electronic health record. We chose to identify patients by their social insurance number as stored on the eCard and find matching blood lab report CDAs as provided by *ELGA GmbH*. [1]

### II. MATERIALS & METHODS

#### A. Hardware

The Austrian eCard is a secure key- and signature card, enabling its owner to identify him-/herself to the Austrian health care system. The card stores the following data:

- Social insurance number
- Date of birth
- Title, First Name, Last Name, Postnomen
- Sex
- Personal identification number
- Card identifier number
- Date of expiration
- The card stores patient identification data, e.g. name, patient ID and insurance number, date of birth.

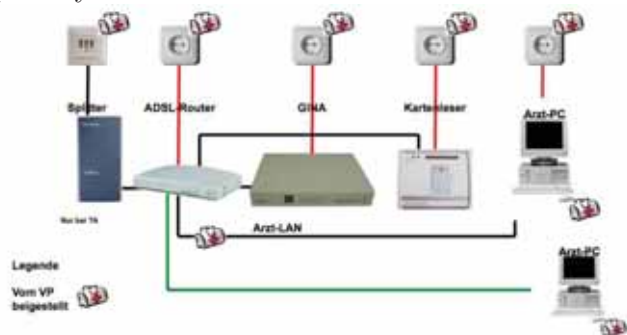
The *GINA–Box* provides the connection to the health information network (GIN) and its services.

Authorized card readers provided by *Kapsch AG* are used to retrieve the data stored on the card's chip.

For our project we exclusively used sample eCards and the testing environment as provided



by UAS Technikum Vienna to ensure that no privacy is violated.

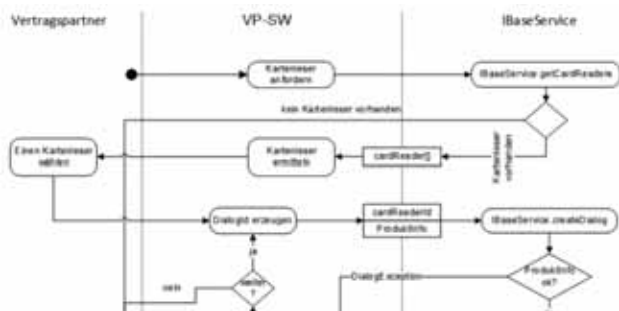


**Figure 1:** GINA and Cardreader Setup Example [2]

### B. Software

We used Microsoft Visual Studio Professional 2013 as the development platform. The code was written in C#. The implementation guidelines for CDA documents are provided by ELGA GmbH. [1]

Guidelines and flow charts for implementing eCard services are provided in the Javadoc interface descriptions (version: 15.1.3.28) published in April 2015 Results. The PDF Extractor SDK [4] was used to parse pdf documents.



**Figure 2:** Excerpt of the implementing flow chart. [2]

### C. Methods

As described in *GINA\_FHTW\_Intro.doc*, provided by UAS Technikum Vienna, Web References to eCard services were created. To access the card reader the corresponding guideline provided by the Javadoc was followed.

Following the detailed flowchart step by step we created all necessary methods and results starting with the Baseservice. After selecting the card reader we were able to retrieve the card data stored on the card's chip.

In order to retrieve data from the CDA docu-

ments a XML parser was used, reading the tags of interest.

## III. RESULTS

Opening a GUI interface the user needs to select a folder where personal CDA documents are stored. In a second step the connection to the eCard reader is triggered, retrieving the social insurance number (SIN). Once the matching SIN is found in the CDA documents, the user can select a specific document to display its blood lab report data.

## IV. DISCUSSION

During the project major management changes occurred at the external partner. The project was therefore re-focused to a technology feasibility study in the lab. Patient ID data was successfully retrieved from the eCard. This was successfully used to select specific clinical documents from sets of test XML and PDF files. Further work should explore more detailed and structured data extraction and requirements for clinical use.[3]

Following the detailed flow chart, it was easy to retrieve the card's data. We didn't need to build up a dialog with the eCard system in order to read the data stored on the eCard. Consequently, we were not able to validate if the plugged in card is a valid eCard. However, for our test set up this was not necessary.

Since CDA documents are XML files, we could easily retrieve their stored date with an XML parser, again following the detailed description as provided by elga.gv.at [3]

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## Gathering permitted services from o-card

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*Abstract*— With the launch of ELGA in Austria a need for new software incorporating it is needed. Therefore this paper focuses on the administration, especially on permissions and services. For this software was written in order to establish a dialog between the card reader and the program. With this, all necessary information, such as office address, medical fields and service permissions were gathered and displayed. These permissions are only available as abbreviations, which have to be looked up individually. For easier use a list containing abbreviation and description would be needed.

---

### I. INTRODUCTION

The application of the e-card improves and automates the Austrian health system. It electronically helps to administer the Austrian insurance system.

After working on requiring and analyzing data in the first semester we wanted to focus on administering such data using the e-card system. We wanted to take a look at the e-card and the different permissions certain doctors have and which additional information we could gather from the e-card.

The aim of the project was to be able connect with the GINA-Box which is located in the laboratory of FH Technikum Wien. The goal was to extract the available services after inserting the o-card into the e-card reader.

### II. MATERIALS & METHODS

To connect with the GINA-Box it was necessary to install a VPN Client to ensure a safe communication and to prevent unauthorized access. The information about the e-card implementation and the methods were taken from the documentation found at [1]. The first step was to integrate all necessary libraries using web references. The libraries servicemanager, baseservice and kseservice were used. To establish a connection between the card reader and the program flowchart, in the documentation, was used as a guideline for implementation. With

the method `getCardReaders` from the `baseservice` all available card readers connected to the GINABox were stored in an object from the `cardReader` class. With the `cardReader` id and FH Technikum Wien specific product information a dialog with this card reader was created using the `createDialog` method. This method returned the dialog id in a string.

The next step was to authenticate the set up dialog. For this the method `authenticateDialog` was used. The method needed the dialog id, a password and the card reader id. `authenticateDialog` returned a `vertragspartnerV2` object, which was used to extract an array of ordination objects. The ordination objects contain for example the address and an id. They also contain the field of use for this card, whether it is used in a pharmacy, doctors office or hospital. These fields of use also have a specific id. This id in combination with the ordination id and the dialog id were used to set the dialog address using the method `setDialogAddress`. This was necessary for the use of the method `getBerechtigungen`, with the argument of the dialog id, to receive all permissions the o-card has. They were received in a sting array.

In the next step the method `getFachgebieteByOrdId` was used to receive the medical fields of the doctor. In addition the method `getKonsultationsdaten` was used to search for previous consultations.

In the last step all gathered information were displayed to the user.

This program was tested on 4 different e-cards.

### III. RESULTS

```

Ordnationsadresse:
ARZTSOFTWAREHERSTELLERSTR 1 WIEN 1030

Berechtigungen :
ABS.CORE
ABS.REZEPTUR
AUM.CORE
BASE.CORE
BKF.CORE
BKF.LA.ABFRAGE
DAS.CORE
DBAS.CORE
DBAS.QZK
DMP.CORE
EBS.ANTRAG
EBS.CORE
EBS.UEBERNAHME
ELGAD.CORE
ELGATSU.CORE
KSE.CORE
KSE.FULL
PROP.CORE
SAS.CORE
SIS.CORE
TSU.CORE
UDAS.CORE

Tätigkeitsbereiche :
Arzt

Fachgebiete :
Allgemeinmediziner
Frauenheilkunde und Geburtshilfe
Radiologie

```

**Figure 1:** Programm output containing address, permissions, field of use and medical field. [2]

The program output as shown in Figure 1 contains the address of the card reader, the abbreviations of the permitted services, the field of use and the medical fields.

All four o-cards displayed different addresses. Two of the cards had 23 permissions, one 24 and another one 21. The field of use in all cases was doctor. The medical fields were either Allgemeinmediziner or Innere Medizin only in three cases. Only the card as shown in Figure 1 has three medical fields: Allgemeinmediziner, Frauenheilkunde und Geburtshilfe and Radiologie.

### IV. DISCUSSION

The aim was to connect with the GINA-Box, create a dialog and get all available services. At first the connection with VPN stated with some difficulties, especial with a Mac computer. After a week of consulting the service desk at the FH Technikum Wien and Internet research the VPN and the connection to the GINA-Box worked.

The documentation in general is very detailed and useful for implementing. However the inconsistency in capitalization is slightly confusing. Some methods and classes in the documentation are written with a capital letter which are, when implemented, written with a lower case letter.

There is no list that contains information about the services we received. Every abbreviation has to be looked up individually in the Java.doc documentation to find detailed information and documentation about the service.

One important thing is to always close the dialog when closing the program in order not to crowd up the GINA-Box.

### REFERENCES

[1] SVC GmbH. *R15b: Schnittstellenbeschreibung - VPSWH (10.1 MB)*. SVC GmbH · Wien, Österreich [online available] <http://www.chipkarte.at/portal27/portal/ecardportal/content/contentWindow?contentid=10007.678631&action=2&viewmode=content>. December 18, 2015.



## **Contributions**

# **Master Biomedical Engineering Sciences**



# Operating table- Analysing a light control system developed to provide consistent lighting

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**Abstract**— Changing out the traditional bulbs in interior and exterior fixtures to light emitting diodes (LEDs) is simply because of saving the overall costs and minimized need for replacement bulbs. However, when it comes to a medical setting, it makes sense to promote systems in many specific fields like surgery in order to have proper and consistent lighting system.[1] This project research is based on a smart lighting equipment called operating table including Philips Hue lighting system which is controlled by a software named LightControl existing in FH Technikum Wien laboratory.[2] It is expected that once completed, this system might prove to serve as a valuable learning tool in adaptive lighting control. Furthermore, in medical purposes this system gives the surgeon the ability of feature adaptive control of intensity and light colour according to his preferences.[3]

## I. INTRODUCTION

Proper and consistent lighting is important to certain fields of work to achieve their peak of efficacy, such field is that of surgery, ensuring the surgeons ability to adequately assess the operating field. Surgery must be well lit for the surgeon. Even a small mistake could result in a serious problem.[4] At the same time, recent studies show how access to open daylight can have an enormous positive effect on surgical staff morale.

The main reasons for using LED lights in surgery center like low heat generation, bright white lighting, versatility, efficiency, reliability, lower maintenance and advanced dimming have led to more convenient lighting environment for the surgery.[1] Therefore companies have started developing adaptive solutions to promote medical devices specifically in the field of surgery.

## II. MATERIALS & METHODS

### A. Hardware

The hardware used in this analysing project is called *Operating Table*. It is a device consisting of Phillips Hue lighting sources controlled by a colour sensor and arduino board created by a student team in FH Technikum Wien.[2]



**Figure 1:** Operating Table with the possibility to be connected to the pc for communication with the LightControl software.

### B. Software

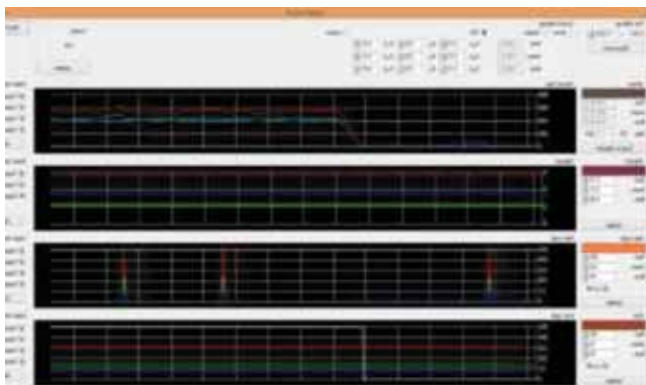
Software used in this task is called *LightControl*. It is a measurement system programmed in *Arduino 1.6.3* by Raphael Siebenhofer as a bachelor thesis for reducing Possible space for a graph or illustration of the project's content ambient light influence on worksite illumination by controlling light sources from an embedded sensor application and compatible with the hardware *operating table*. [2] The system was analysed to find out proper functionality of the device with the convenient values set for the lights on the

software and to test and ensure its ability to avoid the disturbing lights existing in the environment. The measurements were done for the two control settings considered by the software called simple settings and PID settings, testing in different situations with or without disturbing light in the environment. Different primary and mixed colour lights were applied based on main colours of Red, Blue and Green. The measurements were analysed by exporting data in Excel sheets and explanation of the related graphs presenting the main colours oscillations in specific time durations.

### III. RESULTS

The analysis was done for both simple and PID settings in many different measurements for basic (blue, green and red) and mixed (e.g. pink, orange, brown, violet etc) colors in all different ranges of gain ( $1\times$ ,  $4\times$ ,  $16\times$ ,  $60\times$ ). A lot of time was investigated for the analysis of primary colors, as the basis of all other colors in order to firstly assure that the pure basic colors have consistent results on both software and hardware. Then the influence of simulated mixed colors, especially predominant colors on the device was tested, resulting different fluctuations in the graphs.

As an example, Figure 2 demonstrates the result using mixed color (orange) in the presence of both main and error lights (gain  $60\times$ ) regarding the LightControl software.



**Figure 2:** LightControl software using PID control settings.

In this case, the main light blinks for a short period of time as it was possible to observe on the operating table (hardware) in order to reach the maximum RGB values set in the system. In fact, the sensor measures the error light considering also the main light just when it blinks. Furthermore, exportation of data into excel sheets was an essential tool to perform a more detailed analysis.

### III. DISCUSSION

The results from the analysis of LightControl software and the operating table allows to evaluate simple control settings performance as positive concerning primary and mixed colors since there is almost a good balance between fast color changes on the device with stable oscillations in the light control system. The result from the analysis of PID control system which is a more accurate and reliable method, is not indicating of such a perfect balance. In high gains for the mixed colors, the software did not respond as expected so still needs more optimizations to reach to a good balance between the device and the software. As a light control system, it still needs more experiments and improvements to be enough reliable for medical purposes. From the usability aspects, the way how to update data for the control settings could be changed since by changing gains a considerable time is required to reset a proper scale for measurements.

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- [3] Trumpf Medical. *iLED7 Surgical Light: The world in a new light*. [online available] <https://www.trumpfmedical.com/en/products/surgical-lights/iled-7/>. December 21, 2015.
- [4] LUX Live. *design-clinic: Three ways to light a doctor's surgery*. LUX Live company. 2015. [online available] <http://luxreview.com/designclinic/2015/05/three-ways-to-light-a-doctor-surgery>. January 10, 2016.

# Educational System for Selective LASER Sintering

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**Abstract**— Selective LASER Sintering (SLS) is an additive manufacturing process. The technology shows great promise as far as component stability and its broad range of usable materials are concerned. Although there are a variety of commercially available devices for SLS the influence of different process parameters is poorly studied. Therefore the project aims at creating an operational SLS device which can be utilized for educational purposes. This is achieved by modifying a commercial laser cutter and adapting it to function as a SLS working environment.

## I. INTRODUCTION

Selective LASER Sintering (SLS), so far mainly used in the field of rapid prototyping, is poorly studied when it comes to the influence of different process parameters on mechanical work piece properties. Laboratory experiments have to be implemented addressing further optimization. Since commercial machines are limited in their usability for these kinds of studies the aim of the project is to develop a device enabling basic experiments for SLS. As shown in the OpenSLS project a LASER cutter can efficiently be modified to a SLS machine.[1] Therefore an Epilog Mini 24 50 W LASER cutter[2] is adopted in a way to provide a functioning LASER sintering environment. At the end of the first stage of the project it should be possible to sinter a single layer of preheated, powdered material on a custom made construction housed in the Epilog Mini 24.

## II. MATERIALS & METHODS

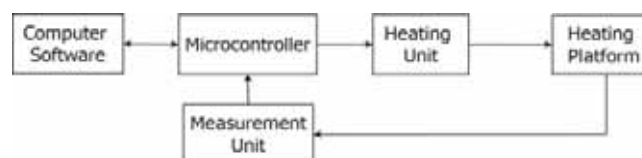
### A. Hardware

The powdered material is preheated by two PTC elements.[3] To stabilize preheating at a temperature near the melting point of the powdered material, the PTC elements are controlled by Pulse Width Modulation (PWM) through high power Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFET). Four Negative

Temperature Coefficient (NTC) thermistors are implemented which make it possible to measure the temperature and run a control loop via microcontroller. The sensors are placed in drill holes in a removable aluminum plate also housing the single layer of sinter powder on top of a six millimeter powder bed. Due to the materials good thermal properties another aluminum plate is holding the heating units. This construction can be leveled with the LASER cutter's working plane and is mounted on a wooden platform. To ensure a sufficient design a 3D CAD model is constructed and a thermal analysis is conducted.

### B. Software

In order to set up and monitor the preheating temperature, a software application communicates with an electronic circuit. The concept for the control loop is shown in figure 1.



**Figure 1:** Concept of the preheating system.

## III. RESULTS

Besides the technical drawings for non-standardised parts like the two aluminum plates, the wooden platform and the aluminum

sleeves connecting them the assembly model seen in figure 2 represents the results of the design and construction process as far as hardware components are concerned.

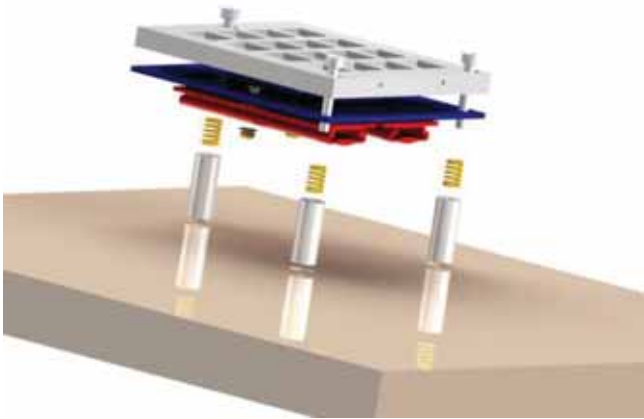


Figure 2: Assembly model of the preheating platform.

The graphical user interface of the developed computer software can be seen in figure 3. The software is capable of setting the heating temperature as well as switching on and off the four sensors individually. Furthermore, the measurement of each sensor and the total average is listed. Additionally, the temperature behavior is displayed graphically in a second tab. The prototype for the electronics of the preheating system shown in figure 4 includes all necessary components for the heating and monitoring process.

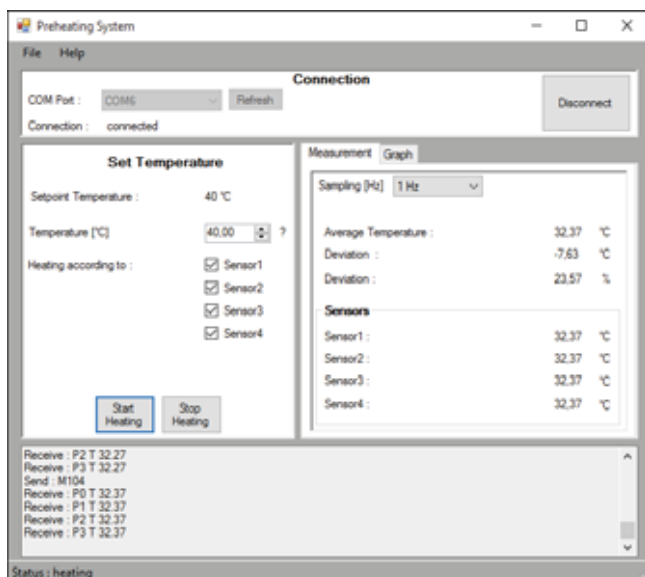


Figure 3: Preheating software solution.

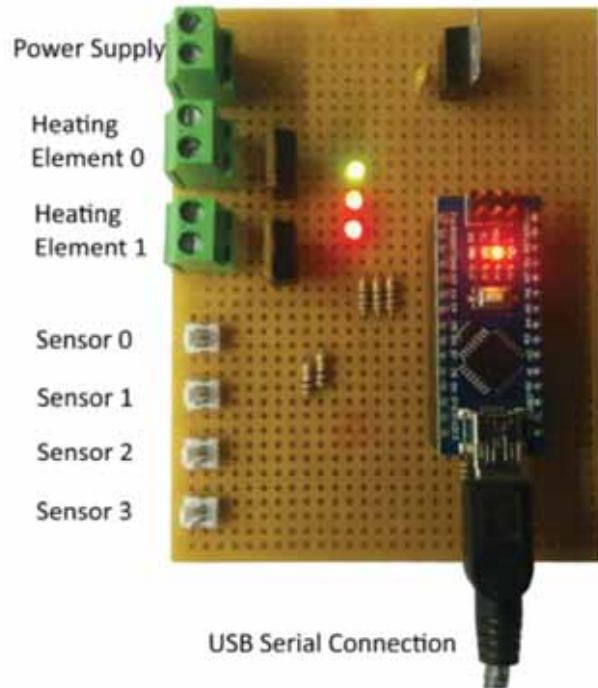


Figure 4: Preheating prototype.

### III. DISCUSSION

At this stage of the project the design of the preheating platform has been approved and manufacturing non-standardised parts is to be initiated. Preheating electronics and software have been tested in simulated conditions and real-time tests will be carried out once the platform is completely assembled.

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# Mobile Decision Support for App Development

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**Abstract**— The necessity of a development-aid for the extraordinary range of mobile health applications has risen to exigency. A database collecting influences, affected areas and hidden implications beyond the scope of common development mechanisms is to be implemented along with a maintenance and querying framework to help developers in creating better mobile health applications, better connecting particular features and use cases to the intended users.

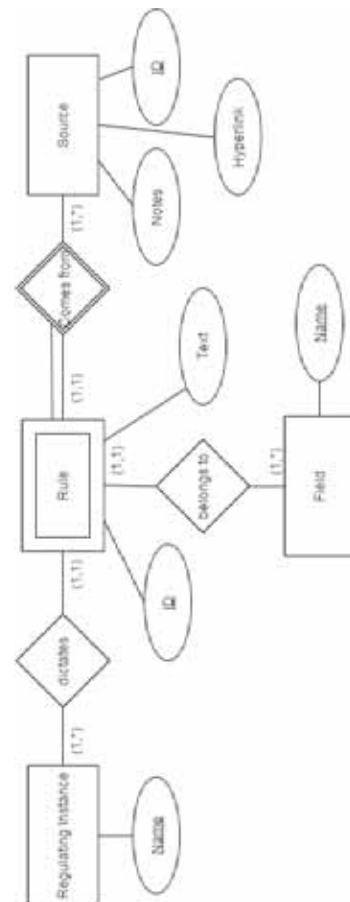
## I. INTRODUCTION

A plethora of mobile applications for health and medical fields is emerging on a daily basis. Recent attempts to get a grip on quality control through post-production assessment have failed spectacularly.[1] Developers[2], Researchers[3] and market experts[4] demand a structure to aid development independently of one another. Due to the sprawling amount of involved parties and interests, a database will be implemented to hold information to better guide developers creating health or medical applications.

## II. MATERIALS & METHODS

Initial literature research comprising various sources to uncover origins of influences on health-related mobile apps is conducted. Contemporary unscientific sources are included to stay updated on progress of the unfolding matter. Scientific journal articles/literature are examined to uncover sources of influence and rules concerning requirements and necessary features/implementations for mobile medical applications. Alongside, sources about the influences are analyzed to retrieve specific information about the form of control held upon medical apps. The information acquired is transformed into an online infrastructure for information sharing in an online spreadsheet, an archetypical database format, which is accessible to all team members in order to append

sources and rules as they are found. The structure is used to review data and structure it according to a logical database model. This model is developed with the aid of a general database development guideline used at universities, which has been retrieved and followed to ensure thorough database development.[5]

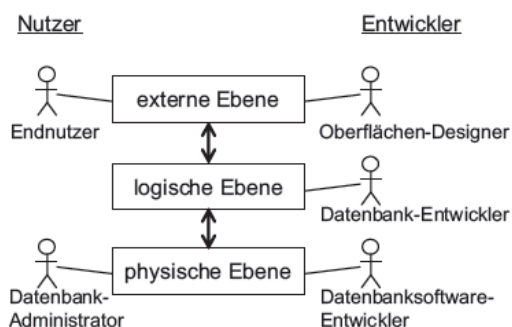


**Figure 1:** Logical database design – entityrelationship diagram of the database prototype.

Diverse online-tutorials and application development literature are analyzed to predictively safeguard interoperability between single components and their environment. Medical application development and best practice guideline topics are closely linked, ergo total separation of work is only feasible after the initial database implementation.

### III. RESULTS

A prototype of a logical database model has been developed. Said model provides basic structure for implementation following steps of unit development and use. An initial set of data is retrieved, formatted according to the structure of the database, and inserted into the online infrastructure. Two influential legislative directives for different realms including extensive partitioning guidelines have been identified and are required to be included in database as well as querying application.[6,7] The technical ISO/IEC-standard 62304 is scrutinized, due to its applicability for all medical software, a parent class of mobile applications. It contains information which is not only to be included in the database but also employable in the development process. The database development has terminated the theoretical phase with the finalisation of a logical database model and is advancing into a physical development process.



**Figure 2:** User and developer database roles, with logical, physical, and external/application layers.

### III. DISCUSSION

The online infrastructure implemented is an intermediate transition point to transform information content into data units. Information is at risk of getting lost while undergoing changes specific to database management system, so the population phase will come once the system is set in place. Following a top-down development process, dividing modules into sub-units is time consuming but necessary to anticipate possible flaws endangering the projects progress. A concatenated development process[5] might have to be abandoned for expeditious results at the risk of interoperability issues.

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## Development of a Set of Respiration Values and Comparison to a Porcine Lung Simulator

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**Abstract**— To provide a model that simulates human lung functioning in a reliable way could significantly reduce the number of laboratory animals needed for research purposes. This can be rendered possible by investing and improving the accuracy of a latex-based human breathing simulator.

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### I. INTRODUCTION

The project is centered on a breathing simulator, the i-Lung model.[1] Its accuracy will be investigated in order to conclude whether it is a reliable human-breathing emulator. By collecting significant data on breathing patterns, through spirometry tests, the aim is to identify the key parameters of a successful and reliable respiratory process. A successful result will lead to the emulation of a breathing process using a latex bag. Subsequently, the aim is to substitute the latex bag with a treated porcine lung and allow the i-Lung model to keep the tissue alive by performing an artificial respiration.

### II. MATERIALS & METHODS

#### A. Hardware

The i-Lung model (See Figure 1) allows the simulation of respiration using a latex bag and also the detection of in- and exhaled particles during the same process. Simulating spontaneous breathing can be useful for the investigation of physiological and pathological conditions. However, one of the limitations of this model is the fact that it is not capable of emulating forced breathing patterns (i.e. inhalation and exhalation at maximum lung capacity are not possible). In order to function, the i-Lung model has a PC control embedded in it. The purpose of this device is to manipulate the breathing process of the lung equivalent and collect the data generated. Furthermore, the testing equipment has been designed in a way to

allow flexibility for what regards the measurement purposes, and hence its energy supply depends solely from a socket.[1]



**Figure 1:** Representation of the i-Lung model. (1) PMMA chamber, (2) Latex bag, (3) piston system enabling the pressure variation within the chamber, (4) movable setup.

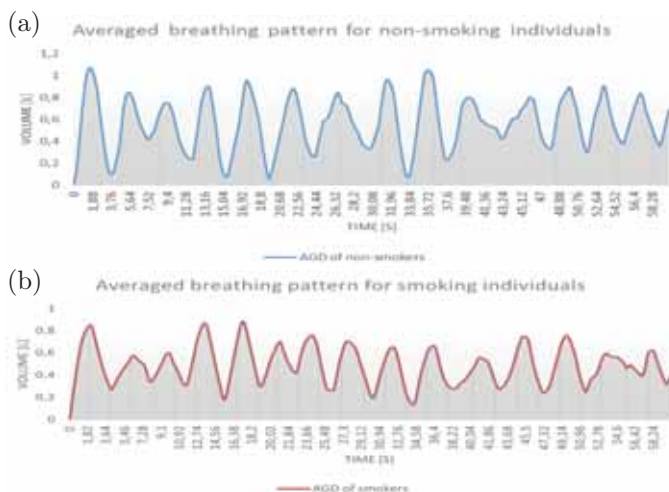
#### B. Software

The software used to conduct the spirometry tests and collect the respective data is Thor-Soft. The software allows the evaluation of nu-

merous breathing exercises, testing the breathing organ under different conditions (e.g. FVC, VC, MVV). Also, it is possible to save the patient's personal data. This is a crucial point since parameters such as weight, height and age influence the exercise evaluation by a high degree.

### III. RESULTS

In order to collect the respiratory data necessary, normal human breathing patterns had to be assessed. Using ThorSoft, in specific, the vital capacity (VC) testing mode, the breathing patterns needed were obtained. The reason for choosing the VC testing mode is mainly its duration, in fact this test requires 60 seconds, this means that a significant amount of data can be collected. However, the actual purpose of the exercise has been altered in order to adapt it to the project's needs. Instead of taking few normal breaths and one forced maximal inhalation followed by a forced maximal exhalation, only normal breathing has been recorded.



**Figure 2:** (a) Averaged breathing pattern of the non-smokers group, (b) averaged breathing pattern of the smoking group.

With the aim to compare the collected data between individuals with the same characteristics,

the volunteers were divided into two groups: non-smokers and smokers. Subsequently, the data of each group was collected, the best breathing patterns of each individual were selected and then the entire set of data was averaged. The results of each group are represented in Figure 2 (a), (b).

### III. DISCUSSION

The plots provided illustrate that there is a clear difference in active lung volumina between the two groups. The average lung volume involved during normal breathing is lower for the individuals with smoking habits. However, an effective distinction between the two is highlighted when performing exercise that require a maximal inhalation and the respective exhalation.

Having this collection of data, it is now possible to impose these parameters, or simply confront them with the breathing patterns delivered by the i-Lung module whose function is based on the latex bag. Nevertheless, in order to render this a more reliable study, in future more volunteers could be gathered and the same spirometry exercises could be conducted. This would increase the amount of data available for the study and would provide a more stable basis for possible conclusions and observations.

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## Hospital at Home

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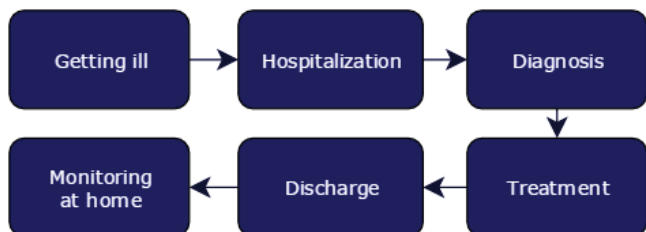
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**Abstract**— Hospitals usually mean the place when we can gain back our health. On the other hand nobody wants to spend longer time at these healthcare institutes, when it is not necessary. We should also mention the risk of severe infections in hospitals. Furthermore it is more economical to discharge treated patients as early as possible. solution can be using a sufficient monitoring system at home. Mobile monitoring devices which can be used by patients themselves at home are already available. Therefore we would like to implement a software which can ensure a reliable, standard-based data transmission between the mobile monitoring devices and smartphones and provide a further transmission to the server of a telemedicine center in a relevant hospital.

### I. INTRODUCTION

Monitoring patients after discharge is fundamental in order to minimize the risk of re-hospitalization. In our century all the necessary equipment is available on the market to make this as a routine process after certain diseases like hyperglycemia, anaphylactic shock, salmonellosis or appendicitis. Our application is going to collect the incoming data from mobile monitoring devices, transform it to medical observation messages and send forward to the telemedicine center. If the results are not similar to the expected signals the patient can be informed and asked to return to the hospital as soon as possible.



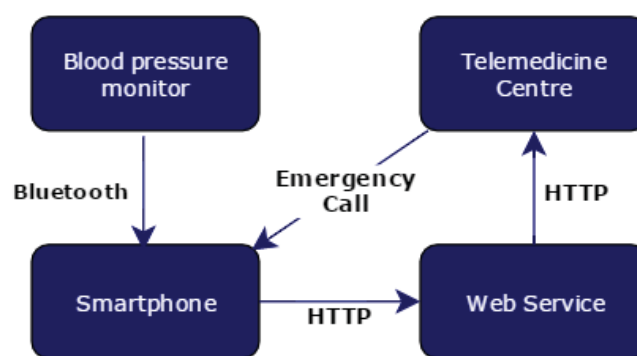
**Figure 1:** Treatment pathway at the H@H system.

### II. MATERIALS & METHODS

#### A. Hardware

There are several kinds of existing mobile healthcare devices, which can be used at home

without any professional control. They are called Personal Health Devices (PHDs). The patient or a care giver can do the measurements at the patient’s home in regular intervals. We need different devices for each of our well-defined use cases. The most common devices are blood pressure monitor, ECG, thermometer and weight scale. We are planning to use a Continua certified blood pressure monitor for the implementation of a data transfer chain model.



**Figure 2:** Wireless connections between each modules

*B. Software* Our main task is to define a standard based and modular architecture. Furthermore we are going to implement a data transfer chain between the personal health device, a smartphone and the telemedicine centre.

### III. RESULTS

The implementation of the Hospital at Home system can several benefits. The most significant is the safety and wellbeing of the patients. Furthermore it spares money for the healthcare systems. On the other hand the data which is collected by the system can be used for further analysis. Big data can contain important correspondences among vital signs and certain diseases.

### III. DISCUSSION

The main target of the project is to discharge the patient from the hospital as the critical pathological situation of the patient is treated and afterwards the mission of the medical staff is to observe the health status of the patient and timely intervention when it's needed. From an economic point to reduce the high costs of the hospital and also from a medical side to prevent the probable infection. As a suggested solution can be using a sufficient monitoring system at home. There are several kinds of mobile healthcare devices, which can be used at home without any professional control. They are called Personal Health Devices (PHDs). The only thing is missing is a software which can ensure a reliable, standard-based data transmission between Personal Health Devices and mobile phones and also the transmission forward to the server of a telemedicine centre in a relevant hospital. For our project we obtained use cases which are applicable to be implemented. The basic use case is the Hypotension when the blood pressure value dropped. The main outcome and measures to be monitored at home is the blood

pressure. We use the mobile platform to transmit the vital values to the telemedicine center where the physicians can observe the data and react if it's needed. A modular approach with standards based (IEEE, IHE, Continua) interoperability will enable future growth and scaling of the system. And for that we extract our specific architecture from the general one for the whole process starting from home and ending at home when the feedback response is back to the patient or to a person who has responsibility of patient. The process must be secured well as a sensitive data is collected and transmitted so the secure side is an important issue in the project.

For the rest of the use cases we did as a package for each case so (which medical devices are required, which measurements must be done and monitored, for how long time and the intervals of the measurements). Finally it's an effective approach to deal with in some cases and take the advantage of the early discharge and minimal the risk of re-admission to the hospital. It is possible to setup a laboratory at the CHT-MAD hospital for testing the technologies developed within this project.

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# **New Projects – Medical and Hospital Engineering**



# Control Software for a Mechanic Eye Model

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**Abstract**— Cataract surgeries are one of the most frequent medical interventions. In the course of the surgery the clouded human lens is extracted and replaced by an artificial intraocular lens (IOL). Nowadays different IOLs with different optical and geometrical properties are used for implantation. Postoperative shifts and tilts of the implant influence the visual outcome of the patient. A mechanical eye model was implemented for testing different types of IOLs under physiological conditions. A new software has to be implemented to perform measurements for analysing optical quality criteria such as modulation transfer function (MTF), point spread function (PSF), Strehl ratio and Zernike coefficients.

---

## I. INTRODUCTION

Optomechanical eye models are used to validate the optical quality criteria of intraocular lenses (IOLs). IOLs are implanted into the human eye during cataract surgery to restore the patient's vision. Due to postoperative healing processes the artificial lens experiences misalignment such as tilts and shifts that influence the quality of vision. The presented mechanical eye model allows a preoperative investigation of the impact of such misalignment. Two motors control tilts and shifts of an embedded IOL. Various setups with cameras and sensors are used to measure physical and optical properties of the model eye.[1]

## II. TASKS

### A. Overall goals of the project

The goal of this project is to unify various existing software to control motors and read out sensors from the model eye.

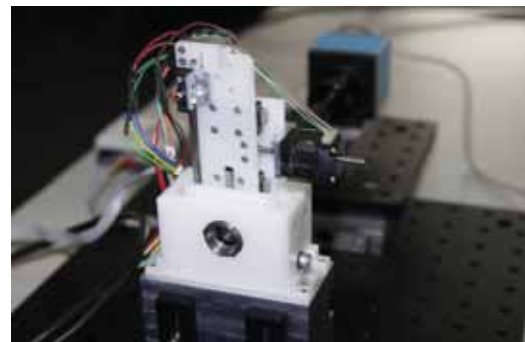
### B. Specific goals to be achieved

- Read through the documentation of the existing software.
- Find a possibility for a modular unification of the existing software under MATLAB, *modular* implies that it has to be easy to add new software modules.

- Develop a guideline to develop new modules.

## III. THE GREATER GOOD

To ensure IOL quality, they are tested according to the ISO 11979-2 [2] standard. New highly sophisticated IOL designs require in parallel the development of new test devices which are currently not existing.



**Figure 1:** Setup of the optomechanical eye model.

## LITERATURE

- [1] L. Traxler, N. Bayer, B. Reutterer, and A. Drauschke. *Improvement of Optics, Mechanics and Usability of a mechanical eye model for vision quality evaluation of IOLs*. Proc. 13th IFAC Conf. PDeS. 2015.
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# Temperature Control for a mechanical Eye Model

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**Abstract**— Cataract surgeries are one of the most frequent medical interventions. In the course of the surgery the clouded human lens is extracted and replaced by an artificial intraocular lens (IOL). Nowadays different IOLs with different optical and geometrical properties are used for implantation. Postoperative shifts and tilts of the implant influence the visual outcome of the patient. A mechanical eye model was implemented for testing different types of IOLs under physiological conditions. A new software has to be implemented to perform measurements for analysing optical quality criteria such as modulation transfer function (MTF), point spread function (PSF), Strehl ratio and Zernike coefficients.

## I. INTRODUCTION

Optomechanical eye models are used to validate the optical quality criteria of intraocular lenses (IOLs). IOLs are implanted into the human eye during cataract surgery to restore the patient's vision. Changes in temperature change the hydration of hydrophilic IOLs. The presented mechanical eye model allows a precise measurement of physical and optical properties.[1] To maintain results which are in consistence with physiology the model eye has to be heated to body temperature.

## II. TASKS

### A. Overall goals of the project

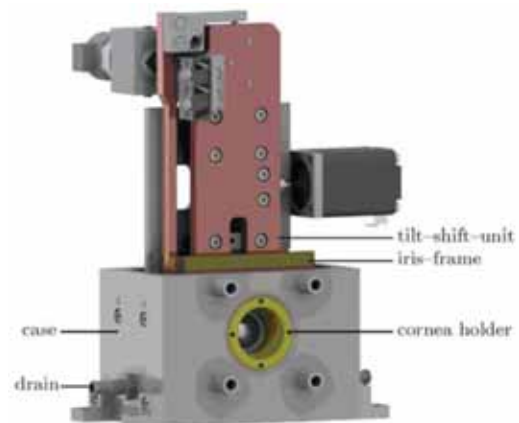
Putting into operation an existing implementation [2] of the heating system.

### B. Specific goals to be achieved

- Read through the documentation of the existing implementation.
- Mechanical integration of heating elements and sensors into the model eye.
- System identification and parameterization of the closed loop controller.
- Extensive testing, error debugging.
- Construction of a case.

## III. THE GREATER GOOD

To ensure IOL quality, they are tested according to the ISO 11979-2 [3] standard. New highly sophisticated IOL designs require in parallel the development of new test devices which are currently not existing.



**Figure 1:** CAD Model of the optomechanical eye model.

## LITERATURE

- [1] L. Traxler, N. Bayer, B. Reutterer, and A. Drauschke. *Improvement of Optics, Mechanics and Usability of a mechanical eye model for vision quality evaluation of IOLs*. Proc. 13th IFAC Conf. PDeS. 2015.
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# Pump Control for ex–vivo Lung Perfusion

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**Abstract**— Lung simulation is an important task for creating more knowledge about the human breathing processes, the movement of particles in the human airways and the applicability and effects caused by ventilation. In order to use a realistic lung model, a porcine lung can be introduced into the simulator. The aim of this project is to develop a wirelessly and remotely controllable pump for an ex-vivo lung perfusion circuit.

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## I. INTRODUCTION

Lung simulation is not only an essential method for teaching and testing purposes. A valid lung simulator using a realistic lung equivalent could be used for replacing hundreds of animal tests every year, which need to be performed for chemical and cosmetic industry purposes.[1]

## II. TASKS

### A. Overall goals of the project

The overall goal of the project is to develop a motor control unit, which drives the pump in an ex-vivo lung perfusion circuit. The control unit shall be wirelessly accessible and the motor data, including rpm, flow in l/min and pressure in mmHg shall be displayed on the mobile device.

### B. Specific goals to be achieved

The project group will have to perform the following tasks:

- Create and refine an existing motor control unit for long time use. ( $\approx 12$  hours).
- Design and create a transmission protocol for BT data transmission.
- Test the circuit, with special reference to the pump, on long term focus on usability and robustness.

## III. THE GREATER GOOD

A realistic lung model, like a porcine lung, will give insight into important topics like breathing and aerosol deposition. This knowledge may be used for evaluating the existing lung simulator as alternative to animal models.



**Figure 1:** i–Lung simulator (left) and mCM circuit (right).

## LITERATURE

- [1] M. Forjan, K. Stiglbrunner, and A. Drauschke. *Development of an Integrated Aerosol Measurement System in the i–Lung*. ALTEX Proceedings. Vol. 1(2). pp. 115–120. 2012

# Development of a Counter–stream Warming Device for ex–vivo Lung Perfusion

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**Abstract**— Lung simulation is an important task for creating more knowledge about the human breathing processes, the movement of particles in the human airways and the applicability and effects caused by ventilation. For simulating a human lung a porcine lung shall be kept alive under isothermic, physiological conditions. Electronics, measurements as well as study design will be integrative parts of this project.

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## I. INTRODUCTION

Lung simulation is not only an essential method for teaching and testing purposes. A valid lung simulator using a realistic lung equivalent could be used for replacing hundreds of animal tests every year, which need to be performed for chemical and cosmetic industry purposes.[1]

## II. TASKS

### A. Overall goals of the project

The overall goal of the project is to develop a counter-stream warming device for an extracorporeal lung nutrition circuit (mCM). The device has to allow the warming and regulation of temperature of the liquid without direct contact between heating elements and the nutrition fluid itself.

### B. Specific goals to be achieved

The project group will have to perform the following tasks:

- Design and simulation of a counter-stream warming device.
- Development of the hardware including electronics.
- Test measurements and long term evaluation of the reliability of the warming device.

- Inclusion of this components into the existing mCM hardware and electronics‘setup.

## III. THE GREATER GOOD

Realistic physiological lung simulation may help to understand the deposition mechanisms of particles in human lung tissue. Such simulations may help to use the existing lung simulator as alternative to animal models.



**Figure 1:** Inflated pig lung after explantation.

## LITERATURE

- [1] M. Forjan, K. Stiglbrunner, and A. Drauschke. *Development of an Integrated Aerosol Measurement System in the i–Lung*. ALTEX Proceedings. Vol. 1(2). pp. 115–120. 2012

# Tensile Stress–Strain Testing System for Selective Laser Sintered Parts

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**Abstract**— Selective Laser Sintering (SLS) is considered as one of the most important additive manufacturing processes. An advantage over other types of rapid manufacturing is high component stability. However, different process parameters like laser power or laser speed, but also orientation within the printing chamber, influences the overall workpiece quality and mechanical properties. Beside surface analysis and dimensions accuracy measurements, mechanical strength parameter evaluation is a powerful tool. There are different standardized test methods to gain information about mechanical properties; one of them is to record so called stress-strain curves with tensile test machines.

## I. INTRODUCTION

During Selective Laser Sintering the energy of a laser beam is used to fuse powder particles together. Doing this layer by layer 3D objects can be produced. Different process parameters like laser power, laser speed and hatch distance have high impact on the overall workpiece quality.[1] One way to get information about the importance of the different parameter is to analyse so called stress–strain curves recorded by a tensile stress machine.[2]

## II. TASKS

### A. Overall goals of the project

The goal of this project is to develop a system which makes it possible to record stress–strain curves of 3D printed test specimens.

### B. Specific goals to be achieved

- Construction of mechanical cage (Aluminium profile system)
- Design of specimen holder (different sizes of specimens)
- Electronics and software for controlling the actuator and the already existing load cell.

## III. THE GREATER GOOD

In industry and research tensile test machines are often used to evaluate if a material is suitable for a special application. In the construction of implants from biomaterials it is very important implants have individual mechanical properties.[3] Figure 1 shows an industry machine (left) and a stress–strain curve with parameters which can be gained.



**Figure 1:** Industrial tensile test machine (left)[4] and stress–strain curve (right).[5]

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# Operating table – Development and evaluation of a light control system

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**Abstract**— Over the course of recent years, advancing LED technology has found its way into many applications. One such area is workplace lighting. Controlling the light under which delicate operations have to be performed is one of these areas, and it is thus no surprise that companies have begun developing smart adaptive lighting for specialty areas such as surgery. The following describes an attempt at developing and testing such a smart lighting control for an operational table at the UAS Technikum Wien. A test stand was built successfully that would allow testing of any number of sensors and lights under controlled conditions. This test stand is to serve as a platform for future research into how light can be effectively measured and controlled in any environment.

## I. INTRODUCTION

Certain fields of work require adequate environments to perform at their peak efficiency. One such field is that of surgery. Proper and consistent lighting is important to ensure the surgeons ability to adequately assess the operating field. At the same time, recent studies show how access to open daylight can have a severely positive effect on surgical staff morale.[1] Ensuring a well-lit work area while counteracting external disturbances is a non-trivial task, however.

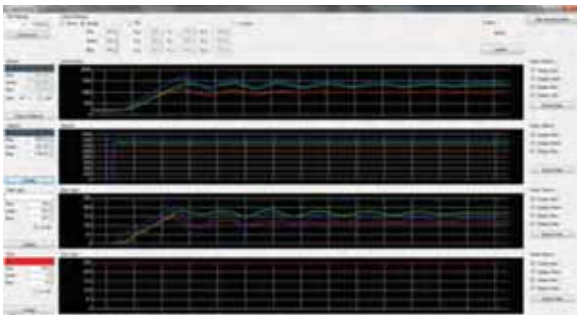


Figure 1: Control program.

## II. TASKS

- Improve accuracy of existing control models.  
 Currently, the system is capable of controlling wired LED lights under controlled conditions. Even under these circumstances, there is still somewhat of an oscillation detectable which should be removed.
- Implementation with Matlab Simulink
- Redesign of the printed circuit board
- Find a usable transformation function for the given light sensor.

Converting the measured data to values that can be used by the actuators – LEDs, that is – is dependent on the sensor’s response to different parts of the spectrum of visible light. These responses to different lighting have to be painstakingly discovered using trial-and-error techniques. A more universal approach is needed and should be found throughout the course of this project.



Figure 2: Test facility.

## III. THE GREATER GOOD

In the long run, models should be created that allow for a variety of light sensors to adequately control common light sources such as LED lights. Vital parameters should be established as to which light sources and sensors should be used to achieve that goal. Furthermore, wireless light sources such as Philips’s Hue system should also be controlled by the system.

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# Hardware re–design of the *Magnetissue* tension bioreactor

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**Abstract**— The Magnetissue bioreactor sets forces to muscle cell cultures to improve their specialisation. The expired control hardware of the system has to be identified in accordance to its function and a new hardware should be designed and fitted to the Matlab GUI and the reactor interface. The redesign should enable an increase in performance, handling and documentation.

## I. INTRODUCTION

The Magnetissue tension bioreactor (Fig.1) is an in–house designed and developed muscle cell bioreactor. The device enables the possibility to set tension forces (movement in one linear axis) to cultivated muscle cell cultures.[1,2] This procedure is needed to gain a better output in specialisation and recruiting of the muscle cells for their theoretical use in human body. Due to the fact that the reactor has developed in several steps over several years the control–hardware (except the reactor itself and the GUI) is not at the state of the art any more. Furthermore there is a lack of documentation about the used components and communication protocols.

## II. TASKS

- The students should identify the needed electrical components for a redesign of the hardware (Fig.2) to measure the signals of the magnetic sensors and to control the stepper–motor.
- Connection of the new designed control hardware to the two interfaces (Matlab GUI as well as the bioreactor).
- Construction of a new control hardware box (PCBs, Casing, Interfaces).
- Testing on function and comparison with the functionality of the original hardware.



**Figure 1:** Magnetissue tension bioreactor.



**Figure 2:** Control hardware.

## III. THE GREATER GOOD

The re–design would enable the possibility to have a more precise handling of the bioreactor as well as the exact knowing about the function of the control unit. It could be possible to increase the performance of the bioreactor.

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# Design and implementation of a high-risk measurement workstation

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**Abstract**— The direct measurement of patients with an oscilloscope to observe bio potentials could lead to severe health problems due to the fact of leakage currents over ground loops. Therefore a high-risk measurement work station is should be designed, developed and implemented in the biomedical engineering laboratory to protect the patient/student during observation at the development of biomedical equipment.

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## I. INTRODUCTION

The development of biomedical equipment often needs the possibility to observe bio potentials. The biomedical engineering laboratory (Fig 1) therefore provides several measurement units that are especially constructed for the use with patients.

The existing equipment is imitated to its dedicated functions. If students want to observe special bio potentials with an oscilloscope they could run into severe problems. The common oscilloscopes as well as the workplace itself have no safety modules to avoid ground loops that could harm or even beat the students to death. Therefore a high-risk measurement workstation in the biomedical engineering laboratory is needed.[1,2]

## II. TASKS

Research on the state of the art of high risk work stations with focus on the legal aspects as well as on security guidelines. Decision on the needed components and setup. Design of an adequate floor and a safety bridge for all electrical components that are in contact with the student/patient. Development of a safety protocol as well as a workflow description for student use.

## III. THE GREATER GOOD

The workstation would provide the possibility to measure bio potentials very precisely with the oscilloscopes without running into severe health problems by causing electrical strikes.



**Figure 1:** BME laboratory for biomedical equipment development.

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# **New Projects – Medical Imaging and Data Engineering**







eLearning4eHealth Network

# Multiple Sclerosis Management System based on HL7 FHIR

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**Abstract**— Multiple sclerosis (MS) is one of the most common diseases of the central nervous system (brain and spinal cord). There is no cure of MS, but treatments are now and many of the symptoms of MS can be successfully managed and treated. The MS Management System shall provide the possibility for patients to manage their daily routine and to exchange clinical data by use of modern interoperability technology, to allow most efficient help and support by clinical staff.

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## I. INTRODUCTION

MS is an inflammatory demyelinating condition, which means it is caused by damage to myelin – a fatty material that insulates nerves, acting much like the covering of an electric wire. It allows a nerve to transmit its impulses rapidly. It is the speed and efficiency with which these impulses are conducted that permits smooth, rapid and coordinated movements to be performed with little conscious effort.

In MS, the loss of myelin (demyelination) is accompanied by a disruption in the ability of the nerves to conduct electrical impulses to and from the brain and this produces the various symptoms of MS. The sites where myelin is lost (plaques or lesions) appear as hardened (scar) areas: in multiple sclerosis these scars appear at different times and in different areas of the brain and spinal cord. The term multiple sclerosis means, literally, many scars.

Symptoms vary widely and include blurred vision, weak limbs, tingling sensations, unsteadiness and fatigue. For some people, MS is characterized by periods of relapse and remission while for others it has a progressive pattern. For everyone, it makes life unpredictable.

Multiple sclerosis (MS) is one of the most common diseases of the central nervous system (brain and spinal cord). Today more than 2,000,000 people around the world have MS. There is no drug that can cure MS, but treatments are now available which can modify the course of the disease and many of the symptoms of MS can be successfully managed and treated.[1,2]

## II. TASKS

### A. Overall goals of the project

The overall goal is to develop a Multiple Sclerosis App, which allows patients to manage their daily routine. That App shall be connected via most modern interoperability technology called HL7 FHIR to a management facility providing help and support of patients.

### B. Specific goals to be achieved

- Analysis of requirements for an MS Management App.
- Definition of capabilities such the App needs to have.
- Planning and developing of an interface conforming to most modern usability requirements.
- Development of HL7 FHIR based interface to exchange the acquired/measured data with. . .
- . . . a physician terminal for data overview and appropriate (to be defined) help and support features.

## III. THE GREATER GOOD

There are a lot of *cobbled* Apps for Multiple Sclerosis. Each one has its strengths and weaknesses. The professional ones are dealing with diary-kind things like documentation of pain. Some provide injection diaries, but none of them unites all features. Furthermore they do not provide interoperability features like HL7 FHIR and most of them have bugs and are expensive. The students may have a chance to change that.

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# Spirometry Data for Lung Simulation Evaluation

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**Abstract**— Lung simulation is an important task for creating more knowledge about the human breathing processes, the movement of particles in the human airways and the applicability and effects caused by ventilation. For evaluating the available lung simulator spirometry data has to be gathered, a protocol has to be designed and the data has to be evaluated based on literature values. The project will work for one semester together with MBE students working on this project. Measurements as well as study design and database design will be integrative parts of this project.

## I. INTRODUCTION

Lung simulation is not only an essential method for teaching and testing purposes. A valid lung simulator using a realistic lung equivalent could be used for replacing hundreds of animal tests every year, which need to be performed for chemical and cosmetic industry purposes.[1]

## II. TASKS

### A. Overall goals of the project

The overall goal of the project is to define a study protocol for gathering comparable spirometry data from human volunteers and the lung simulator. Those data sets have to be stored in a database and have to be searchable and to be used for evaluation purposes. Therefore the database has to provide structured ventilation and spirometry data.

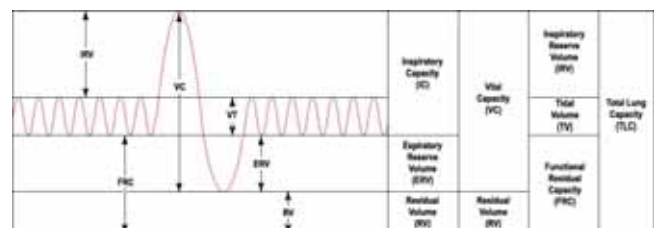
### B. Specific goals to be achieved

The project group will have to perform the following tasks:

- Create and refine a study protocol for gathering spirometry data, based on an existing model.
- Design and create a database for storing respiratory data in a structured way.
- Gather volunteers' spirometry data in the database and evaluate against existing ones and literature.

## III. THE GREATER GOOD

Spirometry data (Fig. 1) can be used as a standardised lung evaluation summary for both, humans and lung simulator. Such values may be used for evaluating the existing lung simulator as alternative to animal models.



**Figure 1:** Spirometry volumes and capacities.[2]

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# Android App für Terminologie Services des Bundesministeriums für Gesundheit

University of Applied Sciences Technikum Wien

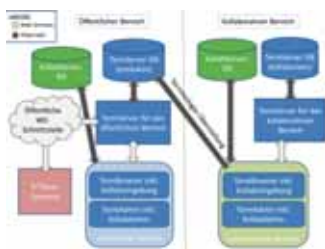
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**Abstract**— Als Teil der Infrastruktur der elektronischen Gesundheitsakt (ELGA) wurde in den vergangenen Jahren der Terminologieserver für das österreichische Gesundheitswesen von MitarbeiterInnen der FH Technikum Wien/Technikum Wien GmbH entwickelt. Terminologien sind in der eHealth Infrastruktur der Zukunft nicht wegzudenken, da diese die Maschinenlesbarkeit von medizinischen Dokumenten ermöglichen, so spezielle jene von ELGA. Andererseits muss medizinisches Personal mit den Terminologien arbeiten um Leistungen zu verrechnen bzw. sind diese für eine qualitativ hochwertige Dokumentation von Konsultationen notwendig. In diesem Projekt soll eine Android Applikation erstellt werden, welche es medizinischem Personal ermöglicht stets die aktuellsten Terminologien vom zentralen Terminologieserver abzurufen und übersichtlich darzustellen bzw. zu durchsuchen und das alles am Smartphone.

## I. INTRODUCTION

Als Teil der Infrastruktur der elektronischen Gesundheitsakt (ELGA) wurde in den vergangenen Jahren der Terminologieserver für das österreichische Gesundheitswesen von MitarbeiterInnen der FH Technikum Wien/Technikum Wien GmbH entwickelt. [1] Der Terminologieserver soll den Stakeholdern des österreichischen Gesundheitswesens die Möglichkeit bieten, eigene Terminologien über das Internet öffentlich zur Verfügung zu stellen, sowie Terminologie-Recherche und Terminologie-Download ermöglichen. Er unterstützt sowohl redaktionelle Arbeiten als auch die Übersetzung und Versionierung von Terminologien und hilft einheitliche, eindeutige und geprüfte Terminologien zu verwenden. [2]



**Figure 1:** Architektur des Terminologieserver Systems.

Über eine Web-Anbindung können Terminologien veröffentlicht werden. Primärsysteme können ihre lokalen Terminologien via Webservices synchronisieren und pflegen (Export-Webservices, in diesem Dokument beschrieben).

## II. TASKS

### A. Overall goals of the project

Das Ziel des Projektes ist es, eine Android Applikation zu entwickeln um die medizinischen Terminologien vom in Österreich vorgeschriebenen zentralen Terminologieserver abzurufen, übersichtlich darzustellen als

auch zu durchsuchen, sodass medizinischem Personal die Dokumentations- sowie Rechercharbeit erleichtert werden kann.

### B. Specific goals to be achieved

- Einlesen und einarbeiten in die Funktionsweise und die API des Terminologieservers.
- Erstellen einer Android Applikation zum Zugriff und Abruf der Terminologien per API (Teilautomatisiert).
- Lokale Speicherung der Terminologien am Smartphone.
- Anzeige und browsing der Terminologien bzw. Suche einzelner Codes.

## III. THE GREATER GOOD

Speziell medizinisches Personal, wie Ärzte, Pflegepersonal aber auch administratives medizinisches Personal, haben so die Möglichkeit mittels einer Android App, Codes innerhalb von Terminologien im österreichischen Gesundheitswesen, an der gesetzlich vorgeschriebenen Stelle, abzurufen und zu durchsuchen. Dies führt zu einer effizienteren mobilen Suche und erleichtert so die Alltagsarbeit jener Personen.

## LITERATURE

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# Projekte mit und für den Wiener Krankenanstalten Verbund

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**Abstract**— Mit elf Spitälern, vier Geriatriezentren (und dem Sozialtherapeutischen Zentrum Ybbs) sowie acht Pflegewohnhäusern zählt der Wiener Krankenanstaltenverbund (KAV) zu den größten Gesundheitseinrichtungen in Europa. Rund 30.000 Mitarbeiterinnen und Mitarbeiter aus 70 Nationen, die dutzende Sprachen sprechen, kümmern sich 365 Tage im Jahr, rund um die Uhr, um das Wohl der ihnen anvertrauten Menschen.[1]

## I. INTRODUCTION

Der Forschungsschwerpunkt eHealth steht in enger Kooperation mit der KAV-IT.[2]

Dies ermöglicht den Studierenden eine Auswahl an verschiedenen Projekten zu unterschiedlichen Themenbereichen, aus dem realen Leben. Im derzeitigen Fokus der KAV IT liegen aus aktuellen Gründen Themen im Bereich der Elektronischen Gesundheitsakte. Dies betrifft vor allem die Bearbeitung von Herausforderungen mit den Dokumenten welche in ELGA gespeichert werden. Diese werden allgemein als CDA Dokumente bezeichnet.



Diagnose	Datum von	Datum bis	Status
M25.40, Meresikus, Empyema gen. sin. post.corpus alienum (ignem operat)	11.02.2013	11.03.2013	Abgeschlossen

Figure 1: Ein CDA Beispieldokument der ELGA[3].

Dahingehend in engem Zusammenhang sind Codelisten und Value Sets. Diese werden in einer zentralen Komponente der ELGA, dem sog. Terminologieserver, verwaltet. Auch diese, von der Technikum Wien GmbH entwickelte, Komponente spielt in den Projekten eine Rolle.

## II. TASKS

Nachfolgend wird eine kurze Übersicht über aktuelle Themen aus und für die Wiener KAV IT gegeben. Da es sich lediglich um eine Übersicht handelt, wird ersucht, bei Interesse die oben angeführten Kontaktpersonen um Details zu kontaktieren:

**Android App für Terminologie Services:** Separates Thema, aber auch im Interesse der Wiener KAV IT.

**Laborbefunde (ELGA-CDA):** Vernünftige Darstellung von Verläufen (Kumulativbefund) der Level-3 Dokumente für z. B.: Ärzte. Eventuelle Integration in web.okra.

**Radiologiebefunde (ELGA-CDA):** Darstellung einer Oberfläche für ELGA-Consumer. Benutzerfreundliche Suche mittels APPC (Service-Events).

**Mapping:** Die Begriffe und die Wertebereiche, die im KAV verwendet werden, müssen für ELGA-Dokumente auf die österreichweit standardisierten Werte und Begriffe von ELGA übergeführt werden. Änderungen sind hier auf beiden Seiten möglich. Wie reagiert man darauf und welches Verfahren wird dabei verfolgt?

**Aufbereitung, Dokumentation und Erarbeitung einzelner ELGA-Themen:** z. B.: *Diagnosestatus* Hierfür ist zuerst eine Einarbeitung in die ELGA Implementierungsleitfäden (*sehr viel Papier*) nötig, wo das *Soll* beschrieben wird. Dann muss die IST-Situation (Ausgangspunkt) im KAV erhoben werden. Als neues Thema wäre der *Diagnosestatus* in ELGA beispielhaft, das Thema *Diagnose* gibt es natürlich im KAV bereits. Darstellung, welche Punkte der Vorgaben sind erreicht bzw. wie weit ist man entfernt und wie kann das Ziel erlangt werden.

## III. THE GREATER GOOD

Die Projekte in diesem Kontext finden nahestmöglich an der Praxis statt. Mitwirkung in diesem Projekt hat dadurch eine direkte Auswirkung auf Patienten der Wiener Bevölkerung.

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