HTBLuVA St. Pölten

Höhere Lehranstalt für Elektronik und Technische Informatik
Ausbildungsschwerpunkt Wireless Systems

DIPLOMARBEIT

Gesamtprojekt

Digital Capnometer Extention-Module

Ausgeführt im Schuljahr 2021/22 von:

Bastian GROßAUER 5BHELS-07
René HAHN 5BHELS-08

Betreuer/Betreuerin:

Dipl.-Ing. Gerald GRUBER
Ing. Rudolf JANECZEK BEd MSc

St. Pölten, am 2. April 2022

Abgabevermerk:
Datum:

Betreuer/in:

Eidesstattliche Erklärung:

Ich erkläre an Eides statt, dass ich die vorliegende Diplomarbeit selbstständig und ohne fremde Hilfe verfasst, andere als die angegebenen Quellen und Hilfsmittel nicht benutzt und die den benutzten Quellen wörtlich und inhaltlich entnommenen Stellen als solche erkenntlich gemacht habe.

St. Pölten, 2. April 2022

_____

Bastian GROßAUER

_____

René HAHN

htl bildung mit zukunft	**HÖHERE TECHNISCHE BUNDESLEHRANSTALT ST. PÖLTEN**
	Abteilung: **Elektronik und Technische Informatik** Ausbildungsschwerpunkt: Wireless Systems

DIPLOMARBEIT
DOKUMENTATION

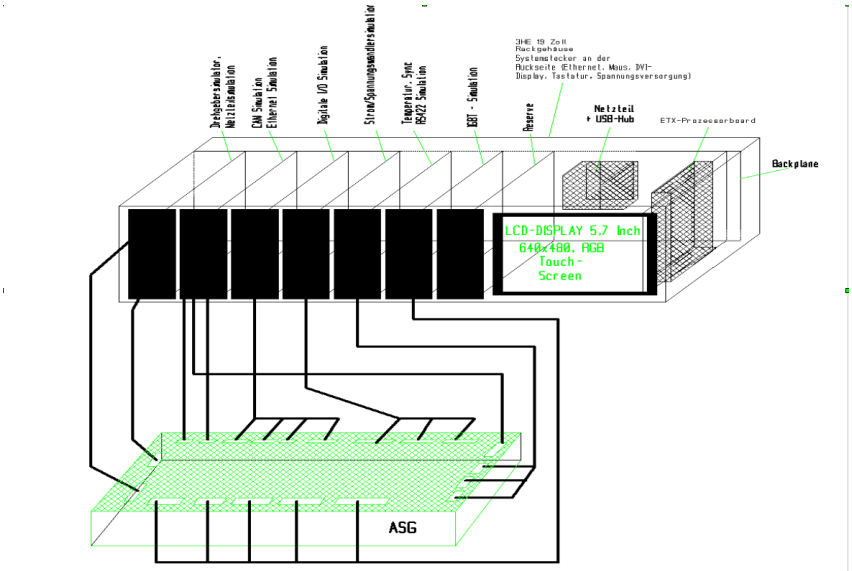
Namen der Verfasser/innen	Bastian Großauer, René Hahn
Jahrgang / Klasse Schuljahr	5BHELS / 2021/2022
Thema der Diplomarbeit	Digitales Kapnometer Erweiterungs-Modul
Kooperationspartner	SIMCharacters GmbH

Aufgabenstellung	Für die Firma Voith soll in Kooperation mit der HTL Krems ein Umrichtersimulator zum Testen eines Antriebssteuergeräts (ASG) entwickelt und gebaut werden. Der Umrichtersimulator ist modular aufgebaut. Gegenstand dieser Diplomarbeit ist das Modul: Temperatur, Synchronisation, RS422. Das ausgewählte Modul beinhaltet folgende Funktionen: • Temperatursimulation – Es sollen 4 von der Bezugsmasse galvanisch getrennte, einstellbare Widerstände zur Verfügung gestellt werden. • Synchronisationsschnittstelle – Diese soll ein variierbares 12.5MHz Signal ein- oder ausgeben, das eine Austastlücke, die den Synchronisationszeitpunkt definiert, beinhaltet. • RS422 Umsetzer – Die vom USB-Bus kommenden Steuersignale sollen an eine RS422-Schnittstelle ankoppelt werden.

Realisierung	Alle drei Teile bekommen die jeweiligen Daten per USB. Diese werden registerweise in einem Dual-Port-RAM eines FPGAs gespeichert. Von dort können die Daten auch simultan ausgelesen und von den dafür zuständigen Teilen verarbeitet werden. Die Temperatursimulation erfolgt durch Ersetzen von Temperaturfühlern durch digitale Potentiometer. Die Daten zur Steuerung der Widerstandswerte werden durch Optokoppler galvanisch getrennt zum Potentiometer übertragen. Die Versorgung des digitalen Potentiometers erfolgt wegen der erforderlichen galvanischen Trennung über DC/DC-Wandler. Das 12.5MHz-Synchronisationssignal wird durch einen externen Oszillator erzeugt. Durch Mischung von zwei Quarzoszillatorsignalen wird ein genügend großer Ziehbereich erreicht, ohne auf den Vorteil der Quarzstabilität zu verzichten. Dem Oszillatorsignal wird dann im FPGA der Synchronisationsimpuls aufgeprägt. Die Übernahme und die Umsetzung der RS422-Daten ins SPDIF-Format erfolgt im FPGA. Die Daten werden über den Hardwaretreiber MAX3077 auf den RS422-Ausgang gelegt. Im Empfangszweig werden die Daten mit dem SPDIF-Receiver CS8416 dekodiert und dem FPGA zu weiteren Verarbeitung übergeben.

htl bildung mit zukunft	**HÖHERE TECHNISCHE BUNDESLEHRANSTALT ST. PÖLTEN**
	Abteilung: **Elektronik und Technische Informatik** Ausbildungsschwerpunkt: Wireless Systems

Ergebnisse	Die Hardware, die Chipware für den FPGA und das GUI-Programm für den Benutzer-PC der HTL Krems wurden erfolgreich entwickelt. In mehreren Testläufen bei der Fa. Voith Turbo GmbH wurden alle wesentlichen Komponenten erfolgreich kombiniert und getestet.

Typische Grafik, Foto etc. (mit Erläuterung)	 Konzept des Umrichtersimulators, mit den einzelnen Einschüben, welche dann mit dem ASG kommunizieren.

Teilnahme an Wettbewerben, Auszeichnungen	

Möglichkeiten der Einsichtnahme in die Arbeit	

Approbation (Datum / Unterschrift)	Prüfer/in	Dipl.-Ing. W. U. KURAN Abteilungsvorstand

htl bildung mit zukunft	**COLLEGE of ENGINEERING ST. PÖLTEN**
	Department: **Electronics and computer engineering** Educational focus: Wireless systems

DIPLOMA THESIS
DOCUMENTATION

Author(s)	Bastian Großauer, René Hahn
Form Academic year	5AHELS / 2021/2022
Topic	Digital Capnometer extention-Module
Co-operation partners	SIMCharacters GmbH

Assignment of tasks (conceptual formulation/job definition)	

Realization	

htl bildung mit zukunft	**COLLEGE of ENGINEERING ST. PÖLTEN**
	Department: **Electronics and computer engineering** Educational focus: Wireless systems

Results	

Illustrative graph, photo (incl. explanation)	

Participation in competitions Awards	

Accessibility of diploma thesis	

Approval (Date / Sign)	Examiner	Dipl.-Ing. W. U. KURAN Head of Department

Acknoledgement

The overall goal of this ...

Contents

0 Preamble

The overall goal of this ...

1 Introduction

The overall goal of this ...

1.1 Current Situation

Paul is a trainingssimulator for medicine students and doctors, who want to practice an emergency case in neonatology.

1.1.1 Pauls Problem without the Capnometer

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

1.2 Possible Approaches

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

1.2.1 Challenges

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

1.2.2 Display

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

1.2.2.1 Problem Factors The objective was to create a module, that simulates a capnometer, while communicating with Paul.

2 Specifications

The overall goal of this ...

2.1 Current Situation

Paul is a trainingssimulator for medicine students and doctors, who want to practice an emergency case in neonatology.

2.1.1 Pauls Problem without the Capnometer

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

2.2 Possible Approaches

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

2.2.1 Challenges

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

2.2.2 Display

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

2.2.2.1 Problem Factors The objective was to create a module, that simulates a capnometer, while communicating with Paul.

3 Concept

The overall goal of this ...

3.1 Current Situation

Paul is a trainingssimulator for medicine students and doctors, who want to practice an emergency case in neonatology.

3.1.1 Pauls Problem without the Capnometer

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

3.2 Possible Approaches

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

3.2.1 Challenges

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

3.2.2 Display

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

3.2.2.1 Problem Factors The objective was to create a module, that simulates a capnometer, while communicating with Paul.

4 Partition in Hardware and Software

The overall goal of this ...

4.1 Current Situation

Paul is a trainingssimulator for medicine students and doctors, who want to practice an emergency case in neonatology.

4.1.1 Pauls Problem without the Capnometer

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

4.2 Possible Approaches

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

4.2.1 Challenges

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

4.2.2 Display

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

4.2.2.1 Problem Factors The objective was to create a module, that simulates a capnometer, while communicating with Paul.

5 Used Technologies

The overall goal of this ...

5.1 Current Situation

Paul is a trainingssimulator for medicine students and doctors, who want to practice an emergency case in neonatology.

5.1.1 Pauls Problem without the Capnometer

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

5.2 Possible Approaches

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

5.2.1 Challenges

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

5.2.2 Display

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

5.2.2.1 Problem Factors The objective was to create a module, that simulates a capnometer, while communicating with Paul.

6 Research

The overall goal of this ...

6.1 Current Situation

Paul is a trainingssimulator for medicine students and doctors, who want to practice an emergency case in neonatology.

6.1.1 Pauls Problem without the Capnometer

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

6.2 Possible Approaches

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

6.2.1 Challenges

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

6.2.2 Display

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

6.2.2.1 Problem Factors The objective was to create a module, that simulates a capnometer, while communicating with Paul.

7 Hardware Design

The overall goal of this ...

7.1 Current Situation

Paul is a trainingssimulator for medicine students and doctors, who want to practice an emergency case in neonatology.

7.1.1 Pauls Problem without the Capnometer

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

7.2 Possible Approaches

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

7.2.1 Challenges

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

7.2.2 Display

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

7.2.2.1 Problem Factors The objective was to create a module, that simulates a capnometer, while communicating with Paul.

8 Software Design

The overall goal of this ...

8.1 Current Situation

Paul is a trainingssimulator for medicine students and doctors, who want to practice an emergency case in neonatology.

8.1.1 Pauls Problem without the Capnometer

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

8.2 Possible Approaches

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

8.2.1 Challenges

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

8.2.2 Display

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

8.2.2.1 Problem Factors The objective was to create a module, that simulates a capnometer, while communicating with Paul.

_

9 Results

The overall goal of this ...

9.1 Current Situation

Paul is a trainingssimulator for medicine students and doctors, who want to practice an emergency case in neonatology.

9.1.1 Pauls Problem without the Capnometer

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

9.2 Possible Approaches

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

9.2.1 Challenges

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

9.2.2 Display

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

9.2.2.1 Problem Factors The objective was to create a module, that simulates a capnometer, while communicating with Paul.

10 Economical Part

The overall goal of this ...

10.1 Current Situation

Paul is a trainingssimulator for medicine students and doctors, who want to practice an emergency case in neonatology.

10.1.1 Pauls Problem without the Capnometer

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

10.2 Possible Approaches

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

10.2.1 Challenges

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

10.2.2 Display

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

10.2.2.1 Problem Factors The objective was to create a module, that simulates a capnometer, while communicating with Paul.

11 Project Management

The overall goal of this ...

11.1 Current Situation

Paul is a trainingssimulator for medicine students and doctors, who want to practice an emergency case in neonatology.

11.1.1 Pauls Problem without the Capnometer

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

11.2 Possible Approaches

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

11.2.1 Challenges

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

11.2.2 Display

The objective was to create a module, that simulates a capnometer, while communicating with Paul.

11.2.2.1 Problem Factors The objective was to create a module, that simulates a capnometer, while communicating with Paul.

12 Appendix

The overall goal of this ...

12.1 Milestones

One part of project management is the milestone setting, because ...

12.1.1 Internal Devision of Duties

Bastian Großauer is in charge of the Hardware Design...

12.2 Schedule

The project was scheduled as ...

12.2.1 Contact with the Projectpartner SIMCharacters GmbH

Initially, an email was sent to Michel Haller if this company could offer a ...

12.2.2 Diploma Seminars

In the following pages the diploma seminars are visualized ...