ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Institut für Integrierte Systeme
Integrated Systems Laboratory

Department of Information Technology and
Electrical Engineering

Spring Semester 2018

Multi-Sensors Control System for a Transportation Vehicle in a Low-Pressure Environment

Bachelor Project

Carl Friess
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25 August 2018

Supervisors: Dr. Michele Magno, michele.magno@iis.ee.ethz.ch

Professor: Prof. Dr. Luca Benini, lbenini@iis.ethz.ch

Acknowledgements

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Abstract

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Declaration of Originality

I hereby confirm that I am the sole author of the written work here enclosed and that I have compiled it in my own words. Parts excepted are corrections of form and content by the supervisor. For a detailed version of the declaration of originality, please refer to Appendix **??**

Carl Friess,
Zurich, 25 August 2018

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List of Figures

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List of Acronyms

AES . . . . . Advanced Encryption Standard
ASIC . . . . . Application-Specific Integrated Circuit

DES . . . . . Data Encryption Standard
DVI . . . . . Device Independent File Format

ECC . . . . . Elliptic Curve Cryptography
ECDSA . . . . . Elliptic Curve Digital Signature Algorithm
EPS . . . . . Encapsulated PostScript

FPGA . . . . . Field Programmable Gate Array

IC . . . . . Integrated Circuit
IIS . . . . . Integrated Systems Laboratory

LED . . . . . Light-Emitting Diode

NIST . . . . . National Institute of Standards and Technology

PDF . . . . . Portable Document Format

WYSIWYG . . . What You See Is What You Get

Chapter 1

Introduction

Give an overview of the problem, and put your work into a bigger context. Motivate the questions addressed in this work and summarize your contributions. Related work should also be mentioned here, especially if you do not have a separate chapter for it.

1.1. Hyperloop Competition

1.2. Swissloop

1.2.1. Escher

1.2.2. Mujinga

1.3. Project Scope

Chapter 2

Specification

Mechanical Specifications (Sensors) Telemetry Specifications (Rules) Drivetrain Specifications Safety Specifications

Everything it does...

Control Panel

State Diagram

Testability / Verifiability

Chapter 3

Platform

- Present Platform - Present Sensors and other devices/systems

Chapter 4

Implementation

- Structure of system (E.g. What on CPU1 and CPU2?) - Flowchart?

Chapter 5

Result

5.1. Competition

5.2. Conclusion

5.3. Outlook

Appendix A

Task Description

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Integrated Systems Laboratory

Bachelor project at the
Department of Information Technology and
Electrical Engineering

for

Carl Friess

Multi-sensors control system for a transportation vehicle in low-pressure environment.

Advisors: Michele Magno

Professor: Prof. Dr. Luca Benini

Handout Date: 26.02.2018

Due Date: 25.08.2018

1 Project Goals

The main goal of this project is to develop a Control algorithms in a multi sensors embedded system. The control system will integrated in a transportation vehicle that can run in low-pressure environment. The student will use a hardware platform developed in the Swissloop project. The main goal of this project is develop and test the hardware-software system in a real vehicle that will compete in summer 2018 in an international competition. Both lab and in-field test are planned to evaluate the control algorithm developed and the whole system and the student will participate to these evaluation.

2 Tasks

The project will be split up three phases, as described below:

Phase 1 (1-2 Months)

1. An important investigation of the state-of-the-art off-the-shelf components, processing and sensing will be the first step of this project. The student together with the supervisors and the Swiss loop team will decide the main components according of the power consumption, the functionality and the availability on the market.)
2. The first preliminary algorithm and sensors interface will be studied and implemented to cover the stringent requirements of the vehicle.
3. Preparation of the measurements set up and preliminary lab test of the developed algorithm implemented in the hardware platform.

Phase 2 (1-2Months)

1. Testing, measurements and eventually simulations for estimation of performance of the developed system.
2. In-field evaluation of the developed solution.
3. Optimization of the algorithms and sensors interface to improve the performance

4. Preparing and helping the swissloop for the competition where the control system will be employed

Phase 3 (1-2 Months)

1. Finalizing the tests and optimizations.
2. Write final document and prepare presentation.

3 Milestones

By the end of **Phase 1** the following should be completed:

- Preliminary control system that include the sensor acquisition and the control.

By the end of **Phase 2** the following should be completed:

- Accurate in-field test and performance evaluation
- A working version of the control system in the real vehicle and competition preparation

By the end of **Phase 3** the following should be completed:

- Summary of the results from the competition in terms of performance and further optimization.
- Final Presentation
- Final Report, including final results.

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4 Project Organization

4.1 Weekly Report

There will be a weekly report sent by the student at the end of every week. The main purpose of this report is to document the project's progress and should be used by the student as a way to communicate any problems that arise during the week. The report, along with all other relevant documents (source code, datasheets, papers, etc), should be uploaded regularly to the assigned SVN account.

4.2 Final Report

PDF copy. All copies remain the property of the Integrated Systems Laboratory. A copy of the developed software needs to be handed in on CD or DVD at the end of the project.

4.3 Final Presentation

At the end of the project, the outcome of the thesis will be presented in a 15 minutes task, again during a group meeting of the Integrated Systems Laboratory.

Appendix B

Declaration of Originality

Include the declaration of authorship with the `\includepdf` command (sign it and scan it). For more information about plagiarism, please visit `https://www.ethz.ch/students/en/studies/performance-assessments/plagiarism.html`

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Declaration of originality

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This is a sample title

Authored by (in block letters):
For papers written by groups the names of all authors are required.

Name(s):	**First name(s):**
First	Student
Second	Student

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- I have mentioned all persons who were significant facilitators of the work.

I am aware that the work may be screened electronically for plagiarism.

Place, date	**Signature(s)**
Zurich, 01.01.2000	First Student Signature
	Second Student Signature

For papers written by groups the names of all authors are required. Their signatures collectively guarantee the entire content of the written paper.

Glossary

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