“Modeling and Debugging Embedded Systems”

Course Syllabus

Approved by
Programme’s Academic Council
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Course Author	University of Colorado Boulder
Course Teacher	Ivanov Ilya A.
ECTS credits	4
Contact hours	2
Self-study hours	150
Year, Programme	2 nd year, Master’s Programme " Internet of Things and Cyber-physical Systems"
Course format	Blended (with online course)

1. Course Description

In this course students will learn :

* About SystemC and how it can be used to create models of cyber-physical systems in order to perform "what-if" scenarios

* About Trimble Engineering's embedded systems for heavy equipment automation

* A deeper understanding of embedded systems in the Automotive and Transoprtion market segment

* How to debug deeply embedded systems

* About Lauterbach's TRACE32 debugging tools

* How to promote technical ideas within a company

* What can be learned from studying engineering failures The course is based on MOOC “Modeling and Debugging Embedded Systems” https://www.coursera.org/learn/modeling-debugging-embedded-systems (Platform - Coursera.org)

2. Course Contents

Module 1: SystemC, Trimble Engineering Guest Speakers

In this module we will look at Modeling using a language called SystemC, and hear guest speakers from Trimble Engineering presenting on their products.

Segment 1 - SystemC 1

Segment 2 - SystemC 2

Segment 3 - SystemC: Example Baggage Handling System

Segment 4 - Explanation of Rotary Shaft Encoders

Segment 5 - Rotary Shaft Encoder use in Paper Cutters

Segment 6 - SystemC Examples

Segment 7 - Baggage Handling System Model Structure

Segment 8 - Trimble - Introduction

Segment 9 - Trimble - Machine Grade Control, Production Study

Segment 10 - Trimble - Machine Types

Segment 11 - Trimble - Excavator

Segment 12 - Trimble - Communication Protocols

Segment 13 - Trimble - Site Gateway

Segment 14 - Trimble - Peer-to-Peer System

Segment 15 Trimble - Predictive Analytics

Segment 16 - Trimble - Security

Segment 17 - Trimble - UAVs

Segment 18 - Trimble - Augmented Reality

Segment 19 - Trimble - Hololens

Module 2: Deep Dive: Automotive and Transportation

In this module we will take a deeper look into the Automotive and Transportation sector, as this sector is poised for large growth. If you'll remember back to course 1 where we looked at market size opportunities, and saw there that the Automotive and Transportation sector was estimated to grow to 154 billion US dollars, at a CAGR of 30%..

Segment 1 - Automotives

Segment 2 - Trucking

Segment 3 - Trucking - Weigh in Motion

Segment 4 - Logistics

Segment 5 - Trains

Segment 6 - Planes

Segment 7 - Shipping

Segment 8 - Smart Roads

Segment 9 - Smart Parking

Segment 10 - Summary

Module 3: Debugging Deeply Embedded Systems, Lauterbach Guest Speaker

In this module you will learn about Debugging deeply embedded systems, and you will get to hear a guest speaker from Lauterbach, a company that provides leading edge debugging solutions for embedded systems.

Segment 1 - Debug

Segment 2 - Log Pages

Segment 3 - Debugging During Validation

Segment 4 - The Importance of Trace

Segment 5 - Lauterbach - Introduction

Segment 6 - Lauterbach - JTAG

Segment 7 - Lauterbach - Tracing

Segment 8 - Lauterbach - Types of Trace Output + Viewing Traces

Segment 9 - Lauterbach - Looking Back in Time

Segment 10 - Lauterbach - Timing and Performance Analysis

Segment 11 - Lauterbach - Code Coverage

Module 4: Promoting Technical Ideas, Learning from Failures

In the final module of this course you will hear my thoughts on how engineers can promote technical ideas up the management ladder, and hopefully get enough traction with management to turn your ideas into shipping products. Additionally, we will briefly take a look at what we can learn from engineering failures.

Segment 1 - Promoting Technical Ideas - Patents

Segment 2 - Promoting Technical Ideas within a Company

Segment 3 - Learning from Failures4

Segment 4 - Learning from Failures - From My Past

Segment 5 - Learning from Failures - Sparkfun

Segment 6 - Learning from Failures - Kickstarter CST-01 Watch

Segment 7 - Learning from Failures - Toyota

Segment 8 - 20 Reasons Startups Fail

Segment 9 - Assessing Business Risks

3. Grading System

Cumulative grade = % online course *0,1

Final grade = 50% cumulative grade + 50% final exam

4. Guidelines for Knowledge Assessment

After completion of online course, students should pass the final exam.

5. Methods of Instruction

The discipline is delivered through online course

6. Special Equipment and Software Support (if required) - none