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# Work Plan

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Friday, 27<sup>th</sup> of February 2015

Group 16

2IO70

The purpose of this document is to help understand and organise the process of our project, by defining the concepts, tasks, subtasks, responsibilities, and deadlines. This document describes how we are going to manage our time to complete the project.

Group 16

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Version 3.0

## **Introduction**

In this document you will find the details on how we will design and build, in the coming eight weeks, a sorting machine and the software that runs it. The Work Plan will contain a clear schedule for the tasks to be completed over the course of the project. This includes, but is not limited to, assigning responsibility and setting deadlines for each deliverable. This document will likely be updated with newer versions later on as unforeseen circumstances arise.

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# Goals and objectives

## Goal of the project

The goal of this project is to design and build a machine capable of sorting black and white disks and the embedded system controlling it. In addition to this, we will learn how to perform different roles in a group project. Obtain experience in specification, design, and construction of a simple embedded system. As well as learning how to keep design and implementation of the software manageable by using a programming language as a stepping stone to the machine language. And to become aware of the influence of electrical and mechanical limitations on the realizability of machine controlled systems.

## Objectives Machine Design

The objectives of Machine Design are to design and construct a physical sorting machine by solely using the parts in the provided Fisher Technik construction kit and to define the System Level Requirements, which consists of use cases, user constraints and safety properties.

Use cases: description of a usage scenario of the machine. Use cases also clarify the features and observable qualities of the machine.

User constraints: description of the expected behaviour of users, with the assumption that the system works properly.

Safety properties: specification of a set of relations between inputs and outputs written in English, but later expressed using UPPAAL.

In the document “Machine Design”, the System Level Requirements, as well as the connections between different parts of the machine and the micro-controller, the so-called machine interface, must be completely and accurately described.

## Objectives Software Specification

The objectives of Software Specification are to write a description, as accurately as possible, of the required behaviour of the PP2. Described are:

Which signals from the machine interface are inputs to the program, and what these signals represent.

Which signals from the machine interface are outputs to the program, and what these signals control.

How the inputs depend on the outputs, that is, how the PP2 reacts to the inputs.

When this is done the document “Software Specification” and accessory UPPAAL model are to be handed in.

## Objectives Software Design

In the phase Software Design one objective is to construct a computer program in high level code, like Java. This should be realized with all requirements defined in the Software

Specification. The code doesn't necessarily need to be compilable and executable. It serves as a stepping stone towards the Assembly Language program of the next phase.

Another objective in this phase is to construct a document containing the design decisions with explanation and/or motivation. To assure correctness of the program it's needed to explain correctness, at least, informally. This should also be part of the document.

### **Objectives Software Implementation and Integration**

For Software Implementation and Integration, the Java program written in the previous phase is converted into Assembly code. Then it is compiled and integrated into the PP2 processor and the Fisher Technik machine. In order to be able to do this, it is required that a representation is chosen of all variables and data structures from the Java program and that a uniform coding standard is developed. Both the data representation and the coding standard are detailed in a document called "Software Implementation".

### **Objectives System Validation and Testing**

The objective of System Validation and Testing is to verify whether or not the end product meets the initial requirements. System Validation and Testing is carried out during all the other software related steps. The process is split in 3 main methods: Code Review , Test Cases and Formal Proofs.

Code review consists of having a group of people assess and review lines of code. For every review a report has to be created, from a simple Walk-through to a Formal Peer Review or Pair Programming.

Test Cases must be created describing with an input and an expected output, the Test Run must cover all statements, conditions and decisions, all executions of the test cases must be documented along with a description of the result of the test.

The Formal Proofs is checking if requirements written in a mathematical logic satisfy the UPPAAL models of the Software Specification.

### **Final Report**

This document is a compilation of all previous documents, and adds to that: a table of contents, an introduction, and a conclusion. This conclusion will go over some of the problems the group faced over the course of this project, and how these problems were eventually solved. The "Final Report" is the final document to be handed in collectively, and marks the completion of the project of designing and building a sorting machine and the software that controls it.

# Roles

**The president** leads the upcoming meetings and, in order to do that, prepares an agenda. The President is succeeded by the secretary after every week.

**The secretary** writes down minutes during the meetings, which are to be discussed and approved during the next meeting. He also compiles all individual logbooks into one collective logbook. Similarly to the president, the secretary is changed weekly.

**The Quality Assurance Manager** has to keep the Work Plan up to date and is responsible for the communication between the group and the tutor. Moreover, he is responsible for the whole process of the project. He makes sure that the products meet the requirements and are handed in time. The Quality Assurance Manager is rotated after the first three weeks and two weeks after that.

**The role of the materials manager** is responsible for the provided materials, with the purpose of maintaining their initial state until the end of the project. The role of materials manager is not changed during the course.

# Defining our terms

Wp	= Work Plan
Df	= Defining our terms
Tt	= Create weekly timetables
L	= Compiling and defining layout of the document
Md	= Machine Design
Mi	= Machine Interface
Tc	= Defining Test cases
L	= Compiling and defining layout of the document
Cr	= Cross-reading
Ss	= Software Specification
In	= Inputs
Ot	= Outputs
Dio	= Dependence of outputs on inputs
Ias	= Inventory of abstract states
Sc	= State changes depending on inputs
UPP	= Create an UPPAAL model of the machine
L	= Compiling and defining layout of the document
Cr	= Cross-reading
Sd	= Software Design
I/o	= Pick variables for In/Out registers
Fe	= Formulate Exception Service Routines
Ec	= Explain the correctness of our program
Dd	= Motivate design decisions
L	= Compiling and defining layout of the document
Cr	= Cross-reading
Si	= Software Implementation and Integration
Cs	= Develop coding standards / Document the compiler
Fa	= Debug the Assembly program
L	= Compiling and defining layout of the document
Cr	= Cross-reading
VaT	= Validation and Testing
Tc	= Evaluate test cases / Perform test cases
SLR	= Check whether SLRs are met
Uf	= Check unintended functionality
Dv	= Define how part of the process is going to be validated
Co	= Code review
Pr	= Make formal proofs
L	= Compiling and defining layout of the document
Cr	= Cross-reading
FR	= Final Report
L	= Compiling and defining layout of the document
Cr	= Cross-reading
Pr	= Presentation
Mp	= Making presentation
P	= Practicing
P	=President
S	=Secretary
Q	=Quality assurance manager
M	=Materials manager

## Total work

Project	Week 4	Week 5	Week 6	Week 7	Week 8	Total
Wp	20					20
Md	20					20
Ss	45	90				135
Sd			90	10		100
Si				60		60
Vat	17	12	12	32	12	85
FR					54	45
Pr					24	45
Total	102	102	102	102	90	500

## Deliverables

Project	Responsibility	Deadline	Week
Work Plan	Rolf	March 3, 2015	4
Machine Design	Maarten	March 6, 2015	4
Software Specification	Rolf	March 13, 2015	5
Software Design	Wigger	March 27, 2015	7
Software Implementation and Integration	Stefan	March 27, 2015	7
Validation and Testing	Tudor	April 3, 2015	8
Final Report	Dat	April 17, 2015	10

All deadlines are at 23:59 on the given date.



# Timetables

## Week 4

Tuesday

Time	Wigger	Stefan	Rolf	Dat (Q)	Maarten (P) (M)	Tudor (S)
1030-1100	Meeting	Meeting	Meeting	Meeting	Meeting	Meeting
1100-1130	Md.mi	Md.mi	Wp.Tt	Wp.Tt	Wp.Tt	Md.tc
1130-1230	Md.mi	Md.mi	Wp.Df	Wp.Tt	Wp.Tt	Md.tc
1230-1330	Md.mi	Md.mi	Wp.Df	Wp.Tt	Wp.Tt	Md.tc
1330-1430		Wp.Tt		Wp.Tt		
1430-1530	Md.l	Wp.Tt	Wp.Tt	Wp.Tt		Md.tc
1530-1630	Wp.Tt	Wp.Tt	Wp.Tt	Wp.Tt	Wp.Tt	
1630-1730	Wp.Tt		Wp.L		Wp.Tt	

Wednesday

Time	Wigger	Stefan	Rolf	Dat (Q)	Maarten (P) (M)	Tudor (S)
1230-1330	Ss.In	Ss.In	Ss.Ot	Ss.Ot	Ss.Ot	Md.tc
1330-1430	Ss.In	Ss.In	Ss.Ot	Ss.Ot	Ss.Ot	Md.tc
1430-1530	Ss.In	Ss.In	Ss.Ot	Ss.Ot	Ss.Ot	Md.tc
1530-1630	Md.l	Ss.In	Ss.Ot	Ss.Ot	Ss.Ot	Ss.in
1630-1730	Md.l	Ss.In	Ss.Ot	Ss.Ot	Ss.Ot	Ss.in

Friday

Time	Wigger	Stefan	Rolf	Dat (Q)	Maarten (P) (M)	Tudor (S)
1030-1130	Meeting	Meeting	Meeting	Meeting	Meeting	Meeting
1130-1230	Ss.dio	Ss.dio	Ss.ias	Ss.ias	Ss.ias	Ss.dio
1230-1330	Ss.dio	Ss.dio	Ss.ias	Ss.ias	Ss.ias	Ss.dio
1330-1430	Ss.dio	Ss.dio	Ss.ias	Ss.ias	Ss.ias	Ss.dio
1430-1530	Ss.dio	Ss.dio	Ss.sc	Ss.sc	Ss.sc	Ss.dio
1530-1630	Ss.cr	Ss.cr	Ss.sc	Ss.sc	Ss.sc	Ss.cr
1630-1730	Ss.cr	Ss.cr	Ss.cr	Ss.cr	Ss.cr	Ss.cr

## Week 5

Tuesday

Time	Wigger	Stefan (S)	Rolf	Dat (Q)	Maarten (M)	Tudor (P)
1030-1100	Meeting	Meeting	Meeting	Meeting	Meeting	Meeting
1100-1130	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp
1130-1230	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp
1230-1330	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp
1330-1430	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp
1430-1530	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp
1530-1630	VaT	VaT	VaT	VaT	VaT	VaT

Wednesday

Time	Wigger	Stefan (S)	Rolf	Dat (Q)	Maarten (M)	Tudor (P)
1230-1330	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp
1330-1430	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp
1430-1530	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp
1530-1630	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp
1630-1730	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp

Friday

Time	Wigger	Stefan (S)	Rolf	Dat (Q)	Maarten (M)	Tudor (P)
1030-1130	Meeting	Meeting	Meeting	Meeting	Meeting	Meeting
1130-1230	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp	Ss.Upp
1230-1330	Ss.Cr	Ss.Cr	Ss.Cr	Ss.L	Ss.Cr	Ss.Cr
1330-1430	Ss.Cr	Ss.Cr	Ss.Cr	Ss.L	Ss.Cr	Ss.Cr
1430-1530	Ss.Cr	Ss.Cr	Ss.Cr	Ss.L	Ss.Cr	Ss.Cr
1530-1630	VaT	VaT	VaT	VaT	VaT	VaT

## Week 6

Tuesday

Time	Wigger	Stefan (P)	Rolf	Dat (S) (Q)	Maarten (M)	Tudor
1030-1100	Meeting	Meeting	Meeting	Meeting	Meeting	Meeting
1100-1130	Sd.I/o	Sd.I/o	Sd.I/o	Sd.I/o	Sd.I/o	Sd.I/o
1130-1230	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe
1230-1330	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe
1330-1430	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe
1430-1530	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe
1530-1630	VaT.Co	VaT.Co	VaT.Co	VaT.Co	VaT.Co	VaT.Co

Wednesday

Time	Wigger	Stefan (P)	Rolf	Dat (S) (Q)	Maarten (M)	Tudor
1230-1330	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe
1330-1430	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe
1430-1530	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe	Sd.Fe
1530-1630	Sd.Ec	Sd.Ec	Sd.Ec	Sd.Ec	Sd.Ec	Sd.Ec
1630-1730	Sd.Ec	Sd.Ec	Sd.Ec	Sd.Ec	Sd.Ec	Sd.Ec

Friday

Time	Wigger	Stefan (P)	Rolf	Dat (S) (Q)	Maarten (M)	Tudor
1030-1130	Meeting	Meeting	Meeting	Meeting	Meeting	Meeting
1130-1230	Sd.Ec	Sd.Ec	Sd.L	Sd.Ec	Sd.Ec	Sd.Ec
1230-1330	Sd.Dd	Sd.Dd	Sd.L	Sd.Dd	Sd.Dd	Sd.Dd
1330-1430	Sd.Dd	Sd.Dd	Sd.L	Sd.Dd	Sd.Dd	Sd.Dd
1430-1530	Sd.Dd	Sd.Dd	Sd.L	Sd.Dd	Sd.Dd	Sd.Dd
1530-1630	VaT.Co	VaT.Co	VaT.Co	VaT.Co	VaT.Co	VaT.Co

## Week 7

Tuesday

Time	Wigger (P)	Stefan (S)	Rolf	Dat	Maarten (Q) (M)	Tudor
1030-1100	Meeting	Meeting	Meeting	Meeting	Meeting	Meeting
1100-1130	Sd.Cr	Sd.Cr	Sd.Cr	Sd.Cr	Sd.Cr	Sd.Cr
1130-1230	Sd.Cr	Sd.Cr	Sd.Cr	Sd.Cr	Sd.Cr	Sd.Cr
1230-1330	Sd.Cr	Si.Cs	Si.Cs	Si.Cs	Si.Cs	Si.Cs
1330-1430	Si.Cs	Si.Cs	Si.Cs	Si.Cs	Si.Cs	Si.Cs
1430-1530	Si.Cs	Si.Cs	Si.Cs	Si.Cs	Si.Cs	Si.Cs
1530-1630	Si.Cs	Si.Cs	Si.Cs	Si.Cs	Si.Cs	Si.Cs

Wednesday

Time	Wigger (P)	Stefan (S)	Rolf	Dat	Maarten (Q) (M)	Tudor
1230-1330	Si.Cs	Si.Cs	Si.Cs	Si.Cs	Si.Cs	Si.Cs
1330-1430	Si.Cs	Si.Fa	Si.Fa	Si.Fa	Si.Fa	Si.Fa
1430-1530	Si.Fa	Si.Fa	Si.Fa	Si.Fa	Si.Fa	Si.Fa
1530-1630	Si.Fa	Si.Fa	Si.Fa	Si.Fa	Si.Fa	Si.Fa
1630-1730	Si.Fa	Si.Fa	Si.Fa	Si.Fa	Si.L	Si.Cr

Friday

Time	Wigger (P)	Stefan (S)	Rolf	Dat	Maarten (Q) (M)	Tudor
1030-1130	Meeting	Meeting	Meeting	Meeting	Meeting	Meeting
1130-1230	Si.Cr	Si.Cr	Si.Cr	Vat.Pr	Vat.Pr	Vat.Pr
1230-1330	Vat.Pr	Vat.Pr	Vat.Pr	Vat.Pr	Vat.Pr	Vat.Pr
1330-1430	Vat.Pr	Vat.L	Vat.L	Vat.L	Vat.L	Vat.L
1430-1530	Vat.L	Vat.L	Vat.L	Vat.L	Vat.L	Vat.Cr
1530-1630	Vat.Cr	Vat.Cr	Vat.Cr	Vat.Cr	Vat.Cr	Vat.Cr

## Week 8

Tuesday

Time	Wigger	Stefan	Rolf (P)	Dat	Maarten (S) (Q) (M)	Tudor
1030-1100	Meeting	Meeting	Meeting	Meeting	Meeting	Meeting
1100-1130	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L
1130-1230	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L
1230-1330	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L
1330-1430	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L
1430-1530	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L
1530-1630	VaT.L	VaT.L	VaT.L	VaT.L	VaT.L	VaT.L

Wednesday

Time	Wigger	Stefan	Rolf (P)	Dat	Maarten (S) (Q) (M)	Tudor
1230-1330	Pr.Mp	Pr.Mp	Pr.Mp	Pr.Mp	Pr.Mp	Pr.Mp
1330-1430	Pr.Mp	Pr.Mp	Pr.Mp	Pr.Mp	Pr.Mp	Pr.Mp
1430-1530	Pr.Mp	Pr.Mp	Pr.Mp	Pr.Mp	Pr.Mp	Pr.Mp
1530-1630	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L
1630-1730	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L	Fr.L

Friday

Time	Wigger	Stefan	Rolf (P)	Dat	Maarten (S) (Q) (M)	Tudor
1030-1130	Meeting	Meeting	Meeting	Meeting	Meeting	Meeting
1130-1230	Pr.P	Pr.P	Pr.P	VaT.Cr	VaT.Cr	VaT.Cr
1230-1330	Pr.P	Pr.P	Pr.P	VaT.Cr	VaT.Cr	VaT.Cr
1330-1430	Pr.P	Pr.P	Pr.P	VaT.Cr	VaT.Cr	VaT.Cr
1430-1530						
1530-1630						

# Validation and Change Policy

## Validation

We validate the work plan by comparing the expected time it would take to finish each task in the schedule with the time spent working on the corresponding task in the collective logbook. The logbook serves as an indication of how much time was spent on a certain task by each member of the group.

## Change policy and conclusions

Suppose that some unforeseen problems arise and it's going to be nearly impossible to meet a deadline. Unfortunately, then we will all have to spend more time on a subtask. Should there be a significant difference between the schedule and the logbook, then it is expected that the member of the group does their work at home.