Robotic Sensorimotor System Testing Platform (RSSTP)

Final Report

Version 0.1

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Executive abstract

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Acronyms and Definitions

|  |  |
| --- | --- |
| Actor | The test subject (e.g., a robot arm) |
| PE | Perception Engineering |
| RSSTP | Robotic Sensorimotor Software Testing Platform |
| TDD | Test-Driven Development |
| UBICOMP | Center for Ubiquitous Computing |
| VR | Virtual Reality |
|  |  |

# Introduction

How does a person learn to traverse their surroundings? How does an animal? When all senses of a living being (e.g., sight, hearing, smell, etc.) are combined, they create a mesh of information, which can be used by said being to obtain a feeling about their environment and consequentially navigate through it. However, what happens when an actor is stripped of most of their senses and is only left with minimal sensory feedback? What is the best algorithm, which can be used to learn one’s environment when there is little to no information to utilize?

In the Perception Engineering (PE) research group of The Center for Ubiquitous Computing (UBICOMP) research unit in the University of Oulu, possible answers for the last question stated above will be explored. It is planned for research to be done, so that optimal algorithms, which e.g., teach a robotic hand to move in an environment with different obstacles, can be found. Before this can be done, however, a testing platform, in which these algorithms can be evaluated and compared needs to be created.

In this document, the design and creation of such a platform, named Robotic Sensorimotor System Testing Platform (RSSTP), are outlined. In the following chapters more information about the customer, the project itself and the realised requirements will be given. This will be followed by an explanation of the software development and testing methods used during the project. Afterwards the project timeline will be discussed, and the document will be concluded with the feedback given to the Software Project course organizers. Any additional (and necessary information) regarding this project will be found in the [*Appendix*](#_Appendix) chapter.

# Customer

The customer for this project is the UBICOMP research unit and more specifically the PE group, which focuses on research related to Virtual Reality (VR) and robotics-related problems, similar to the one described in this document, as for example sensing, sensor fusion, planning, learning and control [1].

The people who will act as representatives for the customer and in so as supervisors and contact persons for this project are Dr. Vadim Weinstein ([vadim.weinstein@oulu.fi](mailto:vadim.weinstein@oulu.fi)) and Dr. Kale Timperi ([kalle.timperi@oulu.fi](mailto:kalle.timperi@oulu.fi)).

# Project description

 Algorithm gets sensory data(0/1) each transition,  
 but sensory feedback (1) only when it reaches a set point (green light)

# Realised requirements

## Internal logic

## External logic

# Used software development method

Scrum/Agile

Sprint = Milestone

Test-driven development (TDD)

# Testing

PyTest for unit tests

Run full algorithm scenarios for acceptance testing

# Project timeline

**TODO: Split into phases?**

The timeline of the RSSTP project starts on the 21st of September. On this date, the first meeting with the clients was had. The timeline ends on the 13th of December, when the Final Presentation was had. The project was conducted in 2022.

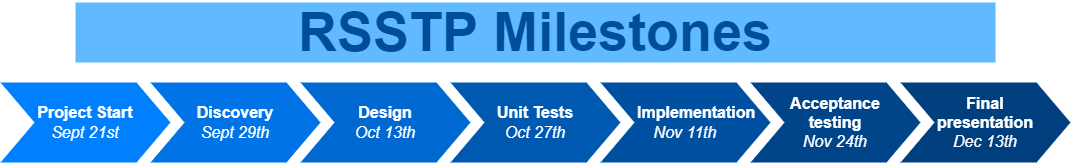


Figure 1 RSSTP Milestones

The Milestones for this project can be seen in Figure 1. Below, an explanation for each one will be given.

## Project start

**Duration:** 2022/09/07 – 2022/09/21

**Description:** Managing to find a project and getting approval from the teacher/TAs was the first milestone for the project. It was completed after the first client meeting.

## Discovery

**Duration:** 2022/09/21 – 2022/09/29

**Description:** The second milestone of “Discovery” was completed once the project goal was better understood. This was done by setting up multiple meetings with the clients and discussing the what the project entailed.

## Design

**Duration:** 2022/09/29 – 2022/10/13

**Description:** Completing the “Design” milestone was achieved when the team designed the software platform with the help of block and class diagrams.

## Unit Tests

**Duration:** 2022/10/13 – 2022/10/27

**Description:** As the project would be implemented following the TDD method, the unit tests for each software component had to be created. Once this was done, the “Unit Tests” milestone was reached.

## Implementation

**Duration:** 2022/10/27 – 2022/11/11

**Description:** Based on the design and unit tests, the software components of the RSTTP were implemented. The “Implementation” milestone was completed once this was done.

## Acceptance testing

**Duration:** 2022/11/11 – 2022/11/24

**Description:** To ensure that the testing platform works as expected, the entire software suite was tested by using it as intended and running different example algorithm through its pipeline. Completion of this milestone meant that the software worked as intended in the requirements.

## Final presentation

**Duration:** 2022/11/24 – 2022/12/13

**Description:** The final step of the project was to create a final presentation on the project. During this milestone any leftover tasks/bugs were also resolved.

# Feedback to the course organizers

# References

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| --- | --- |
| [1] | "Perception Engineering (PE)," [Online]. Available: https://ubicomp.oulu.fi/research/pe/. [Accessed 24 October 2022]. |

# Appendix

## Software structure

Text, letter

Description automatically generated

Text

Description automatically generated

Graphical user interface, text, application

Description automatically generated