**Project plan**

***SSI-Disassembly***

*Fontys Innovation Lab*

***Eindhoven***

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| **Date** **:** **14-03-2024** |
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| **Author** **:** **Tim Spieringhs** |

#### Version

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| 1 | 29-02-2024 | Tim Spieringhs | Made the complete document for reviewing | In progress |
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|  |  |  |  |  |

**Communication**

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| --- | --- | --- |
| **Version** | **Date** | **To** |
| 1 | 29-02-2024 | Brice Guayrin for feedback |
| 2 | 14-03-2024 | Brice Guayrin for feedback |
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# Project Assignment

## Context

The Fontys Lectureship ICT is a hub of innovation in Information and Communication Technology (ICT), focusing on applied research and collaboration with industry partners. Within this framework, the research group 'High Tech Embedded Software' investigates methods and techniques to enhance software development for smart high-tech embedded systems. By delving into areas like real-time operating systems, embedded software architectures, and cybersecurity, the group aims to develop practical solutions to meet the evolving demands of embedded systems. Through interdisciplinary collaboration and a commitment to excellence, the Fontys Lectureship ICT drives innovation and contributes to technological advancement in ICT.

One of the current projects at the Lectureship is about disassembly. Disassembly is about separating products, to get a product decomposed in its parts. It is a phase when remanufacturing, refurbishing or recycling a product. We perceive disassembly as a vital activity when reducing dependencies on critical raw materials and to reduce carbon footprint of manufacturing.

My company observed that companies in the manufacturing industry are faced with the challenge of making their production and materials more sustainable. Sometimes the disassembly of a product is perceived as easy when part is just clicked together. Sometimes the disassembly is more difficult when parts are glued together, and also when thinking about how to determine and guarantee the status of the product components. So, it’s up to the innovation lab to research what the technical possibilities are to this issue.

## Goal of the project

The project endeavours to enhance the disassembly program by advancing the identification and inspection stages. Previous efforts have primarily refined the sorting system utilizing a robotic arm. However, the current focus is to augment product identification and inspection capabilities. The primary objective is to develop a prototype capable of swiftly and accurately identifying products with minimal training requirements. Before proceeding with the prototype development, it is imperative to conduct comprehensive research on the available technologies and methodologies pertinent to this objective.

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Automatisch gegenereerde beschrijving

Figure 1 Project description

## The assignment

Designing and implementing a vision system for the disassembly line entails a comprehensive examination of various factors. This includes determining the necessary conditions for the vision system to operate effectively, such as considerations for distance to the object being observed. Additionally, the assignment involves devising methods for pattern matching specific product parts within the disassembly process.

Various aspects of vision approach need to be considered, including whether a 2D or 3D vision approach is most suitable, as well as integration of artificial intelligence techniques for enhanced recognition capabilities.

Choosing the appropriate camera setup is crucial, with options such as RealSense or ZED3 cameras being evaluated based on their suitability for the task at hand.

The actions that can be enabled by the vision results must also be addressed, such as utilizing vision information to facilitate the precise grabbing of product parts during the disassembly process.

The ultimate goal is to establish a vision system setup that serves as a demonstrator, capable of effectively detecting pre-defined product parts. This could involve methods such as inputting CAD-files or photos to identify desired components among a set of other items.

Through the demonstrator, it will be showcased that even seemingly 'random' product parts, like magnets or prints, can be accurately identified and managed within the disassembly process, thereby enhancing efficiency and effectiveness.

## Scope

|  |  |
| --- | --- |
| **The project includes:** | **The project does not include:** |
| 1. Researching computer vision methods | 1. Disassembly of a product |
| 1. Demos of computer vision methods | 1. Automatically sorting the product |
| 1. Prototype of a product identificator | 1. Automatically storing the product |

## Finished products

* Multiple small prototypes for research testing.
* A research to see which method(s) of computer vision works the best
* Developed prototype of the optimal method found out of the research.

## Research questions

**Main question:** What computer vision methods demonstrate the highest success rates in accurately detecting and recognizing newly introduced products?

**Subquestion 1:**How does the time efficiency of setting up computer vision for product detection vary across different methods, especially considering the effort required in uploading and annotating large datasets?

**Subquestion 2:** How do different computer vision methods vary in their ability to recognize and differentiate between subtle visual cues, contributing to their skill in accurately identifying new products?

**Subquestion 3:** What potential challenges or limitations might arise when applying computer vision to identify novel products, and how do various methods address these issues?

# Approach and Planning

## Approach

In the context of the adopted Scrum framework, the team will conduct weekly standups instead of daily ones, and a stakeholder meeting will take place every week, with a sprint review occurring every three weeks.

### **Test approach**

The chosen approach involves implementing a code review method to assess the functionality of the code. Additionally, unit tests will be employed, and a test plan will be formulated to outline specific requirements that the code must fulfil.

## Research methods

The DOT framework will be applied, for subquestion 1 prototyping, product review and benchmark testing will be used. For subquestion 2 available product analysis, expert interviews and best practices and bad practices. For subquestion 3 prototyping, community research and expert interviews. Additional methods may be incorporated as necessary for every subquestion.

## Time plan

|  |  |
| --- | --- |
| **Sprints** | **Plan** |
| Sprint 1 | Research the possibilities and see what has been done and what might work. Then talk with my product owner and show me my findings and then make a more specific research on certain possibilities. |
| Sprint 2 | Create some demos from the findings I found. |
| Sprint 3 | Perform thorough testing using the demos to identify the most effective solution both in practical application and theoretically. |
| Sprint 4 | Make a prototype of the solution found out of the research |
| Sprint 5 | Make a prototype of the solution found out of the research |
| Sprint 6 | Make a prototype of the solution found out of the research |
| Sprint 7 | Finish up the project for showcasing. |

# Project Organization

## Team members

|  |  |  |  |
| --- | --- | --- | --- |
| **Name + Phone + e-mail** | **Abbr.** | **Role/tasks** | **Availability** |
| Teade Punter, +31 6 57934696, teade.punter@fontys.nl | Lector High Tech Embedded Software (HTES) | Product owner + Company supervisor | 4 days a week |
| Edwin van den Oetelaar, oetelaar.automatisering@gmail.com | Lector High Tech Embedded Software (HTES) | Second product owner | 5 days a week |
| Pim Veroude, +31885076624, p.veroude@fontys.nl | Lecturer-researcher​ | Second company supervisor | 5 days a week |

## Communication

I conduct weekly meetings with each team member to review my accomplishments from the previous week and outline my plans for the upcoming week. I have more frequent interactions with certain team members, namely Edwin and Pim, as I often seek their assistance and share information. Additionally, I plan to implement SCRUM every three weeks to present my work in an organized manner and communicate my overall semester plan.

# Finance and Risks

## Cost budget

The only thing being used from the company is a Lenovo Thinkbook valued at around 699 euros. Borrowed from the ISSD, the Innovation Lab doesn't need to spend on it themselves.

## Risks and fall-back activities

|  |  |  |
| --- | --- | --- |
| **Risk** | **Prevention activities included in plan** | **Fall-back Activities** |
| 1. Company supervisor gets sick for a long time | n/a | Contact fontys for a new company supervisor |
| 1. I get sick for a long time | n/a | Contact fontys for extension of internship |
| 1. Robot arm stops working | Being careful with the robot arm | Ask the product owner for a new robot arm |
| 1. The camera for vision breaks | Be careful with the camera | Request a new camera from the ISSD |
| 1. My laptop breaks | Be careful with the laptop | Get a new laptop and pull my work from git |