

Personal Project Brief – IDE Master Graduation Project

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PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT

Complete all fields, keep information clear, specific and concise

Project title Design a solution to increase the tablet printing efficiency of Rx1

Please state the title of your graduation project (above). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

Introduction

Describe the context of your project here; What is the domain in which your project takes place? Who are the main stakeholders and what interests are at stake? Describe the opportunities (and limitations) in this domain to better serve the stakeholder interests. (max 250 words)

Today, personalised medicine (PM) is often seen as a luxury due to its high cost and limited availability. Doser aims at changing this perception by introducing Rx1, a 3D printer based on semi-solid extrusion (SSE) with reusable cartridges designed to manufacture customised medicines directly through pharmacies. In pharmaceuticals, SSE is used to make PMs with clinical relevance for specific groups, for example paediatric and geriatric patients. Rx1 promises an accessible, affordable, and safe means to individually tailor medication, offering benefits such as lower dosage, easier-to-swallow, better-tasting medicines for children, and minimal side effects.

Technology

The Rx1 is similar to a FDM 3D printer. It employs solid formulations, placing them inside a cartridge, heating them until semi-solid, and extruding them through a nozzle. A mechanical plunger facilitates the extrusion. The material is deposited layer by layer onto the printer table until the desired dosage volume is achieved.

Stakeholders

The printer is meant to serve two sectors: universities for research and pharmacies for drug manufacturing. The current known stakeholders and user groups are compounders and technicians at the pharmacies and the researchers at the universities. They are the primary stakeholders in this project as they use the device. The following stakeholders are vendors who manufacture and fill the cartridges for Doser, as changes made to the cartridge will affect them. The third stakeholder is Doser since the solution must fit their requirements.

Opportunities

The current cycle is suboptimal, leaving room for improvement. The user must place a cartridge in the printer and then heat it to maximum of 90°C, a process that takes considerable time due to the material's inherent characteristics. Once the cartridge is depleted, additional time is needed for cooling before replacement.

Limitations

Adhering to the regulatory requirements presents challenges for the solution. Differences in working conditions and standard operating procedures among user groups further complicate the implementation of the solution.

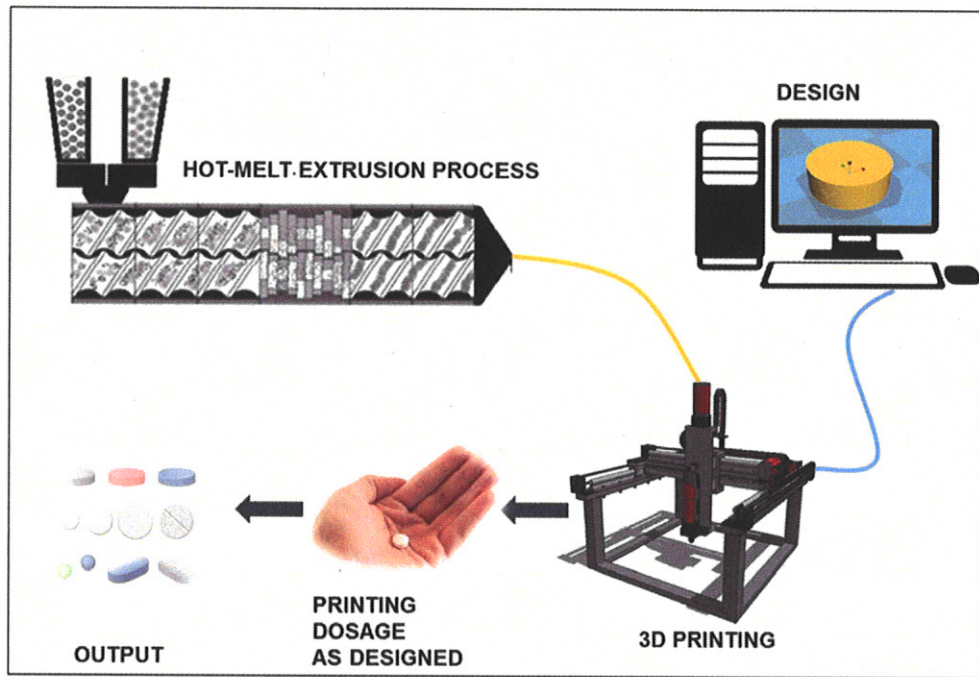


image / figure 1 Schematic of the 3D process for printing tablets. (Zhang et al., 2017)

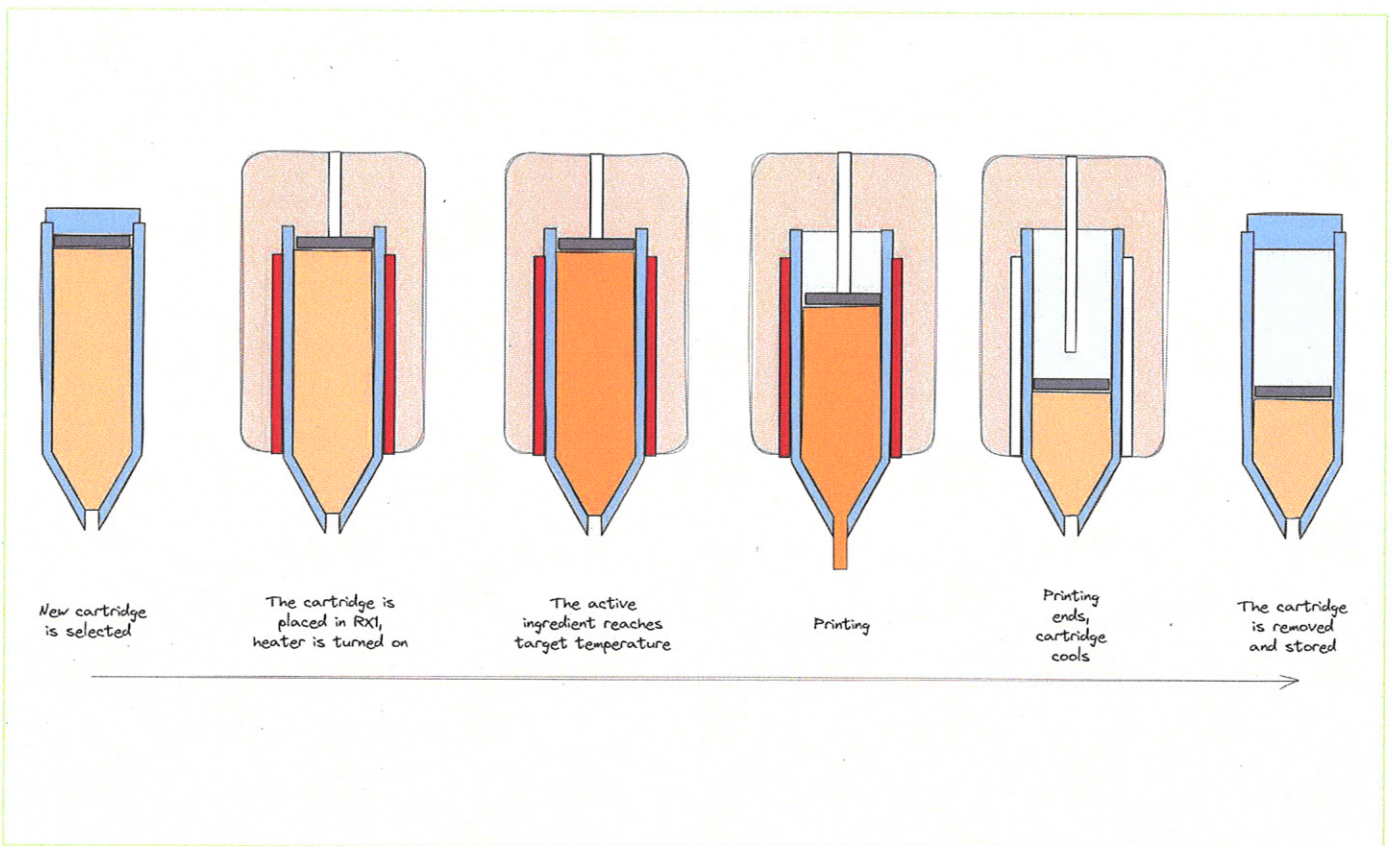


image / figure 2 Cartridge Cycle

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Problem Definition

What problem do you want to solve in the context described in the introduction, and within the available time frame of 100 working days? (= Master Graduation Project of 30 EC). What opportunities do you see to create added value for the described stakeholders? Substantiate your choice.

(max 200 words)

Problem Statement

The prolonged heating and cooling cycle time of cartridges in Rx1 hamper its throughput, causing delays in production and inconveniencing end users.

Firstly, the end user's requirements need to be clarified.

Next, Stakeholders employ Rx1 in varied contexts, lacking a universal Standard Operating Procedure (SOP). Some operate it in large, clean rooms, others as a standard desktop machine.

Moreover, Rx1 offers two cartridge sizes, chosen based on client needs, each with distinct physical properties due to volume and shape differences.

In addition, the target printing temperature is also based on the active ingredient in the cartridge.

Assignment

This is the most important part of the project brief because it will give a clear direction of what you are heading for. Formulate an assignment to yourself regarding what you expect to deliver as result at the end of your project. (1 sentence) As you graduate as an industrial design engineer, your assignment will start with a verb (Design/Investigate/Validate/Create), and you may use the green text format:

Redevelop the Rx1 to enhance personalised drug manufacturing, catering to the needs of researchers and compounders in academic and pharmacy environments, improving efficiencies

Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

Through observation and analysis of the workflow, identifying issues and potential optimisations is possible. This can lead to various solution-spaces.

An Ideal solution will:

1. Streamline heating and cooling processes to minimise production delays.
2. Enhance the user experience by reducing inconvenience during cartridge handling.
3. Ensure compatibility with diverse user environments and operational practices.
4. Maintain the regulatory standards during the production process.
5. Stays in the boundary of manufacturability and costs.
6. Work with both size of cartridges.

Final Deliverables:

1. Prototype or a model to reduce the production time of Rx1

Project planning and key moments

To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a **kick-off meeting, mid-term evaluation meeting, green light meeting and graduation ceremony**. Please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any (for instance because of holidays or parallel course activities).

Make sure to attach the full plan to this project brief.
The four key moment dates must be filled in below

Kick off meeting 4 Mar 2024

Mid-term evaluation 13 May 2024

Green light meeting 9 Jul 2024

Graduation ceremony 30 Aug 2024

In exceptional cases (part of) the Graduation Project may need to be scheduled part-time. Indicate here if such applies to your project

Part of project scheduled part-time	<input checked="" type="checkbox"/>
For how many project weeks	4
Number of project days per week	4,0

Motivation and personal ambitions

Explain why you wish to start this project, what competencies you want to prove or develop (e.g. competencies acquired in your MSc programme, electives, extra-curricular activities or other).

Optionally, describe whether you have some personal learning ambitions which you explicitly want to address in this project, on top of the learning objectives of the Graduation Project itself. You might think of e.g. acquiring in depth knowledge on a specific subject, broadening your competencies or experimenting with a specific tool or methodology. Personal learning ambitions are limited to a maximum number of five.

(200 words max)

My background as a mechanical engineer has cultivated a strong interest in the technical aspects of design. I intend to leverage this experience to bring fresh perspectives to the challenge. Additionally, I'm eager to delve into control systems fundamentals, expanding my skill set beyond traditional design roles. I aim to be equivalent to a 'full-stack developer', encompassing a user-centric approach and technical proficiencies.

In my previous roles, I've worked in large corporate environments with a slower pace and research facilities focused solely on academic projects. This project offers a unique opportunity to immerse myself in the fast-paced dynamics of a start-up environment while contributing to something that I know will be utilised for further development. I'm intrigued by the evolutionary process of start-ups and am enthusiastic about applying my skills and expertise. It also allows me to evaluate whether this working environment fits me.

Competencies to demonstrate:

1. Proficiency in design thinking
2. Strong grasp of product engineering
3. Advanced embodiment techniques

Competencies to enhance:

1. Cultivate creativity and conceptual thinking.
2. Expand knowledge of materials and their applications.
3. Strengthen skills in hardware and electronics prototyping.

