Hazard Analysis
Software Engineering

Team #10, Five of a Kind
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Table 1: Revision History

Date	**Developer(s)**	**Change**
Date1	Name(s)	Description of changes
Date2	Name(s)	Description of changes
...	...	...

Contents

[You are free to modify this template. —SS]

1 Introduction

The following sections aim to provide insight into our project and the role that hazard analysis plays throughout its development. It introduces the concept of a hazard and how it may manifest in software development. It then connects those ideas back to the scope of our current project.

1.1 Problem Statement

Recently, master's students at McMaster University have been developing cutting-edge 3D printer technology that has the capabilities of incorporating complex elements of magnetization and multi-material components. However, with this innovative new design comes the challenge of limited software capabilities that are unable to support the unique needs of property assignment while simultaneously allowing an efficient and intuitive design. Currently, developers of the 3D printer are forced to design their model outside of COMSOL, which is the current software that permits magnetization assignment. To build their model for printing, they must build their entire model voxel-by-voxel in COMSOL, individually assigning each voxel a specific magnetization. This leads to an unintuitive, time-consuming process that is unideal as they look to further test and develop their printer. They require new software that can take a model built through AutoCAD and provide a replica that has been sliced into voxels with the ability to easily assign magnetization and material values to each voxel.

1.2 Hazard Analysis Introduction

As defined by the Canadian Centre for Occupational Health and Safety, a hazard can be defined as any source of potential for harm, damage, or adverse effect to people, property, or the environment [1]. Many of the typical factors that can contribute to a hazard, including human error, unsafe working conditions, equipment malfunction, environmental influences, and inadequate safety procedures. However, from the perspective of a software developer, hazards can extend outside the factors listed above and may take form in data corruption, unstable system components, poor development processes, security risks and technological limitations.

As described above, our project aims to create software that supports slicing a pre-existing model into voxels and permitting easy property assignment for future printing processes.This project has the potential to greatly reduce the time, energy and workload exerted on those using the multi-material 3D printer. However, to accomplish this, there are many potential hazards that must be mitigated during system development. These hazards may come from impractical technical implementations, incompatible input data structures with

pre-existing software or faulty output generation that could result in unsafe or unintended behaviour in the physical system. Therefore, the hazard analysis outlined below aims to identify and assess all hazards to ensure that our team is able to successfully deploy a safe and reliable software system.

2 Scope and Purpose of Hazard Analysis

[You should say what **loss** could be incurred because of the hazards. —SS]

3 System Boundaries and Components

[Dividing the system into components will help you brainstorm the hazards. You shouldn't do a full design of the components, just get a feel for the major ones. For projects that involve hardware, the components will typically include each individual piece of hardware. If your software will have a database, or an important library, these are also potential components. —SS]

4 Critical Assumptions

[These assumptions that are made about the software or system. You should minimize the number of assumptions that remove potential hazards. For instance, you could assume a part will never fail, but it is generally better to include this potential failure mode. —SS]

5 Failure Mode and Effect Analysis

[Include your FMEA table here. This is the most important part of this document. —SS] [The safety requirements in the table do not have to have the prefix SR. The most important thing is to show traceability to your SRS. You might trace to requirements you have already written, or you might need to add new requirements. —SS] [If no safety requirement can be devised, other mitigation strategies can be entered in the table, including strategies involving providing additional documentation, and/or test cases. —SS]

6 Safety and Security Requirements

[Newly discovered requirements. These should also be added to the SRS. (A rationale design process how and why to fake it.) —SS]

7 Roadmap

[Which safety requirements will be implemented as part of the capstone timeline? Which requirements will be implemented in the future? —SS]

Appendix — Reflection

[Not required for CAS 741 —SS]

The purpose of reflection questions is to give you a chance to assess your own learning and that of your group as a whole, and to find ways to improve in the future. Reflection is an important part of the learning process. Reflection is also an essential component of a successful software development process.

Reflections are most interesting and useful when they're honest, even if the stories they tell are imperfect. You will be marked based on your depth of thought and analysis, and not based on the content of the reflections themselves. Thus, for full marks we encourage you to answer openly and honestly and to avoid simply writing "what you think the evaluator wants to hear."

Please answer the following questions. Some questions can be answered on the team level, but where appropriate, each team member should write their own response:

1. What went well while writing this deliverable?
2. What pain points did you experience during this deliverable, and how did you resolve them?
3. Which of your listed risks had your team thought of before this deliverable, and which did you think of while doing this deliverable? For the latter ones (ones you thought of while doing the Hazard Analysis), how did they come about?
4. Other than the risk of physical harm (some projects may not have any appreciable risks of this form), list at least 2 other types of risk in software products. Why are they important to consider?

References

[1] C. C. for O. H. and S. Government of Canada, "CCOHS: Hazard and Risk - Hazard Identification." Accessed: Oct. 08, 2025. [Online]. Available: https://www.ccohs.ca/oshanswers/hsprograms/hazard/ hazard¿*dentification.html*