Hazard Analysis
SFWRENG 4G06 - Capstone Design Process

Team 17, DomainX

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Table 1: Revision History

Date	**Developer(s)**	**Change**
October 6, 2025	Ghena Hatoum	Added the components
October 6, 2025	Ghena Hatoum	Added the Components Diagram
October 4, 2025	Awurama Nyarko	Introduction, Scope, Critical Assumptions
October 6, 2025	Fei Xie	Added FMEA table
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[You are free to modify this template. —SS]

1 Introduction

This Hazard Analysis identifies and evaluates potential risks associated with the Neural Network Libraries (NNL) Assessment Tool, a web-based application that automates evidence collection, data storage, and visualization for assessing open-source neural network libraries.

In this context, a hazard is defined as any condition, event, or design decision that could lead to loss of data integrity, software malfunction, degraded performance, or failure to meet stakeholder requirements.

The tool integrates React (frontend), Flask (backend), a relational database (e.g., MySQL), and public Application Programming Interfaces (APIs), such as the GitHub API, to support automated data gathering, Analytic Hierarchy Process (AHP)–based ranking, and visualization of software-quality metrics.

Because the system involves data integration, user interaction, and deployment on university infrastructure, it faces technical and operational hazards (for example, integration errors, API limits, or performance bottlenecks). This document identifies such risks early in the lifecycle to protect software reliability, data integrity, and user experience.

2 Scope and Purpose of Hazard Analysis

The purpose of this hazard analysis is to systematically identify potential risks that could impact the reliability, usability, and delivery of the NNL Assessment Tool.

Although the tool is non-safety-critical, losses could still occur through:

- Data loss or corruption, affecting research integrity.
- System downtime, delaying project milestones or access for the research team.
- Inaccurate visualizations or metrics, leading to incorrect conclusions in research outputs.
- Security breaches, risking exposure of user accounts or evaluation data.
- Integration failures, which could prevent essential automation and data collection.

These losses would directly reduce the tool's credibility, hinder academic progress, and compromise user trust.

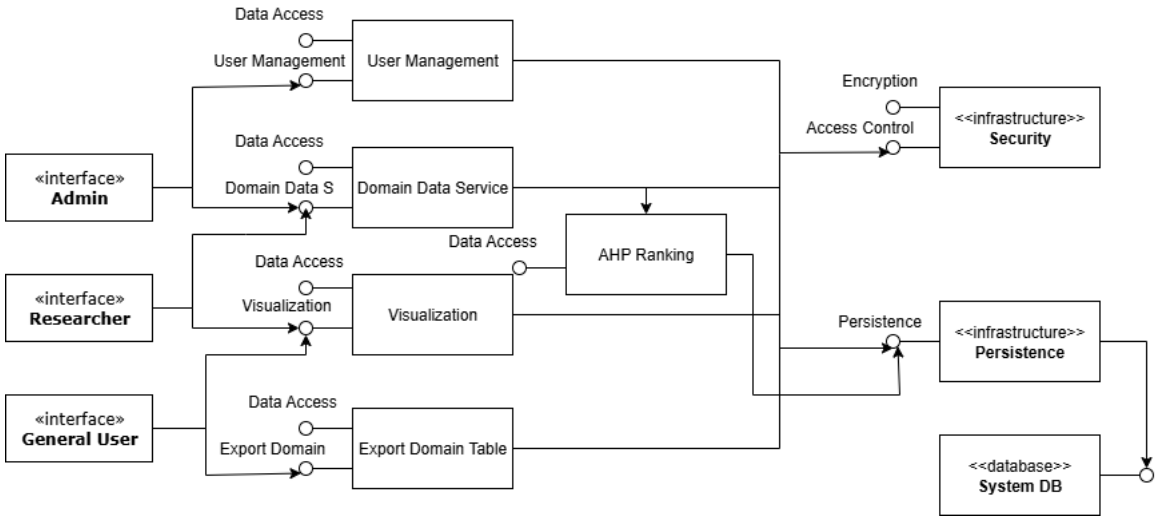
The analysis focuses on identifying, classifying, and mitigating these hazards early to minimize risks and ensure project success.

3 System Boundaries and Components

The following explain the System Components:

- Admin UI: Handles invitation, domain creation, and user management views.
- Researcher UI: Handles data input, updte, and visualization controls.

- User Managment: Handles logic for invite/signup, login, roles, and password reset.
- Domain Data Service: Handles read and write operations for Domains, Libraries, and Metrics.
- AHP Ranking: Handles the Analytical Hierarchy Process (AHP) calculation.
- Visualization: Handles graph generation.
- Export: Handles data downloads (JSON/Excel)
- Security: Handles Access Control, validation, encrypt password, and manages audit trails.
- Persistence: Handles storage and retrieval for all data entities.
- System DB: The underlying data store.



4 Critical Assumptions

The following assumptions support hazard identification and mitigation:

- **Access to Public APIs:** It is assumed that GitHub API and other data sources will remain stable; however, if access limits or outages occur, fallback mechanisms (e.g., cached data, manual upload) will be implemented.
- **McMaster Infrastructure Availability:** University servers will host the tool; if unavailable, contingency hosting (local or alternative cloud) will be explored.
- **Stable Development Team:** All members remain active; if a member becomes unavailable, roles and documentation ensure continuity.
- **Non-Safety-Critical Context:** Hazards relate to data and usability, not physical harm, but errors could still cause loss of credibility or project delays.

- **Defined Scope and Requirements:** Requirements remain stable; changes will trigger re-assessment of risks.
- **Version Control and Standards:** Git workflow reduces integration errors, though merge conflicts remain possible; peer reviews mitigate these.
- **User Feedback Availability:** Testing feedback will be accessible; if delayed, internal testing will substitute temporarily.

5 Failure Mode and Effect Analysis

The following contain our Failure Mode and Effect Analysis table is a breakdown of the hazards that could occur within the system, along with recommanded actions to mitigate them.

Table 3: Failure Mode and Effect Analysis

Component	Failure Modes	Effects of Failure	Causes of Failure	Recommended Action	SR	Ref.
User account	1. User can't login/signup. 2. Cannot set correct role for user. 3. User account information is leaked.	1. User cannot access their work. 2. Refer to H1-1. 3. User credentials are exposed, exposing them to cyber attack or data scrapers.	1. a) Integration with database failure. b) User entered incorrect credentials. 2. Refer to H1-1.a. 3. Weak access controls, lack of encryption, or insecure credentials.	1. a) Implement automated daily system integration testing. b) Provide user feedback during user actions. 2. Refer to H1-1.a, H1-1.b. 3. Implement Multi-factor authentication and follow industry best practices for security.	1. TODO 2. TODO 3. TODO	1. H1-1 2. H1-2 3. H1-3
Domain Creation	1. Cannot create new domains 2. Cannot edit existing domain	1. a) User cannot continue their work on the domain b) User will be delayed when writing their anaylsis 2. Refer to H2-1.a, H2-1.b.	1. Refer to H1-1.a a) User has incorrect role credentials 2. Refer to H1-1.a, H2-1.a.	1. Refer to H1-1.a, H1-1.b. 2. Refer to H1-1.a, H1-1.b.	1. TODO 2. TODO	1. H2-1 2. H2-2

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Design Function	Failure Modes	Effects of Failure	Causes of Failure	Recommended Action	SR	Ref.
Adding Data to Domain	1. User cannot add new datapoint 2. User cannot update existing datapoint 3. Automated process overwriting user data unknowningly 4. Automated data input failure	1. Refer to H2-1.a, H2-1.b. 2. Refer to H2-1.a, H2-1.b. 3. Refer to H2-1.a, H2-1.b a) Loss of user trust towards the tool 4. Refer to H2-1.a, H2-1.b, a) User has to manually input data, reducing usefulness of the tool	1. Refer to H1-1.a a) Network issues b) Save conflict occuring when multiple users are trying to edit the same datapoint 2. Refer to H1-1.a, H3-1.a, H3-1.b 3. a) Lack of user training on how automated datapoints work b) Inadequate user feedback user during system processes 4. Refer to H3-1.a. a) Integration issues with external systems	1. Refer to H1-1.a, H1-1.b. a) Explicit visual block on datapoints that other users are editing 2. Refer to H1-1.a, H1-1.b, H3-1.a. 3. Refer to H1-1.a, H1-1.b a) Provide explict user controls for manual inputs b) Provide training on key features to user c) Implement confirmation system for automated sections 4. Refer to H1-1.a, H1-1.b, H3-1.a.	1. TODO 2. TODO 3. TODO 4. TODO	1. H3-1 2. H3-2 3. H3-3 4. H3-4

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Design Function	Failure Modes	Effects of Failure	Causes of Failure	Recommended Action	SR	Ref.
Data Visualization	1. Visualization method does not match datapoints	1. Refer to H2-1.b, H3-3.a.	1. Refer to H1-1.a a) External system used for visualization not properly configured/working b) Another user is editing the datapoints while current user is trying to visualize	1. Refer to H1-1.A a) Require user to lock the domain when editing, with visualization functionality being available only on un-locked domains.	1. TODO	1. H4-1
Download Data	1. User unable to download the data/visuals of a domain 2. Downloaded data/visuals of a domain are corrupted and unusable	1. Refer to H2-1.b. 2. Refer to H2-1.b, H3-3.a.	1. Refer to H1-1.a, H2.1.a, H3-1.a, H4-1.a. 2. Refer to H1-1.a, H3-1.a, H4-1.a.	1. Refer tp H1-1.a, H1-1.b. a) Provide multiple methods for downloading or sharing 2. Refer tp H1-1.a, H1-1.b. a) Implement proper error handling in code to catch exceptions	1. TODO 2. TODO	1. H5-1 2. H5-2

Concluded

6 Safety and Security Requirements

The hazard analysis revealed several safety-related requirements that were not fully covered in the SRS. These requirements aim to prevent data loss, improve user experience during failures, and keep the tool reliable.

Clear Error Feedback and Account Recovery

The system must show clear error messages (e.g., wrong password, network failure) and give users a way to reset their credentials if they forget them.

Correct Role Assignment

User roles (Viewer / Contributor) must be assigned and saved correctly at signup or when updated by an admin so that permissions are always accurate.

Protecting Manual Edits from Automated Updates

If automated data refreshes could overwrite a user's manual entry, the system must warn the user or ask for confirmation before replacing the data.

Preventing Conflicting Edits

When two people try to edit the same record at the same time, the tool must either block one of the saves or clearly warn the users to avoid losing data.

Consistent Visualization

Publishing visualizations must not happen at the same time as ongoing data edits. The system should either block publishing during edits or enforce a short downtime so charts and scores always reflect a stable dataset.

Reliable Download of Data and Visuals

If an export (CSV, PNG, etc.) fails or the file is corrupted, the tool must alert the user and, where possible, let them retry the download.

7 Roadmap

8 Roadmap

For the Capstone timeline, we will focus on the safety features that are needed to make the tool work properly:

- Login with account recovery so that users can sign in securely.
- Correct role assignment (Viewer / Contributor) so only authorized users can edit data.

- A basic warning when automated updates might overwrite manual edits.
- Reliable downloads for tables and charts, with a simple error message if something goes wrong.

Some features will be added later as future improvements:

- A better system to prevent publishing visualizations while edits are happening (for example, temporary downtime or blocking the publish button).
- A stronger solution for conflicting edits, such as proper locking or live conflict warnings.
- More advanced error handling for things like failed downloads or export retries.

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?
   Haniye: One thing that went well was that looking at the hazards helped us spot requirements we hadn't considered before. Thinking through the risks made certain scenarios much clearer, like what happens if login fails or downloaded file is corrupted.

2. What pain points did you experience during this deliverable, and how did you resolve them?
   Haniye: One challenge was figuring out which safety features to prioritize for the Capstone demo and which to leave for later. After looking at the project scope, we agreed to focus on the most essential features that would keep the tool stable and reliable for the demo.

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?
   Haniye: Some hazards were already on our radar but only partially covered in the original requirements. For example, we had noted the risk of conflicting edits and planned to keep a record of changes, but we hadn't considered that the system should also block or warn other users editing the same record. Similarly, we knew we'd have different user roles, but we overlooked the need to handle role assignment correctly in the database. Other risks, like login failures or charts showing incomplete data, only came up as we worked through the hazard analysis and FMEA table.

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?
   Haniye: N/A