



**University of
Lancashire**

Super fancy name for Advanced Software Modeling Assignment

Sarah Gosch

BSc (Hons) Software Engineering
School of Engineering and Computing
University of Lancashire

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Introduction

Purpose: Briefly introduce the real-time temperature regulation unit being developed for smart laboratory equipment.

Scope: Mention that the report covers the formal specification, UML modeling, and concurrent design required to meet high-integrity safety standards.

System Requirements and Decomposition

Functional Requirements: List the core operations, such as continuous monitoring of multiple sensors and activating cooling/heating components.

Non-Functional Requirements: Detail the constraints, including $\pm 0.1^\circ\text{C}$ accuracy and the 1-second response time limit.

Subsystem Architecture: Describe the modular breakdown into SensorInput, Temperature-Controller, ActuatorControl, and SystemMonitoring.

Use Case Modeling: Present a UML use case diagram showing actors (e.g., Environment, System Operator) and their interactions.

UML Structural and Behavioural Modelling

Class Diagram: Provide a structural view of the system's classes, their relationships, and multiplicities.

Formal Constraints (OCL): Document the Object Constraint Language (OCL) expressions for invariants, preconditions, and postconditions.

Dynamic Behaviour: Include sequence or activity diagrams to model the control loop and sensor reading process.

Formal Specification and Design by Contract (DbC)

Contract Specification: Provide the formal JML (Java Modeling Language) or annotated Java code for the TemperatureController.

Verification Logic: Explain how Design by Contract (DbC) principles ensure correctness by preventing invalid states and software faults.

Testing Support: Discuss how these specifications assist in the verification and testing process.

Concurrency and Real-Time Behaviour

Thread Management: Model the concurrent components, such as multiple sensor threads accessing shared data.

Synchronization Strategy: Identify potential race conditions or deadlocks and explain your use of mutexes, semaphores, or monitors to solve them.

Implementation: Provide Java code snippets demonstrating thread synchronization or real-time scheduling.

Conclusion and Evaluation

Summary: Summarize how the formal models and specifications support the reliability and performance goals of the system.

Technique Evaluation: Briefly evaluate the software development techniques used (UML, OCL, JML, and Java concurrency) in terms of their effectiveness for high-integrity systems.

References

Appendix A - Tables & Figures

Column name	Description
Title	Title of Game
Release Date	Games first version release Date
Team	Developer Team
Rating	Average rating
Times Listed	Number of users who listed the game
Number of Reviews	Number of reviews received from the users
Genres	All genres connected with the game
Summary	Summary of the game provided by the team
Reviews	User reviews
Plays	Number of users that have played the game before
Playing	Number of current users who are playing the game
Backlogs	Number of users who have access but haven't started with the game yet
Wishlist	Number of users who wish to play the game

Table A.1: Detailed column description for 'Popular Video Games 1980–2023'

ID	Title	Release Date	Team	Rating	Times Listed	Reviews	Genres	Summary	Number of				
									Reviews	Genres	Summary	Reviews	Plays
0	Eden Ring	25.02.2022	['Bandai Namco Entertainment', 'FromSoftware']	45	3.9K	3.9K	['Adventure', 'RPG']	Eden Ring is a fantasy, action and open world ...	17K	3.8K	The first playthrough of eden ring is one ...	4.6K	4.8K
1	Hades	10.12.2019	['Supergiant Games']	43	2.9K	2.9K	['Adventure', 'Brawler', 'Indie', 'RPG']	A rogue-lite hack and slash dungeon crawler in ...	21K	3.2K	'convinced this is a roguelike for people who ...	6.3K	3.6K
2	The Legend of Zelda: Breath of the Wild	03.03.2017	['Nintendo', 'Nintendo EAD Production Group No. 3']	44	4.3K	4.3K	['Adventure', 'RPG']	The Legend of Zelda: Breath of the Wild is the first ...	30K	2.5K	'This game is the game (that is not CSGO) that...	5K	2.6K
3	Undertale	15.09.2015	['tobyfox', '8-4']	42	3.5K	3.5K	['Adventure', 'Indie', 'RPG', 'Turn Based Strategy']	A small child falls into the Underground, where ...	28K	679	'soundtrack is tied for #1 with nier automata ...	4.9K	1.8K
4	Hollow Knight	24.02.2017	['Team Cherry']	44	3K	3K	['Adventure', 'Indie', 'Platform']	A 2D metroidvania with an emphasis on close...	21K	2.4K	'this games worldbuilding is incredible, with ...	8.3K	2.3K

Figure A.1: Games Data Head