

Hazard Analysis

Chess Connect

Team #4,
Alexander Van Kralingen
Arshdeep Aujla
Jonathan Cels
Joshua Chapman
Rupinder Nagra

Table 1: Revision History

Date	Developer(s)	Change
2022-10-09	Arshdeep Aujla	Added table for FMEA
2022-10-09	Alexander Van Kralingen	Updated Introduction, Scope, System Boundaries and Critical Assumptions
2022-10-09	Alexander Van Kralingen	Fixed FMEA table placement
2022-10-19	Jonathan Cels	Added requirements
Date2	Name(s)	Description of changes
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1 Introduction

Creating a product designed for consumer use requires a robust hazard identification and mitigation strategy before the product is released to the public. A hazard can be defined as any source of potential damage, harm or adverse health effects on something or someone [for Occupational Health and Safety \(2022\)](#). A hazard for the Chess Connect system is anything that could either harm the user or cause system failure.

2 Scope and Purpose of Hazard Analysis

In this document, the potential cause for hazards will be explored in detail, as well as methods for preemptive detection, and recommended actions should the hazard still present itself. Its purpose is to identify potential sources for harm or failure and address them before they are presented in the finished product.

3 System Boundaries and Components

The Chess Connect system is comprised of three main components:

1. The hardware including the chess pieces, board, microcontroller and all electronic components:
 - LEDs
 - Hall-Effect sensors
 - LCD screen
 - Connecting wires
 - Power adapter
2. The nearby server to receive data through a Bluetooth connection.
3. The hosted Web Application used to connect to the game remotely.

The boundary of this system begins at the chess board and ends at the Web Application (Web-App). The distance between the chess board and the server is spanned by a Bluetooth connection, and the server to the Web-App by Wi-Fi. The user will cross the system boundary by interacting with the hardware and the Web-App, however everything in between will be isolated within the system.

4 Critical Assumptions

The assumptions made in this document are meant to constrain the hazards to those present within typical operation. These assumptions are as follows:

1. The chess board is operated in a dry environment.
2. The server present will be capable of both Bluetooth and Wi-Fi connections.
3. The user is not intentionally trying to disconnect the electronics within the board.
4. The Web-App hosting platform will remain up and running without interruption.

5 Failure Mode and Effect Analysis

The following table (Table 2) is a breakdown of the failure modes and effects analysis (FMEA) for the Chess Connect system.

Table 2: Failure Mode and Effects Analysis

Component	Failure	Causes	Detection	Recommended Action	Probability of Oc-currence
Web Application	Loss of Internet connection	(a) Internet outage (b) Loss of power (c) Internet time-out	Ping the Internet and wait for the response	Alert the user to check Internet connection	0.3
Microcontroller	Bad inputs	(a) If a player knocks down multiple pieces in their turn (b) Loss of power (c) Faulty components and/or connections	Monitoring inputs	Prompt the user to return the system to previous state and redo the turn	0.4
Microcontroller	Loss of Bluetooth connection	(a) Distance between microcontroller and host is too large (b) Physical barriers between microcontroller and host (c) Failed to initialise connection	Continuously monitor Bluetooth connection	Prompt the user to re-establish connection before continuing	0.2
Hall Sensor	Bad inputs	(a) Sensitivity loss over a period of time (b) Interference from external magnetic objects (c) Distance between sensor and object too large	Monitoring Hall sensor inputs	(a) Prompt the user to clear area of obstacles from the board (b) The sensor should be replaced after the recommended use time	0.1

6 Safety and Security Requirements

6.1 Access Requirements

SR1. Only the Chess Connect team are able to modify the software system.

6.2 Integrity Requirements

SR2. The product will not store game data after a game has concluded.

SR3. The system shall locally maintain the current game state, making no changes until a connection is reestablished.

SR4. The system shall alert the user that a connection has been lost.

SR5. The system shall prompt the user to take an appropriate hazard-specific action.

6.3 Privacy Requirements

SR6. The product will not store or collect user data.

6.4 Audit Requirements

SR7. Requirements shall be easy to follow and verify against both the system and the VnV plan in order to facilitate regular inspections.

6.5 Immunity Requirements

N/A

7 Roadmap

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

References

Canadian Centre for Occupational Health and Safety. Hazard and risk: Osh answers. https://www.ccohs.ca/oshanswers/hsprograms/hazard_risk.html, 2022. Accessed: 2022-10-05.