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
2022-10-19	Joshua Chapman	FMEA table edits and description changed
...	...	...

Contents

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

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 anyhting 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 recieve 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 Modes and Effects Analysis

The failure modes and effects analysis is used to identify and analyze potential hazards to the system. Causes of failure discuss existing hazards that will have negative effects on the system. Hazard detection details the methods used to distinguish failures.Recommende actions explains the behavior of the system when the failures occur. Likelihood is a scale to detail the frequency and probability-of-occurence in the event of a failure. All of these methods are used to enhance requirement implementation and hazard prevention.

Component	Failure	Causes	Detection	Recommended Action	Likeliho	Requirements
Web Application	Loss of internet connection	(a) Internet outage (b) Internet time-out (c) Board is taken out of connection range	Ping the Internet and wait for the response	Alert the user to check Internet connection	0.4	SR3, SR4
Web Application	Connection lost between server and client	(a) Deployment hosting platform fails (b) Platform is taken down for maintenance	Loss of connection to the platform	Alert the user of the issue and wait accordingly	0.1	SR3, SR4
Microcontroller	Unable to detect starting game state	(a) A player begins with the pieces in the incorrect location (b) Player does not follow the correct starting protocol	Strict guidelines programmed in the microcontroller to prevent	Prompt user to make appropriate changes to pieces or board state	0.2	SR5
Microcontroller	Unable to follow game state	(a) A player makes two moves in a row (b) A player makes an illegal move (c) Loss of power to system	Edge cases programmed on the controller	Prompt user to make appropriate action to the board	0.3	SR5
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 (d) Packet loss from board to server	Continuously monitor Bluetooth connection	Prompt the user to re-establish connection before continuing	0.1	SR3, SR4
Microcontroller	Loss of Power	(a) Board is unplugged (b) Cable connection failure (c) Power surge	N/A	Store game state in local flash memory	0.1	SR3
Hall Sensor	Bad inputs	3 (a) Sensitivity loss over a period of time (b) Interference from external magnetic objects	Monitoring Hall sensor inputs	(a) Prompt the user to clear area of obstacles from the board (b) The sensor should be re-	0.1	SR5

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 restablished.

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.