System Design for Chess Connect

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1 Revision History

Date	Version	Notes
2023-01-11	Arshdeep Aujla	Introduction, Purpose, User Interface, Other Considered Designs
2023-01-16	1.1	Notes

2 Reference Material

This section records information for easy reference.

2.1 Abbreviations and Acronyms

symbol	description
Chess Connect	Explanation of program name
[... —SS]	[... —SS]

Contents

List of Tables

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3 Introduction

This document outlines the system design portion of this project's design documentation. Design documentation is intended to separate the project into modular components to increase the project's understandability and reusability.
Other useful documents for this project are the following:

- SRS
- HA
- VnV

4 Purpose

The purpose of this document is to outline a detailed system design. The system design includes system variables, user interfaces, a timeline for completion, and designs of many different components such as hardware, electrical componets, and communication protocols. This document also includes references to an intesive list of the project's mechanical and electrical components and a reflection in the appendix.
Other documents relating to design are the following:

- Software Architecture Document
- Detailed Design Document

5 Scope

The Chess Connect system includes a physical chess board and associated software application to aid in the learning and sharing of in-person chess games. Mechanical design of the chess board and electrical systems are included in the scope. Design of the user interface and communication between the systems is also included. Not included is the design of the chess AI being used as a learning tool. Exisiting chess websites and platforms are also out of the scope of Chess Connect.

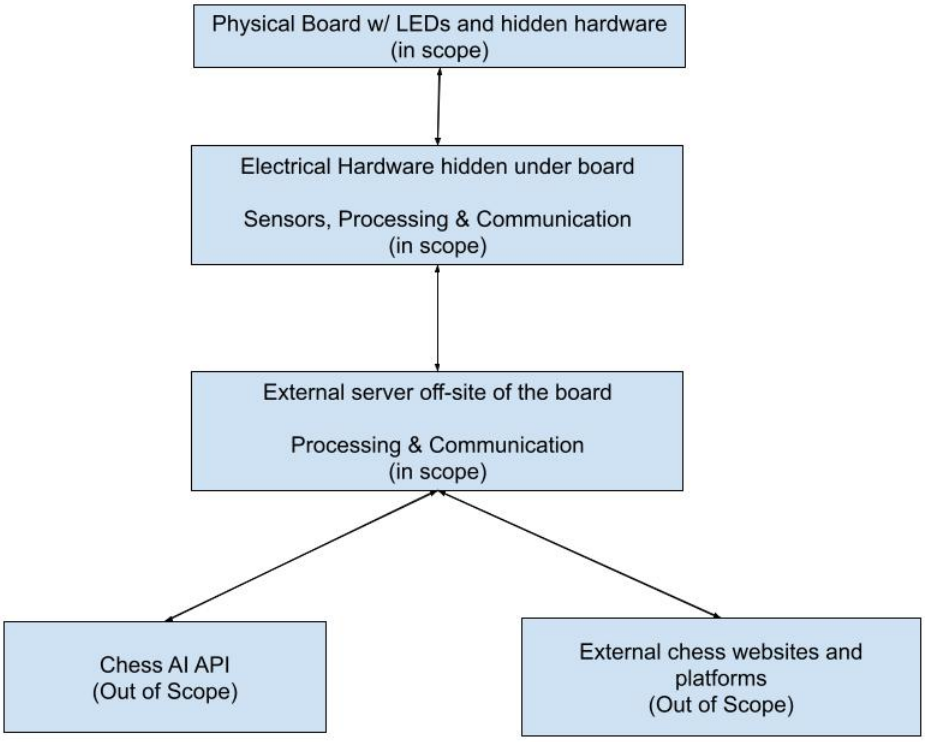

Figure 1: System Context

6 Project Overview

6.1 Normal Behaviour

6.2 Undesired Event Handling

[How you will approach undesired events —SS]

6.3 Component Diagram

6.4 Connection Between Requirements and Design

[The intention of this section is to document decisions that are made "between" the requirements and the design. To satisfy some requirements, design decisions need to be made. Rather than make these decisions implicit, they are explicitly recorded here. For instance, if a program has security requirements, a specific design decision may be made to satisfy those requirements with a password. —SS]

7 System Variables

[Include this section for Mechatronics projects —SS]

7.1 Monitored Variables

7.2 Controlled Variables

7.3 Constants Variables

8 User Interfaces

Hardware Interface

The user will interact with two main components of the hardware.

- Magnetic chess pieces
- Physical chess board containing sensors

They will interact with the chess pieces and chess board as they would in a normal chess game. The chess board reflects a standard chess board, with LEDs in the center of each square. They would move the chess pieces on the board and remove them in according to the rules of chess. If the device is set to beginner mode, the LEDs will light up in according to which available moves are available for that chess piece. They would interact with the LEDs by using them as a guide for potential moves to make.

Software Interface

The users will interact with the software component of this device through a web application. They would need a device with an internet connection and and internet browser to view the application. The user will interact with this interface by visual viewing the chess board status in real time including a visualization of the chess piece locations. They will also be able to turn on and off beginner mode in this interface through clicking an interactive button in the web application.

9 Design of Hardware

[Most relevant for mechatronics projects —SS] [Show what will be acquired —SS] [Show what will be built, with detail on fabrication and materials —SS] [Include appendices as appropriate, possibly with sketches, drawings, CAD, etc —SS]

10 Design of Electrical Components

Aquired Components

Please refer to Appendix C for a detailed list of aquired components.

[Most relevant for mechatronics projects —SS] [Show what will be acquired —SS] [Show what will be built, with detail on fabrication and materials —SS] [Include appendices as appropriate, possibly with sketches, drawings, circuit diagrams, etc —SS]

11 Design of Communication Protocols

[If appropriate —SS]

12 Timeline

[Schedule of tasks and who is responsible —SS]

A Interface

[Include additional information related to the appearance of, and interaction with, the user interface —SS]

B Mechanical Hardware

- Arduino Mega

C Electrical Components

- 64 LEDs
- 64 1000ohm resistors
- 64 HALL sensors
- 64 1mF capacitors
- 3 breadboards
- 22 AND gate chips
- 300 pieces of wire

D Communication Protocols

E Reflection

Project Limitations

Other Considered Designs

One problem that we had to overcome in our design is that there are not enough input and output pins in one microcontoller for all of the components. One solution we considered was having multiple microcontrollers for this project to ensure there is one input pin for each input sensor and one output pin for each output. This design would be beneficial in the way of simplicity of code. The tradeoff would be the complexity in cordinating the communitcation between multiple microcontrollers and the web application. A second option to solve this problem is to use multiplexing to reduce the number of input and output pins needed for a large number of compnents. This option requires more complex code, but only requires one microcontroller device. We chose to implement the multiplexing option becasue it only used

one device which saves money, as well as eliminates the need to coordinate between multiple microcontrollers.

The information in this section will be used to evaluate the team members on the graduate attribute of Problem Analysis and Design. Please answer the following questions:

1. What are the limitations of your solution? Put another way, given unlimited resources, what could you do to make the project better? (LO_ProbSolutions)

2. Give a brief overview of other design solutions you considered. What are the benefits and tradeoffs of those other designs compared with the chosen design? From all the potential options, why did you select documented design? (LO_Explores)