

I. Introduction

Imagine you are 11 years old. You've just received your letter from Hogwarts informing you that you've been accepted into Hogwarts School of Witchcraft and Wizardry. It is the best day of your life, not only have you learned that magic is real and you possess the powers of magic, but also because you no longer have to play with the run of the mill boring chessboard. Now you can use Wizard's Chess! Wizard's Chess entails a chessboard with pieces having the capability to respond to your voice commands. It is a revolutionary way to play chess! Now imagine: sadly you did not receive a letter from Hogwarts emphasizing your acceptance when you were 11. Instead you grew up in the muggle world, studied hard and attended the University of Notre Dame becoming an esteemed Electrical Engineer. Senior Design rolls around and guess what, you have the opportunity to create your own version of Wizard's Chess. Do you take the opportunity? Yes, as long as Professor Schafer approves the project. The following document outlines our group's initial proposal for muggle-world Wizard's Chess.

II. Problem Description

With the intent of combining knowledge acquired throughout several years of electrical engineering, our team will develop an application that combines various technologies including voice recognition, microcontrollers that run in conjunction with motors that control the movement of each individual chess piece, and 3D printing. An interesting problem that we have already discovered we will encounter is that a few members of our team do not know how to play chess. This problem has come from the lack of a friend to play with or a lack of knowledge

for the rules. The proposed systems would take care of all the movement of the pieces, avoiding illegal movements and would provide game play with only one player.

III. Proposed Solution

The chess board will take in the user's command through voice recognition. The board will then locate the piece to be moved and move an electromagnet beneath the piece using stepper motors and rails (similar to a claw machine). The electromagnet will then be powered to grab the piece and drag it to the user's chosen position. If the user has taken an opponent's piece, that piece will be removed from the board by the electromagnet before moving the user's piece into its place.

IV. Demonstrated Features

The available features of this project include a fully automated chess board that responds to commands from the two users. This chess board will move on its own depending on the piece selected and where the user tells it to go. The positioning of the pieces will correspond to normal matrix of a chess board, a-h on the horizontal, 1-8 on the vertical. Once we get all of these features working we will attempt to make the board respond to voice commands from the user.

V. Available Technologies

A. Stepper motors - \$20

- B. Electromagnet - \$20
- C. Circuit board - \$50
- D. Chess pieces/Board - \$20
- E. X-Y Grid subsystem - \$15
- F. Amazon Alexa Data - \$0
- G. LED Team Indicators - Almost nothing

VI. Engineering Content

In order to complete the above mentioned project, it will be necessary to engineer a mechanical system that will move chess pieces, a voice recognition system that can interpret audible commands, and an internal game tracker that can process the moves that have been made and the boundaries of various piece movements. The first of the three major engineering challenges we will face is the mechanical component of the project. In general, this component will have two separate motors each controlling movement of a track in either the x or y direction. After receiving a command, the x and y motors will move a magnet that is suspended by adjustable arms to a coordinate location. Once at the appropriate location, an electromagnet will turn on connecting to a magnet on the bottom side of the chess piece allowing for the piece to then be dragged to the new coordinate location before turning the electromagnet off again. For voice recognition, the use of open sourced “Alexa” technology will be utilized to create a bank of commands that would be used in chess game play. These commands would include coordinate locations (ie. C3, A5, etc.) and piece names (ie. Knight, Queen, Pawn, etc.). This last major

system would be the internal game tracker that would be able to create a virtual game board tracking piece locations and appropriate piece movements.

VII. Conclusions

The Wizard's Chess Board is a fun and exciting way for us to combine all of the skills we have learned in our time at Notre Dame, writing software, electricity and magnetism, serial communications, and circuit board design to name a few, as well as test our skills in some new territory with voice recognition and working with mechanical elements. The end result will be a visually-stunning product of our creativity and engineering experience. In May, we will have an eye-opening demonstration of what is possible if you study electrical engineering!