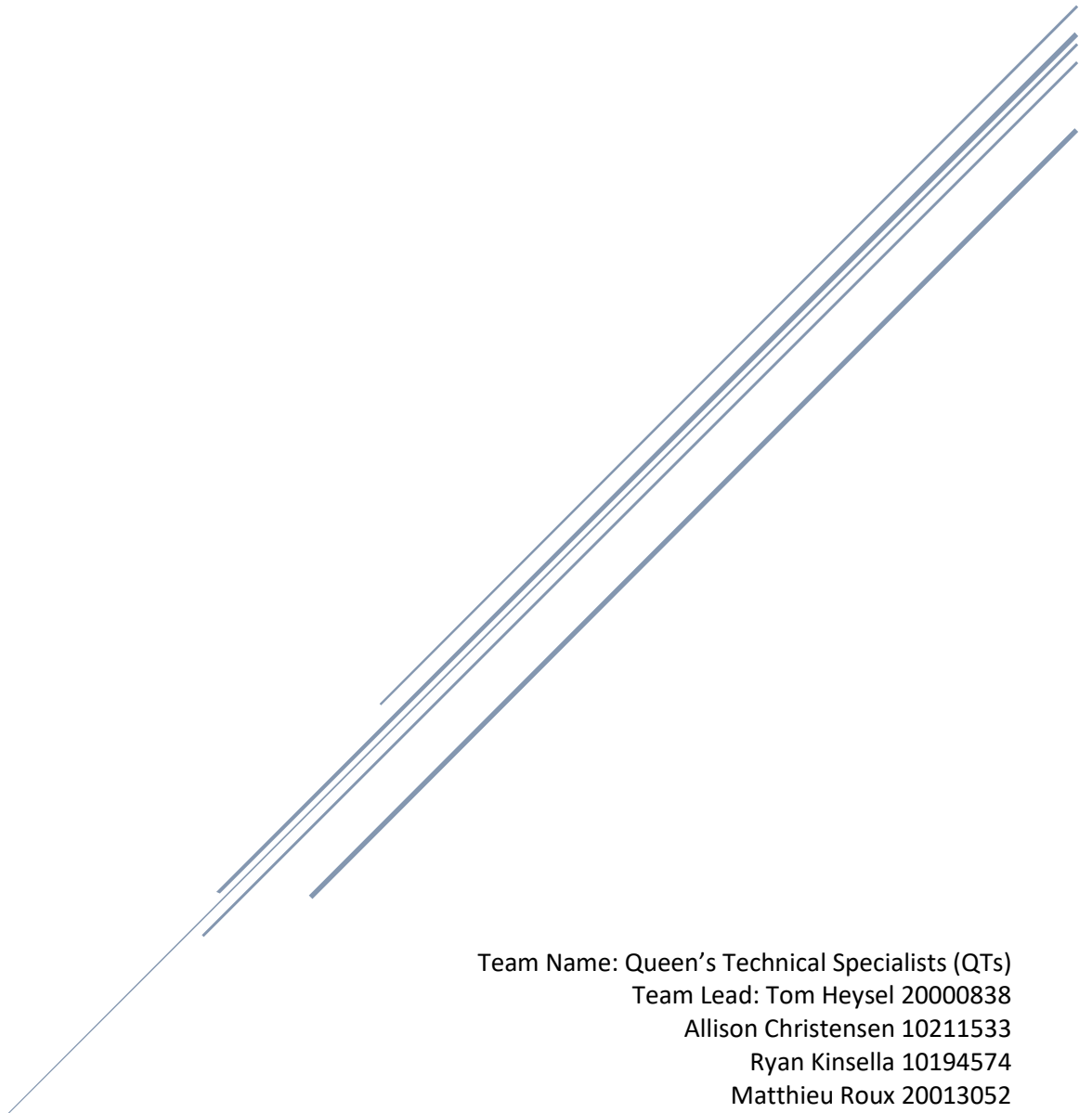


CISC 325 – PROJECT PROPOSAL

Hands Free Chess



Team Name: Queen's Technical Specialists (QTs)

Team Lead: Tom Heysel 20000838

Allison Christensen 10211533

Ryan Kinsella 10194574

Matthieu Roux 20013052

Dennis Grajo 20017666

Project Overview

The proposed project is a voice operated chess board that allows users to play the classic game, hands free. Rather than manually moving the chess pieces from one square to the next, players will state out-loud which piece they wish to move and to where. As a minimum viable product, users will be able to play one another. As a stretch goal, they will be able to play against an AI opponent.

Target Users

Aside from chess players and Harry Potter Fans, the hands-free nature of a voice operated chess board would allow those with disabilities or limited movement to enjoy the game with ease. See the Testing Section for more details.

System Design

The main control of the system will come from a Raspberry Pi, which will regulate the speech recognition and game logic. Once a move has been processed, the Pi will pass the relevant information to an Arduino which will control the mechanics of moving the piece from its current position to its new position.

Software Components

The main software component in use is the speech recognition software. Here there are various choices: Amazon Web Services (AWS), Google Cloud Platform, Microsoft Azure, and IBM Watson are just some of the available technologies. Further decision making will occur in the coming weeks based on available documentation, cost of implementation, and compatibility with existing architecture.

Once the speech has been translated to text, the game logic will determine if the move is legal, if so, it will pass the move to Arduino control, if not it will ask the player to repeat the command.

Hardware Components

There are four board design options under consideration to facilitate the movement of pieces. Each involve a magnet embedded into the base of every piece, and a second, underneath the board on a moveable track (the fourth idea does not follow this convention).

1. Use an electromagnet aligned on a 2D track. Once in place, the electromagnet will turn on, move to the new position, and then turn off.
2. Use a permanent magnet on a 2D track. Once in place, the arm will rotate the magnet 180 degrees to become flush with the bottom of the board, move to the new position, and then rotate back.
3. Use a single permanent magnet on a 3D track. Once in place, the magnet will extend vertically up to be flush with the bottom of the board, move to the new position, and then retract.
4. The board is designed using a grid of electromagnets lying just under the surface, with each individual tile containing multiple magnets. Depending on the piece being moved, the grid will enable and disable key electromagnets along the path of the move to “drag” the piece along.

The team will evaluate the feasibility of each option using the following criteria: the ability to move a singular piece at a time without interfering with other pieces, the cost, and the ease of implementation.

Testing

Components of this project can be designed in parallel and tested independently from each other before being combined into a final product. Game logic will be tested using console or GUI simulation. Speech recognition and track movement will be assessed using small single-goal test programs. In the case of electromagnets, a “test-and-set” model will be used to ensure the voltage is strong enough to pull the piece but not so strong as to affect the surrounding pieces.

Testing the final product will involve implementing user studies with the Queen’s Chess Club and the Queen’s Mobility Center.

Cost Estimation

Using a rough cost estimation (taking the mid-range price in the case of more than one option) the total cost is approximated to be \$90.66. Resulting in \$18.13 per team member. Team members have all agreed that this is a fair price. Additional research into applying for grants or using microcontrollers already owned by Queen’s is being conducted. A proposed list of materials and individual cost estimations is included in the table below.

Name	Price	Quantity	Price per piece
Raspberry Pi A+			
Board Only	32.95	1	32.95
Basic Kit	49.95	1	49.95
Starter Kit	64.95	1	64.95
Raspberry Pi B+			
Board Only	47.95	1	47.95
Basic Kit	59.95	1	59.95
Starter Kit	94.95	1	94.95
Permanent Magnets			
Rare Earth Magnet (each)	2.39	1	2.39
Neodymium Rare Earth (12)	24.99	12	2.0825
Electromagnet			
DC 12V Emag Ebay	2.95	1	2.95
Wires			
Silicone Wire Electric Wire (5)	12.99	5	2.598
Tinned Copper Wire (6)	15.99	6	2.665
17 Gauge Spool Aluminum (1)	4.67	1	4.67
Power Supply			
Power supply for Raspberry Pi	10.5	1	10.5
Audio			
Microphone USB	4.88	1	4.88
Speaker for the Pi	11.95	1	11.95