



**Bilkent University**

Department of Computer Engineering

## CS 319- Object Oriented Software Engineering

# Quantum Chess

Incredible in Thought

### **Final Report**

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## The Game

### Playing and installation

The game can be run from a jar file and it can be played as described below. The game has no system requirements as it can run in all fairly usable CPU's. The game does not require to many resources as it runs on only one thread and only uses the CPU when the user makes an action.

### General Description

The game is similar to normal chess. All the movements are the same, the rules are the same and the pieces remain unchanged. The only difference is the addition of power ups. These power ups are inspired but real quantum physics phenomes. Superposition is a power up which enables one piece to be at two places at the same time, similar to real superposition. The second power up is entanglement which entangles a piece with another one, whereby the movements of the piece that entangle are mirrored by the entangled piece. The third power up is tunneling whereby the piece can move through **one** friendly piece. When a piece is selected the places on where that piece can move will be shown with green whereas the pieces that it can take will be highlighted with red.

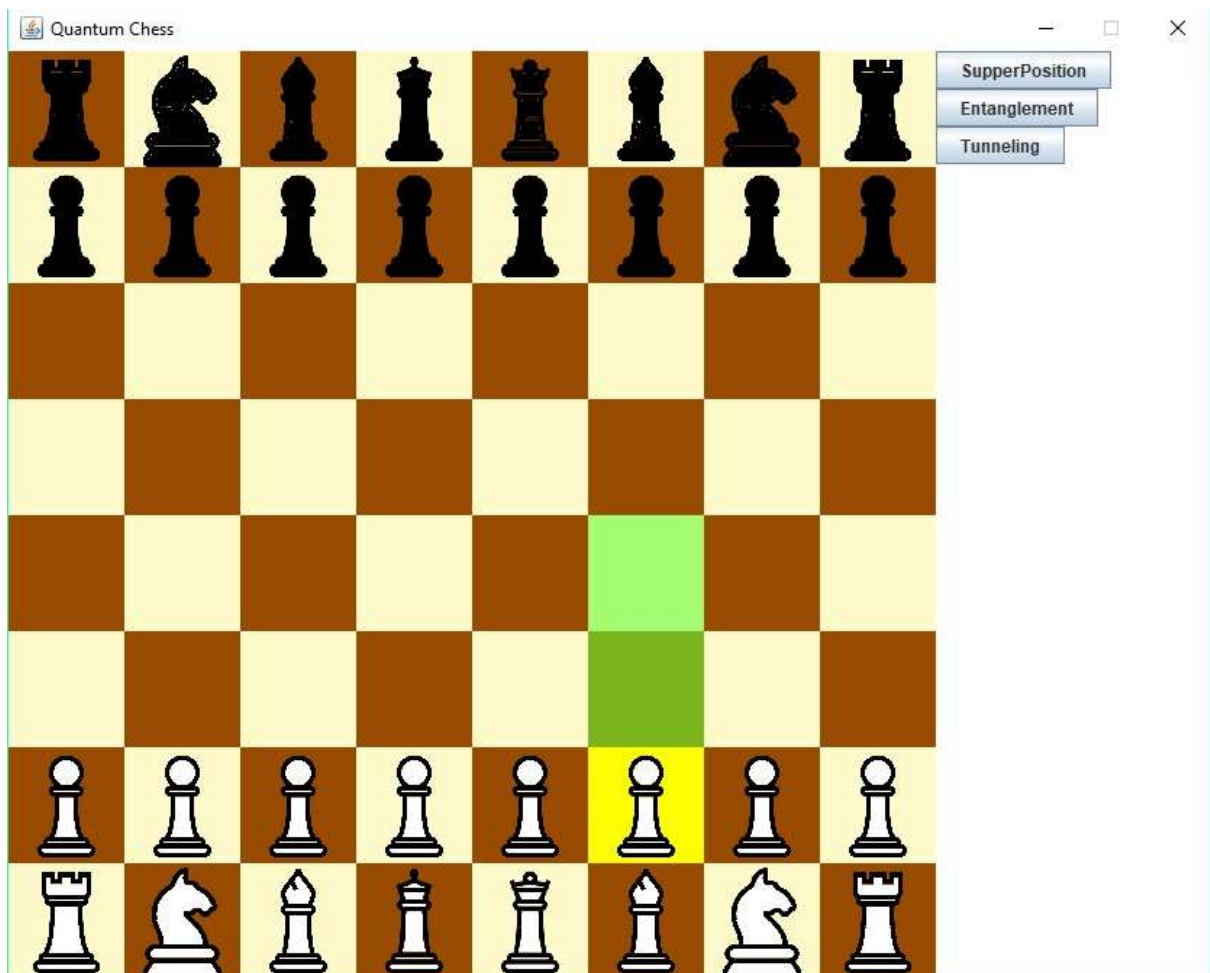


Figure 1: General Gameplay View

## Main Menu

Shows all the navigating options through the games menu.

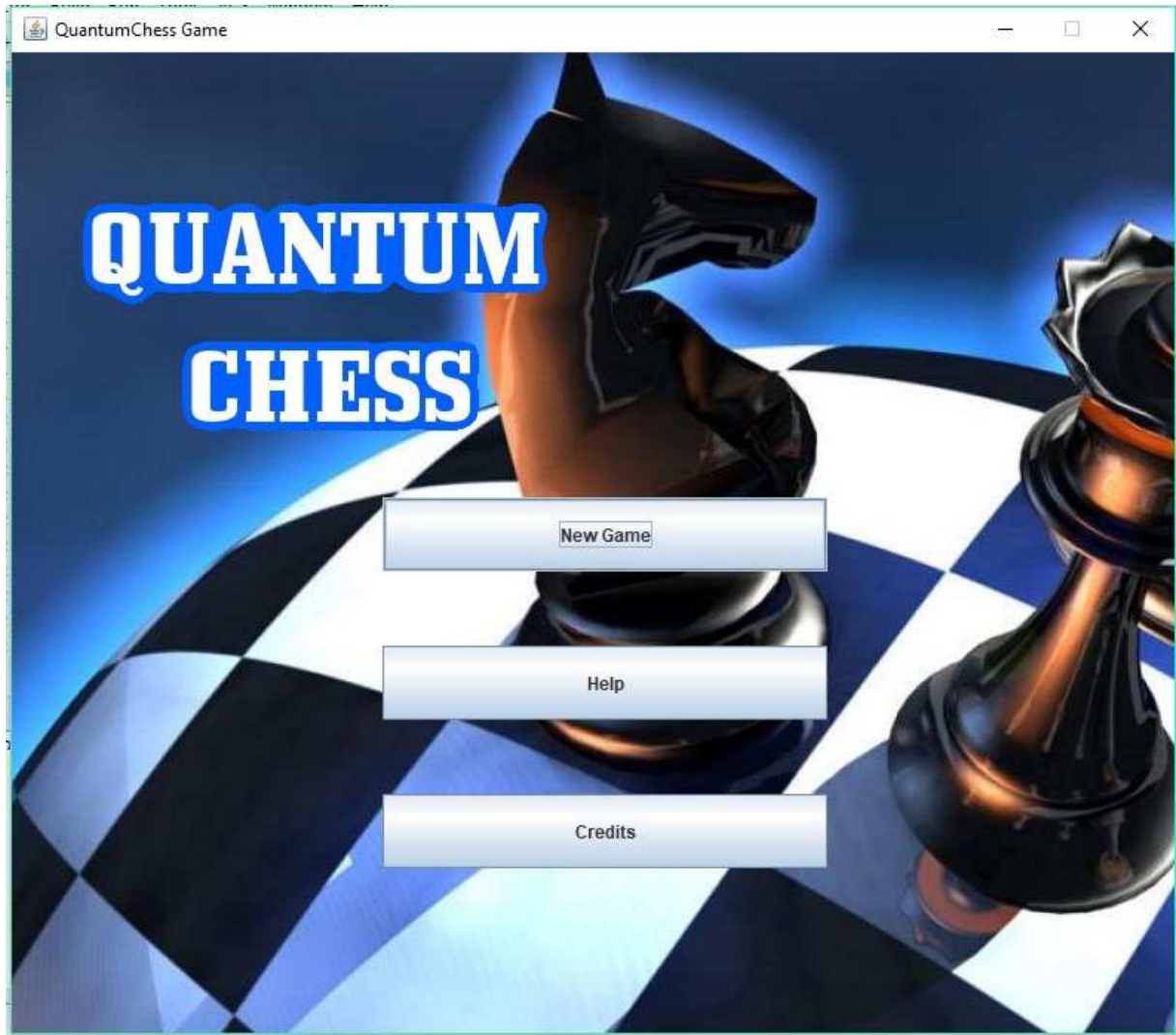


Figure 2: Main Menu

### Start Game

The player name fields should be filled and then the game can be started. If the game is started it cannot be stopped until it is finished unless the program is terminated.

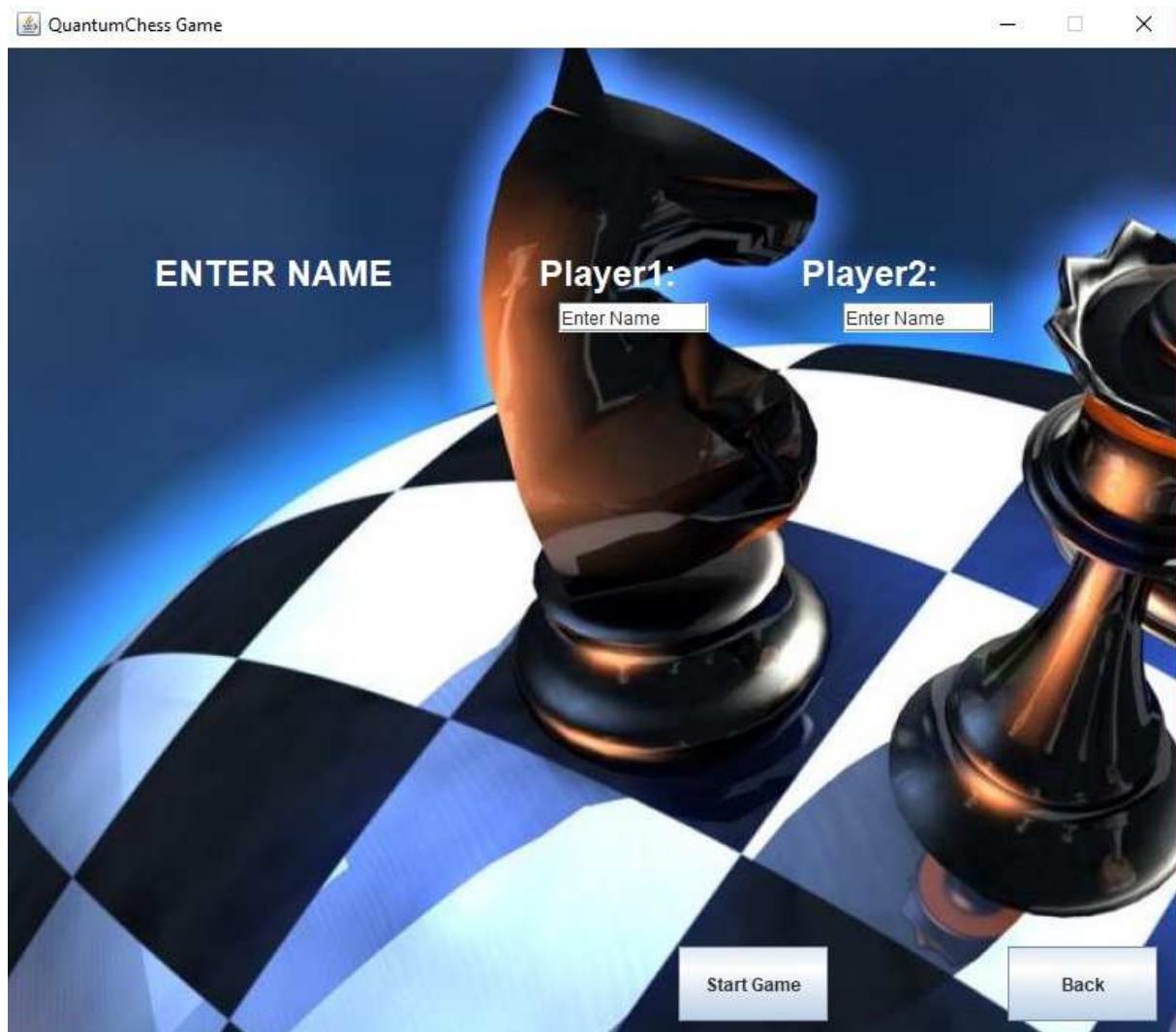


Figure 3: Start Game



## Help

Displays information on how to play the game and explains the basic information about the game.

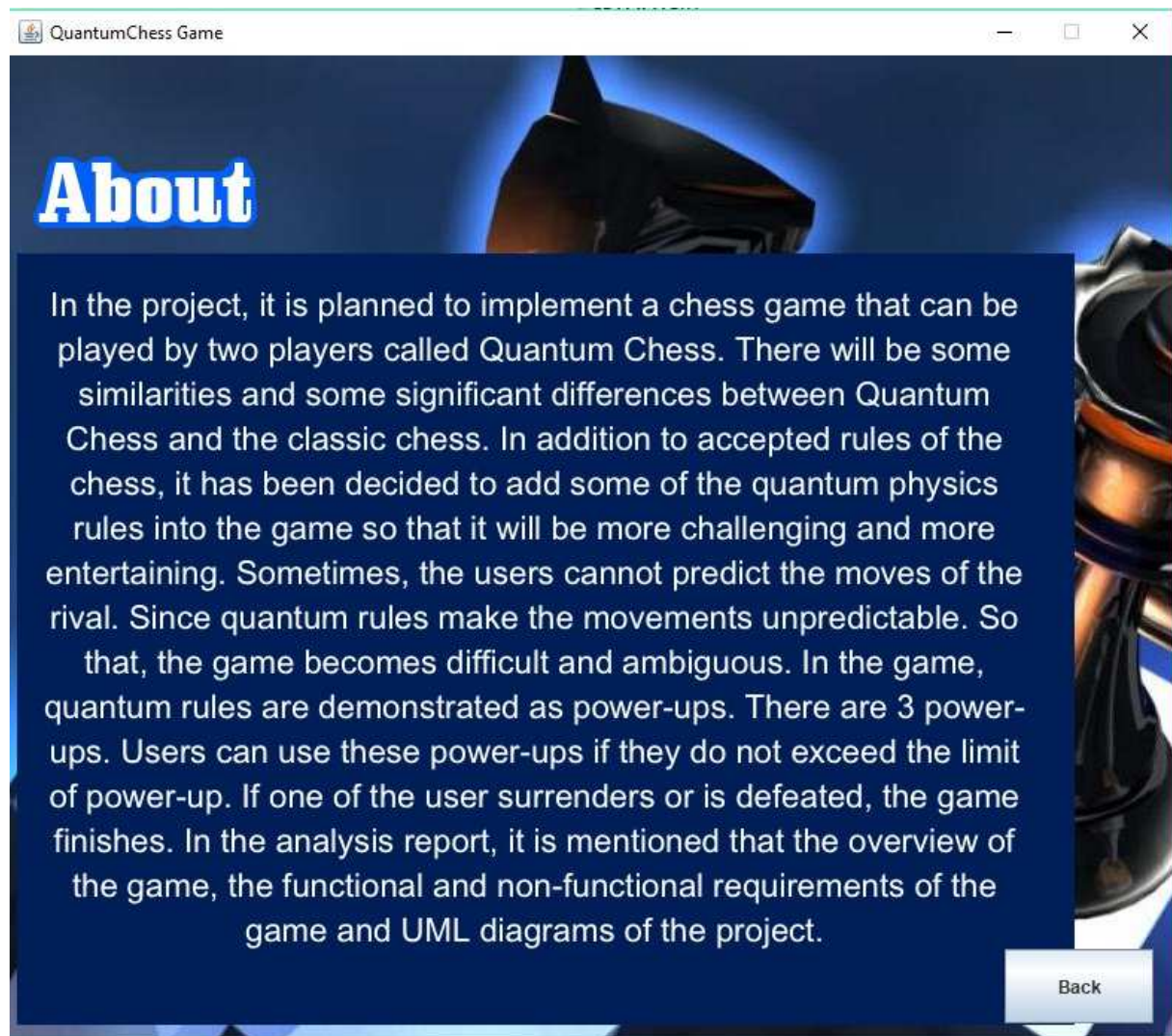


Figure 4: About

## Credits

Shows who the creators of this program are.

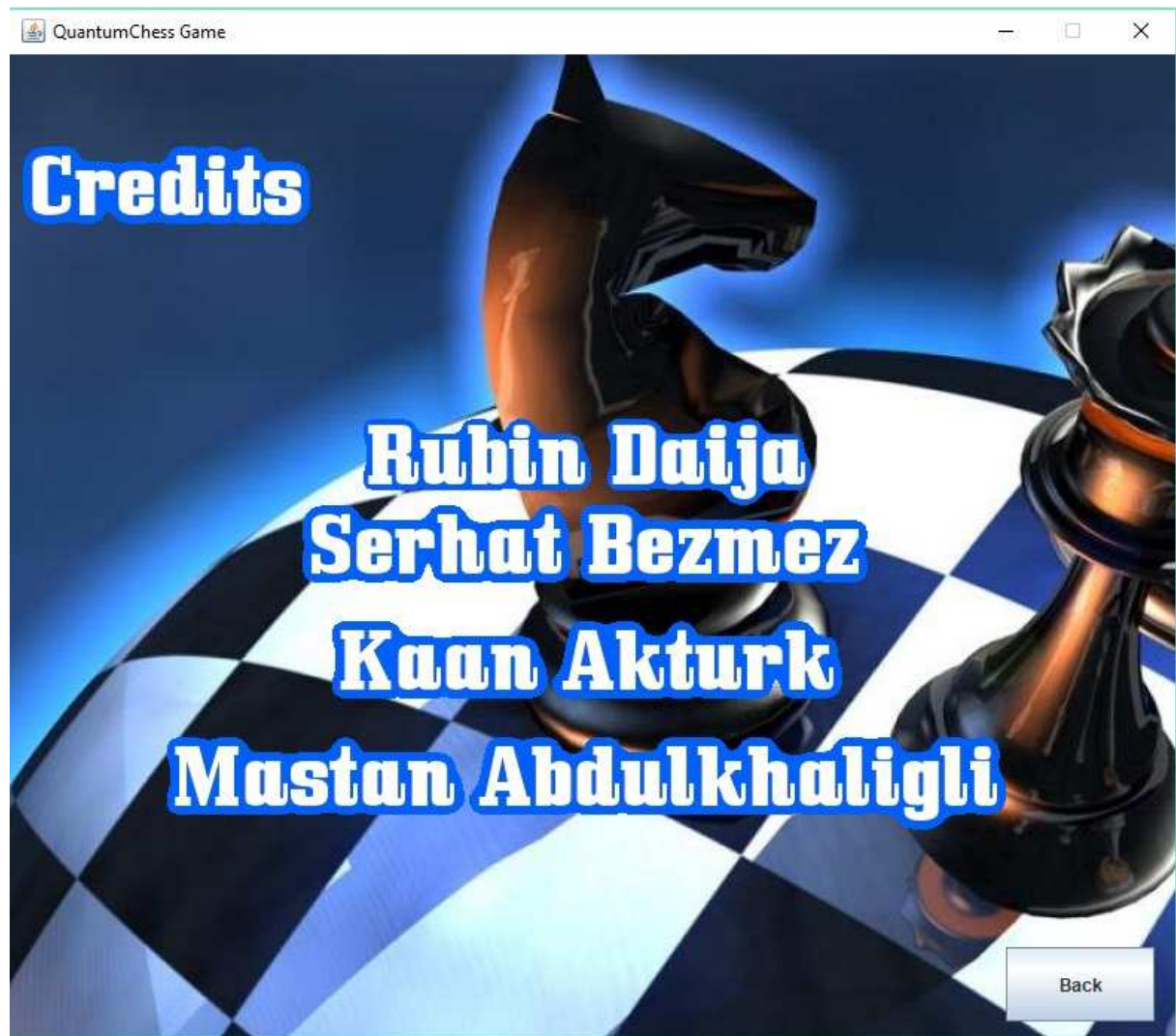


Figure 5: Credits

## The Power Ups

The power ups can be selected by selecting a piece and then selecting the desired power up. They all have limited amounts per player. The player should keep track of how many they have left.

## Superposition

Superposition is only limited to only one miss per piece. A miss is considered when the player puts the piece in superposition and then observes it, whereby the piece loses the ability to go anymore in superposition. However if the piece is in superposition and is attacked, then it will be observed by the enemy, thus it will not lose the ability to be again in superposition again. However the king does not have a limit on misses as he is the king and beyond the quantum realm.

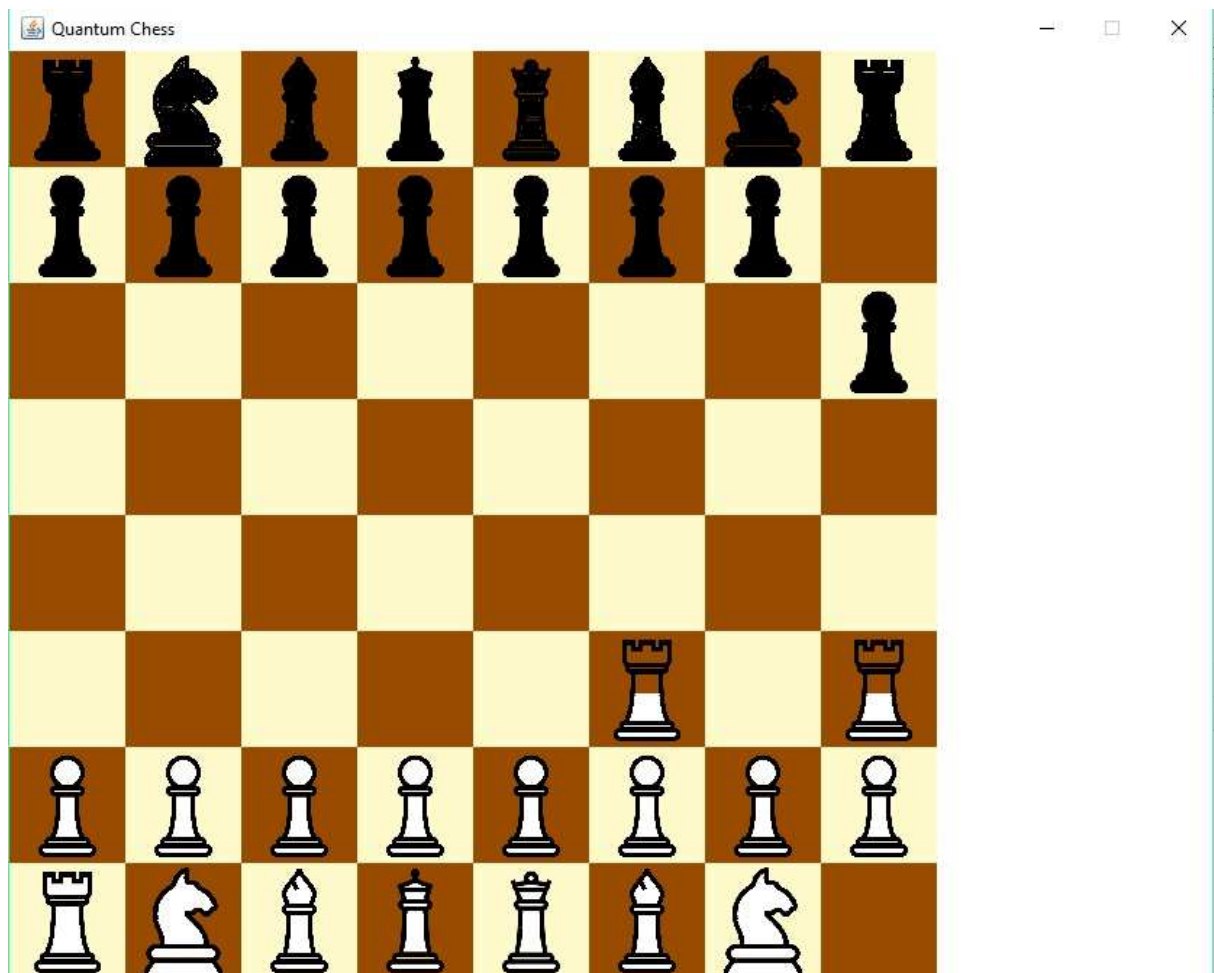


Figure 6: Superposition applied

When a piece is superposed as it can be observed from the picture (Figure 6 ), that piece cannot move, nor can it do anything else except observe itself.



## Tunneling

This power up is only allowed 5 times per player. They can use it on every piece, however, if they use it pieces that can do only one square move it does not work. When the tunneling is activated the piece that is doing it cannot take any pieces and it can only pass through **one** piece and that piece has to be a **friendly** piece.

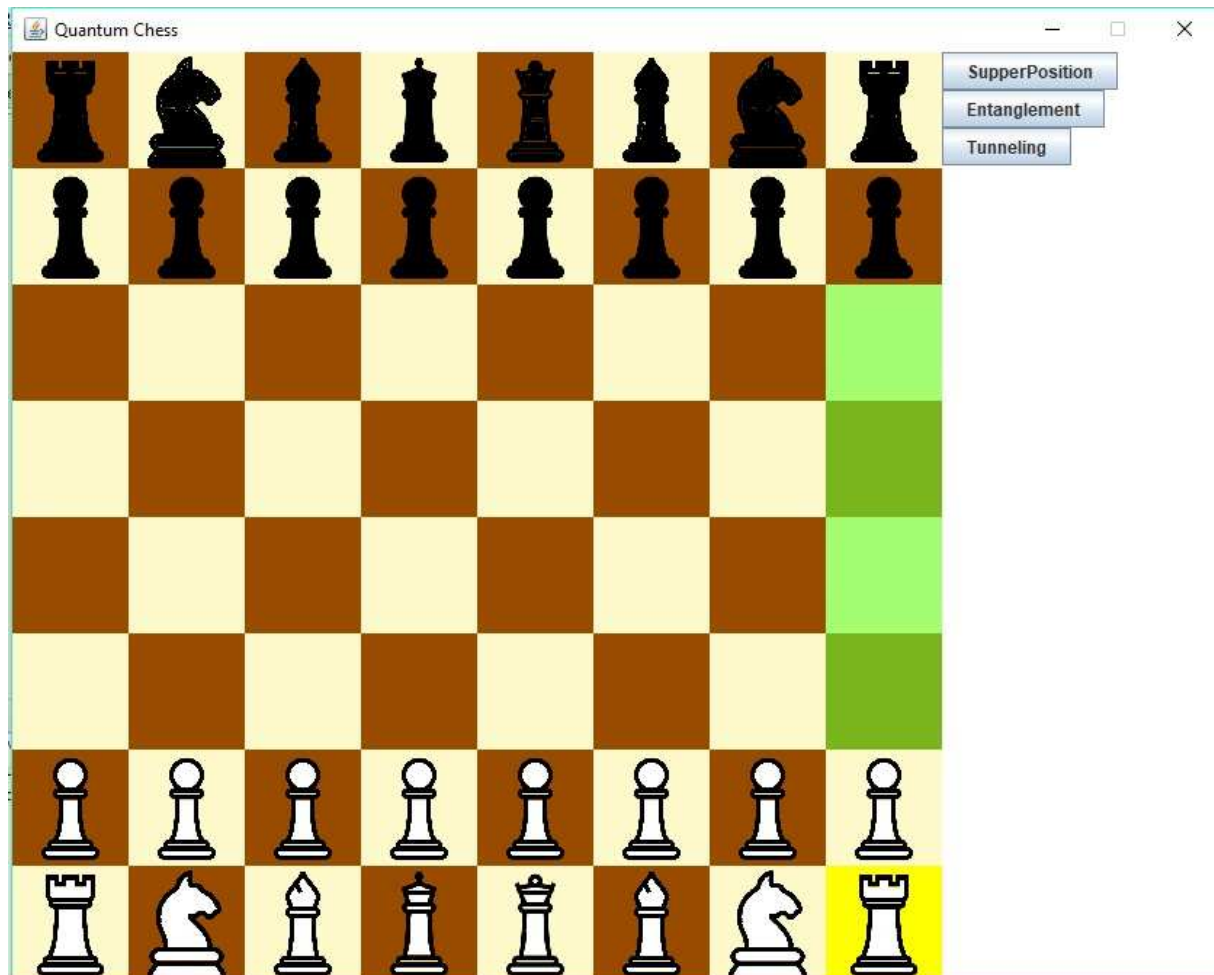


Figure 7: Tunneling applied

## Entanglement

It is only allowed 5 times per player. The piece to be entangled has to be an enemy piece. The entanglement between the pieces is shown with blue. The piece that is entangled mirrors the movements of the other piece that entangles. The movement that is allowed is only when it is valid for both pieces. The entangled piece however is checked as if the entangling piece was at its position.

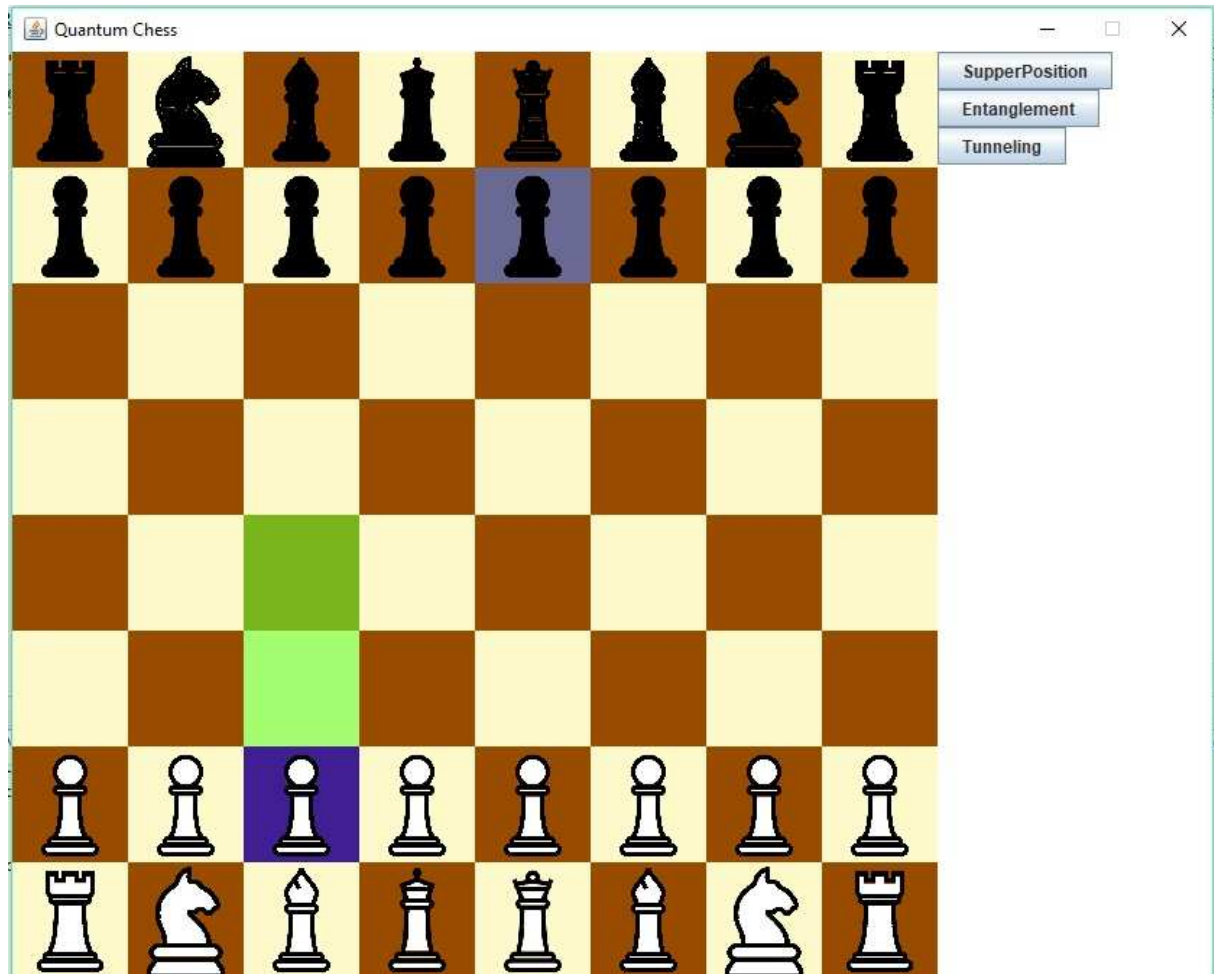


Figure 8: Entanglement applied

In Figure 8 the white piece is entangling the black one.

## Other Options

These are options that are also apparent in the normal chess game however they are added through the use of side buttons.

### Swap

Swap can only be used by pawns. It can be activated when a pawn reaches to the end of the enemy field. The only pieces allowed to swap out are those that have been lost already. This can be activated the next turn the end was reached. The reason why it is not automatic is to allow the possibility to strategize more.



Figure 9: Swap Activated

## Surrender

Surrender is an ability that only the king possesses. If he surrenders the game is finished, the other player wins and the game is closed.

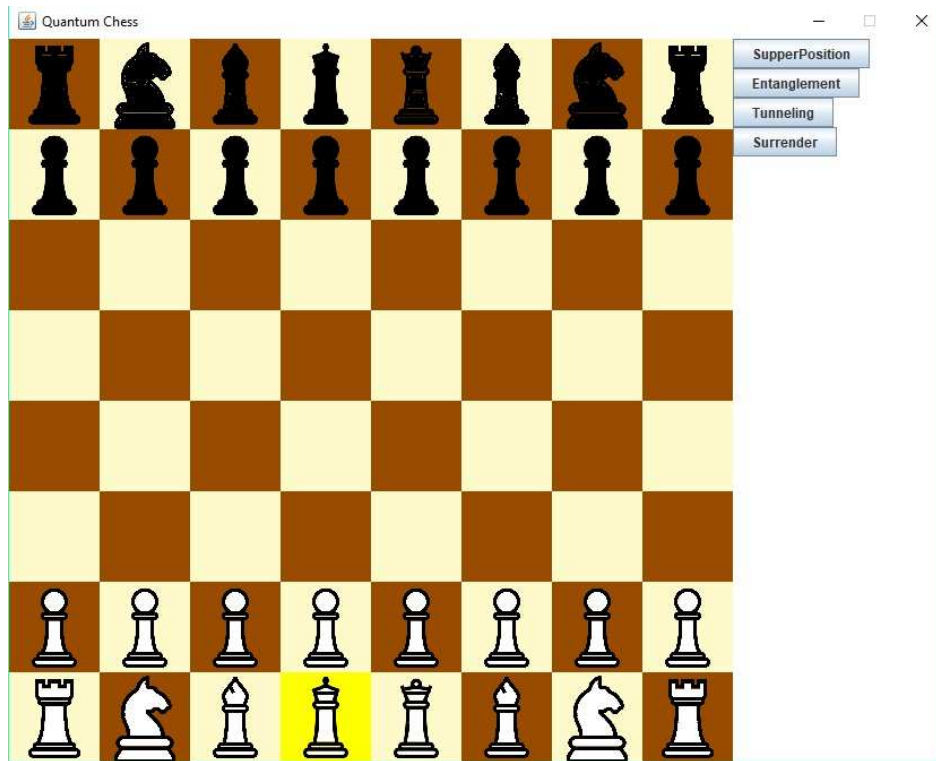


Figure 10: King Options

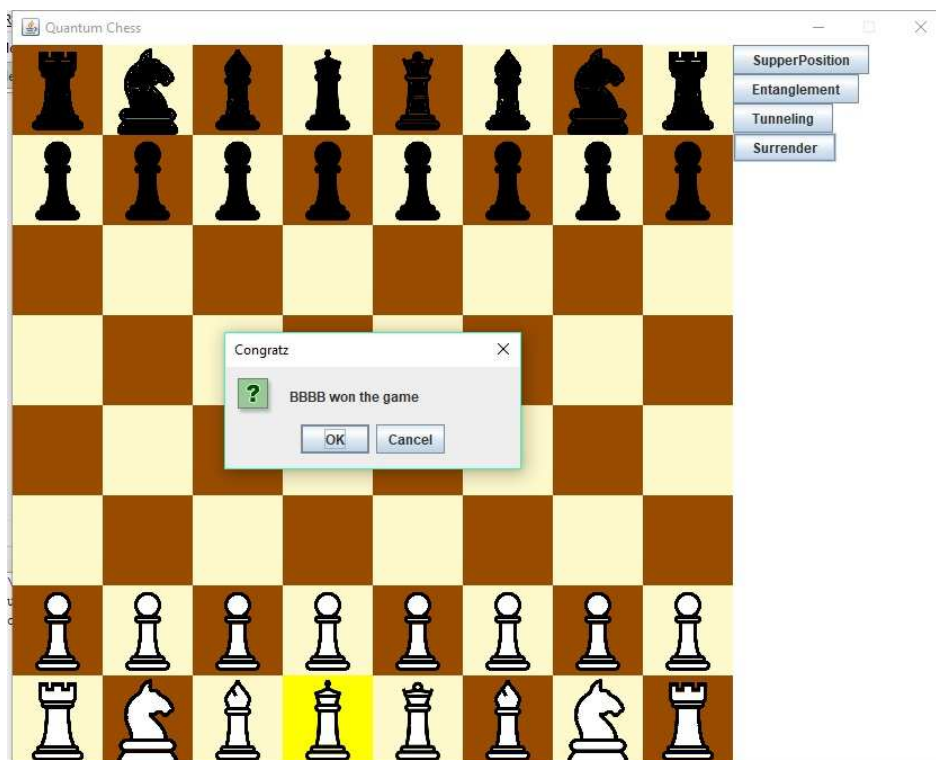


Figure 11: Lost game