Castle Quest

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Abstract

Castle Quest is a new take on a classic board game that utilizes electronics, software, and physical game pieces to bring players together as they venture and progress through a fantasy world. A Raspberry Pi facilitates the game through touch screen user inputs and visual and audio outputs. An Arduino Nano controls the LED displays which are mounted under the game board surface and in the castle. Players interact with each other and the game through the touch screen display which provides an immersive setting for game play. Castle Quest is powered with a removable, rechargeable battery which lasts approximately 3 full games.

Block Diagram

System Overview

The gameplay and computation are facilitated by a Raspberry Pi equipped with a mountable touch screen interface and an Arduino Nano which is linked to the Pi through an I2C connection. The Nano controls a linked set of individually programmable LEDs with serial digital logic in order to enact the movement in the game based on the direction selected by the player on the touch screen. Interacting with the touch screen and certain moments in the game are also linked to audio, which is outputed from the Pi's audio port to an amplifier and speaker. The whole system is powered by a 7.4V Li ion battery, which delivers power to the Pi through a custom voltage regulating circuit.
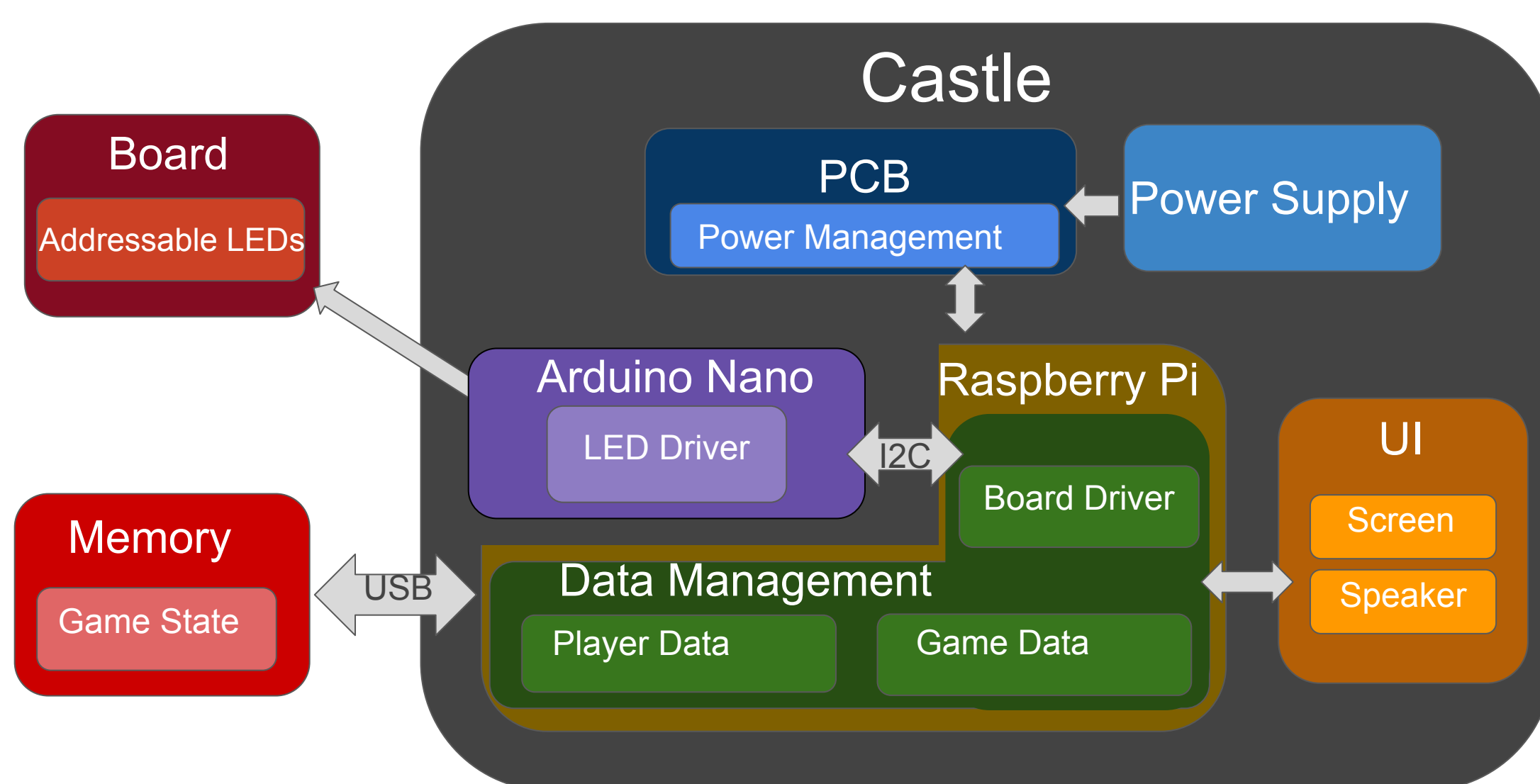
Results

- Castle Quest is a fun, safe, group centric game for up to 4 players
- Removable, rechargeable battery lasts about 3 full games (~4-5 hours)
- Users can save the current game state locally or to USB to be continued later on.
- Touch screen display and LEDs provide an immersive, and intuitive gameplay

Specifications

Meet safety standards of Consumer Product Safety Commission
Game should weigh < 5 lbs
10+ hours battery life
Durability to survive transport and repetitive construction/deconstruction
Support for up to 4 players
Simple, intuitive gameplay mechanics
Inexpensive
Fun to play

Acknowledgements

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Gameplay

The game consists of traveling around the map to each of the 4 kingdoms collecting keys to the castle. Once the player has enough keys, they can try to climb the castle to defeat the boss and win the game.

Along the way, there are traps, creatures, dragons, and magical items that can help or hurt the adventurer.

All the rules are laid out in a player's manual with the game.

The Castle
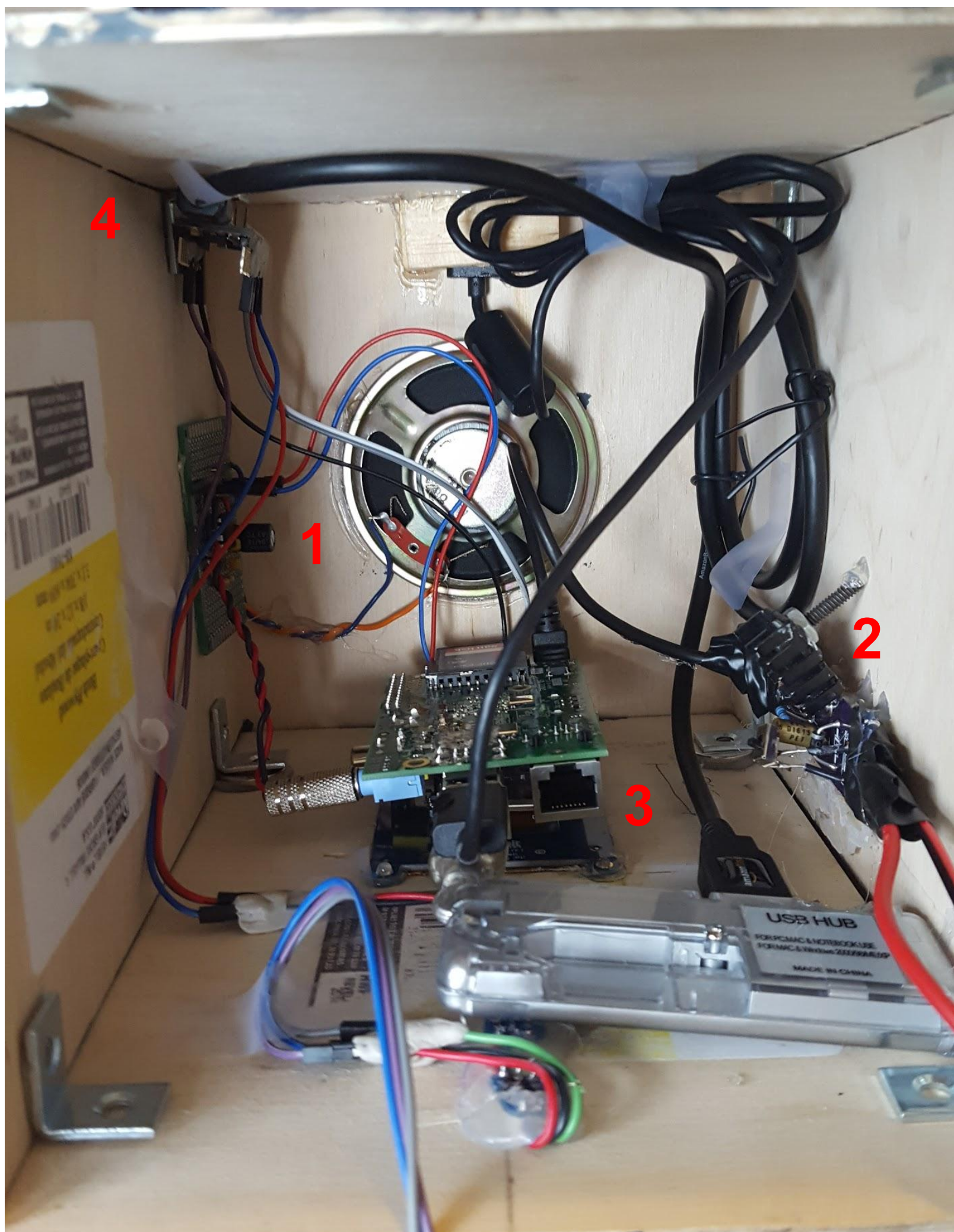
1 - Speaker and Amplifier
2 - PCB
3 - Raspberry Pi and Touch Screen
4 - Arduino Nano

Cost

Development		Production	
Part	Price	Part	Price
PCB	10	PCB	1
RaspberryPi	35	RaspberryPi	28
IO: leds, speaker, touchscreen	190	IO: leds, speaker, touchscreen	30
Arduino Nano	22	Arduino Nano	5
Tower Aesthetics	20	Tower Aesthetics	4
Total	277	Total	68

Computation

The Raspberry Pi uses a Adafruit PiTFT 3.5" display for the UI.
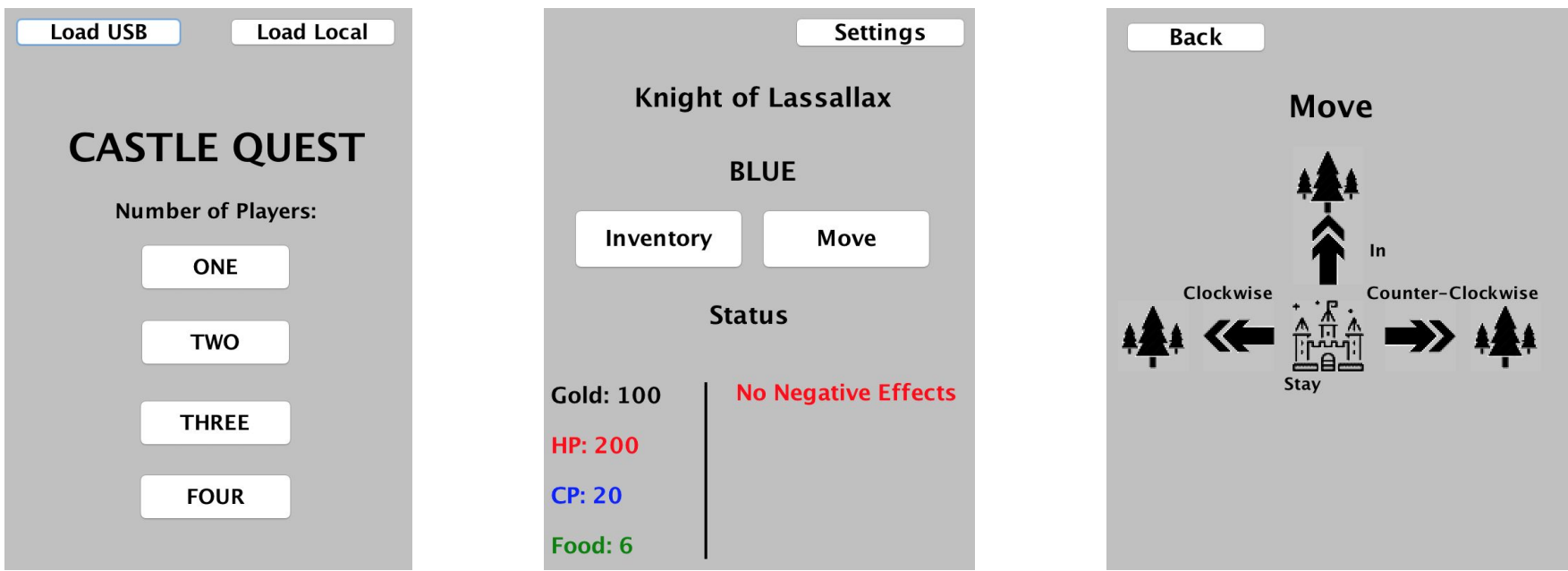
An I2C connection between the Pi and the Arduino is used to send commands to the light controller.

The 3.5mm audio jack on the Pi is used by an amp to power a small speaker driver for audio.

Externals

The peripherals of the game include the board, USB port, and removable battery.

The board consists of 64 NeoPixel WS2812 addressable LEDs mounted on a piece of circular hardboard with a graphic on top. It is connected to the arduino controller being driven by I2C.

The lithium ion battery is detachable for recharging and is located under the tower.

Game Statistics

- One four player game takes approximately one hour and fifteen minutes to complete over the course of 284 moves.
- One single player game takes approximately half an hour to complete over the course of 62 moves..
- A fully charged battery can sustain approximately up to three full four player games.