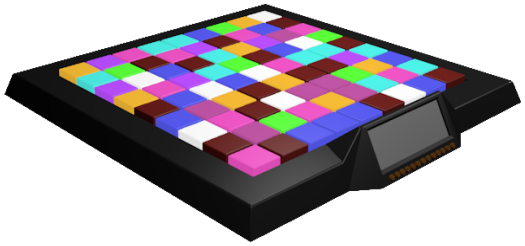
UCF Senior Design 1

LED Board Game



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Group 1

Kevin Cochran

Noah Thering

Taylor Grubbs

Zachery Dunlop

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Project Narrative Description

Everybody knows about the frustrations of buying or owning a board game, but then somewhere down the line, a piece or two falls through the woodwork, never to be seen again. Our design implements an electronically enhanced “smart” game board. This board will be smaller than a chess board but with multitudes more functionality. Featuring a matrix of multicolored square buttons, the board will have the potential to play a number of classic, and not so classic, tabletop games. This idea draws inspiration from various restaurants and other establishments which provide their customers with games or puzzles to pass the time. For example, Cracker barrel with their “peg-jumping” game and Chilli's with their interactive tablet at every table.

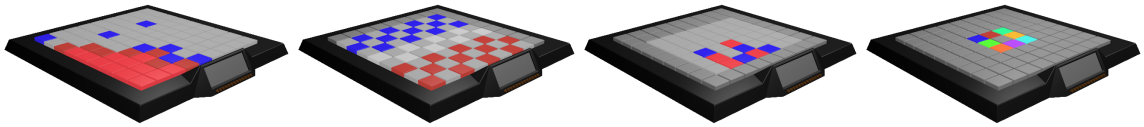
Before the modern rise of electronics, tabletop games and board games ruled the market for family entertainment. Nowadays, these games are still enjoyed around the world, but many have thrown this concept to the wayside in lieu of portable, electronic games or flashy console games. The game board's design combines the simplistic tabletop aesthetic with the flashiness and practicality of the modern electronic age.

Our “flagship” game for this system is going to be the ancient Chinese tabletop game, Go. In its original state, this game features a large tiled board and white and black playing pieces that resemble small stones. Recently publicized when Google's DeepMind artificial intelligence beat one of the greatest players of all time, Go is a deceptively simplistic game. This deceptive simplicity attracts many players who end up only getting discouraged by the daunting difficulty of the game. In Go, two players fight for “territory” of the board. Eventually, it can become difficult to track who controls what territory. This is where the modern design comes in handy.

Using multicolored LED's under the game tiles, the board will be able to show the players what territory they control, along with every possible tile they can make a play on. This visible territory control not only creates a flashy and more modern tabletop experience, it also attracts the newer, more hesitant player to try and stick with the game. The tiles on the game board also act as buttons, completely eliminating the use for game pieces.

It wouldn't be feasible to launch and market this design with just one semi-obscure board game, but thanks to its versatile design, the game board can be used to play a multitude of games and puzzles. Games like Checkers, Connect four, Chinese Checkers, Simon, and many more can be supported by this type of tabletop board. Something like this could be marketed to restaurants; one at every table to entertain their paying customers while they wait for entrees. Toy stores and supermarkets could sell them to people for use on their long car rides or family time. The device is planned to be battery powered so it can be taken anywhere at any time without needing to worry about parts or pieces being lost. A simple LCD screen will display games and options so

starting up a game will be as quick as the touch of a button.



Possible Games, From Left to Right: Go, Checkers, Connect4, Simon

In a world that's over saturated by touch screens, this game board will feature a more affordable and satisfying alternative. All the various tiles on the board will be able to be pressed down, creating a more satisfying aesthetic experience compared to the tactile or "haptic" vibration of modern touch screens. This physical feedback ties into the "old-school feel" that the game board brings to the household or business.

It is our aim to create a truly accessible tabletop gaming experience that strikes the balance between the modern flash of electronic games and the classic nostalgia of board games. Something that attracts people of all generations to physically play board games together, as some may very fondly remember. It's this nostalgic bond of casual enjoyment that inspires this design more than anything. The desire to share with people that fond memory that we have, sitting across from each other, playing games.

Requirement Specifications

Hardware:

- The system shall include up to 81 squares on the board. Each square will be have a pushbutton and led mounted on an individual pcb.
- The system shall include an LCD display for selection of up to 10 games. Example Games include Go and Connect Four.
- The system shall be battery power with a lifespan of at least 4 hours.
- The system will include one pcb for a controller that takes all the input from the buttons and outputs to the LEDs and the LCD display.
- All switch pcbs will be wired to the controller pcb.
- The board shall have dimensions of between 1 ft x 1 ft and 1.5 ft x 1.5 ft and weigh less than 5 lbs.
- The border of the playing field with house the display, microcontroller, and battery.
- The Squares of the game board will be travel linearly when depressed.
- The system will require no configuration or programming from the user.

Software:

- 100 KB flash memory per game
- interface layer for addressing LED component of game board and assigning different colors to individual LEDs
- interface layer for receiving and identifying input from game buttons, and settings buttons/switches
- interface layer for LCD
  microcontroller:
    - capable of executing the most complex algorithms required for each game in a time interval that feels quick and responsive
    - supports power saving features like interrupts

- some way to program the microcontroller's memory on the final board

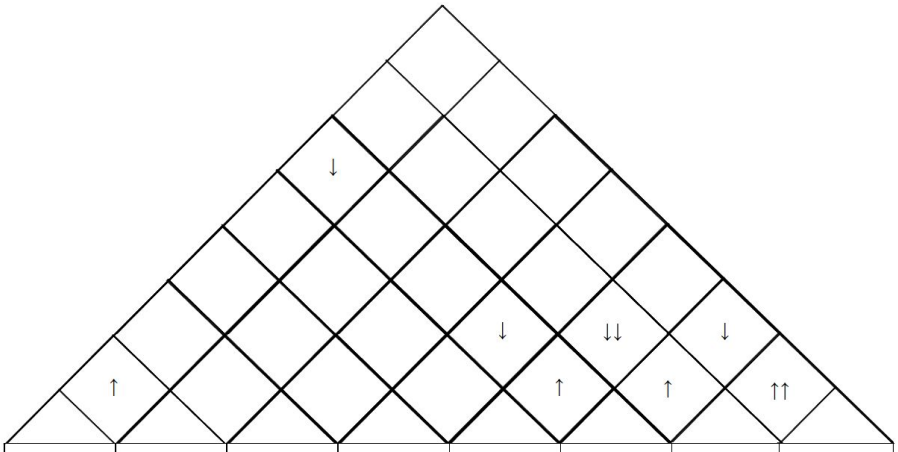
Marketing:

- The system is meant to be played on the go or in public. Because of this, there shall be no pieces that could be lost or stolen.
- Supports a moderate amount of different games that can be played with the light up buttons
- User can provide game input through the buttons that compose the game grid, or control game settings using a LCD display and extra buttons
- game grid buttons light up X different colors to portray multiple different relevant game states
- game goes into low power mode after X minutes of inactivity
- Marketing specifications to be balanced through the use of the House of Quality in figure 1.

-For further information on how the hardware and software interact, see figures 2 and 3.

House of Quality

Figure 1: House of Quality



		Weight	Size	LED Brightness	Input Response Time	Memory	Cost	Number of Games	Number of Colors
		-	-	+	-	-	-	+	+
Weight	-	↑↑	↑						
Durability	+	↓	↑				↓		
Battery Life	+	↓		↓↓			↓		↓
Quantity and Versatility of Games	+	↓	↓			↓↓		↑↑	↑↑
Cost	-			↓	↓	↑	↑↑	↑	↓
Targets for Engineering Requirements		< 5 lb	Between 12" x 12" and 18" x 18"	> 5 lumens per button	< 100 ms	~100 KB per Game	< 400$	> 10 Games	>= 3 Colors

Block Diagrams

Hardware Diagram:

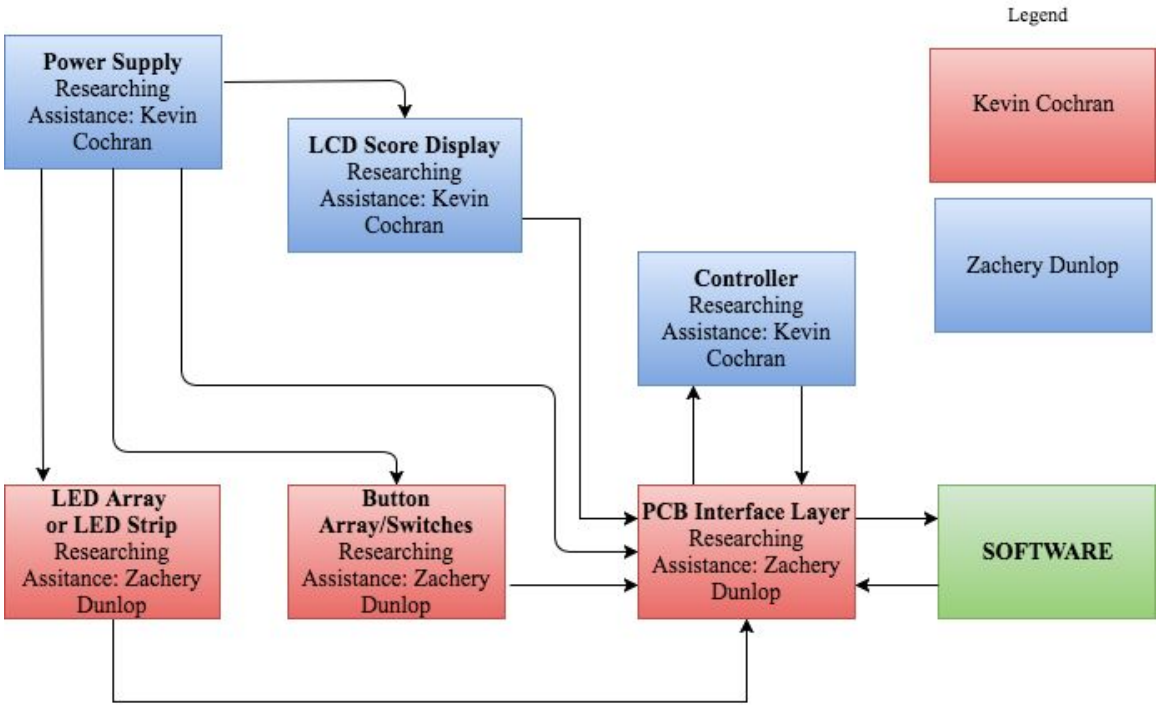


Figure 2: Hardware flow chart

Software Diagram:

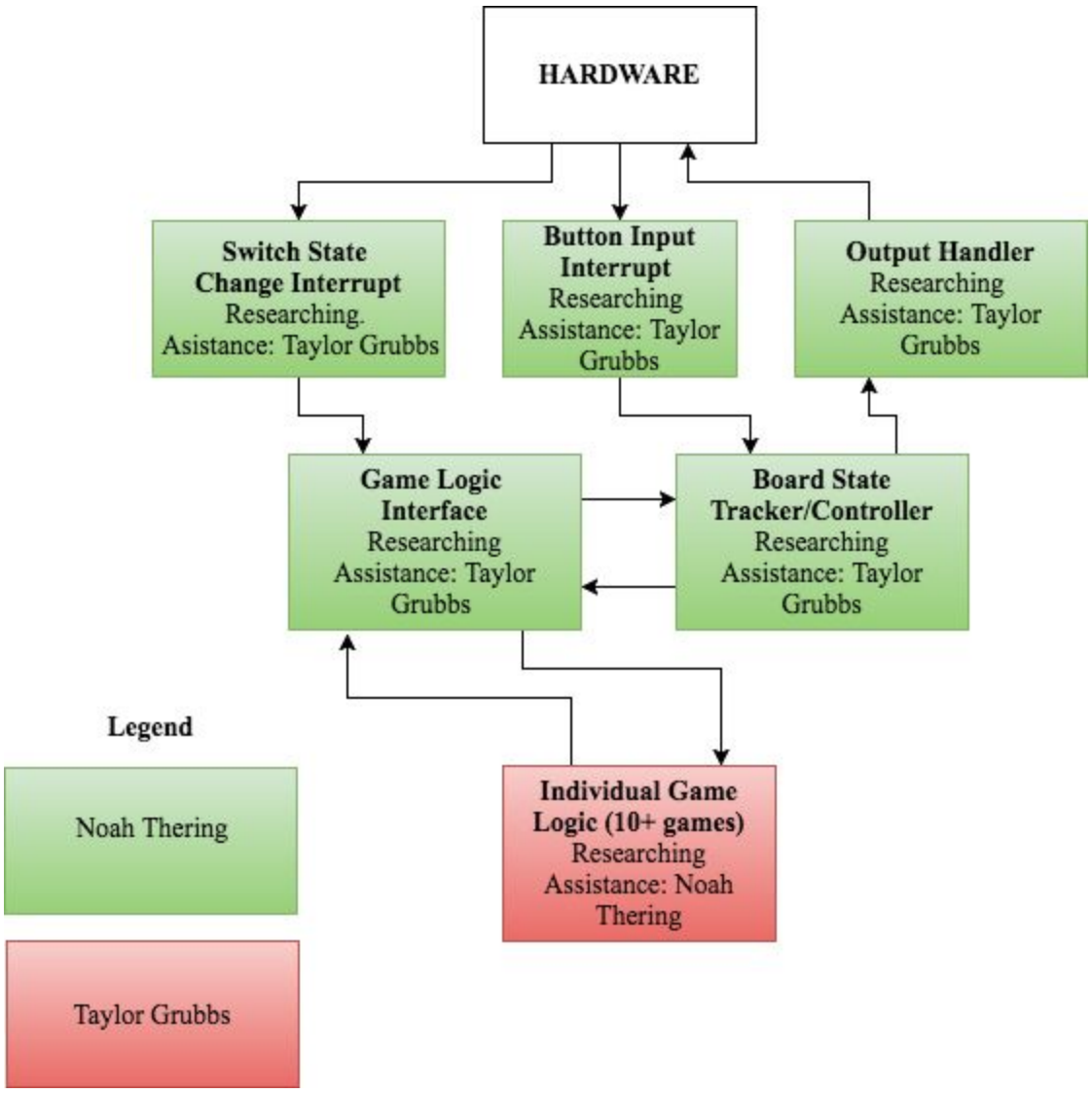


Figure 3: Software flow chart

Estimated Budget

Switch cells:
Switches = $50 (alternate $42.50)
Leds = $50
Resistors = $10
Keycaps = $20-30

Brains:
ATmega2560 = $15
LCD = $10 or $15
Micro SD card = $10

Case = $50-60
PCBs = $90-100 based on OSHpark Pricing

Power = $15-50

Total = $350

Milestones

-These goals and milestones (Table 1 and Table 2) were created to keep our group on track throughout the two semesters of senior design.

SENIOR DESIGN I

Week 1 (8/20-8/26)	Meet with Team to brainstorm project ideas
Week 2 (8/27-9/2)	Senior Design Bootcamp
Week 3 (9/3-9/9)	Project Delayed due to Hurricane Irma
Week 4 (9/10-9/16)	Divide and Conquer
Week 5 (9/17-9/23)	Mental Simulations of Product Function
Week 6 (9/24-9/30)	Update Divide and conquer
Week 7 (10/1-10/7)	Determine Hardware/Software Interface Standards
Week 8 (10/8-10/14)	Basic Concepts Tested and Verified
Week 9 (10/15-10/21)	Finalize Button Design
Week 10 (10/22-10/28)	Mock Up Games on Another Platform
Week 11 (10/29-11/4)	60 page submission due
Week 12 (11/5-11/11)	Finalize Physical Layout
Week 13 (11/12-11/18)	100 page submission due
Week 14 (11/19-11/25)	Finalize Part Choices
Week 15 (11/26-12/2)	Finalize PCB Design
12/4	Final Document Due

Table 1: Senior Design I milestones

SENIOR DESIGN II

Week 1 (1/8-1/14)	Final Analysis of Project Design
Week 2 (1/15-1/21)	Order Parts
Week 3 (1/22-1/28)	Start Assembling Prototype Components
Week 4 (1/29-2/4)	Start Assembling Full Prototype
Week 5 (2/5-2/11)	Finish Assembly of Full Prototype
Week 6 (2/12-2/18)	Extensive Testing Period
Week 7 (2/19-2/25)	Analysis of Testing
Week 8 (2/26-3/4)	Redesign of Weak Components and Bug Fixing
Week 9 (3/5-3/11)	Get New Parts for Required Changes
Week 10 (3/11-3/17)	Apply Needed Modifications
Week 11 (3/18-3/24)	Extensive Testing Period
Week 12 (3/25-3/31)	Make Minor Tweaks to Project, Order Parts
Week 13 (4/1-4/7)	Finish Tweaks and Polish
Week 14 (4/8-4/14)	Extensive Project Testing (Presentation to Faculty Advisors)
Week 15 (4/15-4/21)	Finalize and Pack Up Project
Final Presentation	

Table 2: Senior Design II milestones