Problem Definition

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# Problem statement

The purpose of our project is to create an electronic score pad accessory, showcased with an electronic game board. This will help players enjoy a more personalized and relevant game experience, be able to change difficulty settings, and cut-down on long turn times.

# Customer Impact statement

At the Customer Discovery Dinner, we learned that board gamers are frustrated with long turn times and would like a way to change the difficulty of games. The electronic game board and score pad will help people play board games in a more convenient manner. This device will increase enjoyability and take the guesswork out of tallying points, keeping time and counting money while playing board games. The electric game board and score pad may not work with every game and requires a power source.

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# Benchmarking of related solutions

### Table 1: Benchmarking of related solutions

|  |  |  |  |
| --- | --- | --- | --- |
| Solution  (1 point each) | Description  (1 point each) | Pros  (2 points each) | Cons  (2 points each) |
| Mojo Digital Life Counter ($13)    [www.amazon.com](https://www.amazon.com/Mojo-Best-Digital-Life-Counter/dp/B0768771BR/) | The Mojo Digital Life Counter makes it easy to calculate scores and prevents your score from being lost if your scoring cards/dice fall off the table by using a digital counter. | * Works with many games * Small size - fits in a card deck box * Two counters for each player * Two month battery life | * Only supports two players * No timer feature |
| Legion Lifecalc ($12)    [www.amazon.com](https://www.amazon.com/Legion-Supplies-Lifecalc-Standard-Gathering/dp/B00UG54Q4U/) | The Legion Lifecalc makes it easy to calculate scores and prevents your score from being lost if your scoring cards/dice fall off the table by using a digital counter. | * Works with many games * Small size * Long battery life | * Only supports two players * No timer feature * Battery cannot be changed * Low quality |
| Robolife Digital Chess Clock ($19)    [www.amazon.com](https://www.amazon.com/Robolife-Professional-PQ9907S-Digital-Chess/dp/B01KTFG2OS/) | The Robolife digital chess clock keeps track of two players’ turns using a pair of digital timers. | * Delay/Bonus Time Function * Stores user settings * Portable * Alarm Feature | * Only meant for Chess * Only acts as timer * Batteries have to be replaced |
| Scrabble Electronic Scoring ($25)    [www.amazon.com](https://www.amazon.com/Hasbro-A8167-Scrabble-Electronic-Scoring/dp/B00IFWSOZI) | The Scrabble electronic scoring edition eliminates scoring on paper by using an electronic calculator. | * Supports up to four players * Dial makes it easy to enter large numbers * Built in timer feature | * Only meant for Scrabble * Only available as part of a complete scrabble set * Batteries must be replaced |
| Hasbro “Flash” Games - Scrabble, Yahtzee, and Boggle ($30 - $40)    [www.amazon.com](https://www.amazon.com/Hasbro-24860-Scrabble-Flash/dp/B003B1TI58/) | The Hasbro “Flash” game line reduces the number of components in games and eliminates manual scoring by using smart game pieces. | * Automatically calculates scores * Can be used with a large number of players * Built in timer feature | * Individual sets must be purchased for each game * Batteries must be replaced in each of five separate devices |
| Monopoly: Ultimate Banking Edition ($35)    [www.amazon.com](https://www.amazon.com/Monopoly-Game-Ultimate-Banking-Edition/dp/B01ALHAMTK/) | The Monopoly Ultimate Banking Edition keeps track of wealth, property value, and auction bids by using a digital banking device. | * Supports up to four players * Bank cards keep track of player wealth * Effects of chance cards are automatically applied * Shorter gameplay (30min.) | * Only meant for Monopoly * Batteries must be replaced * Rule changes may decrease market demand for game |
| Phone Apps (Free)    [play.google.com (1)](https://play.google.com/store/apps/details?id=br.com.afadc.magiclifecounter),  [play.google.com (2)](https://play.google.com/store/apps/details?id=com.bobmolenhouse.scorerealms) | Game scoring phone apps provide score counters that are tuned for specific games by using a device that you already own. | * Uses a device the user already owns * Can be tailored specifically to each game * Timer available | * Separate apps must be downloaded for different games * Requires phone to be unlocked * Uses your phone’s battery life |
| Electronic Scoring Device  (US4286323 A)    [Patent](https://www.google.com/patents/US4286323) | The electronic scoring device makes it easier to score games with a complex scoring system by using game-specific programs. | * Numeric keypad allows for fast number entry * External memory port allows different scoring programs to be loaded | * No timer feature * Only supports two players |
| Electronic Score Pad (US20060091603 A1)    [Patent](https://www.google.com/patents/US20060091603) | The electronic score pad prevents calculation mistakes in games with multiple rounds by automatically adding up scores. | * Supports 4+ players * Numeric keypad allows for fast number entry * Saves scores for each round as well as the current total * Allows for custom player/team names | * No timer feature * Display can be cluttered if scores for each round are not needed |

# **Criteria and constraints**.

### Table 2: Project criteria

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criteria**  *(1 point each)* | **Threshold**  ***(Halt & Review)***  *(1 point each)* | **Target Goal**  ***(Plan of Record)***  *(1 point each)* | **Stretch Goal**  ***(Design Stop)***  *(1 point each)* | **Rationale**  *(1 point each)* |
| CR-1: Online scoreboard | Top 5 scores in 1 game | All scores in 1 game | All scores for 10 games | Users can compare their scores with those of others around the world |
| CR-2: Size | Less than 8”x8”x4” | Less than 6”x4”x1” | Less than 5.5”x3”x0.5” | It needs to be portable and stowable |
| CR-3: Turn timer | 00:00:01.00 resolution | 00:00:00.10 resolution | 00:00:00.01 resolution | Users can limit the length of turns |
| CR-4: Reduce the number of game components | Replace the score counter | Replace the score counter and money | Replace the score counter, money, and dice | Setup time and the chance of losing pieces will be reduced |
| CR-5: Long battery life | > 1 month | > 3 months | > 6 months | Device should work for people who play games infrequently |

*Table 3: Project constraints*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Constraints**  *(1 point each)* | **Threshold**  ***(Halt & Review)***  *(1 point each)* | **Target Goal**  ***(Plan of Record)***  *(1 point each)* | **Stretch Goal**  ***(Design Stop)***  *(1 point each)* | **Rationale**  *(1 point each)* |
| CO-1: Keep track of score/other quantities | Count 1 value | Count 5 values | Count 7 values | Allow game and players to know current stats |
| CO-2: Track players’ positions | Track positions in software | Sense positions of players’ game pieces with hardware | Control positions of players’ game pieces with hardware and software | Allow game and players to know current positions |
| CO-3: Generate random events | 10 different events | 100 events | 1000 events | Allow for changeable gameplay of varying difficulty |
| CO-4: Prototype budget[[1]](#footnote-1) | $280 | $200 | $0 | Defined by professors |
| CO-5: Estimated production cost (in quantity) | $0 | 50% of market value | < market value | Defined by professors |
| CO-6: Power supply and voltage regulator circuit   * AC adapter, battery, or solar panel connected to a custom-designed voltage regulator circuit. No USB power packs. | 1 | 2 | 3 | Defined by professors |
| CO-7: Microcontroller (8- or 16-bit, bare IC)   * In-system-programmable (ISP) * No PIC16F887, PIC16F917, dsPIC30F3014, ATMEGA128, or commercial kits[[2]](#footnote-2) allowed | 1 | 2 | 4 | Defined by professors |
| CO-8: Sensor(s) read by a microcontroller | 1 | 10 | 40 | Defined by professors |
| CO-9: Actuator(s) controlled by a microcontroller | 1 | 1 | 5 | Defined by professors |
| CO-10: Wireless communications  (Recommended: [particle.io Photon](https://www.particle.io/prototype#photon)) | 1 | 2 | 4 | Defined by professors |
| CO-11: Serial communications to communicate with another chip or device (could be to #7 module) | 1 (e.g., I2C, SPI, UART) | 1 | 4 | Defined by professors |
| CO-12: Functioning custom printed circuit board   * Must be created in Cadence * No commercial boards (e.g., from Sparkfun) | 1 | 2 | 4 | Defined by professors |
| CO-13: Surface mount components   * Size 0805 or larger recommended | 1 | 10 | 40 | Defined by professors |
| CO-14: Programmed in C or C++ | Programmed in C | Programmed in C++ | Programmed in C/C++ | Defined by professors |
| CO-15: [Hardware and/or software-driven interrupts](http://esdresources.blogspot.com/2017/02/interrupts.html) | 1 | 2 | 40 | Defined by professors |

1. Does not include development kits, components, or PCBs from PRLTA, components from outside of ASU, or free samples. [↑](#footnote-ref-1)
2. Arduino, Pioneer Kit, Raspberry Pi, etc. may (and should) be used for prototyping, coding, and testing. [↑](#footnote-ref-2)