# ECE 350: Digital Systems Project Proposal

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## 1 Introduction

By submitting this LaTeX document, I affirm that

1. I understand that each `git` commit I create in this repository is a submission
2. I affirm that each submission complies with the Duke Community Standard and the guidelines set forth for this assignment
3. I further acknowledge that any content not included in this commit under the version control system cannot be considered as a part of my submission.
4. Finally, I understand that a submission is considered submitted when it has been pushed to the server.

## 2 Introduction to Idea

We plan to create a Harry Potter inspired spell casting game. Users will be shown a pattern on a screen and they will have to trace it, as if they were casting a spell. They will trace patterns using custom built IR Wand controllers to give better game play experience. There will be various challenge opportunities, such as tracing a moving pattern, or tracing a pattern from memory. Additionally, there will be an option to "duel" another user. Keeping with the Harry Potter theme, users will be able to select their Hogwarts House at the beginning of the game, and contribute their score to a House Points leader board.

## 3 Tasks

### 3.1 Game play features

#### 3.1.1 Custom IR Wand Controllers

1. Custom 3D printed wands using IR communication to control user input.

2. This is a very difficult task.
3. We request 30 points.

#### 3.1.2 dueling FPGAs on one screen

1. Have the option to add a second player in a wand "duel"
2. Two users would compete to trace spell patterns the fastest/most accurately through several rounds
3. This is a nontrivial task because we figure out how to run the program simultaneously on two different FPGAs but to keep data shared; figure out how to keep track of two different IR remotes locations on one screen
4. Input: switch
5. Output: multiple wand cursors on a screen
6. Processor use: extensive
7. We propose this item to be worth 30 points.

#### 3.1.3 Multiple Options of Spells

1. This is a significant portion of the game. Creating a series of traces for players to follow allows for variety and interesting game play.
2. This is a moderate task.
3. Input: user chooses a spell
4. Output: Specif trace appears on the VGA screen
5. Processor use: significant
6. We propose this item to be worth 10 points

#### 3.1.4 Power-ups

1. We would like to implement several power-ups, such as to make the line wider so it's easier to trace, increase time left to complete the spell, increase points generation, etc.
2. This is not a trivial task as we would have to keep track of previously obtained power-ups by user when adding new ones and we would need to update all components of the game that the power up affects
3. Input: Power-up
4. Output: Certain property change
5. Processor use: significant
6. We propose this item to be worth 20 points

## 3.2 Graphics/Sound Features

### 3.2.1 Display User Trace on Screen

1. As the user follows the trace on the screen we want to show the users trace on the screen too
2. This is a non-trivial task as we need to process the inputs quickly and synchronously show the user trace on the screen
3. Input: Location user is pointing the remote
4. Output: User's trace on the screen
5. Processor use: significant
6. We propose this item to be worth 30 points

### 3.2.2 "Glitter effect" for wand position on screen

1. User's screen cursor gives off "sparks" (like the end of a wand) on the screen
2. Glitter effect also happens when the user is tracing a pattern
3. This is a nontrivial task because we have to create an algorithm to randomly select pixels around the user's cursor location to color.
4. Input: where a user points their remote must be tracked
5. Output: the glitter effect must show up on the VGA screen
6. Processor use: extensive use of addition
7. We propose it should be worth 10 points.

### 3.2.3 allow users to select Hogwarts House (color scheme)

1. Allow user to select one of four Hogwarts houses to compete for
2. Their choice will entirely change the color scheme of the game
3. This is a nontrivial task because we must remap every pixel depending on user choice of House.
4. Input: user selects Hogwarts House
5. Output: color schema of VGA screen
6. Processor use: nothing significant
7. We propose this item to be worth 20 points.

#### 3.2.4 Theme Music and Sound Effects

1. We want to make the theme music for the game with different sound effects during trace and when trace is done. We would have different sound effect for different spells and the sounds would differ based on how far you are tracing from the line
2. This is a moderate task as we would have to make different sound effects and engage them by specific actions and properties, which is significantly more complicated then the laboratory on this topic.
3. Processor use: not significant
4. We propose this item to be worth 10 points

### 3.3 Scoring Features

#### 3.3.1 Points based on % of design correctly traced

1. A user's score is dependent on how accurately they trace a pattern given to them
2. We must track what percentage of the pattern's pixels the user hits.
3. This is a nontrivial task because we must track every location on the screen that the user moves the wand.
4. Input: location user is pointing the remote over time
5. Output: score
6. Processor use: extensive
7. We propose this item be worth 20 points.

### 3.4 Game Challenge Features

#### 3.4.1 Challenge: Time Limits for Spell Casting

1. We want to be able to make the game more interesting by limiting the users time to cast the spell
2. This is a moderate task
3. Input: counter
4. Output: The spell trace would disappear
5. Processor use: not significant
6. We propose this item to be worth 10 points

#### 3.4.2 Challenge: Non-Static Trace

1. We want to bring the game to upper level by making it harder to trace the line by making non Static traces
2. This is a non-trivial task, as we would have to implement algorithms for trace movement and we would need to keep track of new trace location as well as users to calculate scores
3. Input: Movement algorithm
4. Output: Non-static Trace
5. Processor use: extensive
6. We propose this item to be worth 20 points

# 4 Timeline

**11/08/2018 - PC6**
For the first project check point we plan to start the integration of the task 1, custom IR Wand Controller. In addition, we will implement several spell traces to be displayed on the VGA screen(task 6). We will outline the different color schemes for different Hogwarts Houses(task 4).

**11/15/2018 - PC7**
For the second project check point we plan to finish the integration of the Wand Controller (task 1) and to display the user's trace on the screen as it points to it (task 7) . We will also add the glittering effect in this Project checkpoint(task 2). We will start the implementation of the task 5 - dueling FPGAs on one screen.

**11/27/2018 - PC8**
For this project checkpoint we plan to finish task 5 dueling FPGAs on one screen, implement scoring system (task 3), add theme music and sound effects (task 8). Additionally, we will implement time limits for spell casting and non-static traces (tasks 10 and 11).

**12/06/2018 - PC9 Project Demo**
Project Presentation.

**12/07/2018 - PC10 Report**
Project report and evaluations.