Project Idea for Educational Game on Digital Circuits

By: Mohd. Rahib Hasan
Github: EmAreAitch

Introduction:

Dear Members of the CircuitVerse Team,

The idea is simple:

1. Develop a game that focuses on teaching logical circuits to student or self taught learners.
2. Game would consist of step by step learning with the help of levels.
3. It would not only focus on beginners but also for experienced people who may get some value from it.
4. It will be a 2D board game with great texture and art so it looks friendly and fun to play with.
5. The game's main story or main game would have playtime of minimum 15 hours. Because of this the game would feel achievable and finishable. It won't feel like the game requires a huge commitment.
6. It would have various levels for building real life projects/examples:
    - Traffic Lights
    - Calculator
    - Digital Alarm Clock
    - Digital Combination Lock
    - Elevator Controller
    - Basic CPU
    - Digital Dice Roller
      And many more..
7. Heavy hint system that makes sure that player wont get stuck at any point of the game.
8. It would be 100% responsive mobile as it will contain very minimal and well structured components.
9. Optional enhancements as these are bit difficult to implement and are bit too much to maintain:
    - Allow people to create their own custom level (as people already can build and store their circuit)
    - Game difficulty system.

Why CircuitVerse would need a game like this?

When I heard this word i.e ‘CircuitVerse’, I realized that it's a word that is a combination of ‘Circuit’ and ‘Universe’. Indicating that it's a place that has everything related to digital circuits. And at this moment after going through the entire platform and looking through all the features, I can say that this is truly a universe of circuits available to students, teachers and digital circuit lovers.

But it only comes very close to this problem of making digital circuits easy to understand for every being. I mean digital circuits are still one of the hardest topics for engineering students.

It provides a chess board but fails to provide the list of rules and legal moves in a structured manner.

By the inclusion of Interactive Book, it can be easily understood that CircuitVerse not only cares about providing a simulation for building digital circuits but also it wants its users to also learn about digital circuits within CircuitVerse.

This is where this game would come into place. Providing users a structured and memorable path of learning. Various teachers present on the platform would definitely advise their students to go through this game.

Not only this the game can really make use of the already existing circuit simulation for ease of development.

Also the game would be super exciting to work on and this could push the learning to the next level.

Is there anything something like this built before?

Yes and no, as the games like this do exist in the market but there is no serious option exclusive for digital circuits as there are a lot for electronic circuits.

After a lot of research I can only list two games for digital circuit:

1. nandgame.com - online game with levels to learn various logic gates
2. Turing Complete - paid game available on steam with great graphics and textures

Problems with nandgame:

1. Not beginner friendly - even the first level is hard to clear without taking the hint. Spoiler- they stop giving hints after a few levels which makes the game extremely difficult.
2. Zero responsiveness on mobile: It's only playable on desktop
3. Saves progress locally.

Problems with Turing Complete:

1. It's also not beginner friendly, in the end both of these are for experienced people.
2. Paid
3. Only available on desktop

Our game's main purpose is that it's there for students who are scared of all these complex looking circuits which actually follow a very simple implementation.

How can something be built like this?

According to me the perfect framework for this case would be Phaser.
It's the best framework out there for building 2D games using HTML5 and Canvas.
HTML5 and Canvas already facilitate the entire CircuitVerse for its simulation.

Here are some great games built using Phaser

Next, we will make use of already existing circuits simulation present on CircuitVerse.

- **Working of the game**

  Game wont comprise much but the same drag and drop simulation where the player would drop missing circuit elements into the circuit board which already contain some components for support.

  The player will get either a problem statement or a truth table. By each level new logical gates will be unlocked allowing players to step up their game.

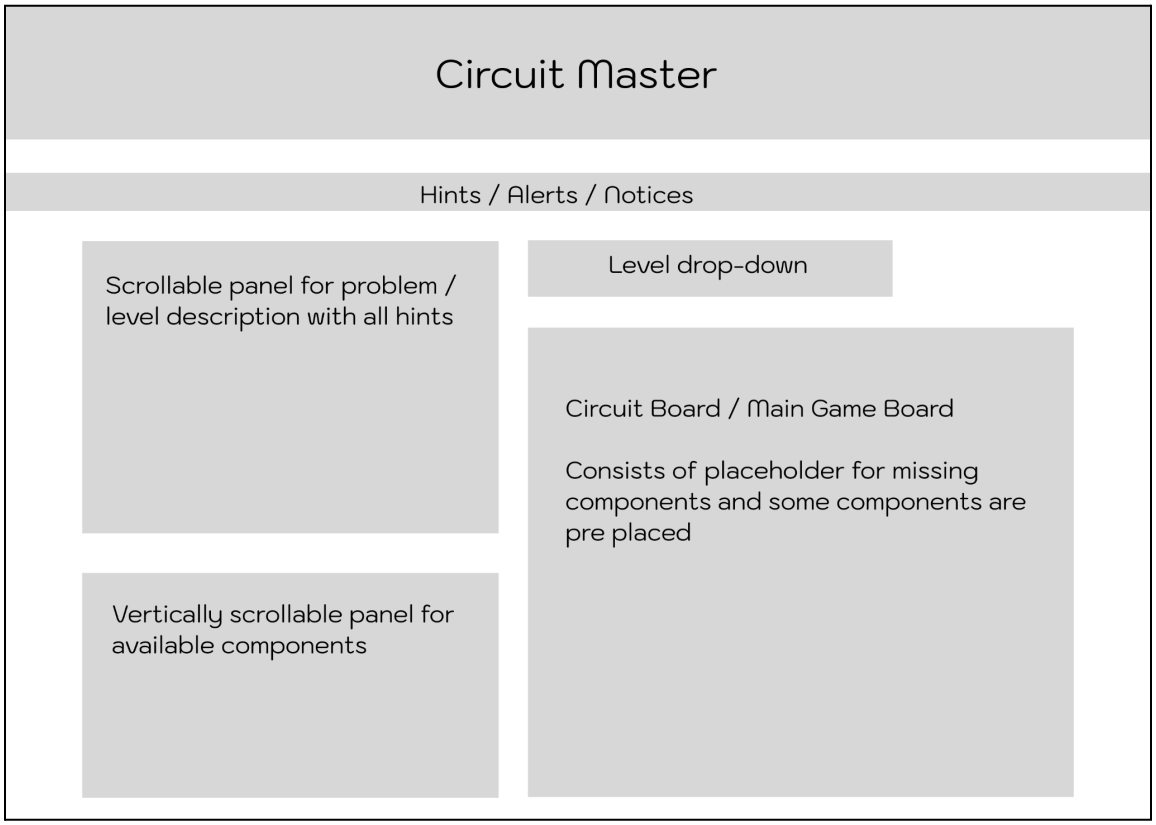
  It is supposed to be really slow in starting so that players get the feels of circuit designing and be able to identify what's happening in the circuit just by looking at it.

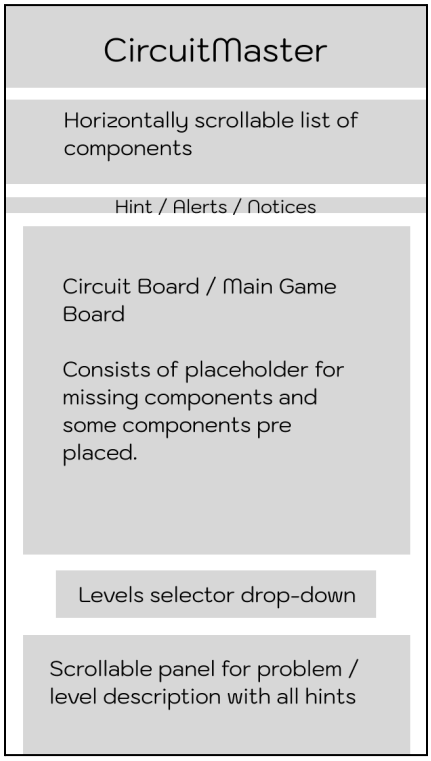
  We can refer to nandgame and turing complete for the building flow of the game.

How can we make this more beginner friendly

1. Acknowledging that this is not a puzzle game or who got the all brains kind of game instead this aims toward teaching but with maximum interactivity.
2. It will be full of “follow through tutorials”. First we solve problem ourselves and then ask the player to follow our steps and solve themselves (might look like spoon feeding but trust me this is the way it should be)
3. Player’s hand won't be left even after making progress in the game. Again this makes sure that they do solve problems and understand the bits. I don't want them to give up after full adder (the farthest students usually go).
4. With a lot of description and knowledge about the level/problem so that they can connect the pieces in their mind.
5. Multipart problem where player will tackle with problem parts instead of whole big problem.

Simple layout idea (Desktop and Mobile)





Conclusion

There have been many games that are there to teach a lot of, especially in the field of tech and programming. But it's disheartening to see that there is none when it comes to digital circuits which I truly believe could be a great candidate for this.

This could be the greatest piece in your art. But still it will take more effort in making sure that the game stands at its core which is that it's not a game that is supposed to test your IQ but actually help you to build your IQ i.e its an Educational Game not a Puzzle Game.

List of some games that help me learn something.

1. Flexbox Zombies - CSS Flexbox
2. CodinGame - JS
3. Grid Garden - CSS Grid
4. CodeCombat - Python, C++, etc (About to explore it in a few weeks).

Thank You
For Reading