

Faculty of Engineering and Technology

Computer Science Department

Serious Gaming Fundamentals (COMP2331)

Final Project SG Design

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1. **Overview of Concept**

"Electron Runner" is conceived as an educational single-player game that aims to teach players about the principal electronic components within the context of electrical circuit rules. The game’s central goal is to enable players to illuminate the maximum number of bulbs. The gameplay involves navigating an electron through a circuit, with the electron able to pass through PN Diodes to increase its speed and requiring players to jump over NB Diodes and capacitors to avoid game over. When encountering resistors, the electron's speed decreases, unless it is at zero, which results in a game over. Inductors also slow the electron and limit its jump space due to the magnetic field. Transistors boost the electron's power, which is necessary to light up bulbs and score points. The game intricately weaves educational content with three levels of gameplay, each introducing new story elements and information. The first level teaches about electron flow through wires, the second reveals the effects of temperature on electron speed, and the third level culminates in an adventure illustrating the electron's role in powering devices and providing electricity to areas like Gaza. "Electron Runner" offers an engaging and interactive way to learn about electronics, making it not just a game but an enlightening journey through the world of electricity.

1. **Instructional Objectives**

Upon completing the game, players will achieve a set of targeted learning outcomes through interactive gameplay. The game is specifically designed with instructional objectives that guide players through a virtual environment where learning is the core of the experience. The objectives are as follows:

* **Cognitive Domain:**

Comprehension: Players will understand the fundamental properties and functions of electronic components such as diodes, capacitors, resistors, inductors, and transistors as they interact with them within the game.

Application: Learners will apply knowledge of electronics to make informed decisions within the game, such as using the behavior of electrons at different temperatures to navigate through the levels successfully.

Analysis: Participants will analyze circuit behaviors under varying conditions, predicting outcomes based on their interactions with different components within the game's levels.

* **Affective Domain:**

Players will develop an interest and positive attitude towards learning electronics, motivated by the game's engaging content and the satisfaction of solving its challenges.

The game will encourage persistence and resilience, as players must often try multiple strategies to overcome a level, reflecting the trial-and-error nature of scientific inquiry.

"Electron Runner" is designed not just to impart theoretical knowledge, but to simulate practical scenarios, thus providing an innovative and engaging platform for players to learn about electronics without the need for physical electronic components.

1. **Outcomes**

After engaging with "Electron Runner," players will emerge with a robust understanding of electronic components and the fundamentals of electrical circuits. They will not only be able to identify and articulate the roles of diodes, capacitors, resistors, inductors, and transistors but also understand the behavior of electrons under various conditions. For example, they will learn how temperature affects electron mobility, equipping players with the insight to predict and discuss these effects. This knowledge will manifest in their ability to solve complex problems involving electron movement and to make informed predictions about electronic circuit behavior in different environmental conditions. The strategic and critical thinking skills developed through gameplay will translate to a practical appreciation of electronics, preparing players to handle real-world electronic scenarios with increased acumen and confidence.

1. **Description of Character**

The game features a unique protagonist, "the electron," an unchangeable character that symbolizes the player's learning journey through the game. The electron, with its constant form, navigates a circuit full of interactive elements representing electronic components. These components challenge the electron in various ways, reflecting real-world electronic behaviors. Through overcoming these challenges, players learn about electricity and electronics, with the electron's unwavering character underscoring the game's educational purpose.

1. **Description of the game environment:**

The game environment is simple and abstract.

There will be three locations for each level. The first will be consisting of a blue background with the wires, electronics components, and light bulb. This allows players to focus on the aim itself without being distracted by extraneous details.

The second is in nature, to clarify the effect of temperature on the electron by changing the climate in which the electron is located (backgrounds that suggest winter, low temperatures, and other backgrounds that suggest that the temperature is rising).

The last one is on the Gaza border, which illustrates the suffering represented by the severe obstacles and barriers in reaching our beloved land to help our people.

1. **Description of the game play:**

After the player chooses the level in which he wants to play, he moves to the environment that belongs to that level, which contains many challenges, which he must either overcome in one way or another or to take advantage of to help him improve his speed and energy.

To explain this in detail:

Objective: Turn ON the maximum number of bulbs by guiding the Electron through various electronic components while following the rules of electricity.

Electron: The player controls the Electron, which has a speed and power.

Initially, the speed is 0, and the power is 0.

The Electron's speed and power will be affected as it interacts with different electronic components.

**Electronic Components:**

PN Diode: Electron can pass through easily, and its speed increases by 1 if it goes through.

NP Diode: Electron cannot pass through; it must jump over. If touched, it's Game Over.

Capacitor:Electron cannot pass through; it must jump over. If touched, it's Game Over.

Resistor: If the Electron's speed is 0 and it touches the resistor, it's Game Over.Otherwise, Electron can go through, and its speed decreases by 2.

Inductor: If the Electron's speed is 0 and it touches the inductor, it's Game Over.Otherwise, Electron can go through, and its speed decreases by 1.

Passing over it decreases the space of jump due to the inductor's magnetic field.

Transistor: Electron can go through it, and its power increases by 1 when touched.

Bulb (Main Character): Electron can go through if its power is greater than 1

.If Electron's power > 1, it can go through the bulb, and the power decreases by 1.

The bulb turns ON, and the bulb score increases by 1.

If Electron's power is 1 or less, it's Game Over.

1. **Reward structure:**

* **Turning ON a Bulb:**

Reward: +1 point

Condition: When the Electron successfully passes through a Bulb with a power greater than 1.

* **Passing through a PN Diode:**

Reward: +1 speed

Condition: When the Electron successfully passes through a PN Diode.

* **Transistor:**

Reward: +1 Power

Condition: When the Electron successfully passes through a PN Diode.

1. **Look and feel of the game:**

This could be different from level to another but it general this is the look and feel of the game:

* **Background:**

Set the game in a circuit-themed environment, with circuit boards, wires, and electronic components in the background.

* **Main Character - Electron:**

Design a character resembling an electron with a orb at its center.

The electron should be positioned at the bottom of the screen, ready to navigate through the electronic components.

* **Obstacles:**

Display PN and NP Diodes: Differentiate between them by color or symbols.

Represent Capacitors as obstacles that the electron must jump over.

Show Resistors as barriers. If the electron's speed is not zero, it can pass through, but its speed decreases by 2. If the speed is zero, touching the resistor results in a game over.

Illustrate Inductors with a coil symbol. Allow the electron to pass through, but its speed decreases by 1. Show a magnetic field effect by reducing the jump space.

Use Transistor symbols to add variety.

* **Bulb:**

Position bulbs at intervals along the circuit path.

Allow the electron to pass through a bulb if its power is greater than 1. When the electron passes through, decrease its power by 1, turn the bulb on, and increase the score.

* **User Interface Elements:**

Display the electron's current speed and power at the top of the screen.

Show the current score prominently.

Include a "Game Over" screen with the final score when the electron collides with an obstacle or the power is insufficient to turn on a bulb.

* **Animations:**

Add animations to show the electron speeding up when passing through PN Diodes, jumping when avoiding Capacitors, and slowing down when passing through Inductors.

* **Sound Effects:**

Use electronic-themed sounds for actions like passing through components, jumping, turning on bulbs, and game over events.

1. **Technical description:**

The game was implemented via the scratch app and to run it you should have the app on your device and also you should have its .sb3 file that's it.

1. **Project TimeLine**

The "Electron Runner" project was executed over a span of two weeks, starting on December 30, 2023, and reaching completion by January 21, 2024. The development was marked by a series of three pivotal meetings between our group members to ensure consistent progress and alignment on the game's direction. The first meeting, on the start date, December 30, 2023, laid the foundation for our level concepts, themes, and the overarching game narrative. The second meeting took place on January 9, 2024, where we delved deeper into the intricacies of our designs and ironed out the finer details. The final meeting on January 19, 2024, served to finalize our discussions and wrap up any outstanding elements, ensuring that the project was ready for its successful completion two days later.