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ElectroKnight
The Ultimate Electronics Adventure

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TABLE OF CONTENTS

Table of Contents.....	i
Acknowledgments.....	ii
Introduction.....	1
Statement of the Problem.....	2
Objectives.....	2
Scope and Limitations.....	3
User Beneficiary.....	3
Review of Related Literature.....	4
System Requirements.....	6
Hardware.....	6
Software.....	6
Language Used.....	6
Interface.....	6
Flowchart.....	7
Summary.....	8
Recommendations.....	9
References.....	10
Appendices.....	12
Mechanics of the Game.....	12
Screenshots.....	17
Proponent's Profile.....	21

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ElectroKnight

The Ultimate Electronics Adventure

INTRODUCTION

Electrical, electronics, and computer engineering programs, as well as computer science and information technology, are rapidly evolving and growing fields of study at present time. Career options for students enrolled in these programs include nanoelectronics, photonics, robotics, energy harvesting and distribution, biomedical engineering, aerospace engineering, systems control, communication networks, hardware engineering, and software engineering.

According to the Commission on Higher Education, Engineering and Technology is the third largest discipline in the Philippines in terms of enrollment with 448,500 enrollees during the academic year 2016-2017, followed by Information and Technology with 398,765 students in the same school year. Upon graduation, students with degrees in these programs are expected to develop electrical systems for commercial and industrial usage. In order to build these systems, students must be familiar with basic electrical components and devices, the bread and butter of electronic circuits.

Mobile learning encompasses learning done on a mobile device such as a smartphone. The benefits of utilizing mobile technology in education are increased interactivity to enrich content, tailored learning progress, and preparation for future careers around these technologies. Hence, the proponents propose an adventure-based, educational mobile application that deals with fundamental electrical components and devices to help electrical, electronics, and computer science and engineering students in advancing their selected career path.

STATEMENT OF THE PROBLEM

Through the development of ElectroKnight, the proponents aimed to answer the following problems: (1) How to create an educational android application that instills knowledge about Electronics; (2) What important categories under Electronics should be considered in developing the game application; And (3) What kinds of test assessments should be applied to the game to evaluate the attained knowledge of the user and the functionality of the Android application.

OBJECTIVES

General:

Throughout the course, Object-Oriented Programming, the proponents achieve to develop an educational Android application wherein the acquired concepts from Object-Oriented Programming is implemented. Moreover, the proponents seek to assist students to grasp knowledge about different concepts and principles about Electronics.

Specific:

- To use Unity software to develop an educational and interactive application to be used by freshmen and sophomore engineering students to acquire new concepts and support previous understandings of basic Electronics concepts
- For the user to be informed of different electronic symbols, to compute the value of resistors, and to be familiar with the Filipino translation of certain Electronic/Electrical terminologies
- To implement an assessment feature consisting of five (5) different levels, having its own different assessment score that will determine whether the user can proceed and unlock to the next game mode.

SCOPE AND LIMITATIONS

The ElectroKnight game application concentrates on different electronic concepts such as basic electronic symbols, subjects under the course Electronic Devices and Circuits, resistor value computation, and a few basic electronic terms translations. The game application is designed for engineering students' who take up the course related to electronics. Other circuit-related subjects are included because it is correlated with the foundation of knowledge in electronics.

ElectroKnight has a minimum hardware requirement of 70 MB available internal storage and 3 GB RAM. Internet connection is no longer necessary while using the game application. It is compatible with Android devices with version Android 4.1 'Jelly Bean' (API Level 16) up to the latest version. Unfortunately, it is not compatible with iOS devices. Although the proponents are keen to further updates and expansion especially in terms of the application's compatibility, but the development of the main application is the priority in the time being.

USER BENEFICIARY

ElectroKnight Android application is developed to be used by engineering students (especially freshmen and sophomores) enrolled in correlated subjects to Electronics, who want to learn and test their knowledge about different electronic concepts. This also serves as a reviewer for the higher-year engineering students who are interested in recalling their past electronics-related lessons.

REVIEW OF RELATED LITERATURE

According to Alruwais et al (2018), E-assessments specialize in accessibility, giving the learners a way to train themselves any time of day and anywhere they are. With the application ElectroKnight, users will be able to sharpen their knowledge without them having to worry about searching for the right materials and instructor to do so. E-assessments have been proved to be useful to instructors who wants to test their students' capabilities. It also removes the hassle of the traditional way of providing examinations through paper, which makes it an even more practical choice and making mobile learning an interesting recourse in learning (Ada 2018).

An existing and similar application, Electronics Quiz, is an offline mobile application, aims to assess one's knowledge in basic electronics. It is developed by Spyder Web and was released at the Google Play Store on September 29, 2018. It has over 1,000 downloads and currently has one version. It aims to assess one's knowledge in electronic fundamentals, components, and their functionalities while having fun. The user is asked of a username at the first launch of the app. Afterwards, the user is given ten random questions in which the results will display immediately after the user submits his answer. The user will be given an assessment according to the final score. These are Bad (0-2 points), Good (3-5 points), Average (6-8 points), and Excellent (9-10 points). As of November 2019, the app has a rating of 4.1 from 31 reviews.

Crook et al. (2012) mentioned that technology 'provide[s] the innovative edge that can help students engage more effectively with their feedback' (p. 387). Amr (2012) conducted a study to attain a conclusion for an educational game design, wherein the outcomes show that the impact of the challenge and fantasy features on learning have been identified as the most important features of an effective instructional game. ElectroKnight contains both challenge and fantasy features present. Developing an educational mobile application with challenge as a feature, Amr (2012) discussed that it will lead to better learning because there is a sense of achievement and engagement, than having a fantasy feature alone. A significant improvement in learning was indicated with both challenge and fantasy features turned on. In order to achieve an effective insructional game, Amr (2012) indicated that the game designers and instructional designers must consider entertainment as well as pedagogical aspects and a proper mix is the essence of instructional game design.

Universities adopted e-assessment, in order to obtain develop, accurate and faster method to assess students. Students prefer E-assessment, because they can have more control, friendly interfaces and test as games and simulations, which resemble learning environment and recreational activities. A subsidiary study from Traxler (2011) specified that mobile learning research has provided evidence that it can enhance, extend and enrich the concept and activity of learning itself. These can be observed in the set-up of the application ElectroKnight wherein user engagement is a priority, making sure that the player gets hooked on the game and makes them want to play it over and over again—improving the total experience of the player and making sure that they learn through the process.

SYSTEM REQUIREMENTS

A. Hardware

The ElectroKnight mobile application is compatible with Android devices with the following.

Minimum hardware requirements:

- At least 70 MB available internal storage
- At least 3 GB RAM

Recommended hardware requirements:

- 4GB RAM

B. Software

The ElectroKnight mobile application is compatible with Android devices with the following minimum software requirements:

- Android Version: Android 4.1 ‘Jelly Bean’ (API Level 16)

C. Language Used

The language used for the development of the system is **C#** since it is the primary language used for programming in Unity.

D. Interface

The user can use the application with or without internet connection, however, the minimum hardware and software requirements must be met for the application to run. Moreover, it is advisable to run the application in a device that meets the recommended hardware requirements for the application to run smoothly.

FLOWCHART

Chart 1 depicts the comprehensive flowchart of ElectroKnight.

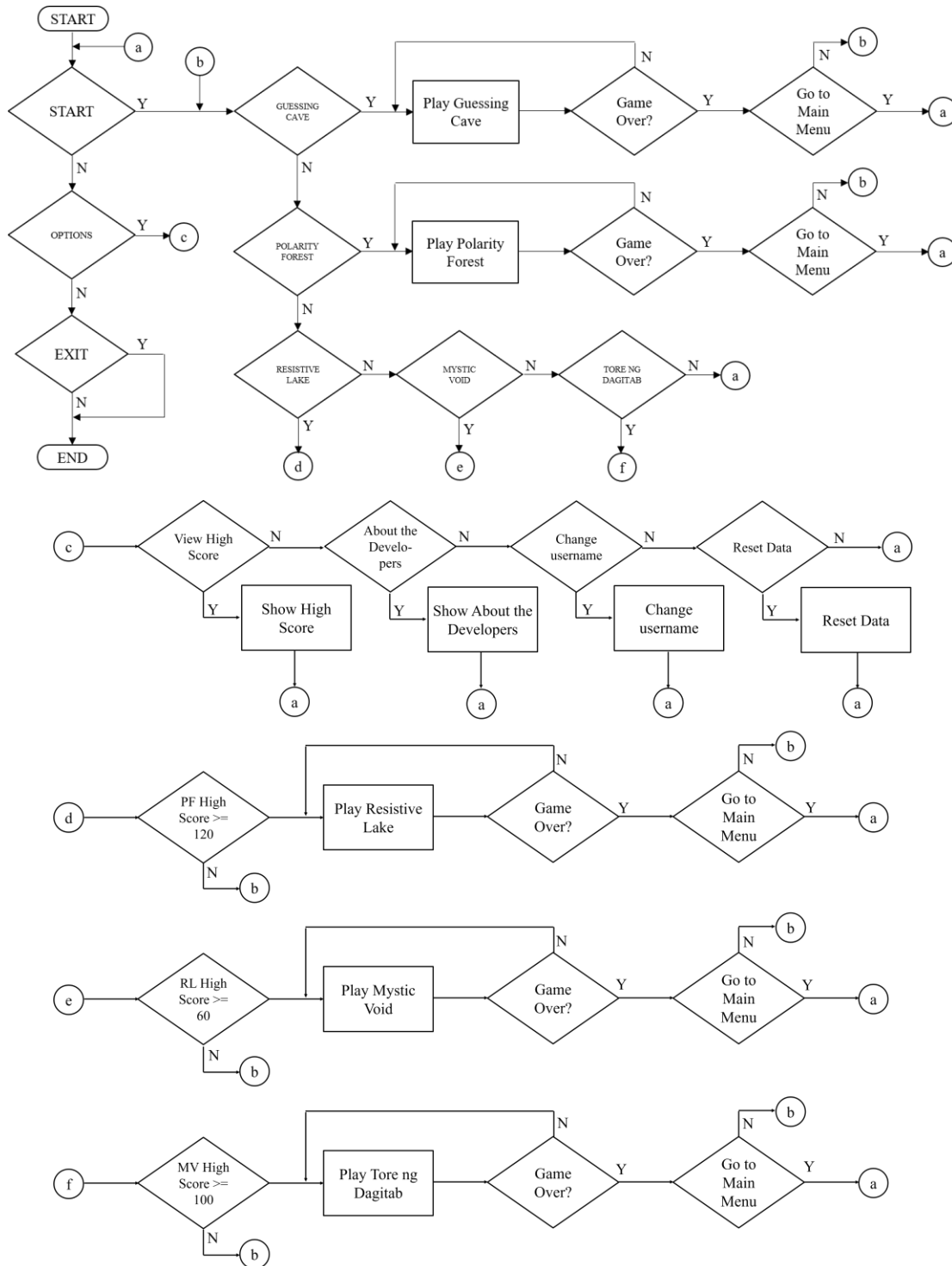


Chart 1. ElectroKnight flowchart

SUMMARY

The ElectroKnight is an offline, adventure-based quiz game dealing with electronic devices and components. The player is challenged to beat his high scores and reach minimum points on each game mode in order to play intermediate game modes.

Two games modes are unlocked by default. The *Guess It* game mode requires the user to input the name of the electrical symbol in the provided text field, while the *Polarity Forest* is simply a true or false quiz game. The user must score at least at 120 points in *Polarity Forest* to play *Resistive Lake* which allows the user to guess the resistance values of conventional four-band resistors. Then, the user must obtain greater than or equal to 60 points in *Resistive Lake* to play *Mystic Void* which consists of multiple-choice questions covering various electronic components and devices. Lastly, the user must get not less than 100 points in *Mystic Void* to access the *Tore ng Dagitab* game mode which serves as a trivia game for equivalent translation of various electrical engineering terminologies in Filipino language.

ElectroKnight utilizes mobile learning and enables tailored learning. It provides an interactive review and trivia game intended for enthusiasts and students in Electrical, Electronics, and Computer Engineering as well as Computer Science and Information Technology programs through a content driven by a story. As a result, the player simultaneously learns about the subject matter and engages in an interesting story by assuming a character while playing the game.

RECOMMENDATIONS

The proponents recommend an inclusion of a feature that would allow the user to upload his score to the Internet in order to generate a leaderboard for all players. Likewise, the placement of the "More Coming Soon" button at the bottom of the page where the user selects the game mode of his choice suggests the creation of new game modes with advanced game formats such as puzzle games, maze, and drag-and-drop. Insertion of a mute option in the settings panel can be a fine and minor addition to the game, as well as adjusting the timer on each game can also be taken into consideration. For further improvement of the application, the proponents also propose the inclusion of new questions and trivias so that the application would provide new knowledge to the players of the game.ssss

REFERENCES

- Alruwais et al (2018, January). *Advantages and Challenges of Using e-Assessment*. Retrieved from: https://www.researchgate.net/publication/318420641_Advantages_and_Challenges_of_Using_E-assessment
- Amr, K. (2012). *Learning through games: essential features of an educational game. Instructional design, development and evaluation – dissertations*. Retrieved from: https://surface.syr.edu/idde_etd/56/
- Belshaw, D (2010). *Mobile and wireless technologies review*. Newcastle upon Tyne, UK: IISC infoNet.
- Bikanga Ada, M (2018). *Using design-based research to develop a Mobile Learning Framework for Assessment Feedback*. RPTEL 13, 3. Retrieved from [doi:10.1186/s41039-018-0070-3](https://doi.org/10.1186/s41039-018-0070-3)
- Gutenberg Technology, Inc. (2016, May 24). *Mobile Learning: The Growing Role of the Smartphone in Education*. Retrieved from <https://blog.gutenberg-technology.com/en/mobile-smartphone-in-education>
- Hernando-Malipot, M. (2017, August 8). *CHED lists popular courses; Business ad, education tops, Manila Bulletin*. Retrieved from <https://news.mb.com.ph/2017/08/08/ched-lists-popular-courses-business-ad-education-tops/>
- McClements, D. (2019, October 29). *8 of the Most In-Demand Engineering Jobs for 2020*. Retrieved from <https://newengineer.com/insight/8-of-the-most-in-demand-engineering-jobs-for-2020-1126177>
- Sarafan, R. (n.d.). *Basic Electronics*. Retrieved from <https://www.instructables.com/id/Basic-Electronics/>

Traxler, J (2011). *Introduction*. In J Traxler, J Wishart (Eds.), *Making mobile learning work: case studies of practice*, (pp. 4–12). Bristol: ESCalate The Higher Education Academy Subject Centre for Education University of Bristol Retrieved from <http://escalate.ac.uk/8250>

University of Toronto, Faculty of Applied Science & Engineering (n.d.) *Electrical & Computer Engineering*. Retrieved from <https://www.ece.utoronto.ca/prospective-students/what-is-ece/>

APPENDICES

MECHANICS OF THE GAME

ElectroKnight is a quiz game which centers on the journey of a dying knight who has asked the player's help to rid his kingdom of a plague cast by evil demons. It is the player's task to help the knight cleanse the kingdom from darkness. The player will be facing demons located at five different locations in the realm, namely, *Guessing Cave*, *Polarity Forest*, *Resistive Lake*, *Mystic Void*, and *Tore ng Dagitab*.

The locations initially available are *Guessing Cave* and *Polarity Forest*, while succeeding locations can be unlocked through achieving a certain score on the accessible ones.

Guessing Cave Mechanics

The player is required to **guess each symbol** that is shown on screen.

- This game mode is unlocked by default.
- The player will **manually enter their answer** on the input field then press *Enter*. The **exact spelling** of the name of the symbol is required but variations will be permitted, also, the answer doesn't need to be case sensitive. As for the symbol shown in Figure 7 which is a Diode Thyristor, answers such as "*diode Thyristor*" or "*thyristor*" will be considered correct, but, answers such as "*Diode*" or "*Thyrister*" will be wrong.
- One correct answer is equivalent to **10 points**.
- If the answer is correct, the player will move on to the **next level** and the succeeding symbol will be displayed, otherwise, a buzzer will ring signaling that the answer is wrong and the player can try guessing again (**infinite guesses**).
- There is **no timer**, instead, the player has the choice to *Give Up* if they want to, ending the game and recording the highest level reached.

Polarity Forest Mechanics

This game has the same mechanics as a **True or False** game.

- This game mode is unlocked by default.
- A statement will be shown on screen and the player has to identify whether the statement is **true or false** through clicking the **positive and negative** buttons, respectively.
- One correct answer is equivalent to **10 points**.
- The player has **5 hearts** which refers to the number of **chances** the player could get a wrong answer, once that exhausts, the game will end, and the score will be recorded.
- There is a **180-second timer** and once it runs out, the game will end, recording the score obtained within the time limit.
- In order to win this game and unlock the next game mode (*Resistive Lake*), the player must score a total of **120 points**.

Resistive Lake Mechanics

In this game, the player is required to identify the value of the **4-band resistor** shown on screen.

There are 5 values which can be calibrated on this game:

- 1st value (**0** (*initial value*), **1, 2, 3, 4, 5, 6, 7, 8, 9**)
- 2nd value (**decimal point** (*initial value*), **0, 1, 2, 3, 4, 5, 6, 7, 8, 9**)
- 3rd value (**0** (*initial value*), **1, 2, 3, 4, 5, 6, 7, 8, 9**)
- Multiplier (**Ohms** (*initial value*), **Kilo ohms, Mega ohms**)
- Tolerance (**1%, 10%** (*initial value*), **5%, 2%**)

As seen in Figure 9.1, there are two buttons for each value, a positive and a negative sign; the positive button will move the value one value higher (**0** (*initial value*), **1, 2, 3, 4, 5, 6, 7, 8, 9**) and will be displayed on the 1st value output field, conversely, if the negative button is clicked, the value will move one value lower. If the player clicks on the “+” **button**, from an initial value of zero, it will become 1 (on the 1st value display), on the other hand the “-” **button** is clicked, the value will become 9 (on the 2nd value display), see Figure 9.2

As for the **Multiplier** and **Tolerance** values, every click on the button will cycle each of their values based on the sequence seen on the bullets on the previous page.

- This game mode will be unlocked once the player scores a minimum of **120 points on Polarity Forest**.
- One correct answer is equivalent to **10 points**.
- There is a **180-second timer** and once it runs out, the game will end, recording the score obtained within the time limit.
- The player has an **infinite number of guesses**.
- The player has **5 passes** which when used will replace the current resistor on display, there will be no deductions to the score, but, once all passes are exhausted, the game will end, and the score will be recorded.
- If the answer is **1.6KOhms – 10% Tolerance**, the values should be set to:
 - 1st Value = **1**
 - 2nd Value = **.** (decimal point)
 - 3rd Value = **6**
 - **Kilohms**
 - **10%**
- However, if the answer is 1KOhms: the values can either be set as:
 - ✓ First Option
 - 1st Value = **1**
 - 2nd Value = **.** (decimal point)
 - 3rd Value = **0**
 - **Kilohms**
 - ✓ Second Option
 - 1st Value = **0**
 - 2nd Value = **0**
 - 3rd Value = **1**
 - **Kilohms**
- In order to win this game and unlock the next game mode (*Mystic Voisd*), the player must score a total of **60 points**.

- ❖ There is a **4-band Resistor Reviewer** included in game located at the **Game Mode Menu** for the player's reference.

Mystic Void

This game has the same mechanics as a **multiple-choice** game.

- This game mode will be unlocked once the player scores a minimum of **60 points on Resistive Lake**.
- A question will be displayed on screen and the player is required to choose from 4 different choices.
- One correct answer is equivalent to **10 points**.
- The player has **5 hearts** which refers to the number of **chances** the player could get a wrong answer, once that exhausts, the game will end, and the score will be recorded.
- There is a **180-second timer** and once it runs out, the game will end, recording the score obtained within the time limit.
- In order to win this game and unlock the next game mode (*Tore ng Dagitab*), the player must score a total of **100 points**.

Tore ng Dagitab

This game is also similar to a **multiple-choice** game, except, the player is required to **translate** the words displayed on screen to **English** if a **Filipino** word is displayed, and vice versa.

- This game mode will be unlocked once the player scores a minimum of **100 points on Mystic Void**.
- A question will be displayed on screen and the player is required to choose from **3 different choices**.
- One correct answer is equivalent to **10 points**.
- The player has **5 torches** which refers to the number of **chances** the player could get a wrong answer, once that exhausts, the game will end, and the score will be recorded.

- There is a **180-second timer** and once it runs out, the game will end, recording the score obtained within the time limit.
- In order to win this game and save the kingdom from the plague, the player must score **100 points**.

SCREENSHOTS



Figure 1. ElectroKnight Home Screen



Figure 2. Settings Panel

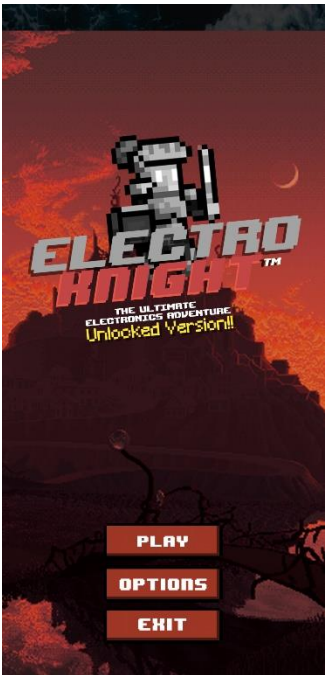


Figure 3. Home Screen Unlocked



Figure 4. Settings Panel Unlocked



Figure 5. Game Mode Screen

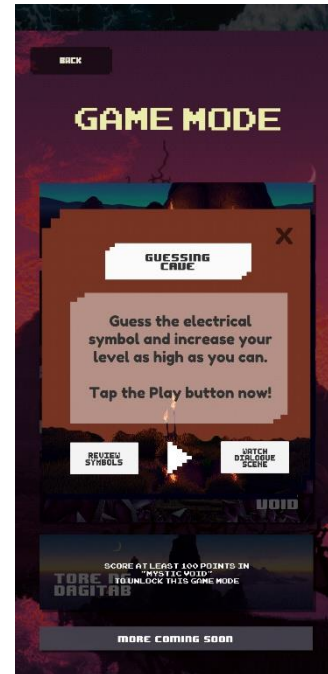


Figure 6. Game Mode Pop-Up Screen

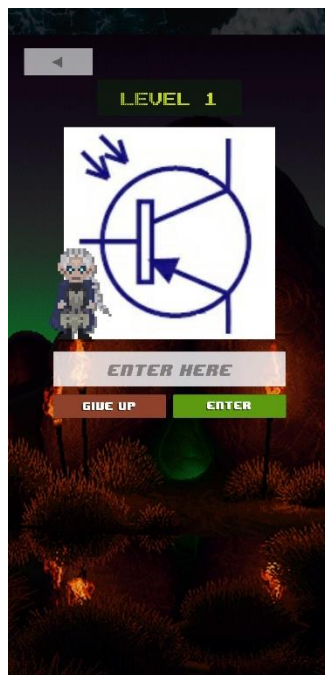


Figure 7. Guessing Cave Screen

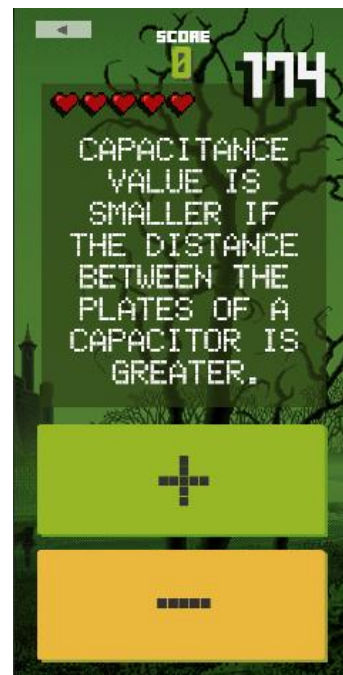


Figure 8. Polarity Forest Screen



Figure 9.1 Resistive Lake Screen



Figure 9.2 Resistive Lake Value Change

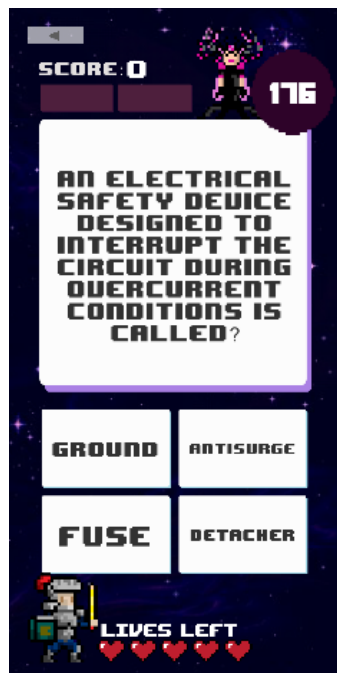


Figure 10. Mystic Void Screen

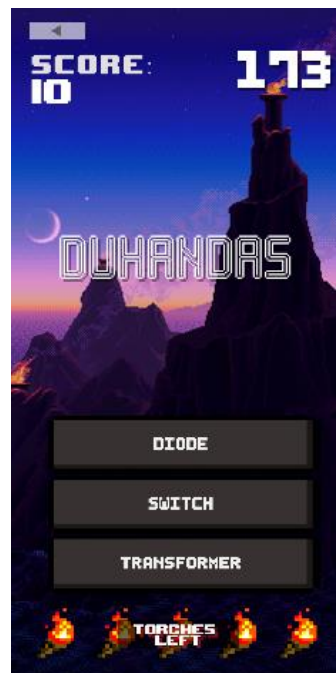


Figure 11. Tore ng Dagitab Screen



Figure 12. Electro Boy

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