

# Green Horizon: Raising Climate Change Awareness through Gaming

JJKRG STUDIOS

Gabriela Carbonell Hernández – Documentation Director

Ricardo Andres Morales Chamorro – Design Director

Jesús Andrés Santos Bastidas – Project Manager

Keiner David Barragán Sarmiento – UI/UX Director

Juan Sebastián Rodríguez Gallardo – Testing Director

*Professors:* Daniel José Romero Martínez, Margarita Rosa Gamarra Acosta,  
Eduardo David Angulo Madrid, Marlene Duarte Hernandez.

# 1 Abstract

The growing concern about climate change demands new forms of awareness and education. This project addresses this need through the development of "Green Horizon," a role-playing game (RPG). The main objective is to design and implement a playful and interactive experience that, using the principles of Object-Oriented Programming (OOP), raises awareness among players about the causes and consequences of climate change, while simultaneously promoting sustainable practices to mitigate its impact. For project management and the incremental development of game mechanics that reflect ecological challenges, the agile SCRUM framework was employed. As a result, "Green Horizon" was developed, a video game whose purpose primarily focuses on awareness and learning about climate change. Through interactive narratives and game mechanics where the player's decisions have direct consequences on the virtual environment, it actively educates about its causes, effects, and possible solutions, transforming the gaming experience into an experiential learning tool.

# Contents

<b>1</b>	<b>Abstract</b>	<b>2</b>
<b>2</b>	<b>Introduction</b>	<b>4</b>
<b>3</b>	<b>Related Works</b>	<b>5</b>
<b>4</b>	<b>Methodology</b>	<b>6</b>
4.1	Software Development Methodology: SCRUM . . . . .	6
4.2	Functional Requirements . . . . .	7
4.3	Non-Functional Requirements (FURPS) . . . . .	8
4.4	UML Diagram . . . . .	9
4.5	Work Methodology . . . . .	10
<b>5</b>	<b>Results</b>	<b>11</b>
5.1	Survey Questions . . . . .	11
5.2	Software . . . . .	13
5.3	Evidence of Data Structures . . . . .	15
5.4	Evidence of File Management . . . . .	17
<b>6</b>	<b>Conclusions</b>	<b>19</b>
<b>7</b>	<b>Bibliographic References</b>	<b>20</b>

## 2 Introduction

Climate change is one of the greatest challenges humanity faces today, and its effects are already visible in various regions of the world, such as increased extreme weather events, loss of biodiversity, and threats to natural resources. Indeed, the Intergovernmental Panel on Climate Change underscores this urgency, stating, “Climate change is a threat to human well-being and planetary health... There is a rapidly closing window of opportunity to secure a liveable and sustainable future for all” [1]. Despite growing global concern, the lack of adequate awareness and action at both individual and collective levels remains a significant obstacle to addressing this issue. This highlights a critical educational need, as Education International and UNESCO argue, “Closing the emissions gap will require closing the education gap... [transforming] the way we ‘do’ education so that education can catalyze the mindset expansion, behavioral adaptation, and systems change required to support social transformation” [2].

In this context, this project proposes the development of a video game as an educational tool to raise awareness about climate change and encourage the adoption of sustainable practices. This approach is supported by research demonstrating that gameplay can be an effective approach to climate change education, as studies show educational games can improve “students’ knowledge of climate change... [and] some of an individual’s precedent attitudes for pro-environmental behaviour” [3]. The primary goal is to create an interactive experience that not only entertains, but also informs and empowers players, providing practical knowledge on how their daily decisions can reduce environmental impact. As observers in the gaming sphere like Stealth Gaming note, “The most important thing about video games is that they can be fun and engaging while being educational. When we show the impact of all our planet’s environmental issues, we immerse gamers and show them the consequence of inaction” [4].

By combining gameplay and educational elements, the project aims to facilitate understanding of climate-related concepts while fostering a shift in mindset toward sustainability. The potential impact of such tools is significant, as research indicates that “Virtual environments, such as educational games... have demonstrably been shown to alter behavior in real-life settings” [5]. In this way, it seeks to positively influence player attitudes and behaviors, contributing to global efforts in effectively combating climate change.

### 3 Related Works

Video games have proven to be effective tools for raising awareness of climate change among young people by integrating gameplay with educational content, making complex topics like global warming more relatable and memorable [6]. Research indicates that digital games can foster environmentally friendly attitudes and behaviors by allowing players to explore real-world consequences in a safe environment, leading to practical learning and long-term behavioral changes, such as increased recycling [7]. Additionally, engaging educational approaches, such as participatory activities, action projects, and structured programs, enhance children's climate awareness, empowering them to take meaningful action [8]. Serious games further reinforce learning by combining interactive experiences with problem-solving and collaboration, particularly in areas such as environmental awareness and health, although future designs should balance educational depth with engaging mechanics to maximize impact [9]. Notable examples, such as *Minecraft: Education Edition*, *Eco*, and *Alba: A Wildlife Adventure*, demonstrate how serious games promote sustainability through role-playing, decision-making, and multiplayer collaboration, ultimately encouraging real-world pro-environmental behaviors [10]. Collectively, these studies highlight the potential of video games and interactive education in fostering climate literacy and motivating young people to contribute to sustainability efforts.

## 4 Methodology

The proposed solution to address the need for awareness and education about climate change is the development of "Green Horizon," an RPG video game. For the implementation of this project, the RPG Maker MV development platform has been selected.

The choice of RPG Maker MV is based on some key considerations:

- **Easy use for RPG genre:** It is a specialized tool for creating role-playing games, which simplifies the development of narrative mechanics, quest systems, interaction with non-player characters (NPCs), and inventory management—crucial elements for the "Green Horizon" experience.
- **JavaScript-based:** RPG Maker MV uses JavaScript as its underlying scripting language. This offers great flexibility to customize and extend the engine's base functionalities, allowing for the implementation of specific game mechanics that reflect the consequences of player decisions on the virtual environment and climate change concepts.
- **Focus on Narrative and Interaction:** The platform is ideal for creating experiences where narrative and interaction with the game world are central, aligning with the goal of educating and raising awareness through an engaging story and meaningful decisions.

### 4.1 Software Development Methodology: SCRUM

For the management and execution of "Green Horizon's" development, the agile SCRUM methodology was adopted. This choice is justified by:

- **Iterative and Incremental Development:** SCRUM allows the project to be divided into short development cycles (Sprints), at the end of which a functional increment of the video game is delivered. This is ideal for a game development project, where mechanics and gameplay need to be continuously tested and adjusted.
- **Flexibility and Adaptability:** The nature of climate change and the need to effectively convey complex concepts may require adjustments in game design. SCRUM facilitates adaptation to changes and continuous feedback.
- **Collaboration and Communication:** It fosters constant communication and close collaboration among team members, which is vital to ensure that the educational vision of the game is maintained throughout development.
- **Complexity Management:** It allows for managing the inherent complexity of video game development by progressively addressing different modules and features.

## 4.2 Functional Requirements

- Player progress tracking
  - The system will record and display the character’s advancement (level, statistics), completed quests, acquired abilities, etc...
- Enemy battles
  - The player will be able to engage in turn-based battles against entities representing pollution, misinformation, or the consequences of climate change (e.g., "Smog Specters," "Waste Beasts"). Victories could partially "cleanse" an area or weaken negative influences.
- Ability unlock system
  - The player will be able to unlock and upgrade abilities as they progress. These can be combat skills (for the aforementioned battles) or, more importantly, "eco-conscious" abilities like "Ecological Restoration," "Green Persuasion". They will be unlocked by leveling up, completing quests, or through discoveries.
- Ally system
  - The player will be able to recruit or collaborate with various characters (scientists, activists, organic farmers, renewable energy engineers) who will assist with unique skills, specific knowledge about sustainability, or access to new quests and areas. Some may participate in "battles" or help with restoration tasks.
- Interaction with zones
  - The player will be able to interact with different ecosystems or areas. Player actions (completing quests, using abilities, making decisions) can visibly transform these zones, improving their ecological health (e.g., from a toxic swamp to a thriving wetland) or, conversely, showing the consequences of neglect.
- Character evolution
  - Beyond increasing levels and stats, the main character will evolve in their understanding of and commitment to the environmental cause. This will be reflected in new dialogue options, the ability to inspire other NPCs, and access to higher-impact quests.
- Story and quests
  - The game will feature a main storyline guiding the player through the discovery of climate change problems and the search for large-scale solutions. Side quests will focus on specific local issues and teaching concrete sustainable practices (recycling, energy saving, sustainable agriculture, etc...).

- Final showdown with antagonist
  - The game’s climax will involve a confrontation with the primary force or entity perpetuating environmental damage (e.g., a negligent corporation, a personification of mass apathy or misinformation). ”Victory” will not just be about defeating an enemy but implementing a significant solution or catalyzing a large-scale shift in consciousness.

### 4.3 Non-Functional Requirements (FURPS)

- **Functionality:** Meets functional specs.
  - The software will completely and correctly implement all defined functional specifications, ensuring the game fulfills its educational and entertainment purposes.
- **Usability:** Minimalist UI, intuitive controls.
  - The game will feature a minimalist user interface and intuitive controls, facilitating an accessible and enjoyable learning and gaming experience for the user.
- **Reliability:** Stable structure and error management.
  - The system will operate stably, with robust error management to prevent critical failures or data loss, and ensuring consistent gameplay mechanics.
- **Performance:** Optimized for efficiency.
  - The game will be optimized for efficient system resource usage, ensuring smooth gameplay, reasonable loading times, and good responsiveness on target platforms.
- **Supportability:** Easy maintenance and documented codebase.
  - The codebase will be documented and modular, allowing for straightforward maintenance, efficient debugging, and facilitating future software updates or expansions.



## 4.4 UML Diagram

To represent the static structure of the system, the main game classes, their attributes, methods, and the relationships between them, the following class diagram was developed.

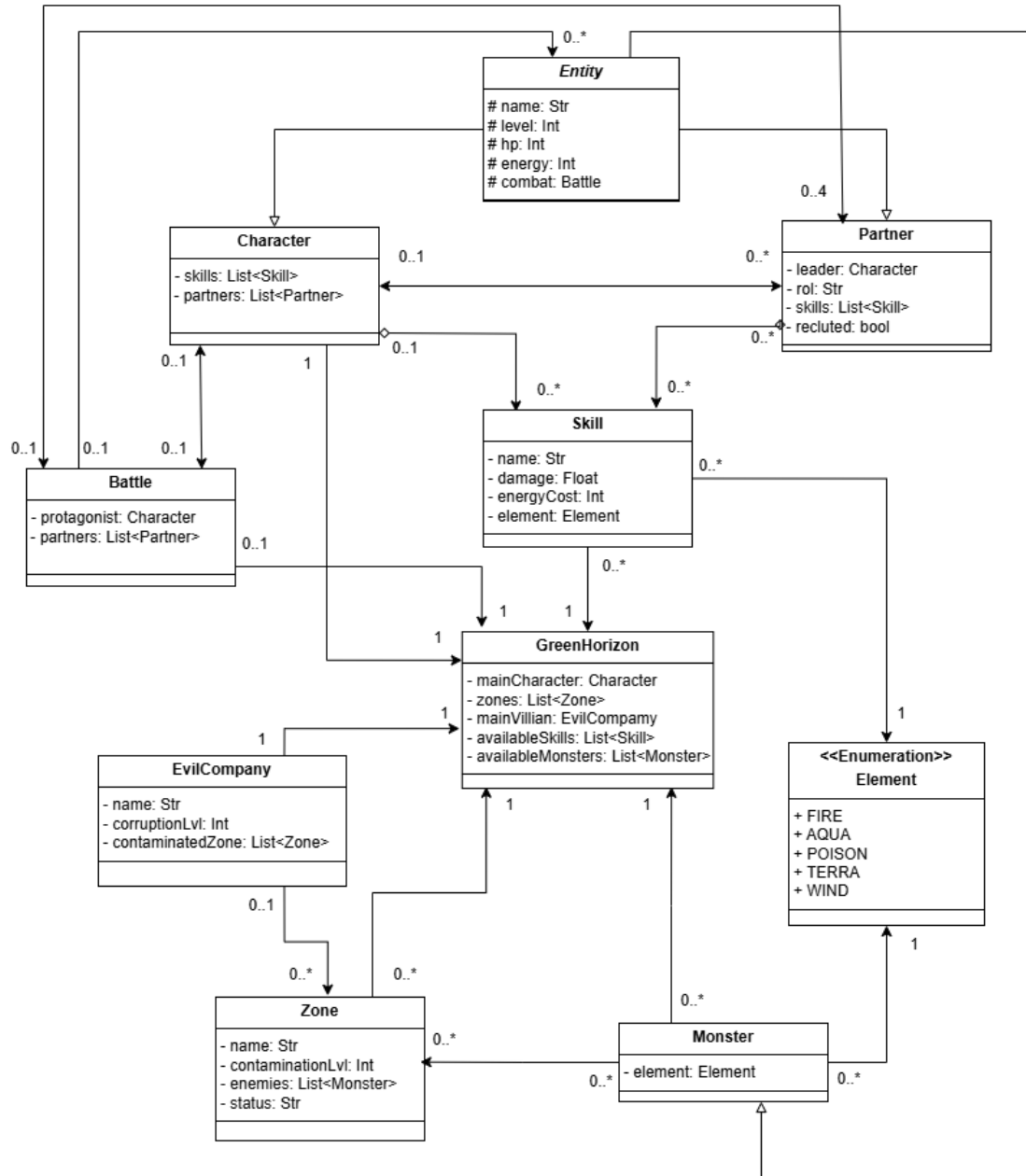


Figure 1: UML Class Diagram

## 4.5 Work Methodology

Development followed the **Scrum** model, using tools like Jira for sprint management and iterative improvement.

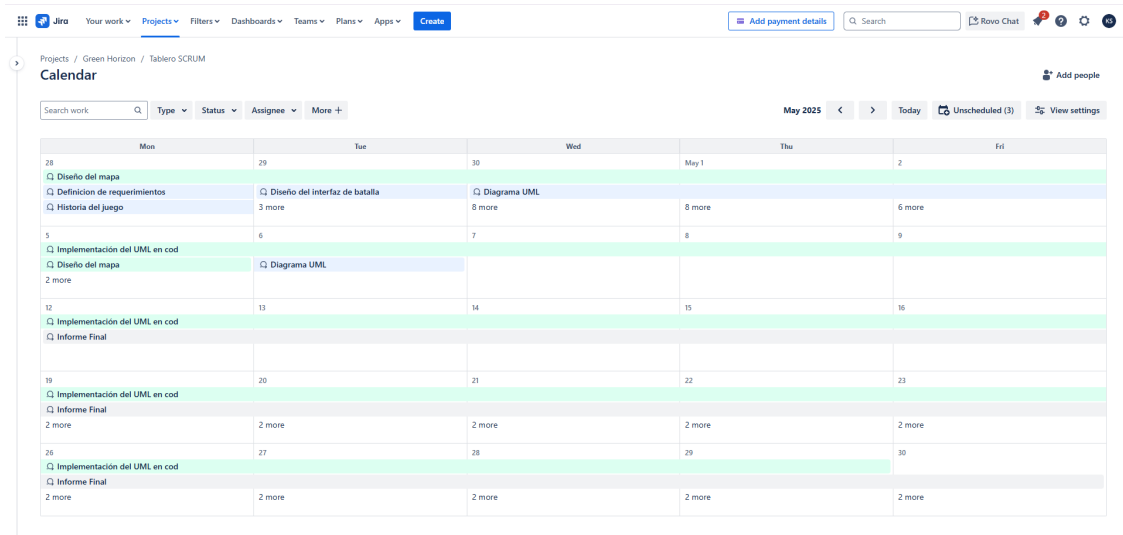


Figure 2: Jira's Work Schedule

## 5 Results

Validation of performance and usability was done through player testing.

### 5.1 Survey Questions

1. How easy was it to understand the game mechanics?
2. Did you encounter any errors or technical issues?
3. Would you recommend the game?
4. How clear were the messages or visual cues?
5. Was the game effective as an educational tool?
6. Did it raise awareness about global warming?
7. What improvements would you suggest?

The following are the survey results:

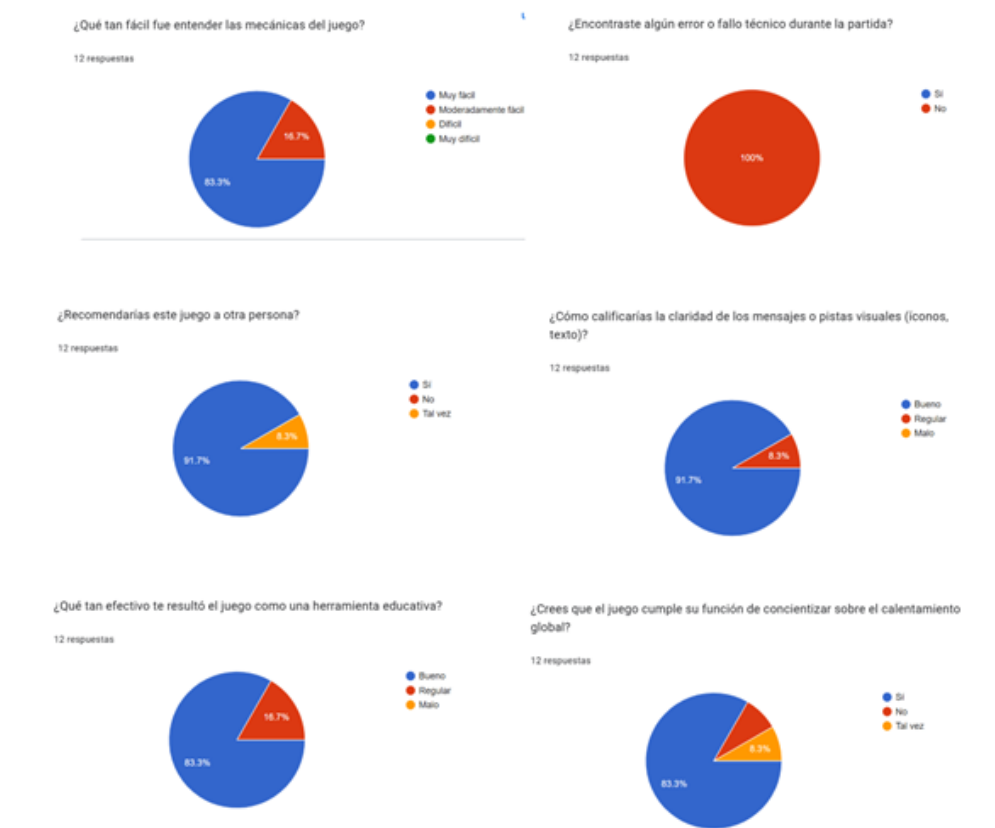


Figure 3: Survey Results

¿Qué mejorarías del juego?

debería de haber más exploración

que los diálogos sean más cortos

deberían haber más batallas

Figure 4: survey Results

Based on the responses of the usability testing survey, the game mostly fulfills its purpose but requires some improvements, such as adding more battles and exploration and reducing dialogue.

## 5.2 Software



Figure 5: Exploration Area

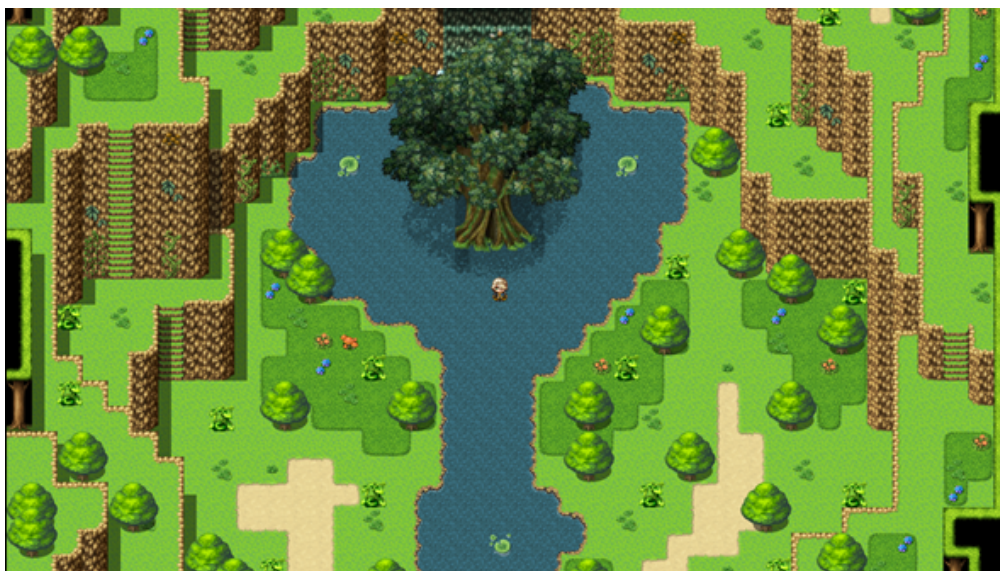


Figure 6: Exploration Area





Figure 7: Battle Screen



Figure 8: Menu Interface

### 5.3 Evidence of Data Structures

(Game elements implemented using data structures such as lists, nodes, and object hierarchies.)

```
// --- Función para añadir una entrada al historial (PUSH) ---
// La añadimos a Game_System para que se guarde con la partida
Game_System.prototype.addHistoryEntry = function(entry) {
    if (!this._gameHistoryStack) { // Por si acaso no se inicializó
        this.initGameHistory();
    }
    // Añade la entrada al principio del array (simulando el tope de una pila)
    this._gameHistoryStack.unshift(entry);
    // Si el historial excede el tamaño máximo, eliminamos la entrada más antigua (al final)
    if (this._gameHistoryStack.length > Yanfly.Historial.MaxEntries) {
        this._gameHistoryStack.pop(); // Elimina el último elemento (el más antiguo)
    }
};

// --- Función para limpiar el historial ---
Game_System.prototype.clearHistory = function() {
    this._gameHistoryStack = []; // Simplemente lo reestablecemos a un array vacío
};

// --- Manejo de Comandos de Plugin ---
// Esto permite llamar a nuestras funciones desde los eventos de RPG Maker.
var _Game_Interpreter_pluginCommand = Game_Interpreter.prototype.pluginCommand;
Game_Interpreter.prototype.pluginCommand = function(command, args) {
    _Game_Interpreter_pluginCommand.call(this, command, args); // Llama al manejador original

    if (command === 'AddHistoryEntry') {
        // Unir todos los argumentos para formar el mensaje completo
        var message = args.join(' ');
        $gameSystem.addHistoryEntry(message);
    } else if (command === 'ClearHistory') {
        $gameSystem.clearHistory();
    }
};
```

Figure 9: Data Structure

```
var Imported = Imported || {};  
Imported.MiHistorial_Plugin = true;  
  
var Yanfly = Yanfly || {};  
Yanfly.Historial = Yanfly.Historial || {};  
Yanfly.Historial.version = 1.00;  
  
var parameters = PluginManager.parameters('MiHistorial_Plugin');  
Yanfly.Historial.MaxEntries = Number(parameters['Max History Entries'] || 10);  
  
var _Game_System_initialize = Game_System.prototype.initialize;  
Game_System.prototype.initialize = function() {  
  _Game_System_initialize.call(this); // Llama a la función original de inicialización  
  this.initGameHistory(); // Llama a nuestra nueva función para inicializar el historial  
};  
  
// --- Función para inicializar el historial ---  
Game_System.prototype.initGameHistory = function() {  
  // Si _gameHistoryStack no es un array, lo inicializamos como un array vacío.  
  // Esto asegura que se guarde correctamente con la partida.  
  if (!Array.isArray(this._gameHistoryStack)) {  
    this._gameHistoryStack = [];  
  }  
};
```

Figure 10: Data Structure



## 5.4 Evidence of File Management

(Save/load systems, resource management.)

```

Yanfly.Save.StorageManager_isLocalMode = StorageManager.isLocalMode;
StorageManager.isLocalMode = function() {
  if (Yanfly.Param.SaveTechSaveMode === 'local') {
    if (!Utils.isWrjs()) return false;
    return true;
  } else if (Yanfly.Param.SaveTechSaveMode === 'web') {
    return false;
  } else {
    return Yanfly.Save.StorageManager_isLocalMode.call(this);
  }
};

StorageManager.localFilePath = function(savefileId) {
  var name;
  if (savefileId < 0) {
    name = Yanfly.Param.SaveTechLocalConfig;
  } else if (savefileId === 0) {
    name = Yanfly.Param.SaveTechLocalGlobal;
  } else {
    name = Yanfly.Param.SaveTechLocalSave.format(savefileId);
  }
  return this.localFileDirectoryPath() + name;
};

Yanfly.Save.StorageManager_webStorageKey = StorageManager.webStorageKey;
StorageManager.webStorageKey = function(savefileId) {
  if (!$dataSystem) return Yanfly.Save.StorageManager_webStorageKey.call(this);
  var title = $dataSystem.gameTitle;
  this.loadConfig();
  if (savefileId < 0) {
    return Yanfly.Param.SaveTechWebConfig.format(title);
  } else if (savefileId === 0) {
    return Yanfly.Param.SaveTechWebGlobal.format(title);
  } else {
    return Yanfly.Param.SaveTechWebSave.format(title, savefileId);
  }
};

StorageManager.loadConfig = function() {
  if (this._configloaded) return;
  this._configloaded = true;
  ConfigManager.load();
};

```

Figure 11: File Management

```
Scene_File.prototype.performActionSave = function() {
    $gameSystem.onBeforeSave();
    if (DataManager.saveGame(this.savefileId())) {
        this.onSaveSuccess();
    } else {
        this.onSaveFailure();
    }
};

Scene_File.prototype.performActionLoad = function() {
    if (DataManager.loadGame(this.savefileId())) {
        this.onLoadSuccess();
    } else {
        this.onLoadFailure();
    }
};
```

Figure 12: File Management

## 6 Conclusions

The development of *Green Horizon* has successfully demonstrated how interactive gaming can serve as an innovative medium for raising awareness about climate change. Through meticulous implementation of functional requirements—including player progress tracking, dynamic combat systems, skill progression, ally mechanics, world interaction, character development, narrative-driven quests, and a climactic confrontation with the game’s antagonist—the project delivered a technically robust and engaging experience. Application results from usability testing confirmed this success, with 83.3% of participants rating the game mechanics as easy or very easy to understand, and 100% reporting no technical errors during gameplay. These metrics not only validate the game’s functional stability but also reflect thoughtful design choices that prioritized accessibility and smooth user experience.

In terms of impact, *Green Horizon* has proven particularly effective in its educational mission. 83.3% of testers acknowledged its value as a climate change awareness tool, with an equal percentage affirming that it successfully communicates its environmental message. This educational efficacy, combined with a 91.7% recommendation rate, highlights the game’s potential to reach wider audiences and inspire meaningful engagement with sustainability issues.

However, the project also revealed areas for growth. Participant feedback pointed to specific limitations, including requests for more expansive exploration opportunities, shorter dialogue, and additional combat variety. These critiques, while not diminishing the game’s overall achievements, provide crucial insights into player preferences and expectations. Addressing these aspects in future updates could significantly elevate both the entertainment and educational value of *Green Horizon*.

Looking ahead, several strategic improvements are recommended to build on the game’s strong foundation. First, expanding explorable zones would deepen immersion and reinforce the game’s environmental themes through richer world-building. Second, optimizing dialogue delivery—whether through tighter scripting, voice acting, or player-controlled pacing—could improve narrative engagement. Finally, introducing more diverse enemy encounters or combat mechanics would add depth and extend playtime.

## 7 Bibliographic References

### References

- [1] Intergovernmental Panel on Climate Change. (2023). Summary for Policymakers. In H. Lee & J. Romero (Eds.), *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1-34). IPCC. [https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC\\_AR6\\_SYR\\_SPM.pdf](https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf)
- [2] Education International, & United Nations Educational, Scientific and Cultural Organization. (2022). *The Climate Change Education Ambition Report Card*. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000383444>
- [3] López-Fernández, D., & Ezquerro, A. (2022). “Stickier” learning through gameplay: An effective approach to climate change education. *Journal of Geography in Higher Education*, 46(3), 449-466. <https://doi.org/10.1080/03098265.2021.1989149>
- [4] Stealth Gaming. (n.d.). Video games and environmental education. [Name of Website if known]. Retrieved June 1, 2025, from [<https://www.stealthgaming.net/blog/video-games-and-environmental-education/>]
- [5] de Kort, Y. A. W., IJsselstein, W. A., & Poels, K. (2003). Digital games as social presence technology: Development of the social presence in gaming questionnaire (SPGQ). In *Proceedings of the 6th Annual International Workshop PRESENCE 2003* (pp. 61–73). Aalborg University.
- [6] Barcena-Vazquez et al. (2023). *Designing and evaluating Reto Global, a serious video game for supporting global warming awareness*. *International Journal of Human-Computer Studies*, 177. <https://doi.org/10.1016/j.ijhcs.2023.103080>
- [7] Janakiraman et al. (2021). *Effectiveness of digital games in producing environmentally friendly attitudes and behaviors: A mixed methods study*. *Computers & Education*, 160. <https://doi.org/10.1016/j.compedu.2020.104043>
- [8] Trott, C. D. (2020). *Children’s constructive climate change engagement: Empowering awareness, agency, and action*. *Environmental Education Research*, 26(4), 532–554. <https://doi.org/10.1080/13504622.2019.1675594>
- [9] Hasanah, A., & Baars, R. C. (2023). *Serious Games, Motivation, and Learning: A Study on Marginalized Youth*. *Creative Education*, 14, 2747–2776. <https://doi.org/10.4236/ce.2023.1413174>
- [10] Tan, Cedric & Nurul-Asna, Hidayah. (2023). *Serious games for environmental education*. *Integrative Conservation*, 2, 19–42. <https://doi.org/10.1002/inc3.18>