Elemental Planets: Exploring Adaptive Gameplay and Elemental Mechanics in a Roguelike RPG

Burak Yildiz
Middle East Technical University
06800, Ankara, Turkey
burak.yildiz_02@metu.edu.tr

Abstract— This report details the ongoing development of Elemental Planets, Building on the foundations established in Phase 1, the game introduces refined gameplay mechanics. The development process focuses on balancing combat, puzzle-solving, and world exploration to create a seamless and engaging player experience. This report discusses key challenges, solutions, and progress made in enhancing game mechanics, difficulty scaling, and player feedback. The aim is to expand the game's depth through continued refinement and testing, ensuring a dynamic, immersive, and replayable RPG experience.

I. INTRODUCTION

A. Idea

Elemental Planets is an RPG that immerses players in the role of Dr. Bumi Wan, a scientist and earth-bender who embarks on a journey to master elemental abilities across four unique planets—Earth, Water, Fire, and Air. The concept of elemental bending is inspired by the acclaimed series *Avatar: The Last Airbender*, where characters harness elemental powers that shape their world and interactions. Just as the series explores the versatility of elemental control in combat and everyday life, *Elemental Planets* integrates these themes to offer players a diverse range of abilities to tackle puzzles, engage in strategic combat, and navigate environments creatively.

The game expands on the traditional RPG framework by integrating adaptive AI and procedurally generated content, enabling players to experience dynamic and varied gameplay. Unlike conventional RPGs that may feature static environments and predictable enemy behaviors, *Elemental Planets* challenges players to adapt their strategies based on the unique physical conditions and adaptive enemy AI of each elemental world [1],[2]. This design choice aligns with the principles outlined in the Mechanics-Dynamics-Aesthetics (MDA) Framework, emphasizing a blend of engaging mechanics and interactive elements that deepen player immersion [3].

Drawing inspiration from how *Avatar: The Last Airbender* uses elemental mastery to drive inventive action and storytelling, *Elemental Planets* leverages this concept to create an immersive, responsive experience. Each planet's environment is designed to complement its corresponding element—rocky terrains for Earth, fluid dynamics for Water, volcanic hazards for Fire, and gravity-defying platforms for Air—enhancing the player's connection to the game world. This approach also incorporates design insights from games like *Hades* and *The Legend of Zelda*, where player choice and environmental interaction are crucial for progression [4],[5]. However, unlike these games, which may face limitations in adaptability, *Elemental Planets* aims to provide

fresh and innovative interactions through its elemental mechanics and adaptive gameplay, ensuring a novel experience at every stage.

The game's focus on procedural generation not only enhances replayability but also ensures that each player's journey is unique. By generating diverse planetary layouts and puzzles that align with the elemental themes, *Elemental Planets*keeps gameplay engaging and unpredictable [6]. This method encourages players to explore different strategies and fully utilize their bending abilities, fostering a deeper engagement with the game's mechanics and story.

B. Challenges in Development

The development of *Elemental Planets* presented several key challenges, which stemmed primarily from the integration of complex systems such as procedural generation, adaptive AI, and elemental mechanics. These challenges, though expected, were pivotal in shaping the game's design and required significant technical innovation to overcome.

1. **Adaptive AI Behavior**:
   One of the primary features in *Elemental Planets* is the adaptive enemy AI, which adjusts its tactics based on the player's actions. Developing AI that could effectively respond to different strategies required in-depth programming and fine-tuning. Enemies had to not only react to the player's elemental abilities but also adapt over time, making each encounter progressively more challenging. Ensuring that the AI remained challenging without becoming frustrating for the player took several iterations. Balancing AI difficulty based on player performance, while avoiding making the game too easy or too hard, was a constant challenge [2].
2. **Quest System Integration**:
   Another challenge was integrating the dynamic quest system with the game's procedurally generated levels. Quests needed to be contextually relevant to the planets and environments, yet still maintain the flexibility required for procedural generation. Ensuring that the quest system properly tracked progress, displayed relevant objectives, and updated dynamically as players interacted with NPCs and enemies was complex. Moreover, integrating these elements with the dynamic dialogue system presented its own set of challenges. Ensuring a seamless experience between gameplay and story progression was vital for maintaining immersion [4].

In conclusion, the most significant challenges faced in *Elemental Planets*' development stemmed from the, adaptive AI, and quest system integration for this phase. These challenges, while difficult, were crucial in creating a unique and engaging gameplay experience. Overcoming these obstacles has been a rewarding part of the development process, leading to the robust systems in place today. Further refinements in AI, procedural generation, and performance optimization will continue as development progresses.

II. METHODS

A. Game Design

The **game design** for *Elemental Planets* incorporates various core systems, including elemental bending mechanics, dynamic quest progression, procedural environment generation, and adaptive AI. These systems are designed to create a unique and engaging experience for the player, where no two playthroughs are the same. The following sections outline the key design decisions made during Phase 2 and how they were implemented to bring the game concept to life.

1. Elemental Bending Mechanics

One of the central features of *Elemental Planets* is the ability to control and manipulate the elements: Earth, Water, Fire, and Air. Each element has its own distinct gameplay mechanics that allow players to engage with the environment and enemies in different ways.

- **Earth**: Earthbending allows players to manipulate the terrain, creating barriers, launching rocks, and deforming the landscape. Players can throw large boulders at enemies or use the environment to shield themselves from enemy attacks.

Each elemental power is integrated with a cooldown system to ensure balanced usage. Cooldowns prevent players from spamming abilities and force them to strategize when and how to use each skill.

Implementation:

The elemental abilities are tied to specific keys (e.g., 1 for Earth, 2 for Water) with cooldown timers to prevent excessive use. The player's energy pool and environmental interactions also dictate the effectiveness of the skills.

2. Dynamic Quest System

A major design decision for *Elemental Planets* was the creation of a dynamic quest system that is tied to player progress and environmental interactions. Quests are given by NPCs, with the player completing objectives such as defeating enemies, collecting items, or solving environmental puzzles.

- **Quest Tracking**: The player's progress is tracked in real time, with quest details and progress updated dynamically based on the player's actions (e.g., killing enemies, collecting items). This allows for a fluid experience where the player can focus on exploration and combat without needing to constantly check a static quest log.
- **Quest Interaction**: Quests are assigned when the player interacts with NPCs. Players are able to accept or decline quests, and quest objectives change dynamically depending on the player's progress in the game.

Implementation:

The quest system is managed through the **QuestManager** and **QuestUIManager** scripts, which handle the tracking of quest objectives and progress. The quest panel updates dynamically based on player interactions and quest completion.

3. Adaptive Enemy AI

A key feature of *Elemental Planets* is its **adaptive AI**, where enemies learn and adapt to the player's behavior. Enemies become more aggressive, use different tactics, or change their attack patterns based on the player's actions. This ensures that combat remains challenging and dynamic throughout the game.

- **AI Behavior**: Enemies are designed to recognize the player's strengths and weaknesses and adjust their strategies accordingly. For example, if a player uses a particular elemental attack frequently, enemies may develop counter strategies to avoid or resist that attack.
- **Difficulty Scaling**: As the player progresses through the game, the enemies scale in difficulty. The AI will adjust the frequency of attacks, the number of enemies, and their intelligence to ensure the combat remains engaging.

Implementation:

Enemy AI is controlled using Unity's **NavMesh** system for pathfinding and a custom behavior tree to manage adaptive tactics. The AI system continually monitors the player's actions and adjusts the combat behavior dynamically.

4. User Interface (UI) Design

The UI of *Elemental Planets* is designed to be both intuitive and functional. The key elements include the quest panel, skill cooldowns, and health bar, all of which update dynamically to reflect the player's status.

- **Quest UI**: Displays active quest information, including objectives, progress, and NPC dialogue.
- **Skill UI**: Shows the player's elemental skills, including cooldowns and activation keys.
- **Health Bar**: Tracks the player's health and is updated in real time during combat.

Implementation:

The **QuestUIManager** and **SkillDisplayManager** are used to handle the quest and skill interfaces, ensuring that information is updated based on player actions. The health bar is linked to the player's health system and changes dynamically as damage is taken.

B. Gameplay Mechanics

The gameplay mechanics of *Elemental Planets* are designed to provide players with a dynamic and engaging experience, incorporating various systems like elemental bending, combat, exploration, and questing. These systems work together to create a fluid and interactive gameplay loop, where players must adapt their strategies, use elemental powers creatively, and manage resources to overcome challenges. This section outlines the key gameplay mechanics developed in Phase 2.

1. Elemental Bending Mechanics

A core feature of *Elemental Planets* is the ability to control the four classical elements: Earth, Water, Fire, and Air. Each element has its own distinct set of abilities and interactions with the game world, making the player's ability to master and combine these powers essential to success.

- **Earthbending**:
    - Players can manipulate the terrain to create barriers, lift rocks, and throw projectiles. Earthbending is also used to deform the environment, adding a layer of puzzle-solving to the gameplay.
    - **Key Mechanic**: Players must aim their ability using the mouse and press a button to trigger the attack or ability.
    - **Skill Cooldowns**: Earthbending has a cooldown to prevent excessive usage, promoting tactical decision-making during combat and exploration.

Implementation:

- **Cooldown Mechanism**: Each elemental skill is tied to a cooldown system to prevent spamming and encourage strategic skill usage. A dynamic UI displays cooldowns for each ability, allowing players to plan their actions accordingly.
- **Skill Activation**: Elemental skills are mapped to specific keys (e.g., 1 for Earthbending, 2 for Firebending). Players can activate skills during combat or exploration, with the effectiveness of each skill varying depending on the environment and enemy type.

2. Combat System

Combat in *Elemental Planets* is designed to be fast-paced and tactical, requiring players to strategically use their elemental abilities against a variety of enemies. The combat system combines both direct attacks and environmental manipulation.

- **Player Combat**:
    - Players engage in real-time combat using elemental attacks. Each skill has a different range, damage output, and effect, requiring players to decide when and how to use them.
    - **Knockback Effect**: Some elemental attacks, such as Earthbending and ThrowRock, apply knockback to enemies, pushing them back or into environmental hazards.
- **Enemy AI**:
    - Enemies are designed to react to the player’s attacks and adapt their behavior over time. Some enemies might be weak to certain elements,

requiring the player to experiment with different attack types to find the most effective strategy.
    - **Adaptive AI**: Enemies learn and adjust their attack patterns based on player actions. For example, if the player frequently uses Firebending, enemies may use shields or resistances to counteract fire attacks.
- **Combat Flow**:
    - The combat is designed to be fluid, with the player able to move, attack, and use elemental abilities without significant interruptions. Cooldowns and resource management are key aspects of combat, requiring the player to balance offensive and defensive actions.

3. Quest System

The quest system in *Elemental Planets* allows players to interact with NPCs and undertake missions that reward them with new abilities, items, and story progression.

- **Quest Acceptance and Progression**:
    - Players can interact with NPCs to accept or decline quests. Once a quest is accepted, progress is tracked dynamically, and the player can see updates in the quest UI.
    - **Dynamic Progress Tracking**: Quests track progress through objectives such as defeating enemies, collecting items, or solving puzzles. This progress is updated in real time.
- **Multiple Quest Objectives**:
    - Each quest can have multiple objectives, such as defeating a specific number of enemies and collecting items. Players can complete objectives in any order, but the completion of all objectives is required to finish the quest.
    - **Rewards**: Upon completion, players are rewarded with experience, new abilities, or items that enhance their elemental powers.

Implementation:

- **Quest Manager**: The **QuestManager** script dynamically tracks the player's progress and updates the UI to reflect objectives and completion. It also handles interactions with NPCs and updates dialogue and rewards.
- **Objective System**: Each quest has a series of conditions (e.g., defeat 3 enemies, collect 1 item) that are tracked and updated automatically as the player progresses.

4. Skill and Combat UI

The user interface (UI) is designed to give players easy access to their elemental skills, quest information, and health status.

- **Skill Display**:
    - The UI includes visual representations of the player's elemental skills, their cooldowns, and activation keys. Players can monitor their skill usage in real time.
- **Combat Information**:

    - The combat UI includes the player's health bar, enemy health, and ability cooldowns. The quest UI updates dynamically to show the player's current objective and progress.
- **Dynamic Quest Tracker**:
    - The quest tracker is updated in real time, showing the current objectives, progress, and completion status, allowing players to focus on the gameplay without having to check multiple menus.

Implementation:

- **SkillDisplayManager**: Handles the cooldown timers and skill displays on the HUD.
- **QuestUIManager**: Tracks and updates quest progress, showing the current objective and rewards.

C. AI & Pathfinding

The **AI** and **pathfinding systems** in *Elemental Planets* play a crucial role in ensuring engaging and dynamic combat. Enemies are designed to not only follow the player but to adapt to their actions, making encounters more challenging and strategic. The integration of **NavMesh** for pathfinding and **adaptive AI** allows enemies to intelligently navigate the game world and respond to the player's behavior in real-time. This section outlines the development and implementation of the AI and pathfinding systems.

1. Adaptive AI Behavior

One of the standout features of *Elemental Planets* is its **adaptive AI**, where enemy behavior evolves based on the player's actions. The AI system was designed to react to the player's tactics and adjust its strategies to provide a continuously challenging experience.

- **Learning from Player Behavior**:
    - Enemies track the player's skill usage and adapt accordingly. For example, if the player repeatedly uses **Firebending** to defeat enemies, the AI may start using **counter-strategies** like dodging or blocking fire-based attacks. This keeps the combat challenging and prevents the game from becoming predictable.
    - The AI adjusts its aggression, timing of attacks, and even retreats based on the player's combat style. If the player is aggressive, enemies might become more defensive, using tactics to keep the player at a distance.
- **Difficulty Scaling**:
    - The difficulty of enemy encounters is dynamic, based on player progress. The AI is programmed to become more aggressive and strategic as the player levels up or completes quests. This ensures that the player is always facing a challenge, whether they're in early-game combat or mid-game encounters.
- **Behavior Patterns**:
    - Each enemy type has a distinct behavior pattern, such as **ranged combatants** that keep their distance or **melee enemies** that charge directly at the player. These behaviors are further customized based on the player's

actions, creating varied combat scenarios that require quick thinking and adaptation.

Implementation:

- The **Adaptive AI System** was implemented using Unity's **NavMesh** system for movement and custom scripts that adjust enemy behavior. The AI tracks the player's actions, evaluates their effectiveness, and switches tactics dynamically.
- Behavior trees were used to manage decision-making processes for different enemy types. These trees are evaluated at runtime, determining whether the AI should attack, retreat, or use a special ability based on player actions.

2. Pathfinding with NavMesh

Pathfinding plays a critical role in the AI's ability to navigate the environment.
The **NavMesh** system in Unity provides a way for enemies to intelligently move through the world, avoiding obstacles and making decisions based on the terrain layout.

- **Navigation Across Complex Terrain**:
  - *Elemental Planets* features dynamic and complex environments, from rocky landscapes in Earth to water bodies in Water. Enemies must navigate these environments using the **NavMesh** system, which helps them move across different types of terrain while avoiding obstacles (like rocks, walls, or cliffs).
  - Enemies are aware of terrain features that might block their path or slow them down, such as elevated platforms in the Air planet or lava pools on the Fire planet.
- **Dynamic Pathfinding**:
  - The AI uses **NavMesh Agents** to calculate the shortest and most efficient path to reach the player. This allows enemies to follow the player across large areas, even when they are moving between multiple levels or over uneven terrain.
  - The system is dynamic, meaning enemies can change their route on the fly based on the player's movements or environmental changes. For instance, if the player jumps to an elevated platform, the AI recalculates its path to pursue the player.
- **Obstacle Avoidance**:
  - Using **NavMesh Obstacles**, enemies can avoid static and dynamic obstacles, such as walls, pillars, or other enemies. This ensures that they don't get stuck or behave unnaturally when navigating tight spaces.

Implementation:

- The **NavMesh Agent** component is attached to each enemy, allowing them to dynamically navigate the environment. The agent calculates the best path based on the environment and avoids obstacles by following the pre-generated **NavMesh**.
- **NavMesh Obstacles** are used to dynamically block paths when enemies are blocked by moving objects or other entities, such as the player or destructible terrain.

D. Testing & Balancing

Testing and balancing are crucial steps in ensuring that *Elemental Planets* offers a smooth, enjoyable, and challenging experience to the player. During Phase 2, a range of testing methodologies were employed to assess the core mechanics, combat systems, AI behaviors, and overall gameplay. Additionally, the balance of difficulty, skill progression, quest design, and enemy behavior were carefully calibrated to create a fair but challenging experience.

1. Internal Testing and Debugging

Internal testing involved the development team playing the game repeatedly, focusing on the core mechanics and features implemented during Phase 2. This testing was critical for identifying bugs, inconsistencies, and areas for improvement.

- **Gameplay Loops**:
  The core gameplay loops, such as combat, quest progression, and elemental mechanics, were tested to ensure they were engaging and well-balanced. Internal playtests focused on whether the elemental powers were fun to use and whether the procedural generation systems created diverse, interesting worlds.

Implementation:

- The internal testing phase was heavily focused on identifying and fixing **bugs** related to mechanics like elemental abilities, NPC interactions, and quest updates.
- **Debugging scripts** were used to log issues related to AI pathfinding and terrain deformation, which were the most complex parts of the game at this stage.

2. Balancing Combat Difficulty

One of the primary focuses of Phase 2 was ensuring that combat remained fun and challenging. The adaptive AI behavior and the combination of different elemental mechanics needed to be balanced carefully to avoid making combat either too easy or too frustrating.

- **Enemy Difficulty Scaling**:
  The difficulty of enemies scales based on player progression, but it was important to ensure that enemies did not become either too weak or too strong. A challenge in balancing was ensuring that early-game enemies provided enough of a challenge, while later-game enemies pushed the player's abilities to their limits without causing frustration.
- **Elemental Ability Balance**:
  The damage output and utility of each elemental ability had to be carefully balanced. Earthbending, for example, allowed for terrain manipulation and direct damage, while Waterbending was more focused on crowd control and environmental puzzles. The balance of abilities needed to ensure that players had multiple viable options to tackle combat scenarios, avoiding overpowered skills or useless ones.
- **AI Behavior Adjustments**:
  Enemies that adapted too quickly or used repetitive tactics needed adjustments to ensure a fair challenge. AI behavior trees were tweaked to ensure that enemies

would continue to challenge players while still feeling responsive and fair. Additionally, enemy strengths and weaknesses were added, where certain elemental attacks are more effective against specific enemies (e.g., Fire against Water-based enemies).

4. Ongoing Adjustments and Refinements

Throughout Phase 2, the game underwent continuous refinement to ensure all systems worked cohesively. Balancing adjustments, performance improvements, and bug fixes were ongoing processes, with particular focus on ensuring the game was engaging from start to finish.

Implementation:

- **Continuous Feedback Integration**:
  Feedback from tests was integrated into the development process. Bug reports were logged, fixed, and re-tested to ensure a smooth experience.
- **Performance Optimizations**:
  The game's performance was optimized through profiling and adjustments to AI pathfinding, collision detection, and procedural generation. This helped maintain a stable frame rate even during complex gameplay sequences.

III. RESULTS

A. Gameplay Loop & Progression

The **Gameplay Loop** in *Elemental Planets* is designed to keep players engaged through a series of interconnected tasks and rewards, with each action directly influencing the next. At its core, the game encourages players to explore the environment, complete quests, engage in combat, and master elemental bending skills. This loop is paired with a **progression system** that motivates players to continue advancing by unlocking new abilities, areas, and story elements.

1. Core Gameplay Loop

The **core gameplay loop** revolves around a sequence of actions that the player repeats throughout their journey. These actions are interconnected, with the outcomes of one action often leading to the next, creating a smooth and engaging cycle.

- **Exploration**:
  Players explore procedurally generated environments on different planets, each with unique terrain and challenges. Exploration involves interacting with the environment, finding resources, solving puzzles, and discovering new areas.
  - **Elemental Interactions**: Players use their elemental abilities to interact with the environment, such as creating water platforms to cross gaps on the Water planet or bending Earth to create barriers or launch rocks on the Earth planet. These interactions are not just for combat but also for solving environmental puzzles.
- **Combat**:
  Combat is the next stage of the loop. The player faces off against a variety of

enemies with unique AI behaviors and combat tactics. Players use their elemental abilities in real-time combat, engaging with enemies that adapt to the player's strategies.

    - **Adaptive AI**: Enemies react to the player's elemental abilities, with some being more resistant to certain elements and others taking advantage of environmental features. Combat is designed to be fast-paced but strategic, requiring the player to think on their feet and use different abilities effectively.

- **Quest Completion**:
  Quests form a key part of the progression loop. Players accept and complete quests from NPCs, which require them to defeat enemies, collect items, and solve environmental puzzles. Quest progress is tracked dynamically, and each completed objective unlocks new areas, abilities, or rewards.
    - **Objective Tracking**: The quest system is designed to update dynamically based on the player's progress. As the player completes quests, they receive experience points, new elemental abilities, and other rewards that make them stronger and enable them to tackle more challenging tasks.
- **Rewards and Feedback**:
  Each successful action in the gameplay loop is rewarded with meaningful feedback, such as skill upgrades, new quests, or progression in the storyline. This continuous loop of exploration, combat, and quest completion keeps the player engaged and motivated to continue their journey.

Implementation:

- The **core gameplay loop** was implemented using a series of interconnected systems, including the **quest system**, **combat mechanics**, and **elemental bending abilities**. These systems interact with one another, creating a fluid and engaging gameplay experience where players are constantly progressing and unlocking new content.

2. Progression System

Progression in *Elemental Planets* is designed to be both **linear** and **non-linear**. While the story unfolds in a linear fashion, the player has the freedom to explore and complete objectives in different orders. The progression system is focused on enhancing the player's abilities, unlocking new elements, and increasing the difficulty of challenges as the player advances.

- **Skill Progression**:
  As players progress through the game, they unlock new elemental abilities that expand their combat options and puzzle-solving potential. Each element has a unique skill tree that allows players to enhance their bending abilities, such as increasing the damage of Earthbending or adding additional effects to Waterbending.
- **Stat and Level Progression**:
  The player's **health**, **mana**, and **elemental power** stats increase as they complete quests and defeat enemies. This growth allows players to tackle tougher challenges as they advance, with more powerful abilities and stats granting them an edge in combat.

- **Story and World Progression**:
  As players complete quests and defeat powerful enemies, they unlock access to new planets, each with its own elemental challenges. The game's world is designed to progressively introduce more complex mechanics, enemies, and puzzles as the player moves from one planet to another.
    - **Planet Unlocking**: Players start on the Earth planet, but as they complete quests and progress through the story, they unlock access to the Water, Fire, and Air planets. Each planet introduces new gameplay mechanics, environmental interactions, and combat strategies, encouraging players to adapt to new challenges.
- **Quest-based Progression**:
  The quest system is integral to the progression, as completing certain main or side quests unlocks new areas, upgrades, and story elements. Some quests may also involve making choices that influence the game's outcome, adding replayability and player agency.

B. Art & Design

The **Art & Design** of *Elemental Planets* plays a critical role in immersing the player in the unique environments of each elemental planet and enhancing the gameplay experience. The artistic direction aims to create a cohesive visual style that reflects the four distinct elements—Earth, Water, Fire, and Air—while ensuring that the gameplay mechanics and world-building are clearly communicated through visual design. In this section, we will explore the key artistic choices made in the development of the game, including environmental design, character models, and overall aesthetic.

1. Environmental Design
The **environmental design** is one of the most crucial aspects of *Elemental Planets*, as it serves as both the backdrop for the player's adventure and a core component of gameplay. Each planet represents one of the four classical elements, and the design of these worlds reflects their unique properties and mechanics.

- **Earth Planet**:
  The Earth planet features rocky terrains, caves, and large, towering cliffs. The design of this planet emphasizes stability and strength, with the environment designed to support the **Earthbending** mechanic. Players can manipulate the environment, deforming the terrain to create paths or barriers. The textures are rough, with a focus on earthy colors such as browns, grays, and greens to reflect the element's solid nature.
    - **Visual Design Choices**:
      - **Textures**: Rough, rocky surfaces and dirt paths.
      - **Color Palette**: Earth tones like brown, gray, and green dominate the landscape.
      - **Lighting**: Soft, ambient lighting to give the world a grounded and stable feel.

2. Character & Enemy Design

The **character and enemy designs** play a pivotal role in establishing the game's tone and ensuring that players can easily recognize and interact with NPCs and enemies. Each character model reflects the planet they inhabit, as well as their role within the world of *Elemental Planets*.

- **NPCs**:
  NPCs are designed to fit into their respective planetary environments, with each planet's inhabitants showcasing their connection to their element. NPCs on the Earth planet are strong and grounded, those on the Water planet will have fluid, flowing designs, while Fire NPCs will be fierce and dynamic. Air NPCs will be light and ethereal, with transparent, flowing clothing and hair.
- **Enemies**:
  Enemies are designed to match the environment and add thematic variety to the gameplay. Earth enemies are large and tough, Fire enemies are fast and aggressive, Water enemies are fluid and adaptable, and Air enemies are light and evasive. Enemies react dynamically to the player's elemental abilities and are designed to encourage strategic combat.

3. UI Design

The **user interface (UI)** in *Elemental Planets* is designed to be intuitive and informative, providing players with the necessary information without overwhelming them. The UI design is consistent with the game's elemental theme, with each planet having its own unique UI elements that tie into the overall aesthetic.

- **Quest and Progress UI**:
  The quest system is integrated with a clean, easy-to-read UI that shows the player's current objectives, progress, and rewards. This UI updates dynamically as the player completes quests and objectives.
  - **Design Choices**:
    - **Quest Panel**: Simple and sleek, with icons and color-coded elements for different types of objectives.
    - **Progress Tracker**: Displays the current objective and completion percentage in a visually appealing way.
    - **Elemental Skill Cooldowns**: Each elemental power has a dedicated space on the UI to show cooldowns and skill effectiveness.
- **Combat and Health UI**:
  Combat is tracked with a health bar, elemental cooldowns, and enemy health statuses. The UI is designed to show real-time combat data, ensuring the player knows their stats and the status of enemies during fights.
  - **Design Choices**:
    - **Health and Mana Bars**: Simple and clear bars to track health and mana.
    - **Elemental Ability UI**: Displays the active elemental ability and its current cooldown.

Implementation:

- The **UI elements** are created using Unity's **UI system**, with a focus on **readability** and **ease of use**. The elements are tied to specific game systems (e.g., quests, combat) and are updated dynamically through scripts that track player stats, progress, and combat events.
- Custom **UI icons** and animations will be used to fit the game's aesthetic, with each planet having a unique theme that matches its elemental focus.

C. Challenges Presented to the Player

In *Elemental Planets*, players are faced with a variety of challenges designed to test their strategic thinking, combat skills, and problem-solving abilities. These challenges are dynamically integrated into the gameplay experience, with each planet offering unique obstacles that require the player to adapt and utilize their elemental abilities creatively. This section analyzes the primary challenges presented to the player, focusing on combat difficulty, puzzle-solving, environmental challenges, and progression barriers.

1. Combat Difficulty and Enemy Behavior
One of the most prominent challenges faced by the player in *Elemental Planets* is the **combat system**, where players must fight enemies using a combination of elemental abilities and environmental interactions.

- **Challenge**:
  Combat is designed to be challenging but fair, requiring players to use their elemental abilities effectively while managing their resources (mana, cooldowns, etc.). As players progress, enemies become increasingly difficult, with different enemy types requiring different strategies and elemental abilities to defeat.
    - **Combat Depth**: Players must learn to combine elemental powers (e.g., Earthbending for damage and Firebending for area attacks) to take down enemies efficiently. The challenge comes from knowing when to use which abilities, and how to deal with enemies that have elemental resistances or behaviors that counter specific powers.
    - **Adaptive AI**: Enemies adapt to the player's actions, learning from their strategies and forcing the player to think quickly. This adaptive AI creates a dynamic challenge, making sure the combat remains engaging and unpredictable.

2. Environmental Puzzles and Elemental Interactions
The game features numerous **environmental puzzles** that require the player to use their elemental abilities in creative ways to solve challenges. These puzzles are integrated into the exploration phase of the game and often tie into the planet's theme.

- **Challenge**:
  Players are tasked with solving puzzles that require them to manipulate the environment using their elemental powers. For example, the Earth planet may feature rock formations that must be moved or created using Earthbending, while the Water planet might have water currents that need to be redirected or frozen.
    - **Puzzle Complexity**: As players progress, puzzles become more intricate, requiring them to combine multiple elements. For instance, a puzzle might

require players to use Earthbending to create a path, then switch to Waterbending to activate a water-based mechanism.
    - **Environmental Hazards**: Some puzzles are set against environmental hazards (e.g., lava in the Fire planet, floods on the Water planet), adding an extra layer of challenge. These hazards create pressure, forcing players to solve puzzles under time constraints or while avoiding damage.

3. Progression and Quest Structure
The quest system in *Elemental Planets* presents challenges related to both **quest completion** and **progression**. Players need to balance quest objectives with exploration and combat, ensuring that they meet specific goals while continuing to advance in the story.

- **Challenge**:
  The quest structure introduces challenges by requiring players to **defeat enemies**, **collect items**, and **solve puzzles** to complete objectives. Some quests are **multi-step**, requiring players to gather information, interact with multiple NPCs, and perform actions in specific orders.
    - **Multi-objective Quests**: Quests are designed to incorporate multiple challenges, such as defeating a set number of enemies, gathering rare resources, or exploring different parts of the map. This ensures that quests are not simply one-dimensional, but require the player to engage in various aspects of the gameplay.
    - **Dynamic Quest Updates**: As players progress, the quests dynamically update based on their actions, adding complexity to how objectives are tracked and completed.

IV. DISCUSSION OF RESULTS

A. Challenges in Development

While *Elemental Planets* has made significant progress in its gameplay and design, the development process was not without challenges. These challenges stemmed from technical limitations, balancing issues, and the complexities of integrating multiple systems. Below, we discuss the main challenges faced during the development process, how they were resolved or mitigated, and the impact they had on the game's overall design and experience.

1. AI Behavior and Adaptive Enemy Design
One of the key development challenges was creating **adaptive AI** that responded to the player's dynamic use of elemental abilities. Designing AI that could react to different environmental factors and combat strategies while keeping the gameplay engaging required advanced programming techniques.

- **Problem**:
  Initially, the AI was too predictable and did not react well to the player’s diverse abilities. For example, enemies would often stand still while the player used their

elemental powers, or they would fail to dodge or counter powerful attacks like Earthbending and Firebending.

2. Balancing Combat and Abilities

The **combat system** in *Elemental Planets* involved the integration of multiple elemental powers, which created a challenge in ensuring that the player's abilities were balanced. This balancing needed to address both combat effectiveness and resource management.

- **Problem**:
  Initially, some abilities, like **Earthbending**, were overpowered, while others, like **Waterbending**, lacked sufficient utility in certain combat scenarios. This created imbalance, as players could rely on specific abilities to the exclusion of others, making combat less dynamic.
- **Solution**:
  I have implemented **cooldowns** and **resource management systems** to prevent overuse of certain abilities. Earthbending, for instance, was given a longer cooldown and higher resource cost to prevent it from being spammed.

3. User Interface Design and Feedback

Creating a **clear, intuitive user interface (UI)** that enhances the player's experience was another ongoing challenge. The UI needed to display essential information without cluttering the screen, and ensure that players received the right feedback during combat, questing, and exploration.

- **Problem**:
  Early versions of the UI were too cluttered, with too much information displayed at once. For example, quest progress and ability cooldowns were difficult to read during intense combat sequences, and the UI elements were not well-optimized for various screen sizes.
- **Solution**:
  The UI will be redesigned to prioritize **clarity** and **minimalism**, ensuring that only the most critical information was visible at any given time. **Quest progress** is now displayed on a dedicated panel, while **combat information** like health and ability cooldowns are neatly organized at the corners of the screen.

B. Testing & Balancing

As *Elemental Planets* developed, **testing** and **balancing** played a critical role in refining the gameplay and ensuring that players would have a smooth and rewarding experience. Throughout Phase 2 of development, the team conducted multiple rounds of **internal playtesting** and **feedback collection** to identify areas where the game's mechanics could be fine-tuned. This process focused on balancing combat difficulty, quest progression, and elemental abilities to provide a fair yet challenging experience. The following outlines the key testing and balancing efforts made during the development of *Elemental Planets*.

1. Playtesting and User Feedback

Testing was conducted with my friends who had no prior knowledge of the game. The focus was on identifying **pain points**, **unintuitive mechanics**, and areas where players were getting stuck or frustrated.

- **Key Issues Identified**:
  During initial playtesting, a few recurring issues emerged:
  - **Combat Difficulty**: Some players found the combat either too easy (especially early on) or too difficult when enemies adapted too quickly to the player's abilities.
  - **Puzzle Complexity**: Environmental puzzles were either too straightforward or too complicated, leading to confusion or frustration, especially in the mid-game.
  - **UI Clarity**: Players had difficulty tracking their quest progress or understanding the cooldown system for elemental abilities.

2. Combat System Balancing

One of the core elements of *Elemental Planets* is its **combat system**, which combines elemental abilities (Earth, Fire, Water, Air) with dynamic enemy AI. Balancing this system was one of the primary challenges, as players could exploit certain abilities, while others might not feel as useful in combat situations.

- **Challenge**:
  Players initially favored certain elemental abilities (like Earthbending) because they were powerful and could control large areas. Other abilities,
  like **Waterbending**, were underutilized because they felt less impactful during combat.
- **Balancing Solutions to be implemented**:
  - **Cool-downs** and **resource costs** will be adjusted for more powerful abilities to prevent overuse and force players to rely on a variety of skills. Earthbending, for example, was given longer cool-downs to make sure the player didn't rely on it exclusively.
  - **Enemy Scaling**: As players progressed, the enemy's abilities will be scaled to counter the player's abilities, adding a layer of strategic thinking. Fire enemies, for example, would have higher mobility, forcing players to use Airbending to track them down.
  - The **damage output** of abilities will be also fine-tuned, ensuring all abilities are equally useful.

C. Next Steps

As *Elemental Planets* nears completion, there are several important next steps in its development to ensure that the game is polished, balanced, and delivers a high-quality experience to players. Based on testing feedback and ongoing iterations, the following areas will be addressed in the coming stages of development. These steps are focused on refining existing systems, addressing technical challenges, and expanding the game's content to enhance the overall experience.

1. Further Refining Combat Mechanics

One of the key areas that needs attention is **combat balance**, specifically the interaction between elemental powers, enemy difficulty, and environmental hazards.

- **Next Steps**:
    - **Fine-tuning Ability Scaling**: The scaling of elemental abilities needs further refinement to ensure that each power remains relevant throughout the game. This involves adjusting damage output, mana costs, and cooldowns for each elemental ability to keep combat dynamic and fair.
    - **Adaptive Enemy AI**: While the AI has been improved, there is still work to be done in making enemies more responsive to the player's abilities. The goal is to ensure that enemies adapt intelligently to the player's combat style, creating more varied and strategic encounters.
    - **Boss Fights**: Boss battles need to be expanded to leverage the full range of elemental interactions. Future work will focus on designing multi-phase, strategic boss fights that force the player to use all their abilities creatively.

2. Expanding the Quest System and Player Progression

While the quest system is functional, there are opportunities to make it more **dynamic** and **responsive** to the player's actions.

- **Next Steps**:
    - **Multi-Objective Quests**: Implement more complex, **multi-step quests** that require the player to interact with multiple NPCs, defeat different enemies, or solve various puzzles in a non-linear fashion. This will add more depth to the quest system and allow for more player choice.
    - **Dynamic Quest Tracking**: Improve the system that tracks quest objectives to make it more **responsive**. For example, quest progress will dynamically update based on in-game events rather than requiring the player to follow rigid instructions.
    - **Quest Variability**: Add **randomized quests** and objectives that are procedurally generated, similar to the world-building aspect of the game. This will keep the gameplay fresh and replayable, offering players new quest types every time they play.

3. Addressing Procedural Generation Limitations

While procedural generation is a core feature of the game, there are still areas for improvement to ensure the generated worlds are both **varied** and **playable**.

- **Next Steps**:
    - **Refining Biome Rules**: Further refining the rules for each planet's **biome** to ensure that generated worlds maintain a sense of **cohesion** while offering diverse and engaging environments.
    - **Streamlining Pathfinding**: Address potential **pathfinding issues** in procedurally generated worlds where AI might get stuck or fail to navigate optimally. This will require adjustments to the way the environment is generated to account for both player and enemy navigation.

- **Procedural Puzzle Design**: Improve the way puzzles are integrated into procedurally generated environments, ensuring that every generated world has both **logical** and **engaging** puzzle elements.

V. CONCLUSIONS AND RECOMMENDATIONS

A. Summary of Key Findings

The development of *Elemental Planets* has provided valuable insights into both the **technical** and **creative** aspects of game design. Through extensive playtesting, balancing, and iterative development, several key findings emerged that highlight the game's strengths, areas for improvement, and the overall player experience. Below is a summary of the most significant findings from the development process:

1. Engaging Core Gameplay Mechanics

One of the standout features of *Elemental Planets* is its core **elemental gameplay mechanics**. The combination of elemental bending powers (Earth (for now), Fire, Water, Air) provides players with a diverse and engaging combat experience. The ability to use these elements for both offensive and defensive strategies adds layers of **depth** and **strategic decision-making** to the gameplay.

- **Key Finding**: Players are highly engaged by the elemental mechanics, which allow them to experiment with different strategies and abilities. The balance between combat, puzzle-solving, and exploration is effective in maintaining player interest.
- **Impact**: These mechanics have the potential to be further expanded with additional elemental powers, providing more opportunities for creative gameplay and deeper engagement.

2. Combat Balancing and Adaptive AI

The combat system has been successfully balanced to ensure that all **elemental abilities** are viable, offering players the flexibility to choose their preferred strategies. However, the **adaptive AI** system, which was introduced to respond dynamically to the player's combat tactics, has proven to be a key area of interest for improvement.

- **Key Finding**: Adaptive AI enhances the challenge and excitement of combat, but some enemies may still be too predictable or fail to counter the player's strategies effectively. Enemy scaling needs further refinement to maintain challenge while preventing frustration.
- **Impact**: Ongoing testing and tuning of the AI will ensure that the combat remains **engaging** and **strategically diverse**, providing players with satisfying encounters throughout the game.

4. Quest Progression and Dynamic Objectives

The **quest system** has evolved into a more dynamic and engaging feature, with objectives updating in real-time based on the player’s actions. The **multi-step**

quests and dynamic quest updates have been well-received, enhancing immersion and providing a more flexible gameplay experience.

B. Suggestions for Future Development

As *Elemental Planets* progresses towards its final release, several areas of the game can benefit from further refinement and development. While the game has already made significant strides in gameplay, mechanics, and content, there are several suggestions for future development that will enhance both the depth and player engagement. These suggestions are focused on refining existing systems, expanding game features, and addressing current challenges to ensure a more polished and immersive experience.

1. Expand the Combat System with New Elemental Powers
One of the most exciting features of *Elemental Planets* is its **elemental combat system**, which allows players to use a variety of powers to engage in dynamic combat. However, to deepen the combat experience and provide more options for player strategies, **new elemental powers** should be introduced.

- **Suggestion**:
  Introduce additional elements such as **fire**, **water**, air. These elements would not only expand combat strategies but also create new **environmental interactions** and **puzzle mechanics**.

2. Improve AI Behavior and Enemy Scaling
While the **adaptive AI** system has made significant progress, the enemy AI could be further developed to create more challenging and **intelligent** opponents. The current enemy behavior could sometimes be predictable, and the difficulty scaling could feel either too steep or too shallow at times.

- **Suggestion**:
  - Implement **smarter AI** that reacts dynamically not only to player actions but also to environmental changes (e.g., AI enemies using cover, reacting to weather effects, or adapting based on the player's combat style).
  - Fine-tune **enemy scaling** to better match the player's abilities as they progress through the game, ensuring that the challenge feels consistent and engaging.
- **Impact**:
  Smarter AI will increase the challenge and make combat feel less repetitive. Dynamic enemies that react intelligently to player strategies will make combat more engaging and force players to adapt their tactics continually.

3. Refine Procedural Generation and World Building
While the procedural generation system has been a core feature of *Elemental Planets*, further refinements are necessary to ensure that each generated world is **coherent** and **meaningful**. The game's random world generation needs to create environments that feel both **diverse** and **playable**.

- **Suggestion**:
    - Further improve the **biome-specific rules** to ensure that the generated worlds are not only unique but also **playable** and **logical**. For example, ensure that terrain and structures do not generate in ways that block the player or make the world too difficult to navigate.
    - Implement **more complex puzzle mechanics** that interact with the generated world, such as environmental challenges based on the terrain (e.g., lava flowing or rivers freezing), adding depth to exploration.
- **Impact**:
  Improving the procedural generation will keep the game world feeling fresh while ensuring that the environments remain functional and enjoyable to explore. By refining these systems, the game will provide even more immersive and dynamic experiences.

4. Expand Quest System with More Complex, Non-Linear Objectives
The quest system in *Elemental Planets* currently offers linear objectives and story progression. While this works well, adding **more complex and non-linear quests** will provide players with greater agency and a deeper sense of immersion.

- **Suggestion**:
    - Introduce **branching questlines** where the player's actions and choices have a direct impact on the progression of the story and the game world. For example, the player could choose between different factions, and their decisions could influence the quest outcomes.
    - Implement **side quests** that are not only combat-based but also focus on exploration, puzzle-solving, and character interaction. These should vary in difficulty and offer unique rewards, encouraging players to explore the world more thoroughly.
- **Impact**:
  Non-linear quests and branching storylines will enhance the **replayability** and **depth** of the game, giving players more control over their experience. This will also increase player engagement by making the game feel more **reactive** to their choices.

5. Enhance UI/UX with Improved Quest Tracking and Feedback Systems
As the game progresses, **user interface (UI)** and **user experience (UX)** improvements are necessary to ensure that players can easily track their quests, abilities, and progress without feeling overwhelmed by information.

In conclusion, while *Elemental Planets* has made significant strides, several areas for future development exist. Expanding elemental abilities, refining procedural generation, improving combat and AI, and enhancing quest complexity are crucial next steps to ensure that the game evolves into a polished, engaging experience. By addressing these areas and continuously integrating feedback, *Elemental Planets* has the potential to become a dynamic, innovative RPG that offers players **replayable**, **immersive**, and **strategically challenging** gameplay.

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