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2 Introduction

Dyslexia is a neurodevelopmental disorder that is characterized by a reduction in the ability to read and spell. It prevents the growth of skills in reading and spelling, despite sufficient intelligence and education (Franceschini et al., 2017). It affects 5% to 10% of the population (Turker et al., 2023), with a relatively high prevalence in males (Grossard et al., 2025). Dyslexia (SLD reading) is observed in phonological processing, verbal memory, and rapid automatized naming (RNA) (Grossard et al., 2025). The reduced ability of dyslexic students prevents them from decoding written words and recognizing them. Over time, this leads to academic challenges and disappointment. It can also prevent the student from developing vocabulary, reading ability, and ultimately have a significant impact on educational performance. This literature review examines interventions for dyslexia, from traditional phonics-based teaching to technology-driven tools, focusing on serious games as a new approach to support spelling and word learning. In the review, strategies (including phonics, technologies, social, and emotional support) will be discussed, as well as how games, especially serious games, and their game mechanics can affect the ability to read, spell, recognize words, and develop literacy skills. Finally, the review identifies a gap in current educational serious games design for dyslexic learners, particularly for children older than ten years old and in multilingual contexts. The review emphasizes findings from recent academic papers and scientific sources that will be referenced in this review.

Research Aim and Contribution

The principal goal of this dissertation is to study the design and development of a serious game to teach spelling and vocabulary to dyslexic people aged over ten. For this, the serious game, Spellexis, a 2D dark fantasy platformer which integrates educational word-based mechanics with exploration, combat, and progression systems is created to improve motivation to learn.

The goals this dissertation is aiming to achieve are:

To analyze the literature concerning dyslexia, their impact on education and current intervention strategies. To evaluate the potential of serious games in providing an engaging learning environment for improving literacy. To recognize a lack in the current serious game design for over ten years old dyslexic learners. To design and implement a serious game combining teaching spelling and vocabulary with such gameplay mechanics as exploration, combat, mini-games, and boss fights. To design and implement technical mechanisms in the serious game such as save/load function, progression, adaptive challenge, multiple language support and user interface design. The contribution of this project consists in proposing a solution for an existing problem in the current serious game design for dyslexic individuals over ten years old. Many educational games are oriented to young children or simple quiz-based learning. Spellexis seeks to develop an educational game with an immersive and fun-like experience, by providing it with a 2D platformer structure; at the same time, this project introduces the use of multilingual support, adaptive challenge, and progression mechanism for an educational purpose.

3 Literature Review

3.1 Defining Dyslexia and Educational Impact

The definition of dyslexia, also known as SLD Reading (specific learning disorder in reading), is a specific difficulty in learning to read and spell, which is not explained by general intelligence or lack of schooling and knowledge (Franceschini *et al.*, 2017). It is characterized by difficulty in accurately or appropriately recognizing words, limited spelling and decoding abilities. Scientific and medical research have documented that dyslexia is linked to a deficit in phonological processing (Franceschini *et al.*, 2017), (Grossard *et al.*, 2025). People with dyslexia have difficulties in segmenting and manipulating the sounds of language (phonemes), which reduces their ability to match letters with sounds and decode (the process of converting letters into phonemes) written words. As an example, children with dyslexia show deficits in phonological awareness (awareness of the sound structures in words), verbal working memory, and rapid automated naming (RAN) (Grossard *et al.*, 2025). These weaknesses make it difficult to achieve automated word reading, and many dyslexic students remain slow, they make a great effort, even they have improved through specific instructions (Franceschini *et al.*, 2017).

It is important to note that the manifestation of dyslexia can vary depending on the language and writing system. In languages like Italian and Spanish that are “shallow” (where there is a direct correspondence between letters and sounds), dyslexia affects reading speed because these languages have consistent spelling to sounds rules and help dyslexic learners to read words correctly but slowly (Franceschini *et al.*, 2017). In languages like English or French with “deep” orthographies, dyslexia often effects both accuracy and fluency because the irregular orthographies (spelling) increase the decoding difficulties (Franceschini *et al.*, 2017). Dyslexia is observed in all languages studies and scripts writing despite these difference that may have (Franceschini *et al.*, 2017). Dyslexia is a global learning disorder with a neural basis. Dyslexic readers show atypical activation and connectivity in the brain networks which are responsible for reading and language (Grossard *et al.*, 2025). Recent neuroimaging studies confirm that dyslexia involves differences in the way the brain processes written language, sound and rhythm like disruption in visual and auditory processing networks (Grossard *et al.*, 2025). These findings prove that dyslexia is not simply a developmental delay, but a distinct learning profile that requires targeted intervention (Turker *et al.*, 2023).

3.2 Evidence Based Intervention for Dyslexia

The effective intervention for dyslexia requires a multidimensional approach for helping people. It is not an illness that can be cured but language disorder that can be improved with the right methods and practices. Best practices that a recommended are to directly address the phonological and orthographic skills that restore reading skills , like methods based on phonics instructions with supportive tools and strategies to reinforce the learner in real time and reinforced by attention to social-emotional needs (Grossard *et al.*, 2025) (Suneesh, Pasupuleti and Garate, no date).

3.3 Phonics Based Instructions

Given the roots of dyslexia in phonological deficits, teaching methods that each phonics, the systematic corresponding between graphemes and phonemes, are the fundamental methods and practices. Researches through now have shown that structured systemic phonics instructions, significantly improves the decoding skills of learners with dyslexia, enabling them to sound letters and

words more accurately (Grossard *et al.*, 2025). This approach typically involves direct and specific teaching of letter with its sound mapping, phonemic segmentation and blending those two together as the repeatedly review of phonics patterns (Grossard *et al.*, 2025). Programs like *Orton Gillingham*, *Willson reading system* and *GraphoGame* implement these principles with variety of ways, engaging visual, audio, colours, shapes and kinesthetics channels. Studies results confirms that dyslexic children practicing in phonics intervention improve their functional reading accuracy and decode most of the words correctly. The evidence of the result of the phonological training, bring gains in a single word reading and spelling for young dyslexic children can be found on the review note of (Grossard *et al.*, 2025). Another Example is the use of *GraphoGame* for promoting *English Phonics Knowledge* which had significant benefits (Ahmed *et al.*, 2020). Graphophonological training, mapping letters with sounds and teaching spelling methods as mentioned, are vital and the current clinical recommendations (*French College of Speech Therapy*) persist to be included always in dyslexia learning methods (Grossard *et al.*, 2025). However, all learning methods that focus on phonetic learning need to be intensive and repeatable to achieve results, it may require daily teaching for months or even years. Even then, dyslexic readers continue to read more slowly than normal readers because creating automaticity is very difficult (the ability to read quickly without conscious effort. In dyslexia, the brain expends excessive resources on decoding, leaving no space for understanding the text) (Franceschini *et al.*, 2017). This difficulty in automaticity has forced researchers to find supplemental training such as a rapid shifting of visual attention (the ability of the eyes and the brain of moving fast from one to the other letter while reading), with the goal of enhancing reading speed (Franceschini *et al.*, 2017). While phonics instructions are beneficial in the early stages of dyslexia and for decoding the code, older students with dyslexia who already have a basic decoding ability may require additional strategies such us decoding multisyllabic words by recognizing roots, prefixes, suffixes and learning irregular words that do not follow typical phonetic rules. It is worth mentioning that a recent systematic review observed that most existing serious games for dyslexia emphasize phonemes and syllables but neglect whole word recognition and reading irregular words (Marinelli *et al.*, 2023a).

3.4 Assistive Technology

The technology that helps dyslexic learners and gives them the opportunity completing tasks using their existing skills are called Assistive technologies. A range of new Assistive Technologies tools have been developed and are useful in mitigating the everyday effects of dyslexia. Some of these technologies are Text-To-Speech that allows digital text to be converted into speech, enabling dyslexic learners to study literature and textbooks that exceed their independent reading level. Speech-To-Text helps dyslexic learners compose written assignments by leveraging their strengths in oral speech. The existing software such as audio books and screen readers ensure that dyslexia learners can access to their appropriate studies content (*Assistive Technology Tech Sheet - International Dyslexia Association | Oregon, no date*). In addition, even simpler tools can offer substantial support, such as electronic spell checkers, word prediction software and specialized fonts like *Dyslexie* or *OpenDyslexic*, which are designed with greater weight of the bottom of letters to reduce visual confusion. These technologies “reduce written language disorders by replacing deficient cognitive functions” (Grossard *et al.*, 2025).

Research into new immersive educational technologies for dyslexia has also explored more experimental tools. (Buele *et al.*, 2020) developed a 3D virtual reality system for practicing reading exercises, finding that such interactive environments can maintain user engagement and be as effective as conventional interventions. Similarly, augmented reality technology has been tested to

enhanced students learning skills (Gentile and Alesi, 2025). The advantage of digital tools is that they can be personalized, adjust the size of the text, change the background color, increase or decrease the reading speed, and adjust the difficulty. Can be used independently at home and increase the opportunities for learning (Gentile and Alesi, 2025). However, Assistive technology is not a standalone treatment. It works best in combination with evidence-based teaching.

3.5 Socio-Emotional Support

A completed and well-structured intervention plan for dyslexia must necessarily consider the child's social and emotional well-being. Students with dyslexia often face discouragement, anxiety and low self-confidence (Suneesh, Pasupuleti and Garate, no date) due to repeated difficulties in reading within an educational environment that places enormous value of literacy. These emotional challenges can create a vicious cycle, where failure to read leads to avoidance of schoolwork, which widens the learning gap. Therefore, psychological encouragement and the cultivation of supportive environment are just as important as the teaching of reading skills (Suneesh, Pasupuleti and Garate, no date). Research indicates that incorporating game elements and playful attitude to learning can significantly improve motivation and reduce stress for students with dyslexia (Suneesh, Pasupuleti and Garate, no date). Games provide immediate feedback clear goals and rewards, all of which can enhance the students sense of achievement. By making learning more enjoyable, games help to reframe the narrative from "failure" to "challenge and achievement". Social emotional support can also include explicit teaching of copying strategies and self-advocacy. Students can learn about famous people with dyslexia, discuss their feelings or practice explaining their learning difference to others. This approach can encourage dyslexia people and remove thoughts like "I am stupid", "I cannot do it" and feelings like anxiety and disappointment. It is important parents and counsellors to involve in such a way that a supportive environment will be created, that focus on mental health. All these, benefits the dyslexic student, can reinforce the positive effects and help the emotional stability. In summary, addressing the emotional needs of dyslexic students is just as essential as addressing their cognitive needs. A well-designed educational game can contribute on both fronts, providing a safe space for practicing skills and rewarding progress in a way that builds self-confidence.

4 Serious Games

4.1 Serious Games and Cognitive Training

Serious games for dyslexic students are games designed for purposes beyond entertainment. Are tools for providing intensive, personalized instruction to students for dyslexia (Grossard *et al.*, 2025). These games leverage the motivational power and interactivity of video games to encourage students to practice literacy skills much more frequently and effectively than traditional teaching alone would allow. In this section will be first examined their cognitive benefits. Then it will be discussed which game mechanics have been identified as supportive of literacy development.

4.2 Serious Games for Dyslexia

The last decade has seen increasing research activity on the use of serious games and gamified interventions to improve reading skills in students with dyslexia. (Marinelli *et al.*, 2023a) conducted a systematic review of such serious games and found that, although the number of tested literacy games are limited, existing interventions do indeed show positive effects on reading and spelling performance.

In the six randomized trials examined, engagement with educational games led to improvements in basic reading and phonological skills, while high levels of engagement and enjoyment were reported by users (Marinelli *et al.*, 2023a). However, (Marinelli *et al.*, 2023a) also noted significant limitations like that the games usually targeted on a subset of literacy skills (e.g. letters – sounds matching, syllable reading), often leaving out spelling or reading comprehension and the benefits did not always generalize to skills that had not been taught (Marinelli *et al.*, 2023a). This highlights the need for more comprehensive game-based interventions. It is worth noting that all studies in the reviews involved primary school students and none included secondary school students. Most games for dyslexia to date have been designed for children under the age of ten, reflecting a gap in available resources for older students (Marinelli *et al.*, 2023a).

Despite these gaps, individual game studies highlighted the potential of serious games. (Franceschini *et al.*, 2013), demonstrated in a landmark study that just 12 hours of playing an action video game significantly improved reading speed in children with dyslexia in Italy. This improvement was so impressive that it equated to more than a year of typical reading development. Additionally, in United Kingdom using *GraphoGame Rime* in children six to seven years old. The studies found that the game has beneficial effects on children with dyslexia (Ahmed *et al.*, 2020). Another randomized controlled trial examined a popular action game “*Fruit Ninja*” as a tool for training visual attention in English speaking children with dyslexia, aged eight to thirteen years. After just five hours of play, the groups trained through the game showed significant benefits in reading accuracy, reading rate and reading comprehension compared to a control group that did not participate in the game (Peters *et al.*, 2021).

Other serious games take a more direct approach, including several literacy exercises into their game scenarios. For example, *GraphoLearn* (a game developed in Finland) trains the player in letter-sounds correspondences and word recognition through a series of mini games. It has been shown to be effective in many languages for improving phonological decoding. (Yildirim and Surer, 2021) created a suite of five serious mini games targeting different skills area. The five of these mini games are a word game for practicing spelling, a memory game for strengthening cognitive recall, a categorization game for vocabulary development, a space navigation game for attention training and a math game for addressing dyscalculia. In their two-phase usability study they conducted, 23 children with various learning difficulties, including dyslexia, played the games and provided feedback for both students and teachers reported high levels of usability and satisfaction. The children gave an average of 9/10 for the enjoyment derived from the game. Teachers rated the usability and usefulness of the game at 8.5/10 (Yildirim and Surer, 2021). Such results suggest that well designed educational games can be both effective and well received by the target audience. Another notable example is the *Mila-Learn/Poppins* series of games from France. *Mila-Learn* was a 2D rhythmic platformer game aimed at improving phonological timing skills like rhythm perception and synchronization, in children aged 7-11 with dyslexia (Grossard *et al.*, 2025). A randomized trial of *Mila-Learn* 154 children showed significant benefits in reading accuracy and speed after two months of using the game. Based on these findings, Descamps and colleagues (Grossard *et al.*, 2025) added graphemic exercises (letter-sounds matching) to create new game called Poppins, which combines rhythm training with phonics method. In a single arm study, using Poppins for 8 weeks led to remarkable improvements in word reading accuracy and reading speed (Grossard *et al.*, 2025). These improvements are in line with what would be expected from traditional high-quality interventions, emphasizing that a serious game can provide intensive practice in basic skills. The author emphasizes that Poppins follows the best practices intervention guidelines, incorporating both phonological and orthographic training. Furthermore, the argue that

such games are a scalable way to reach more children who need the necessary daily practice to make progress (Grossard *et al.*, 2025).

In summary, serious games for dyslexia have demonstrated effectiveness in improving fundamental literacy skills and related cognitive abilities. They offer promises to provide high frequency, high engagement instruction that would be difficult to implement in other ways. For example, 20 minutes of extra practice each day could be boring and forced in a traditional therapy setting, but it is entirely feasible through a game used at home (Grossard *et al.*, 2025). At the same time, the current range of games leaves room for further development. Many games focus narrowly on phonological decoding and are aimed at young children, there is a lack of games for older students with dyslexia, who may need support at more advanced levels of reading (multisyllabic words, comprehension) or in vocabulary and word learning. This is an area that researchers have identified as neglected game-based interventions (Ekawati *et al.*, 2024). This project responds to this need by developing a 2D platformer game that is explicitly oriented towards word learning for students with dyslexia over 10 years old, featuring built-in accessibility features and bilingual functionality. Before analysing these design choices in detail, will be examined which game design elements the literature suggests are beneficial for the student with dyslexia.

4.3 Game Mechanics that Support Literacy

Effective serious games are not limited to simple, repetitive content drilling. They employ game mechanics and user experience UX design to optimize learning. Certain game design that has been found to be particularly supportive for students with dyslexia are as follows.

- I. *Adaptive Difficulty and Personalized Learning:* Games that adjust their difficulty in response to player performance can keep students in the “zone of optimal challenge” so they do not get bored with tasks that are too easy but also do not get frustrated by tasks that are too difficult. This can be achieved with adaptive algorithms. As an example, introduce more difficult words only after simple ones have been mastered or after the failure of difficult words return to the easiest. (Yildirim and Surer, 2021) found that adding adaptive difficulty improved both students and teachers satisfaction with their dyslexia games. Many successful literacy games like GraphoLearn include levels that gradually build skills, ensuring a progression from simple to difficult that provides the necessary scaffolding for learning (Jaramillo-Alcázar *et al.*, 2021).
- II. *Immediate Feedback and Rewards:* Instant feedback is crucial for learning to read and serious games excel in this area. A good serious game immediately indicates when a player mispronounces a word or makes a wrong letter match, often highlights the error and allows a new attempt. Conversely, correct answers can be reinforced with rewards like points and stars or praise from the character. It can also unlock some other features of the game or add a certain skill to the character. Such explicit rewards and positive feedback keep motivation high and help the player connect effort with achievement (Jaramillo-Alcázar *et al.*, 2021). (Marinelli *et al.*, 2023a) note that high engagement and enjoyment are common in dyslexia games, which they attribute to the built in reward loops that make learning feel like play.
- III. *Multisensory Cues and Modalities:* Following the principles of multimodal teaching for dyslexia (VAKT approach, visual, auditory, kinesthetics and tactile), serious games often incorporate multiple senses. For example, a game can combine a written word with an audio clip of the word or use animations that the child can control, thus engaging motor skills. This redundancy of information helps strengthen neural connections, if the student does not understand a word

through its written form alone, auditory and visual stimuli can reinforce comprehension. Some serious games also incorporate rhythmic or musical elements, which can improve timing and aspects of auditory processing related to reading (Grossard *et al.*, 2025). The game Poppins is a prime example, it incorporates graphemic exercises into rhythmic game world, training children to synchronize sound and symbols. This model approach is supported by research showing that training in rhythm and music can enhance phonological awareness in students with dyslexia (Grossard *et al.*, 2025).

- IV. *User Friendly and Accessible Interface:* Player with dyslexia may have specific needs in terms of interface design. Accessibility guidelines (Jaramillo-Alcázar *et al.*, 2021) recommend using simple, clear language for instructions and story text, avoiding unnecessarily complex vocabulary that could confuse or frustrate the player. The fonts should be easy to read (with enough space between letters, use specific fonts for dyslexic) and high contrast visual elements should be used to clearly distinguish letters from game objects (Jaramillo-Alcázar *et al.*, 2021). Additionally, providing subtitles for spoken dialogue assists players who have difficulty with auditory processing. A repeat button for instruction or word pronunciation is another essential choice, as students with dyslexia often need multiple exposures to the same stimulus. One more useful choice is the student can pause or save the game progress and take breaks. Continue the game in his time without pressure (Jaramillo-Alcázar *et al.*, 2021). All these choices ensure accessible design in the difference between a game that is therapeutically beneficial and one that causes unintended frustration. This project will incorporate these principles like subtitles, plain language in user interface, dyslexic fonts, so it will be as inclusive as possible.
- V. *Engaging Narrative and Theme:* Although not necessary for skill improvement, having an engaging story or theme in the game can significantly boost motivation. Students with dyslexia in older groups may not be attracted to educational software that seems to be "babyish". On strategy, as used by (Grossard *et al.*, 2025) for the game Poppins, is to adopt a more mainstream aesthetic so that the game resembles popular titles played by their peers. Poppins drew inspiration from platform games for all ages, such as Rayman and Mario, including a heroic character and an adventure plotter to attract players (Grossard *et al.*, 2025). This approach can make the students feels like they are just playing a "cool game". A narrative with goals like "recover the lost letters to save the kingdom" gives meaning to the exercise and can activate the player motivation. It also allows literacy tasks to be integrated into the plot itself.
- VI. *Repetition with Variety:* Mastering reading requires a lot of practice. Games are great at providing repetitive practice in a more engaging way, adding variety and challenges. A good literacy game will "circle" a target skill through different min games or scenarios. For example, to teach a set of sight words, the game may ask the player to collect these words in a treasure hunt, or to use them to fill in blanks in sentences, or to form letters using letter tiles. This approach reinforces the same word in multiple contexts. This repetition helps to encode learning, but the variety prevents the process from becoming tedious. In addition, serious games often encourage replayability by tracking progress and providing incentives for improvement, this can lead students to voluntarily devote more time to the activity than they would to traditional schoolwork. One study note that achieving high intensity training is rarely feasible in conventional therapy, but serious games make it achievable because they are fun and accessible at home (Grossard *et al.*, 2025).

In conclusion, combining careful instructional design with engaging game mechanics can yield a powerful learning tool for students with dyslexia. Games can offer frequency, immediate feedback and

adaptability that maximize skill acquisition, while providing the motivation, safety and enjoyment that reinforce the learner's willingness to persevere. The next section will examine the areas where current game designs still fall short, to clarify how a new 2D platformer game could fill these gaps.

5 Educational Game Design

5.1 Gaps in Current Educational Game Design

Despite progress in serious games for dyslexia, there remains some notable gaps. Identifying these gaps is crucial to guide the design of new interventions that will better serve dyslexic students, especially those in the target group, by this project. As a reminder, target group is over 10 years, the project focuses on word learning and multilingual support.

5.2 Age Group Gaps (focus on young children)

Most existing serious games that focus on dyslexia, as well as related research studies, target the early grades of elementary school ages from 5 to 10 years old (Marinelli *et al.*, 2023b). The reasoning is that early intervention is crucial and young children are often more receptive to learning through play. However, dyslexia does not disappear after childhood. Many older students continue to experience reading difficulties and could benefit from personalized interventions. Unfortunately, serious games landscape lacks tools for learners over the age of 10. (Marinelli *et al.*, 2023a) explicitly stated in their review that none of the identified game-based interventions included secondary school students. Similarly, the games by (Yildirim and Surer, 2021) were tested on children from 7 to 10 years, while other notable games, such as GraphoGame, were designed primarily for beginner readers. This leaves a gap for middle and high school students, who may be reading at a lower level or need a refresher intervention. Older students have different interests and needs. They may feel embarrassed about their reading difficulties and be less motivated by childish game themes. They also often face more complex reading demands, such as longer texts with complex structures or learning a foreign language. Therefore, there is an urgent need for educational games that are age appropriate and attractive to older students with dyslexia. This project proposed a 2D platformer game aims to fill this gap by appealing to students with more sophisticated game genre and focusing on word learning and vocabulary areas that remain critical for this age group.

5.3 Lack of 2D Platformers or Gamified Word Learning Tools for Older Users

An additional gap is found in the genre and content of today's dyslexia games. Many interventions take the form of mini-games, drills or quizzes, for example, a memory game with cards to match letters and sounds or a "whack-a-mole" game to choose the correct spelling. Although effective for specific skills, these formats may seem repetitive and may not engage students who are familiar with richer commercial games. Notable is the absence of full-fledged adventure games or platformers that incorporate literacy challenges into an action-oriented gameplay. Platform games (such as *Mario*, *Rayman*, etc.) are popular with a wide age range and could provide an intimate yet educational experience if designed specifically for dyslexia intervention. To date, few platform games have been developed specifically to practice reading skills. The previously mentioned Poppins game included some elements of a platforming aesthetic in its design (Grossard *et al.*, 2025), but at its core it remained a set of short activities rather than an ongoing platforming adventure. This presents an opportunity, by creating a true 2D side scrolling platformer, where progress in the game requires the application of

reading and vocabulary knowledge (for example, decoding words to open gates or collecting letters to form words), the game can engage older players with dyslexia in a game format they find enjoyable.

In terms of content focus, a notable gap is found in vocabulary and word learning. Traditional dyslexia interventions focus on decoding and spelling, sometimes overlooking that students with dyslexia often have reduced exposure to texts, which can lead to weaker vocabulary development in reading. An analysis of game-based dyslexia interventions found that skills such as vocabulary acquisition, semantic decoding and spoken language comprehension were rarely targeted in serious games (Ekawati *et al.*, 2024). Instead, the emphasis was overwhelmingly on basic reading mechanisms (phonological awareness, letter recognition, etc.). This suggests that students with dyslexia, particularly older ones who may decode but not comprehend well, lack play-based tools to practice understanding new words or connecting words to their meanings. This game addresses this issue by making “word learning” a core mechanic, for example, introducing new words into a context. Using images or translations (for multilingual support). Reinforcing these words through gameplay tasks. By doing this in a platform game environment, the game hopes to 'marry' the excitement of an adventure game with meaningful word learning.

5.4 Language and Orthographic Diversity

The last gap concerns the linguistic range of educational games. Dyslexia is studied and supported more extensively in only a few languages (mainly English, but also Italian, Spanish and Finnish) and many interventions are monolingual. However, students with dyslexia exist in all language contexts and, in today's globalized world, many students are taught a second language. In this context, dyslexia can pose additional barriers, such as when a dyslexic child whose first language is Spanish must learn to read in English. There is a lack of serious games that take multilingual needs or different spelling systems into account. Most games are built for the spelling of a specific language and cannot be easily adapted. An exception is the "*GraphoGame*" platform, which has versions in different languages (*GraphoGame English*, *GraphoGame German*, etc.), each adapted to the specific spelling rules. However, few games offer multilingual support within the app itself. An interesting approach by (Jaramillo-Alcázar *et al.*, 2021) was the design of a Spanish literacy game that included English translations alongside the Spanish text in the interface, to potentially help bilingual children with dyslexia. They also drafted accessibility guidelines that could benefit multilingual users, for example, the use of symbols or color-coding that transcend language (Jaramillo-Alcázar *et al.*, 2021). Overall, though games rarely address the reality that a student with dyslexia may need help in more than one language or may benefit from cross-language reinforcement, for example, hearing a word in their strong language while seeing it written in their weaker language.

Moreover, differences in orthography (alphabetic vs. logographic systems, or shallow vs. deep orthographies) mean that a game that is effective in one language may not transfer directly to another. For example, an English game that trains the player in irregular sight words is irrelevant for a language like Italian, which has almost no irregular sight words. Conversely, a game that focuses on syllabic timing (important in Italian and Spanish) may not cover the basic difficulties of English language readers. This suggests the need for an adaptable or "language-aware" game design. As a step in this direction, this game is designed to support multilingual gameplay. The initial version will allow players to choose between English or Greek (representing a deep and a relatively shallow orthography, respectively), with identical game mechanics but localized word content. The game's narration and instructions are kept language neutral by using pictorial aids, so adding another language (e.g.

Estonian, Romanian or Spanish) is possible in the future. In this way, we hope to make the tool useful to a wider audience and enable a comparative investigation of how students with dyslexia in different language contexts interact with the same game.

In addition to multilingual support, ensuring accessibility for the diverse needs of users is an area for significant improvement in educational game design. Although there are guidelines and some games follow them, many of the popular educational games do not fully accommodate players with dyslexia or other learning differences. Simple features that are often missing, but can make a game much easier to use, include ability to select dyslexia-specific fonts. Background color options, to reduce visual stress. Auditory scaffolding, audio support in texts and instructions. In the future, developers should incorporate inclusive design from the start of development, not as an afterthought. In this project, testing with students with dyslexia will guide UI modifications. Change the language of the text on the menu screens and dialogues. Use dyslexia friendly font. Adjust the game speed via difficulty selection or add destructor letters. These choices echo a broader shift towards Universal Design, ensuring that technology products are accessible to as many users as possible.

6 Conclusion

In summary, dyslexia is a complex learning disorder that requires interventions targeting both fundamental reading skills and the holistic needs of the student. Traditional approaches, particularly systematic phonological instruction are the backbone of improving the phonological decoding and are based on a strong foundation of scientific evidence. At the same time assistive technologies and reinforcement practices help students with dyslexia meet academic demands and maintain their self-confidence. Serious games have emerged as an exciting complementary intervention, offering a way to provide high intensity, individualized instruction in a format that students truly enjoy. The literature shows that serious games can improve reading accuracy, speed, phonological awareness and even underlying cognitive skills like attention and rapid naming with children with dyslexia (Marinelli *et al.*, 2023a) (Peters *et al.*, 2021) They also tend to boost motivation and engagement which are critical for sustained practice (Ekawati *et al.*, 2024) (Peters *et al.*, 2021).

However, the current generation of educational games for dyslexia has limitations. They are few and often focus on narrow skills. Primarily target young children and rarely consider the diversity of students ages and linguistic backgrounds (Ekawati *et al.*, 2024) (Marinelli *et al.*, 2023a). This is a clear opportunity and need for the development of more comprehensive and inclusive game-based interventions that will incorporate a range of literacy skills, from phonics to vocabulary and comprehension. Serve both older and younger students and adapt to different languages or orthographies. By incorporating knowledge from successful interventions and considering the gaps identified, we can design a game that effectively supports students with dyslexia.

Spellexis 2D platformer game, developed in Unreal Engine 5 With accessibility and multilingual features, is designed to address these gaps. It will implement best practices derived from literature such as providing systematic practice in word reading, the use of engaging game mechanics to maintain motivation, and the implementation of accessibility guidelines to meet the needs of players with dyslexia. Multilingual support aims to broaden the game's application and explore cross-linguistic strategies. If successful, this game could not only improve specific reading and word learning outcomes for players but also serve as a model for how serious games can be adapted for older learners with dyslexia. Ultimately, the convergence of educational psychology, game design and accessibility

represents a promising frontier for dyslexia intervention, with potential to empower students through play and technology. The following chapters will delve deeper into methodology of developing and evaluating this game, but as this literature review has shown, such an endeavor is based on a solid foundation of previous research and identified needs in the field of dyslexia support.

6.1 Summary

The aim of this thesis was to analyze the creation process of Spellexis, a serious game which has been developed in order to aid spelling and vocabulary acquisition among dyslexic learners aged ten and above. This paper first examines dyslexia, a neurodevelopmental disorder, and analyzes both traditional and technological methods used to address it. Special emphasis is placed on serious games, a highly effective form of educational entertainment, which provides an excellent means of developing language skills. Based on the identified research gaps, such as the scarcity of literacy-related serious games for adolescents, lack of multilingual functionality, and the absence of a 2D platformer gameplay mechanic, the author developed Spellexis. Spelling and vocabulary exercises are combined within the framework of a dark fantasy-style 2D platformer, which integrates exploration, battles, boss fights, adaptive levels of difficulty, save/load mechanisms, and multilingual capabilities.

6.2 Future Work

Despite the success in building up an excellent platform for dyslexic students through Spellexis as a gaming platform for dyslexics, there are several potential improvements that may be explored in future versions. First, the game needs to undergo proper user testing by dyslexic users within the targeted age group, in order to gauge how effective the platform is in its educational objectives as well as the enjoyment of gameplay. Secondly, future versions can explore adding more levels in the game, adding more categories of vocabulary in the game, adding more bosses to the game, and even extending the storyline of the game. An adaptive learning system can also be integrated into the platform in future versions of the game, which will increase personalization of the experience. Additionally, the multilingual feature in the game can be extended to cover more languages as well as culturally relevant content.

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SPELLEXIS GAME DESIGN DOCUMENT

8 Table Of Contents GDD

8.1 Game Overview

Game Concept

Spellexis is a 2D platformer and educational serious game developed in Unreal Engine 5 with Blueprints. It combines exploration, enemy encounters, platform challenges and spelling-based learning activities inside a fantasy world called Draggaar.

Feature Set

- 2D platform exploration with combat and collectible resources.
- Spelling mini games that use images, letter tiles, audio pronunciation and rewards.
- Boss fights where spelling is integrated into combat.
- Multilingual educational content (English, Greek, Estonian)
- Save/Load persistence for progression, solved mini games, items, gems and defeated enemies
- Checkpoints for loading

Genre

2D platformer / Serious game / educational / Fantasy Adventure

Target Audience

- Dyslexic learners aged 10+
- Students improving spelling skills

- Educational institutions
- Speech therapists and special education programs
- Students are learning a foreign language.
- Casual players.

Game flow

The player moves from intro and setup screens into level exploration, completes spelling challenges, reveals hidden objects, collects rewards and progresses to boss encounters and new levels. See [Start Game Flow Chart \(Appendix A\)](#).

Look and Feel

Spellexis uses a fantasy visual identity with dark magical environments, ruined architecture and educational interfaces layered over game progression. The tone is more mature than many dyslexia focused games, aiming to engage players over the age of ten

Project Scope

- Five narrative Levels planned: Eldrath Dungeons, Veilwood Forest, Velgrath Keep, Kelmar cave, and Blacktide Haven (epilogue)
- Multiple player Characters
- Enemy encounters, educational mini games, bosses battles, collectible items, save/load and localization systems
- Different kind of enemies

8.2 Gameplay & Mechanics

8.2.1 Gameplay

Game Progression

Progression starts with language, difficulty and character selection. The player then explores levels, completes mini games, collects gems and items, fights enemies and reaches boss arenas that gate advancement to the next stage.

Mission / challenge structure

The game alternates between free exploration challenges and structured educational tasks. Standard stages include traversal, resource collection, enemy encounters and mini-game triggers. Boss stages combine timed spelling with direct combat consequences.

Puzzle structure

Each spelling puzzle presents an image, an audio cue, a shuffled pool of letters and empty slots matching the target word. The player must assemble the correct spelling to receive feedback and rewards. See [Mini-Game System Flowchart \(Appendix B\)](#).

Objectives

- Improve spelling through repeated multisensory interactions.
- Progress through levels and survive encounters.
- Collect gems, items and rewards.

- Complete spelling mini games.
- Reveal hidden objects and continue the level.
- Defeat bosses by implementing spelling challenges under pressure.

Play Flow

Explore → Collect → Encounter challenge → Solve spelling task or combat encounter → Receive reward → Continue exploration → Reach boss fight → Unlock next level.

8.2.2 Mechanics

Spellexis is built around movement, resource management, educational word construction and combat. Core mechanics include running, jumping, interacting with triggers, collecting resources, melee/ranged attacks depending on character class, and timed boss word challenges.

Physics

The game uses 2D side-scrolling style platform movement with collision, gravity, fly mode, jump arcs, trigger overlaps and custom collision channels implemented in Unreal Engine

Movement

The player can run, jump and navigate platform spaces. Additional movement such as ladder climbing is supported in the player Blueprint. See [Character System Architecture \(Appendix J\)](#)

Objects

World objects include gems, items, mini-game triggers, checkpoints, environmental hazards and boss-fight triggers.

Pick Up Objects

Mana (Fruits & Potions) and Health (Meat & Potions) Objects: when overlap add mana and health to the player stats.



Gems are the score and the economy of the game.



Moving Objects

Moving platform and invisible bricks

Actions

Primary actions include exploration, interaction with triggers, light/heavy attacks or ranged spells depending on the active character, backspace correction in spelling interfaces and pause/menu controls.

Switches & Buttons

UI buttons manage language selection, difficulty selection, character selection, menu transitions and in widget letter interactions.

Dialogs

Dialogue appears through scripted intro/boss-speech widgets and narrative presentation rather than free NPC conversation.

Reading

Reading and spelling is central to the educational design. Player process letters, words and image associations during both mini games and boss fights.

Combat

Combat is class dependent. The player can perform attacks and may use mana or stamina gated actions. Enemies use Blackboard driven AI states, combat targeting and melee or ranged attacks. Boss fights combine combat and timed spelling. See [Enemy System Architecture \(Appendix M\)](#), [Boss Fight System Architecture \(Appendix F\)](#) and [Character Gameplay Loop \(Appendix K\)](#).

Economy

The economy is reward based rather than transactional. Gems act as the primary score/progression resource, while items replenish health/mana or support survivability.

8.2.3 Screen Flow

See [Start Game Flow Chart \(Appendix A\)](#) and [Full Game Architecture Diagram \(Appendix I\)](#).

Screen description

- Intro screens: logos, language selection, narrative intro and
- Main menu: start, continue, Help, quit.
- Character selection: Choose the active player class
- Game HUD: Health, Mana, Stamina, XP, Gems
- Mini game widget: Image, Audio, Letters, Slots,
- Boss Fight UI: Boss Health, Player Health, Timer, Names, Descriptions

Main Menu Screen

Provides entry to new game, continue, help, difficulty selection and quit.

Help Menu Screen

Give instructions on how to play the game with images.

Difficulty menu Screen

- Easy: No destructor letters. Default damage and health of the enemy. Visibility of target word for 2 seconds. Default time for boss fight.
- Medium: 1 destructor letter. +10 damage and +10 health of the enemy. Visibility of target word for 1 sec. -5 seconds in time for boss fight.
- Hard: 2 destructor letters. +20 damage and +20 health of the enemy. No visibility of target word. -8 seconds in time for boss fight.

Continue and Saving

Saving and loading are managed centrally by BP_GameInstance and BP_SaveGame. The system stores player state, level name, defeated enemies, solved mini-games, collected items, gems, checkpoints and difficulty data. See [Save / Load System Architecture \(Appendix Q\)](#), [Save Game Flowchart \(Appendix R\)](#) and [Load Game Flowchart \(Appendix S\)](#).

8.3 Story, Settings

8.3.1 Story & Narrative

Spellexis - Draggaar: The Forgotten Realm. The story follows Kaelis, the last known survivor connected to the shattered Arcane Circle, as the seals of Draggaar weaken and ancient magic resurfaces.

Back Story

Long ago, the realm of Draggaar was ruled by the Arcane Circle, a powerful order of mages who maintained balance between magic and the natural world. At the center of their power was an ancient force known only as Spellexis living source of magic woven into the very fabric of the realm. But the Circle grew divided. Some sought to control Spellexis and reshape Draggaar through its limitless power. Others feared that awakening it fully would destroy the realm. The conflict shattered the Circle and unleashed catastrophic magic that nearly tore the world apart. To prevent complete ruin, the surviving mages sealed Draggaar behind powerful arcane barriers, burying its secrets beneath ruins, forgotten cities, and ancient dungeons. Over centuries, the truth faded into legend. But the magic of Spellexis was never truly silent. Now the seals weaken, the dead rise from forgotten tombs, and ancient powers begin to stir once more. At the center of it all stands Kaelis an exile marked by a mysterious glyph that pulses with the forbidden energy of Spellexis itself. Whether warrior, rogue, or mage, Kaelis carries the same destiny: To uncover the truth behind the fall of the Circle and the awakening of Draggaar.

Plot Elements

- A mysterious glyph links Kaelis to Spellexis.
- Each level reveals more of the realm's collapse and the fate of the Arcane Circle.
- Boss encounters act as narrative gates and escalation points.
- Blacktide Haven sets up the sequel hook for Spellexis II.

Game Progression

- Level 1 - Eldrath Dungeons
- Level 2 - Veilwood Forest
- Level 3 - Velgrath Keep
- Level 4 - Kelmar Cave

8.3.2 Game Word

General look

Draggaar is a dark fantasy world of sealed ruins, magical decay, undead threats and ancient arcane environments. The world should feel mystical, dangerous and slightly tragic, while still readable and motivating for educational play.

Area #1

Eldrath Dungeons: Underground prison, undead guardians, traps and the first major boss encounter.

Area #2

Veilwood Forest: Forest environment, Monster and animals, traps and the second major boss encounter.

Area #3

Velgrath Keep: Volcano environment, Monster, traps and the third major boss encounter.

Area #4

Kelmar Cave: Cave inside mountain, monsters, traps and the fourth major boss encounters.

Area #5

Blacktide Haven (epilogue): Harbor environment, Human enemies traps and the last major boss encounter.

8.4 Characters

Kaelis (player protagonist)

8.4.1 Character #1 (Mage)

Back Story

Last born of the shattered Circle, marked by a glyph that should not exist. Kaelis commands the forgotten tongues of Spellexis power that bends even death to its will. Every spell he casts pulls him closer to the truth buried beneath Draggaar.

Look



Characteristics

Max Health	Max Stamina	Light Attack	Heavy Attack	Stamina consume	Mana consume	Run speed	Walk speed	Climb Speed
150	200	15	35	5	25	500	350	300

Animations

Climb





Death



Hurt



Idle



Run



Attack1



Attack2



Jump

**Special Abilities**

Mana Spell: Health to Mana (Final Version)

Health Spell: Add Health

Relevance to Game Story

Kaelis is the lens through which the player experiences the fall and reawakening of Draggaar.

Statistics

class-specific data are driven by Data Tables.

8.4.2 Character #2 (Rouge)

Back Story

Born in the smoke and salt of Blacktide Haven, Kaelis learned early that shadows have sharper edges than blades. Once a smuggler for Eldrath's enemies, he now hunts the secrets that drowned with his past. In Draggaar's silence, he moves unseen a whisper where others leave footprints.

Look



Characteristics

Max Health	Max Stamina	Light Attack	Heavy Attack	Stamina consume	Mana consume	Run speed	Walk speed	Climb Speed
200	300	20	30	5	10	600	350	300

Animations

Climb



Walk



Death



Hurt



Idle



Run



Attack1



Attack2



Jump



Special Abilities

Health Spell: Convert Mana to Health

Relevance to Game Story

Kaelis is the lens through which the player experiences the fall and reawakening of Draggaar.

Statistics

class-specific data are driven by Data Tables.

8.4.3 Character #3 (Knight)

Back Story

Forged in exile, tempered by ruin. Kaelis once guarded the gates of Eldrath before the Circle fell to dust. Now, his blade carries the same magic that shattered his realm and has the strength to reclaim it.

Look



Characteristics

Max Health	Max Stamina	Light Attack	Heavy Attack	Stamina consume	Mana consume	Run speed	Walk speed	Climb Speed
250	250	25	35	5	5	500	300	250

Animations

Climb



Walk



Death



Hurt



Idle



Run



Attack1**Attack2****Jump****Special Abilities**

Health Spell: Convert Mana to Health

Relevance to Game Story

Kaelis is the lens through which the player experiences the fall and reawakening of Draggaar.

Statistics

class-specific data are driven by Data Tables.

8.5 Levels**8.5.1 Level #1**

Eldrath Dungeons

Synopsis

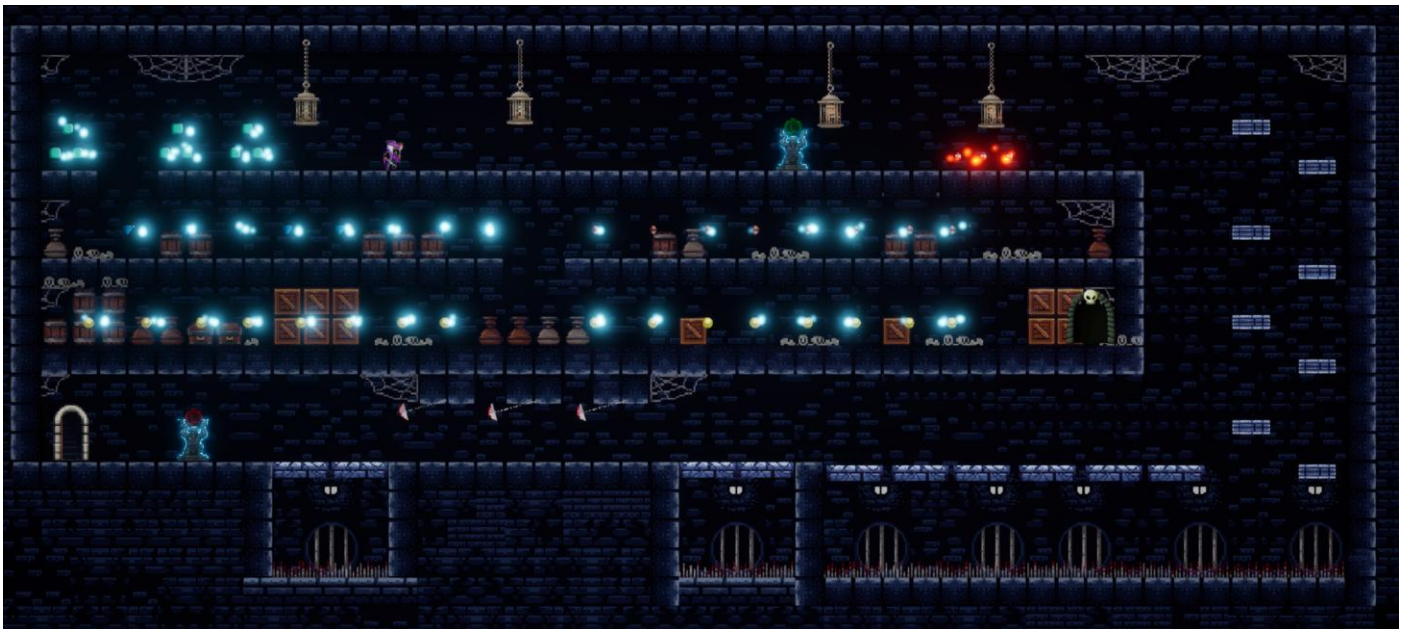
The adventure begins beneath the ancient city of Eldrath, where Kaelis awakens within the abandoned dungeon of the fallen Arcane Circle. The underground prison is now overrun by undead guardians and forgotten traps left behind by the Circle. Here, Kaelis encounters imprisoned survivors and fragments of the realm's lost history. At the deepest chamber of the dungeon, Kaelis faces Thal'Zuur, a corrupted mage who once belonged to the Arcane Circle. After attempting to harness the power of Spellexis centuries ago, he was sealed beneath Eldrath as punishment. Now revived by the weakening seals of Draggaar, Thal'Zuur guards the path forward. Upon defeat, he warns Kaelis that something far worse sleeps beneath the realm.

Introductory Material

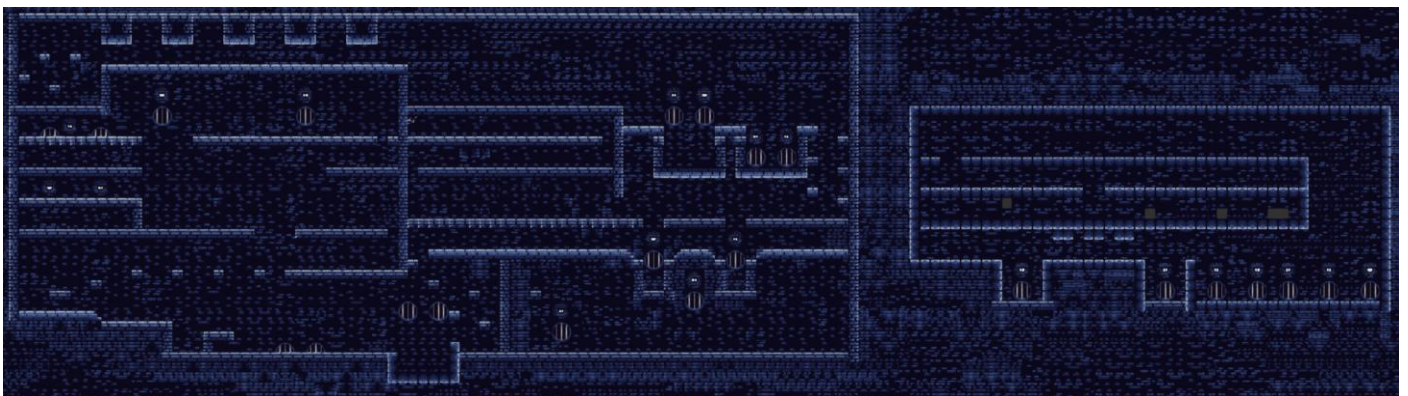
Intro narrative widget + startup flow.

Objectives

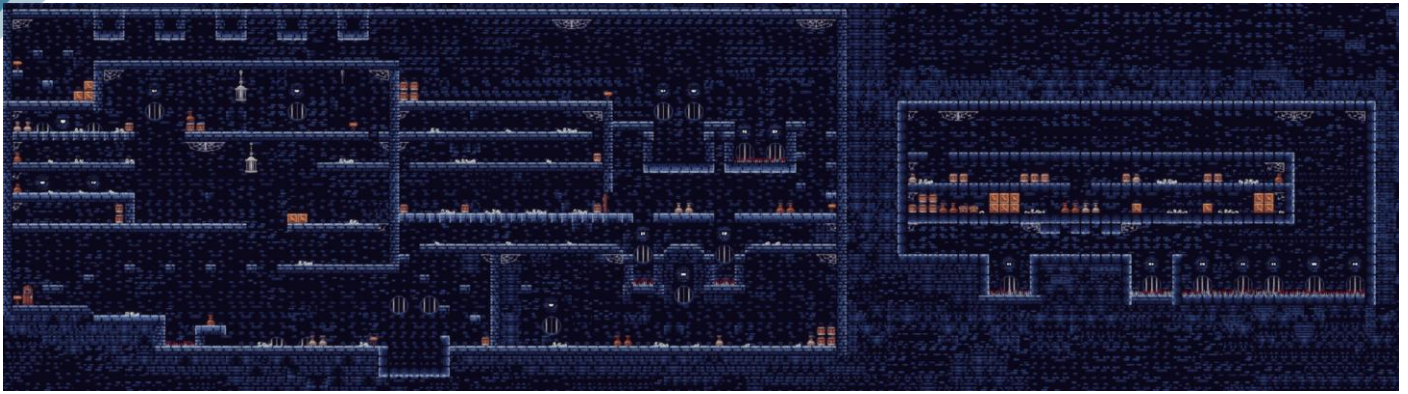
Explore, survive, complete spelling tasks, collect rewards and defeat the boss to unlock progression.



Map

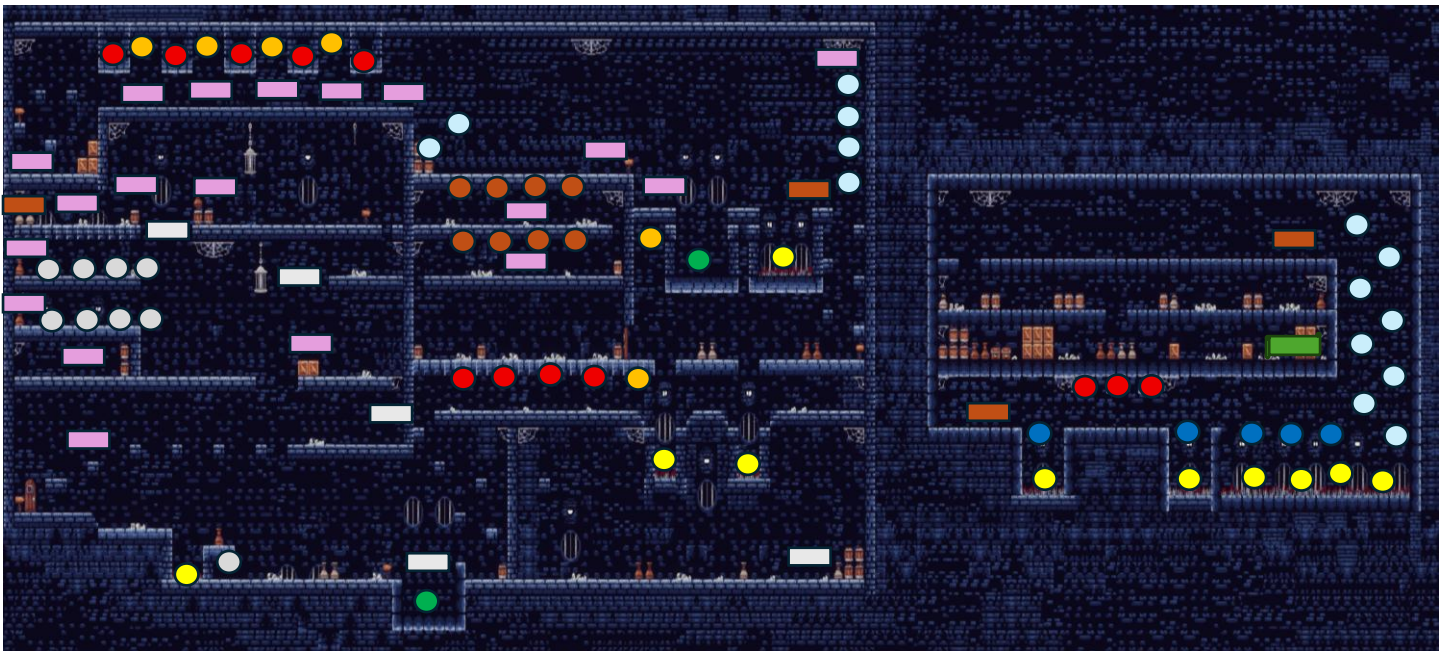


Decoration



Blades ● Fallen Brick ● Poison ● Deadly Spikes ● Flip/Flop Bricks ● Fire Trap ● Fallen Floor ● Rocks ●

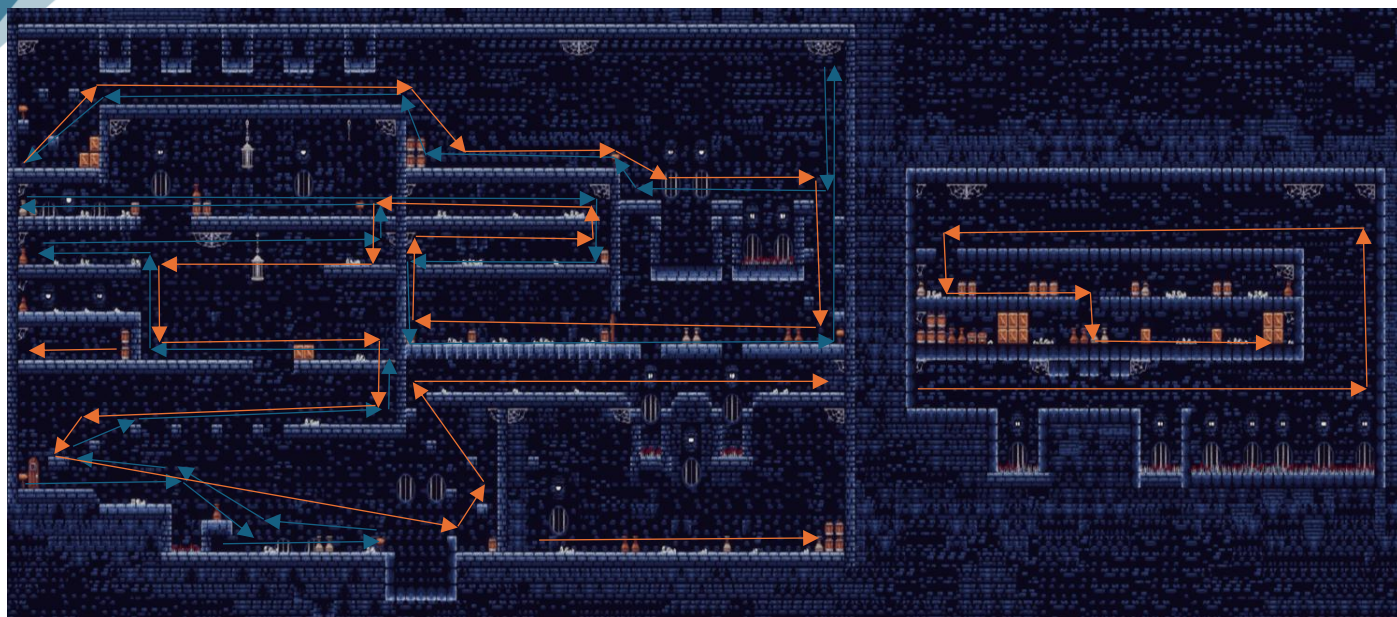
Mini game trigger ■ Hidden object ■ Checkpoint ■ End Level ■



Encounters

Axe Skeleton ★ Archer Skeleton ★ Spear Skeleton ★ Boss ★





Closing Material

Boss defeat, narrative escalation and transition to the next stage.

8.5.2 Level #2

Veilwood Forest

Synopsis

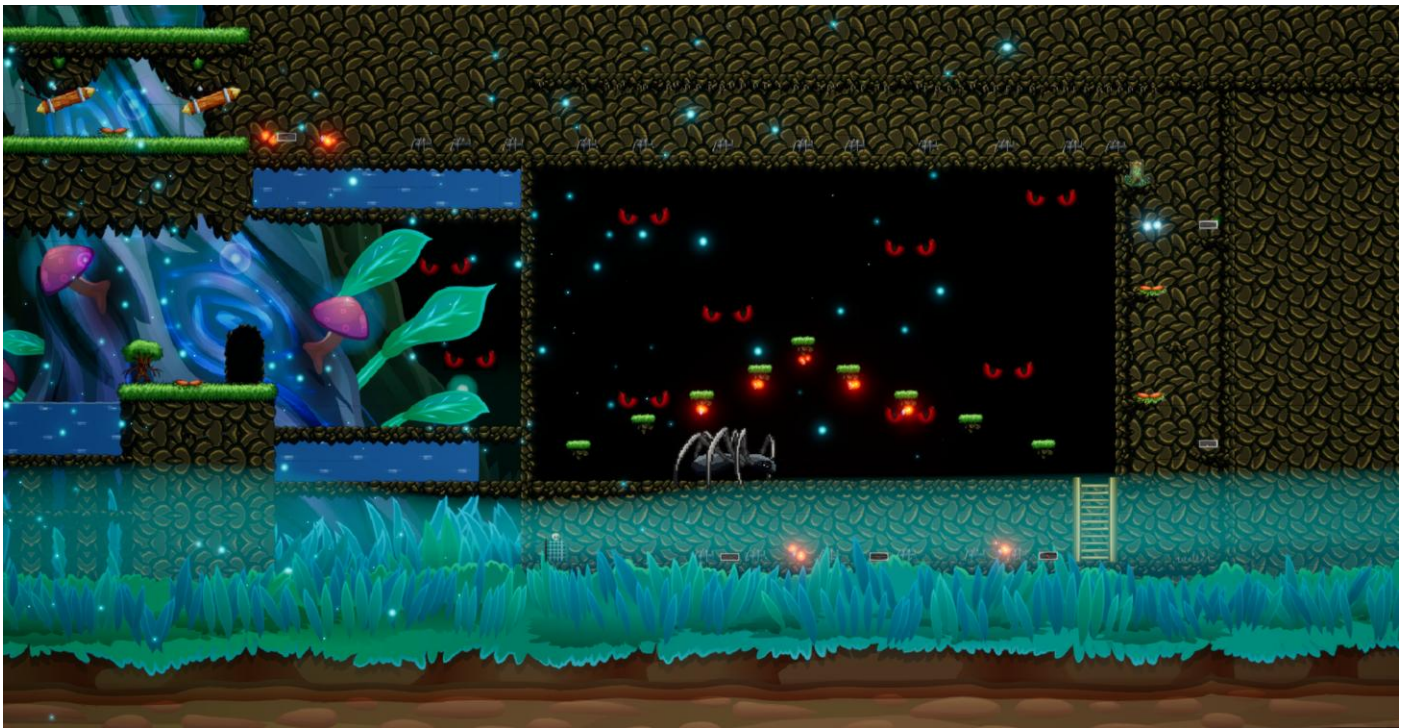
Beyond Eldrath lies the ancient Veilwood Forest, a dense and mysterious woodland where magic still lingers in the roots of towering trees. Once a sanctuary for the Circle's druids and spellkeepers, the forest has become twisted by unstable arcane energy. Creatures corrupted by forgotten spells roam the forest floor. Within Veilwood, Kaelis discovers remnants of the Circle's past and clues pointing toward the source of the realm's awakening power: the volcanic stronghold known as Velgrath Keep.

Objectives

Explore, survive, complete spelling tasks, collect rewards and defeat the boss to unlock progression.

Description

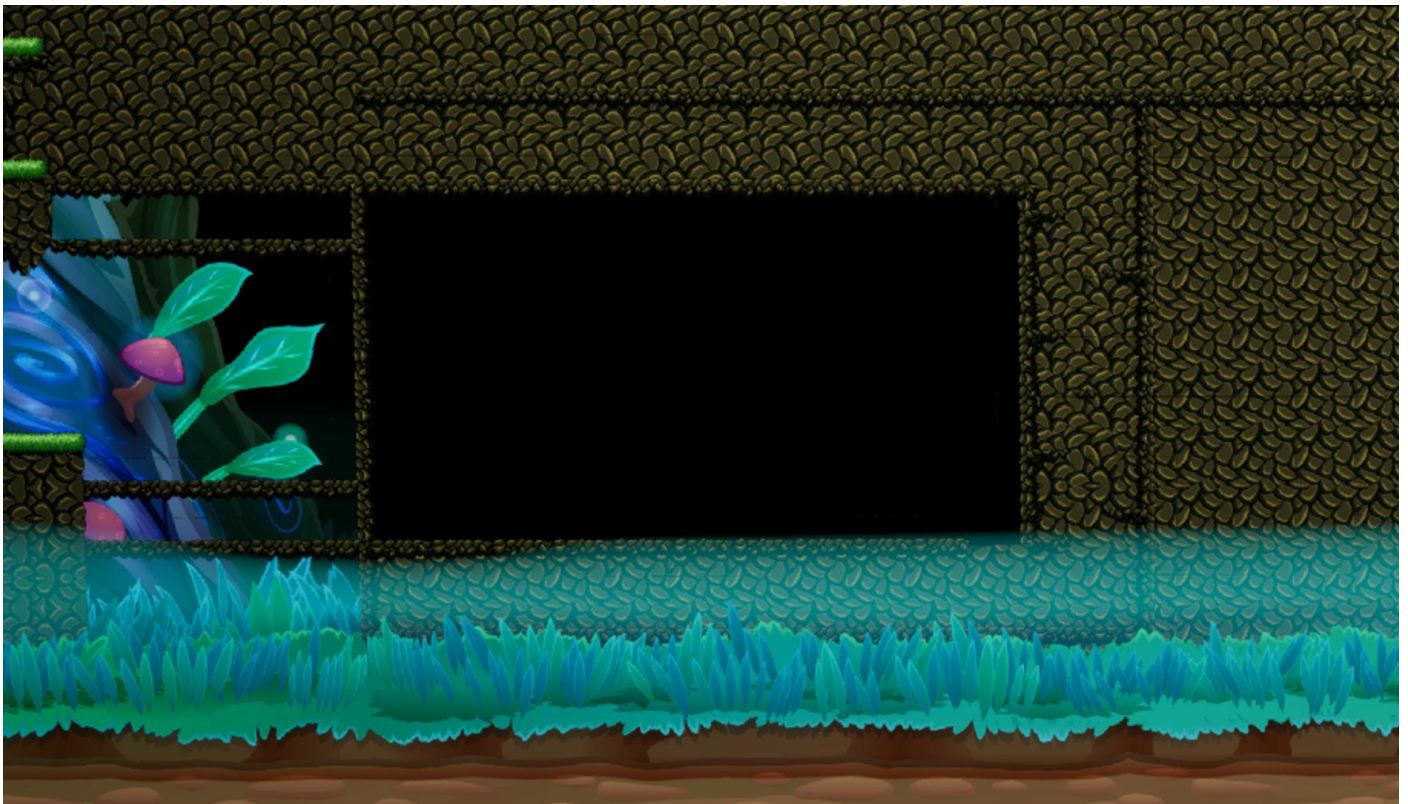






Map

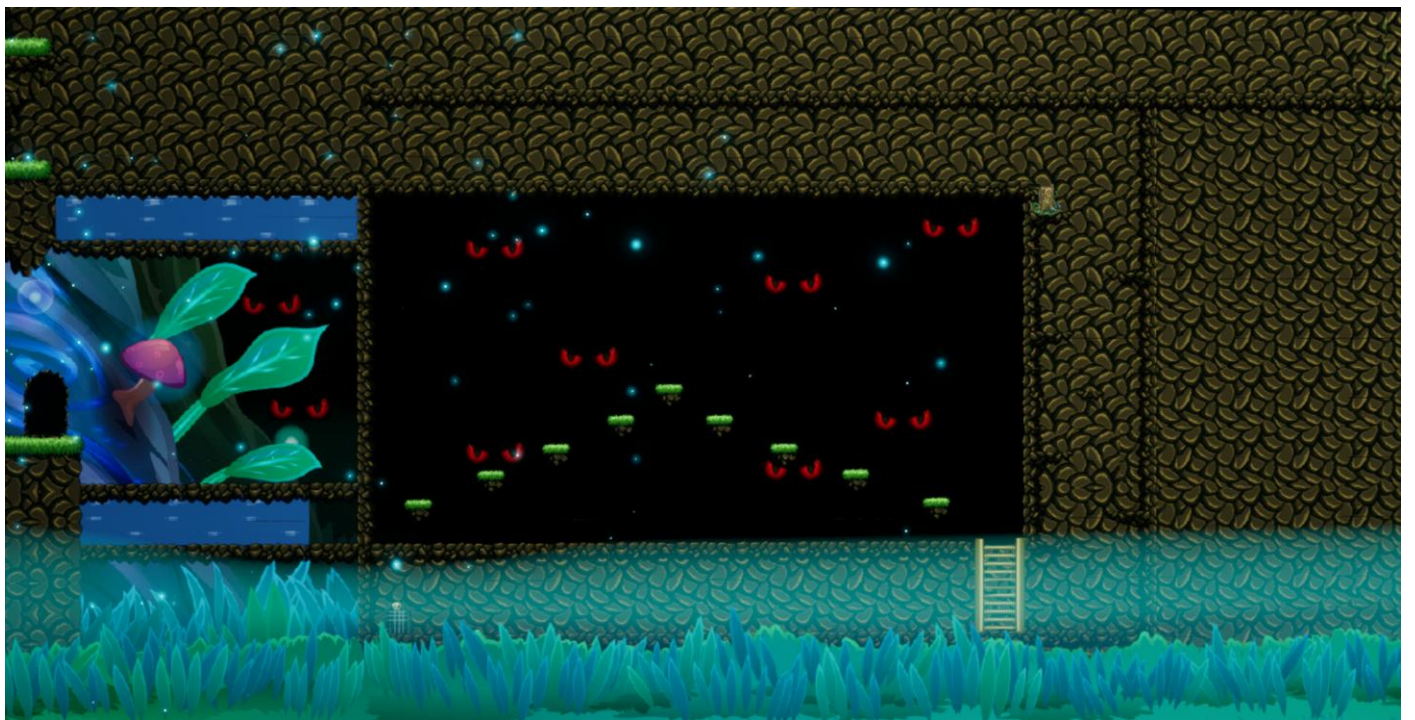






Decoration







Ram ● Fallen Spikes ● Lake ● Deadly Plant ● Moving Platform ○

Mini game trigger ■ Hidden object □ Checkpoint ■ End Level ■ Mine Entrance ■ Mine Exit ■





Ram ● Fallen Spikes ● Lake ● Deadly Plant ● Moving Platform ○

Mini game trigger ■ Hidden object □ Checkpoint ■ End Level ■ Mine Entrance ■ Mine Exit ■



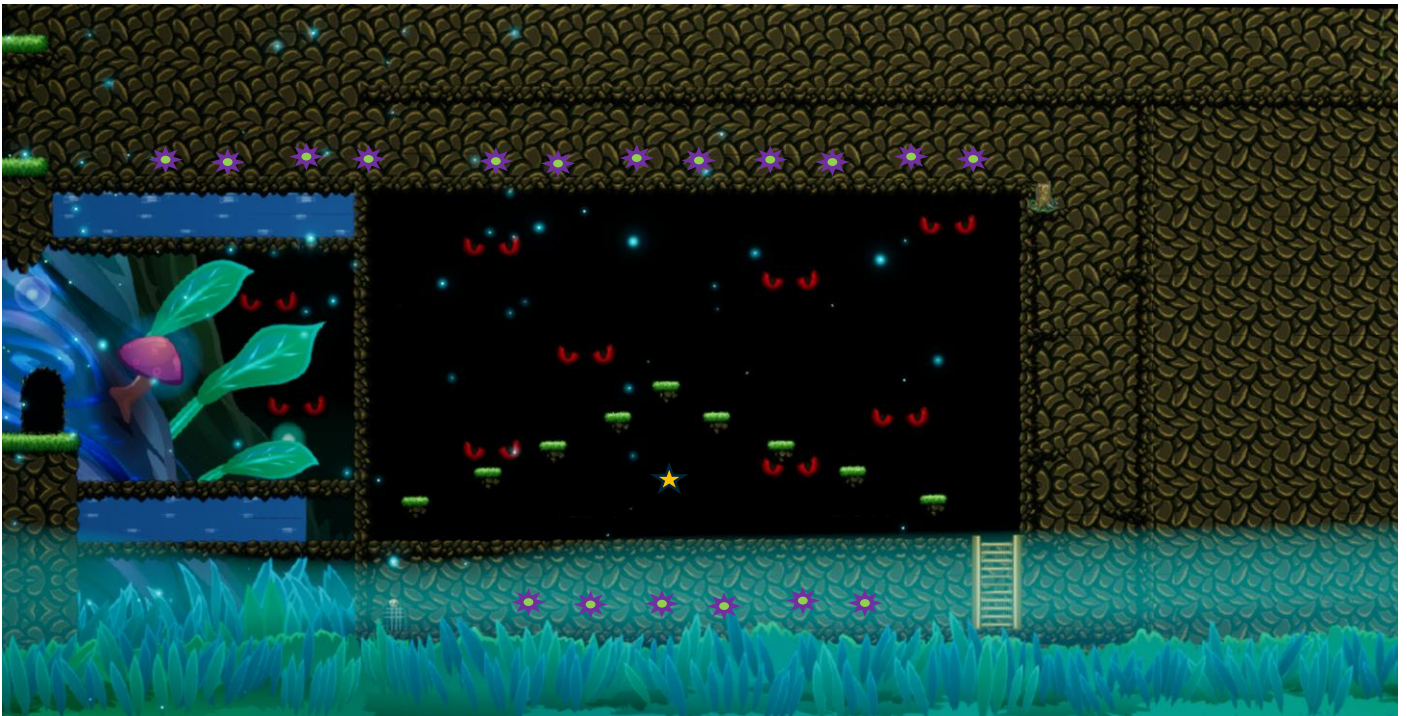


Encounters

Ent  Snake  Orc  Mosquito  Spider  Spider MiniBoss  Boss 



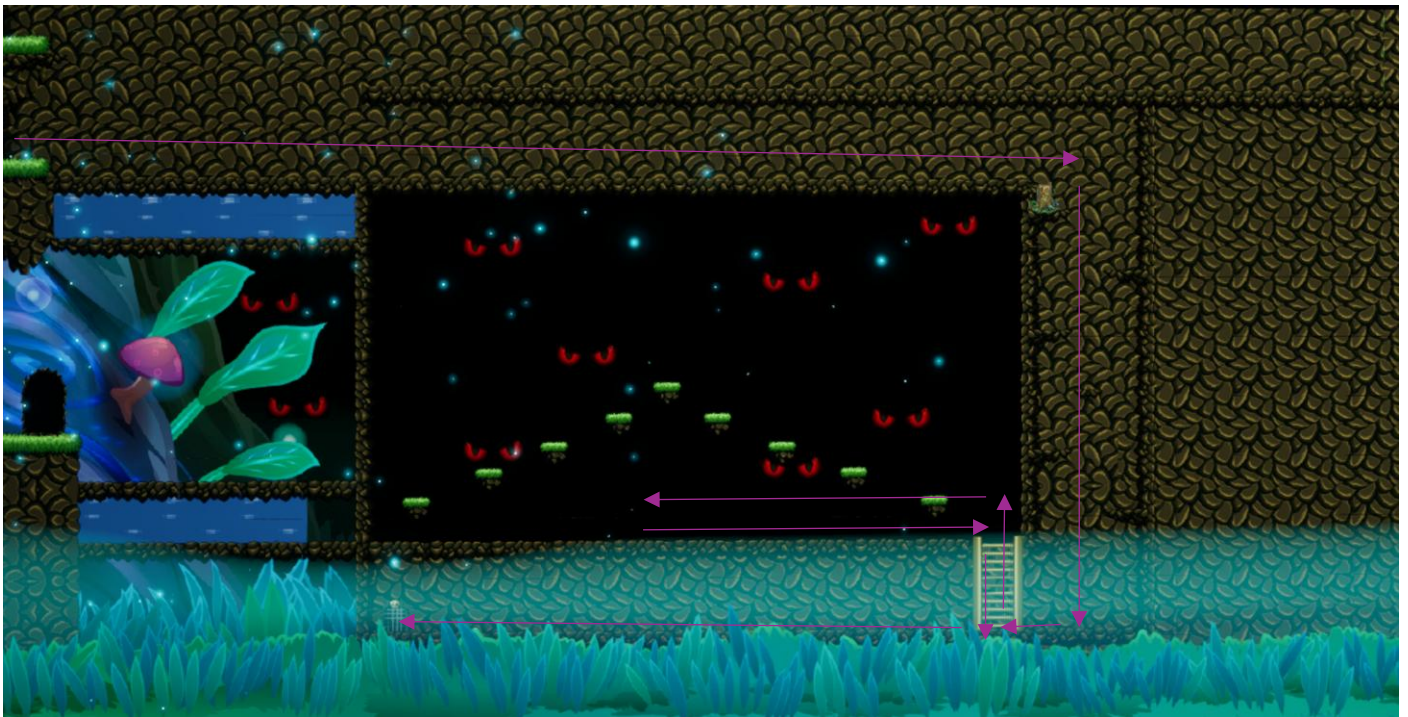
Ent  Snake  Orc  Mosquito  Spider  Spider MiniBoss  Boss 





Level Walkthrough







Closing Material

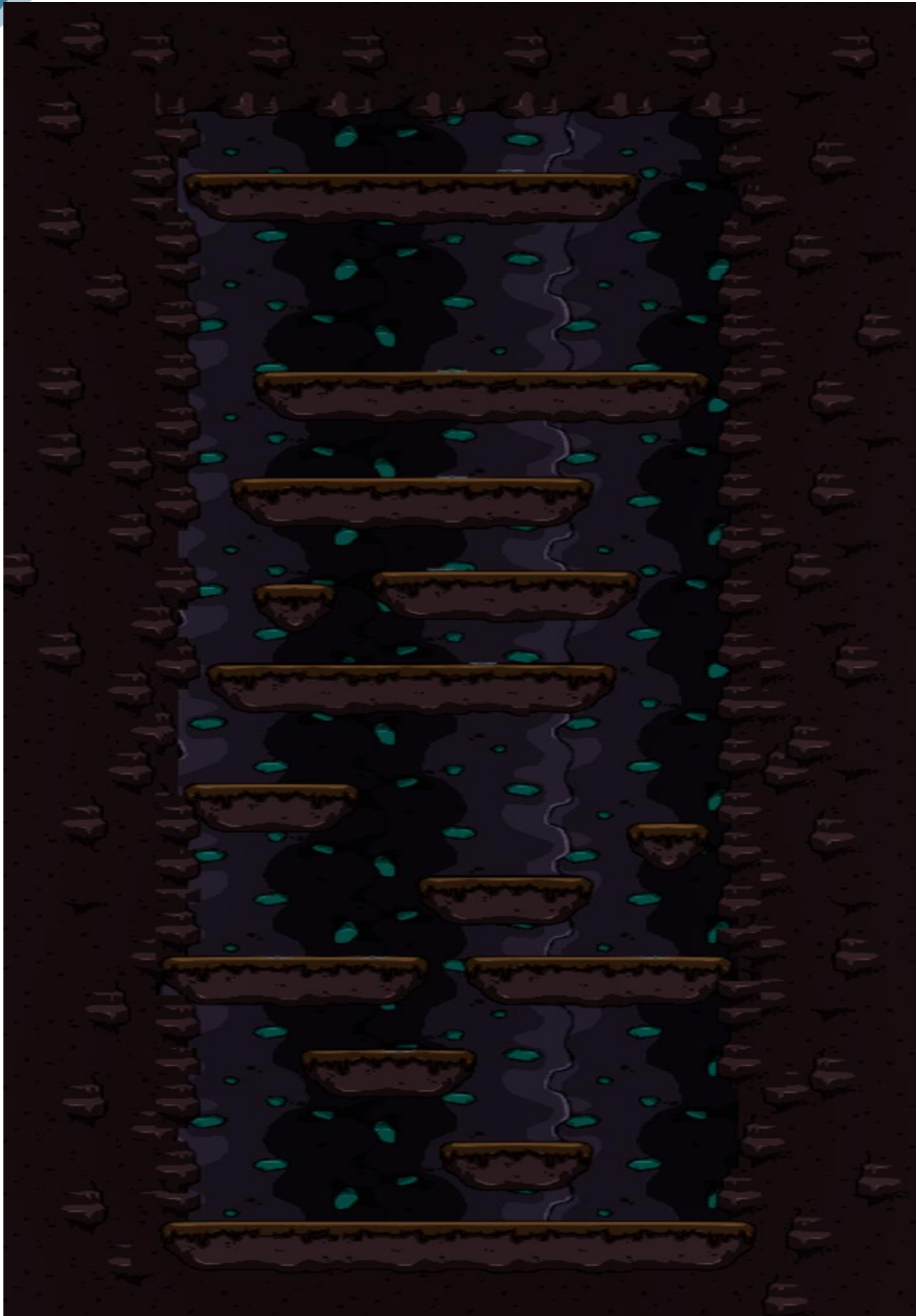
Boss defeat, narrative escalation and transition to the next stage.

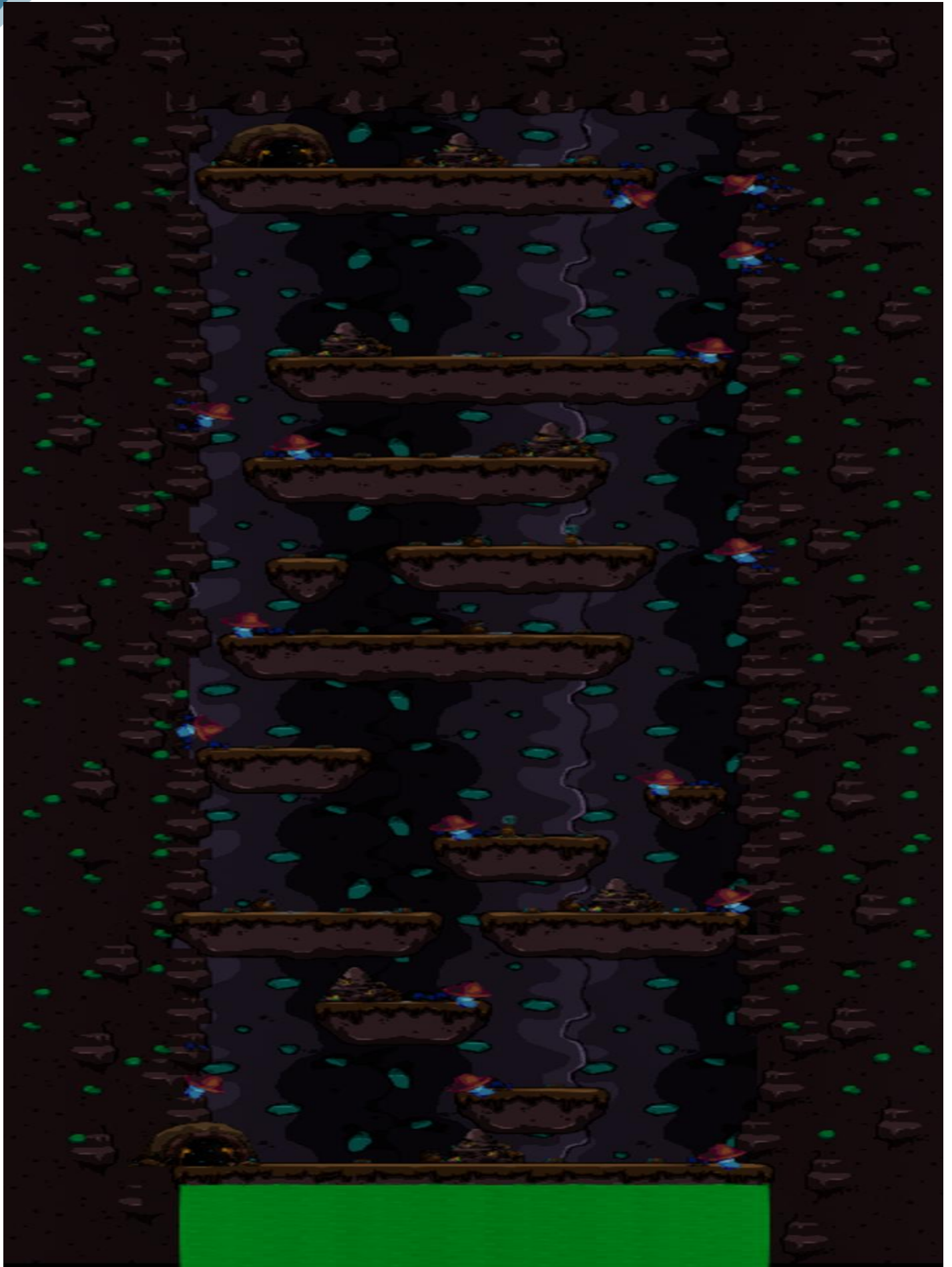
8.5.3 Sub Level mines

Objectives

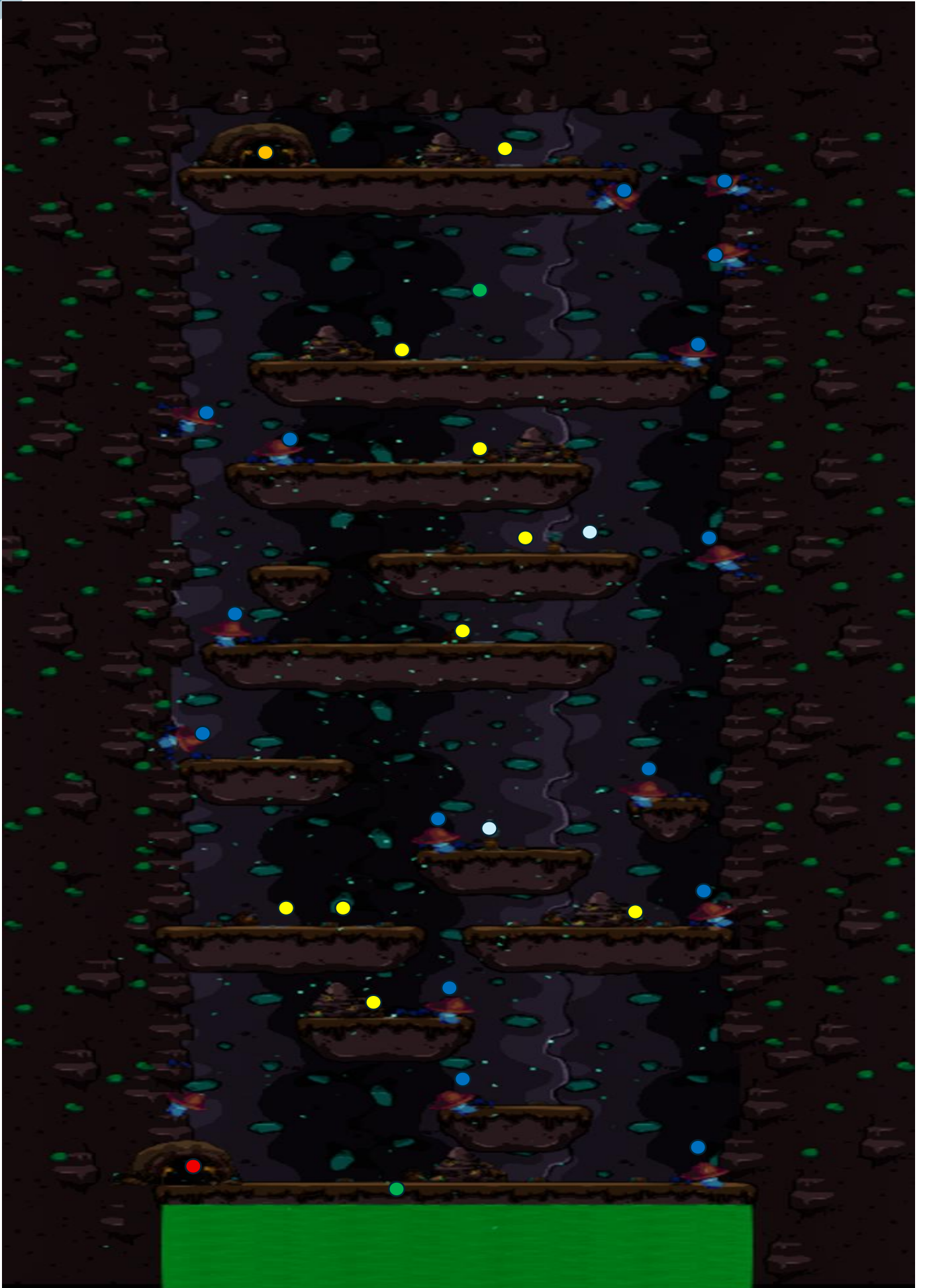
Collect gems survive return to forest map.

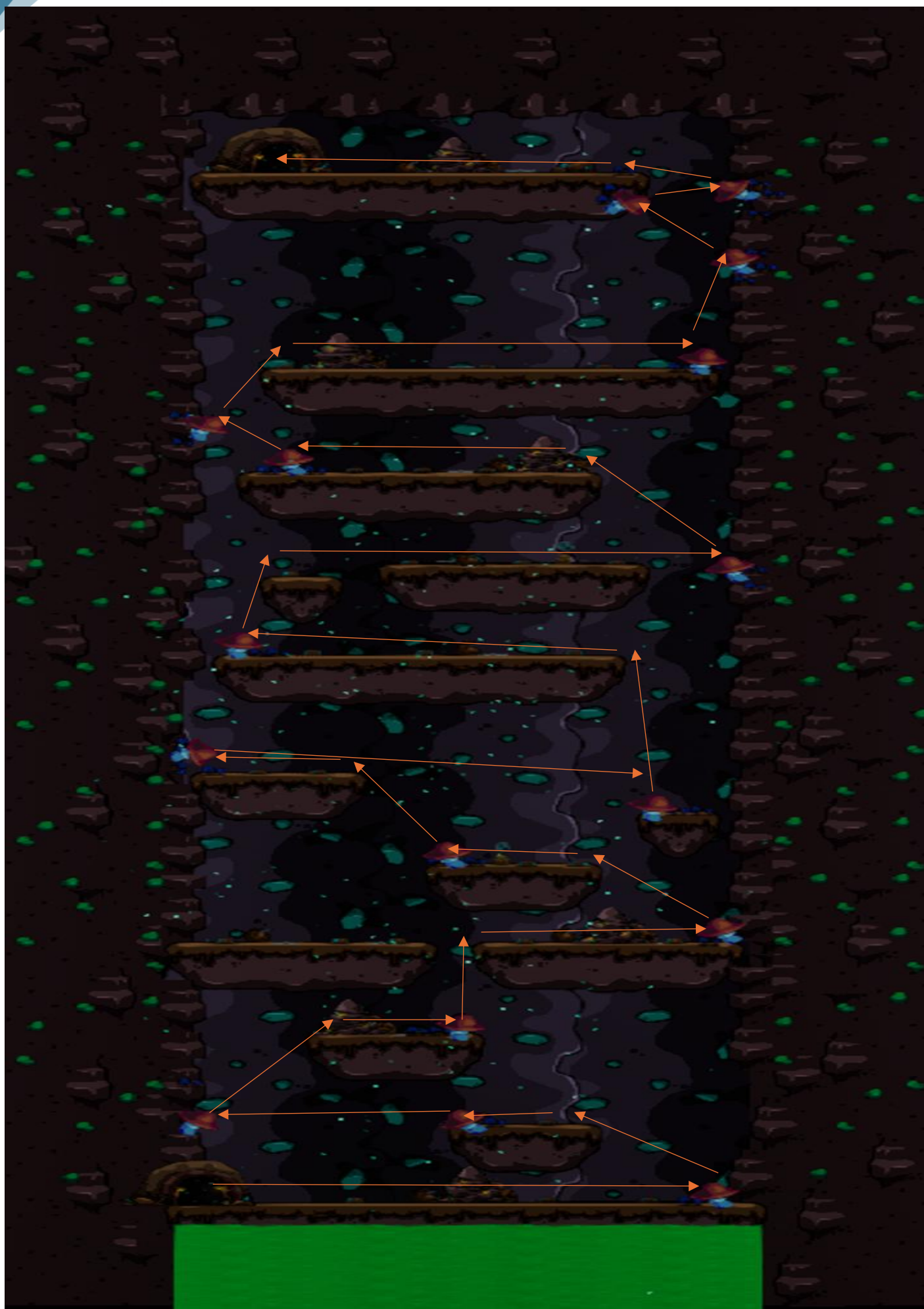






Entrance ● Exit ● Rising Poison ● Jumping Mushrooms ● Check Point ○ Trap ●





8.6 User Interface (UI-UX)

Visual System

The interface combines gameplay HUD elements with educational widgets. It includes health/mana/stamina bars, gem counters, damage numbers, boss bars, spelling slots and letter buttons. See [Character System Architecture \(Appendix J\)](#), [Mini-Game System Architecture Diagram \(Appendix C\)](#) and [Boss Fight System Architecture \(Appendix F\)](#).

HUD

The Hud controls the widget and is the manager for the visual presentation. It manages communication between widgets and updates the player overlay values. Health, Stamina, Mana, XP Points, gems, showing damages, mini games and boss fight. The UI updates through delegates and widget references.

Menus

Menus include intro, language selection, Main Menu, Help, quit, Pause game, Pause Boss fight, Death Menu and Confirmation Menu.

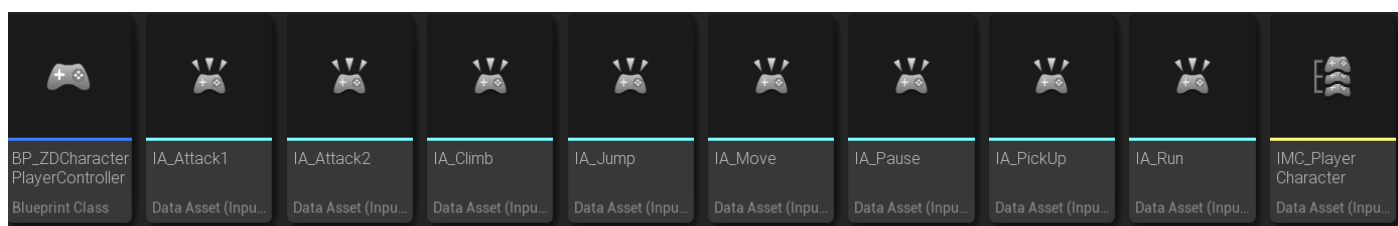
Camera

The camera generally follows standard side-scrolling gameplay, but boss fights change the active view target to a static camera that support encounter framing.

Lighting Model

For lighting emmersive color is used inside the levels (Torch)





8.7 Audio

Music

- Intro Music plays through the game until the 1st level (dungeon starts)
- Music in cut scenes
- All Levels Have their own Ambience music.

Sound Effects

- Pick up SFX
- Hit action SFX
- Death SFX
- Enable & disable Traps SFX
- Traps SFX

- Damage SFX
- Click Buttons SFX
- Decoration objects SFX (Floating Cage)
- Actions SFX

Sound Attenuation implemented to provide a realistic 3D spatial audio environment, enhancing player immersion through distance-based volume scaling and spatialization.

8.8 Help System

The help system is a visual presentation inside the Main Menu. It explains the inputs, how to interact with triggers for mini games, how to play the mini game and the items that can overlap for getting health and mana

8.9 Artificial Intelligence

Opponent AI

Spellexis does not use a strategic opponent AI in the sense of a strategy game, but it does use combat enemy AI with targeting, hit reaction and melee/ranged behaviours

Enemy AI

Enemies inherit from BP_BaseEnemy and use Blackboard values for alive state, hit reacting, combat target and ranged attack capability. Difficulty scaling adjusts health and damage. See [Enemy System Architecture \(Appendix M\)](#), [Enemy Gameplay Loop \(Appendix N\)](#) and [Ranged Enemy Attack Flow \(Skeleton Archer\) \(Appendix P\)](#).

Non-Combat Characters

The levels will include non-combat characters

Friendly Characters

No friendly characters

Player and collision detections

Collision and overlap events are used heavily for pickups, mini-game triggers, boss triggers, ladders, hazards and attacks.

8.10 Technical

Target hardware

PC (Windows)

Hardware Specifications

Spellexis is designed to run on mid-range desktop and laptop systems. As a 2D serious game developed in Unreal Engine 5, it does not require high-end gaming hardware, but benefits from a dedicated graphics card and SSD storage for smoother loading and stable performance.

Minimum requirements

OS: Windows 10 64-bit

Processor: Intel Core i3 8th gen or AMD Ryzen 3 1200

Memory: 8 GB RAM

Graphics: NVIDIA GTX 750 Ti / GTX 950, AMD RX 550, or equivalent

DirectX: Version 11 or 12

Storage: 8–12 GB available space

Resolution / target: 1280×720 at low/medium settings

Recommended requirements

OS: Windows 10 or Windows 11 64-bit

Processor: Intel Core i5 10th gen or AMD Ryzen 5 3600

Memory: 16 GB RAM

Graphics: NVIDIA GTX 1650 / GTX 1060 or AMD RX 580 or better

DirectX: Version 12

Storage: SSD with 12–20 GB free space

Resolution / target: 1920×1080 at stable performance

Development Procedures and standards

The project follows modular Blueprint architecture, event-driven communication, data-driven gameplay and persistent save state logic.

Game Engine

Unreal Engine 5.4.4 (Visual coding)

Overall System view

For an overall system view, see [Full Game Architecture Diagram \(Appendix I\)](#), [Character System Architecture \(Appendix J\)](#) and [Save / Load System Architecture \(Appendix Q\)](#)

8.11 Game Art

Concept Art

Visual approach combining the exploration of ancient ruins with the power of word magic.

Mood & Atmosphere:

- The aesthetic is based on the "Forgotten Realm" of Draggaar, with a strong emphasis on shadows and lighting originating from magical sources.

- Environments should evoke a sense of mystery and ancient danger, avoiding overly "childish" colors to remain engaging for players aged 10+.

Environment Concept:

- **Eldrath Dungeons:** Dark, stone dungeons cages, traps, light from torches and skeleton enemies.
- **Veilwood Forest:** A dense forest with earthy tones (deep green, brown), where tree roots glow with unstable arcane energy.
- **Velgrath Keep:** A warm-colored environment (red, orange, volcanic black), conveying a sense of intense heat and volcanic power.

Visual integration of educational Elements:

- **Visual Feedback:** When a word is spelled correctly, the visual effect should be a burst of light or energy that "strikes" the enemy or unlocks a path, making learning an integral part of the action.
- **Magical Runes:** Letters and words in mini-games do not appear as plain text; they are glowing runes floating in the air, reinforcing the visual connection to the magic of Spellexis.

Style Guides

Art Style:

- **2D Platformer Aesthetic:** The game utilizes a 2D platformer style built with modular Blueprint architecture in Unreal Engine 5.
- **Visual Tone:** A serious and "dark fantasy" tone is maintained to avoid a childish appearance that might discourage older students (aged 10+).

Color Palette

- **High Contrast:** Use of strong color contrasts between letters and backgrounds to facilitate easier character recognition.
- **Functional Coloring:** Different colors and shapes are applied to letters (Visual channel) to enhance orthographic recognition.
- **Thematic Colors:** Dominance of blue (arcane/magic), green (nature/forest), and red (lava/keep) depending on the specific level environment.

Typography & UI Design

- **Dyslexia-Friendly Fonts:** Selection of fonts with clean designs and appropriate spacing (kerning) to reduce visual confusion.
- **Dynamic UI Elements:** Letters appear as "Letter Buttons" placed within "Word Slots" using dynamic slot index calculation.
- **Multisensory Feedback:** Simultaneous display of Word Text and Word Images to strengthen the connection between meaning and spelling.

UI Feedback & Accessibility

- **Success/Fail Indicators:** Clear visual effects and sounds for correct and incorrect spelling attempts (Correct/Wrong Visual feedback).

- **Tier Visuals:** Automatic updates to visual difficulty indicators (Easy, Medium, Hard, Very Hard) based on the player's performance score.

Characters

The character design follows a "Dark Fantasy" philosophy to maintain the interest of older learners 10+ while ensuring clear visual communication.

Undead Enemies:

- **Skeleton Melee/Spear:** Skeletons equipped with spear. Designed with strong silhouettes to ensure they are easily recognizable during fast-paced platforming combat
- **Skeleton Melee/Axe:** Skeletons equipped with axe, Designed with strong silhouettes to ensure they are easily recognizable during fast-paced platforming combat
- **Skeleton Archer:** Features a visually distinct bow and a specific "Ranged Attack Animation" that precedes the spawning of the projectile arrow.

Enemy Visual Feedback

- **UI Integration:** Every enemy features an overhead "Enemy Health Bar" (WBP_EnemyHealthBar).
- **Combat Feedback:** Visual "Damage Numbers" pop up upon impact, providing immediate reward and clarity for the player's actions.

Cut Scenes

The narrative sequences in *Spellexis* are designed to advance the lore of Draggaar while remaining accessible and engaging for the target audience.

- **Intro Sequence:** Features the Unreal and Fallen Angel logos, followed by a cinematic intro video.
- **Game Intro:** Typewriter Narrative Text" effect presents the story's introduction during the loading screen phase.
- **Visual Style:** Uses static and semi-animated 2D illustrations that maintain the game's dark fantasy aesthetic.
- **Level Intro:** Typewriter Narrative Text" effect presents the level story's introduction
- **Level Visual Style:** Uses static and semi-animated 2D illustrations that maintain the game's dark fantasy aesthetic.
- **Boss Intros:** Upon triggering a boss fight, the camera automatically switches to a "Boss View" and a dialogue begins. Count down timer before the fight. Focusing on the antagonist to build tension before combat begins

8.12 Secondary Software

Gimp, Audacity, CapCut, Piskel.

8.13 Localization Plan

Spellexis supports English, Greek and Estonian through a data-driven localization pipeline. Language selection occurs early in the startup flow and the chosen language is stored in BP_GameInstance. This drives the current word list, letter sounds, textures and educational media used by mini-games and boss fights. See [Localization System Architecture \(Appendix V\)](#), [Language Selection Flow](#)

8.14 Management

Schedule

PROJECT PLAN

October - November	November- February	February – May
Reference research <input checked="" type="checkbox"/>	Create Story <input checked="" type="checkbox"/>	Difficulty System <input checked="" type="checkbox"/>
Ethical Form <input checked="" type="checkbox"/>	Create 1 st level <input checked="" type="checkbox"/>	Full word hearing <input checked="" type="checkbox"/>
Game concept <input checked="" type="checkbox"/>	Flow game <input checked="" type="checkbox"/>	Boss difficulty algorithm <input checked="" type="checkbox"/>
Find & Create assets <input checked="" type="checkbox"/>	Multilanguage support <input checked="" type="checkbox"/>	Level up system <input checked="" type="checkbox"/>
	Save-load <input checked="" type="checkbox"/>	Create 2 nd level (Forest) <input checked="" type="checkbox"/>
	Literature Review <input checked="" type="checkbox"/>	Testing – debugging <input checked="" type="checkbox"/>
	Testing <input checked="" type="checkbox"/>	Fixing bugs <input checked="" type="checkbox"/>
	Fixing bugs <input checked="" type="checkbox"/>	Game Design Document <input checked="" type="checkbox"/>
	Package Game V1.0 <input checked="" type="checkbox"/>	Final thesis <input checked="" type="checkbox"/>
		Package Game V2.0 <input checked="" type="checkbox"/>
		BackSpace Functionality <input checked="" type="checkbox"/>
		Package Game V3.0 <input checked="" type="checkbox"/>
		Visual Word in Mini-Game <input checked="" type="checkbox"/>
		Visual Word in Boss-Fight <input checked="" type="checkbox"/>
		Microsoft Evaluation Form <input checked="" type="checkbox"/>
		Create SubLevel(Mine) <input checked="" type="checkbox"/>
		Create Mini Boss. <input checked="" type="checkbox"/>
		Loot Mechanic <input checked="" type="checkbox"/>

Risk Analysis

- Scope creep due to many systems (combat, mini-games, boss logic, localization, save/load).
- Balancing educational readability with game challenge.
- Maintaining correct persistence across levels and widgets.

Test Plan

- Validate startup flow: intro, language selection, menu transitions, continue/new game logic.
- Validate spelling mini-games: correct/incorrect answers, audio cues, slot reset, reward assignment.
- Validate boss fights: timer, damage application, reset behavior, win/lose states.
- Validate save/load: player transform, collected items, solved mini-games, defeated enemies, checkpoints and difficulty restoring.
- Validate Dynamic difficulty in boss fights
- Validate difficulty choice from difficulty menu
- Validate localization: correct word table, correct audio, correct letter textures and UI text per language
- Validate playing the correct animations
- Validate the character statics

8.15 Dynamic Difficulty Boss Fight System

The Dynamic Difficulty Adjustment (DDA) system in the boss fight modifies the challenge level according to the player's performance. After each round, the system evaluates whether the player succeeded or failed in the spelling task and adjusts the Difficulty Score accordingly. The magnitude of change depends on the current difficulty tier, making upward progression slower at higher levels and downward correction stronger after mistakes. This design ensures that players are challenged appropriately without becoming trapped in a difficulty tier beyond their capabilities.

The score modification depends on the current tier:

- **Easy:** Success +15 fail -5
- **Medium:** success +10, fail -10
- **Hard:** success +5, fail -15
- **Very Hard:** success +5, fail -20

After the score is updated, the function `UpdateTierFromScore` assigns the new difficulty tier using predefined thresholds:

- **Easy:** Score < 25
- **Medium:** 25 <= Score < 50
- **Hard:** 50 <= Score < 70
- **Very Hard:** Score >= 75

8.16 Experience point system

XP Thresholds

- Level 1 → 2: 100 XP
- Level 2 → 3: 250 XP
- Level 3 → 4: 450 XP
- Level 4 → 5: 700 XP
- Level 5 → 6: 1000 XP
- Level 6 → 7: 1350 XP
- Level 7 → 8: 1750 XP
- Level 8 → 9: 2200 XP
- Level 9 → 10: 2700 XP

This scaling allows fast early progression and slower late-game progression.

Class-Based Stat Progression

When the player levels up, different stat bonuses are applied depending on the selected character class.

	Mage	Fighter	Rogue
MaxHealth	+8	+15	+10
MaxMana	+18	+2	+3
MaxStamina	+6	+10	+12
AttackDamage1	+5	+3	+4
AttackDamage2	+8	+6	+8

After applying the increases, the following current values are refilled and a Niagara system is attached to the character and plays once, this makes each level up feel immediately rewarding to the player.

- **Health = MaxHealth**
- **Mana = MaxMana**
- **Stamina = MaxStamina**

9 Appendix – System Flowcharts

9.1 Appendix A - Start Game Flow Chart

This flowchart illustrates the startup and menu flow of Spellexis, implemented in Unreal Engine using Blueprints. The process begins in the Intro level, where the BeginPlay event casts to BP_GameInstance, starts the intro music, and creates the WBP_Intro widget. Player input is disabled while the intro sequence is presented. The intro sequence contains three main stages: the Unreal logo animation, the Fallen Angel logo animation, and the cinematic intro video. After the video finishes, the player is taken to the language selection screen, where they can cycle through available flags and choose a language. The selected language updates the current culture and loads the correct localization data tables. Next, the system displays a loading screen. During this phase, a typewriter-style narrative text effect presents the story introduction, while a progress bar simulates loading. When loading reaches 100%, the progress bar is hidden, a “Press Any Key” prompt appears, and player input is re-enabled. Once the player presses a key, the intro widget is removed, a hardware benchmark is executed, settings are applied, and the game opens the StartMap level. Inside StartMap, the WBP_StartScreen widget is created and shown with UI-only input mode. The main menu then gives the player four primary options: Start Game, Continue, Options, and Quit. If the player chooses Start Game, the system deletes old game data, marks the session as a new game, saves the selected difficulty, and opens the Character Selection widget. If the player chooses Continue, the system loads existing save data, restores game mode input, and removes the start screen widget. If the player opens Options, they can navigate to the Difficulty Selection overlay and choose between Easy, Medium, or Hard, after which the selected difficulty is saved and the system returns to the main menu. Choosing Quit closes the game.

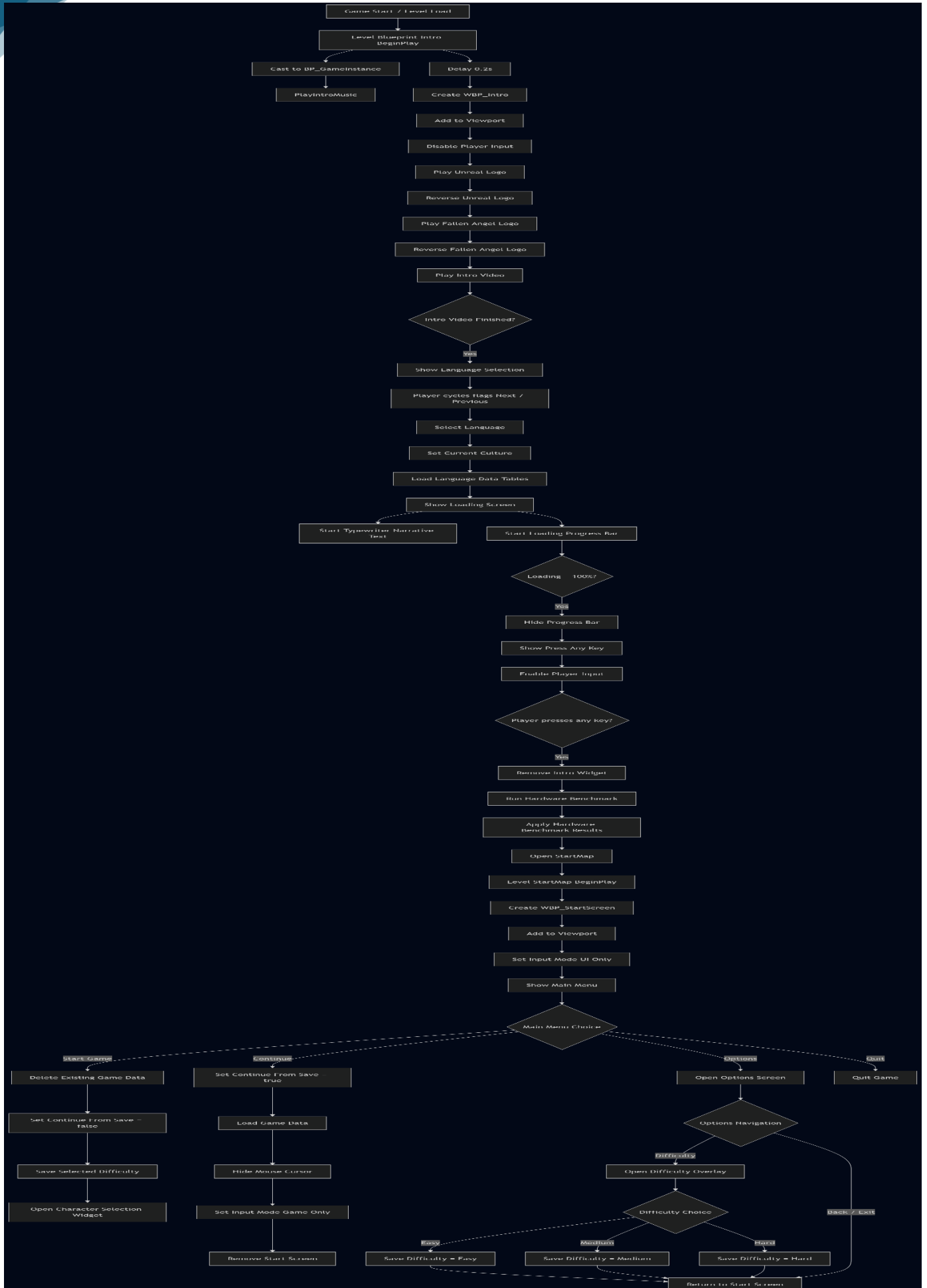


Figure A. Start Game Flow Chart

9.2 Appendix B - Mini-Game System Flowchart

This flowchart describes the architecture of the Spellexis spelling mini-game system, implemented using Unreal Engine Blueprints. When the level loads, each BP_MiniGameTrigger actor executes the BeginPlay event. The system retrieves the trigger identifier (SolvedID) and checks the player's saved data to determine whether the mini game has already been completed. If the mini game has been solved previously, the trigger immediately applies to a solved visual state. Otherwise, it waits for player interaction. When the player overlaps the trigger, the system opens the WBP_MiniGame widget and temporarily disables player movement. The mini game initializes its data by loading the word, corresponding letter sounds, and visual assets from Data Tables designed to support multiple languages. During gameplay, the player selects letters to spell the target word. If the spelling is incorrect, feedback is provided through sound cues. When the correct spelling is achieved, the system marks the mini-game as solved, updates the Save Game data structure, and records the solved mini-game identifier. Finally, the result screen is shown briefly before the mini-game widget closes. Player movement is restored and the trigger updates its visual state to indicate completion.

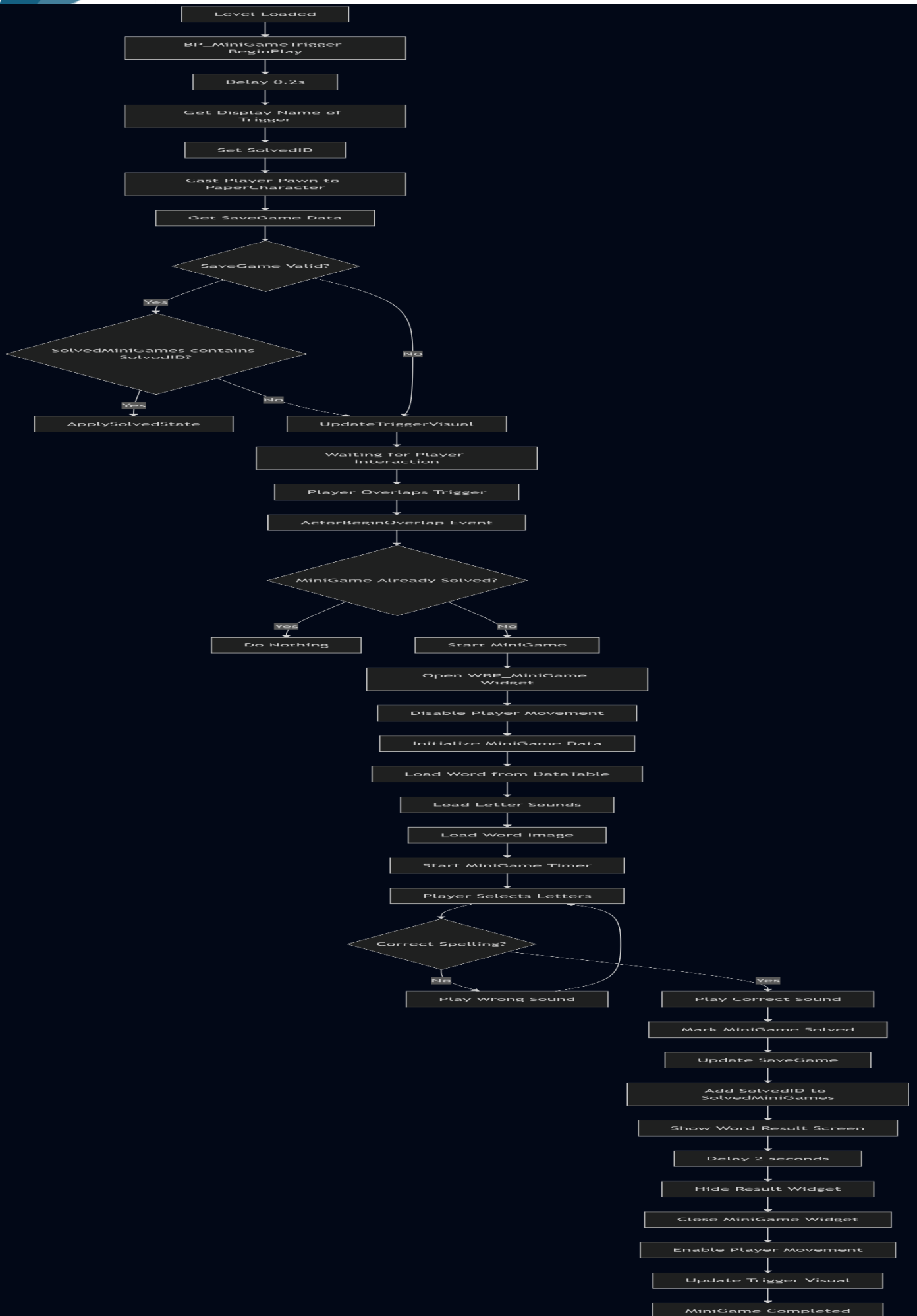


Figure B. Mini-Game System Flowchart

9.3 Appendix C - Mini-Game System Architecture Diagram

The mini-game system is composed of several interconnected components. The player interacts with a BP_MiniGameTrigger, which launches the WBP_MiniGame widget. The widget retrieves gameplay data from Data Tables that store multilingual words, letter sounds, and images. When the mini-game is completed, the system updates the save Game object, which stores the identifiers of solved mini-games. This information is used by triggers to visually update solved locations.

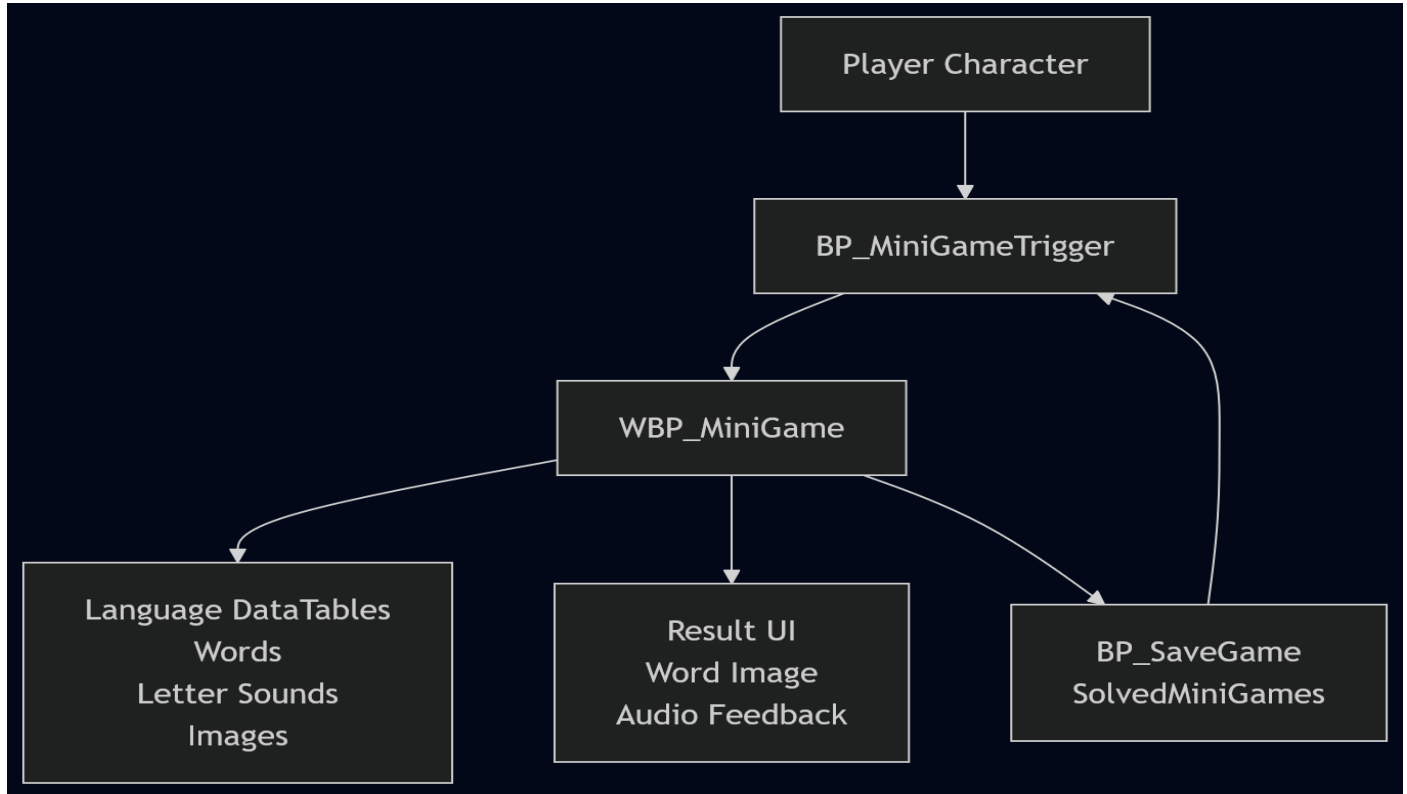


Figure C. Mini-Game System Architecture Diagram

9.4 Appendix D - Mini-Game Gameplay Loop Diagram

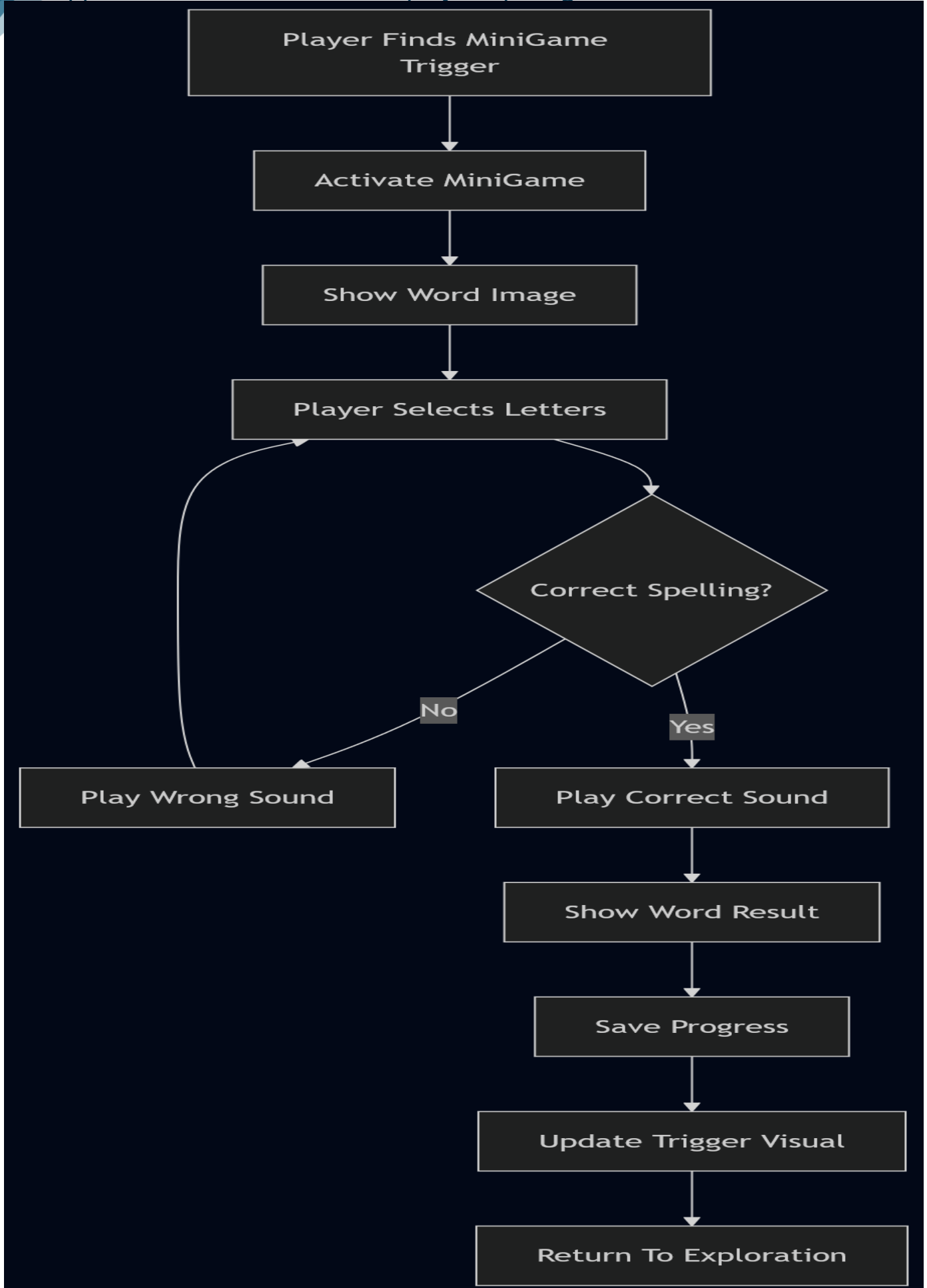


Figure D. Mini-Game Gameplay Loop Diagram

9.5 Appendix E - Mini-Game Blueprint Logic Flowchart

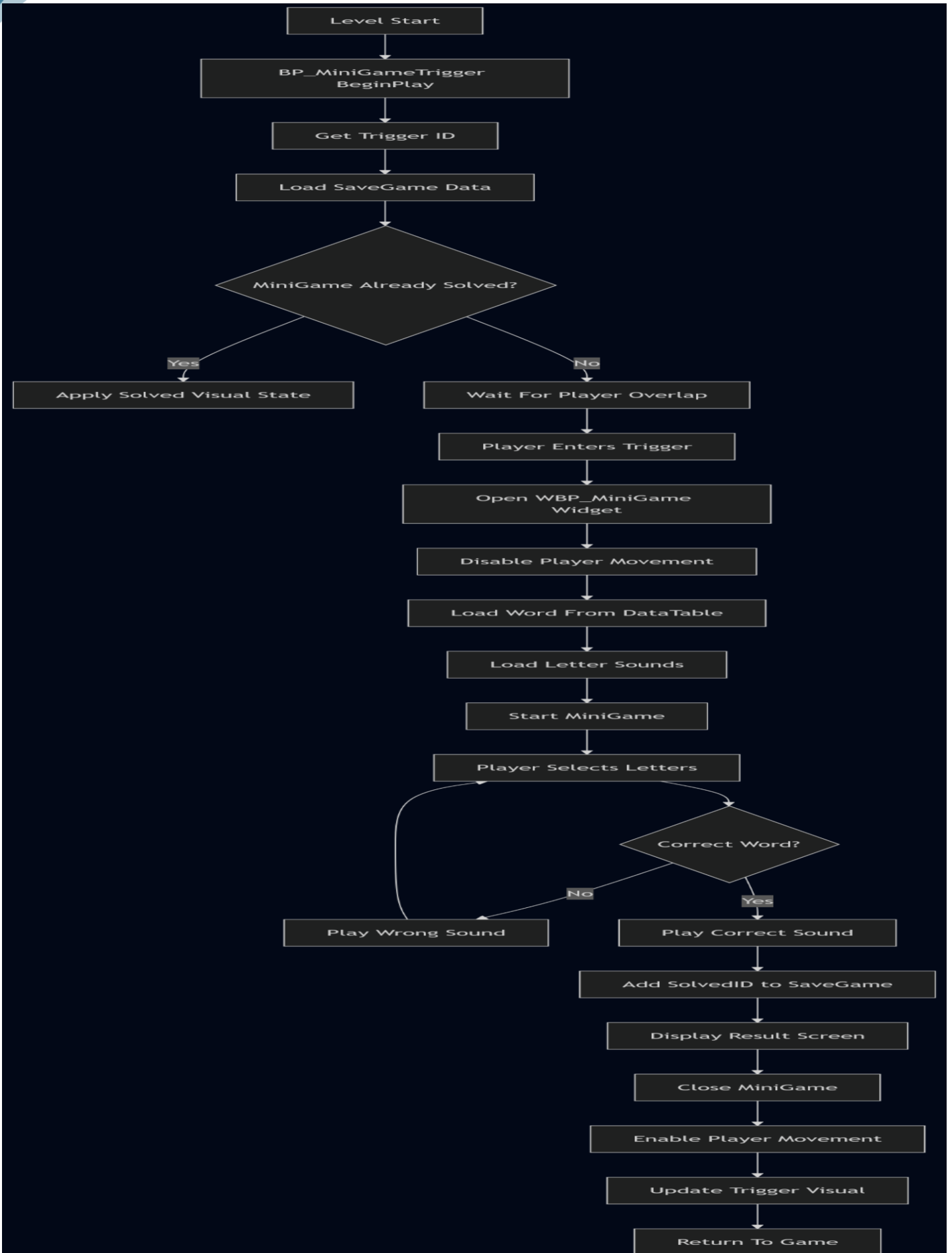


Figure E. Mini-Game Blueprint Logic Flowchart

9.6 Appendix F - Boss Fight System Architecture

The boss fight system is activated through a BP_TriggerBossFight actor placed in the level. When the player enters the trigger, the system temporarily disables player movement, adjusts the camera, and hides the standard gameplay HUD. The boss fight system then loads the word data from localization Data Tables and displays the boss UI. Progress and completion states are stored through the Save Game system.

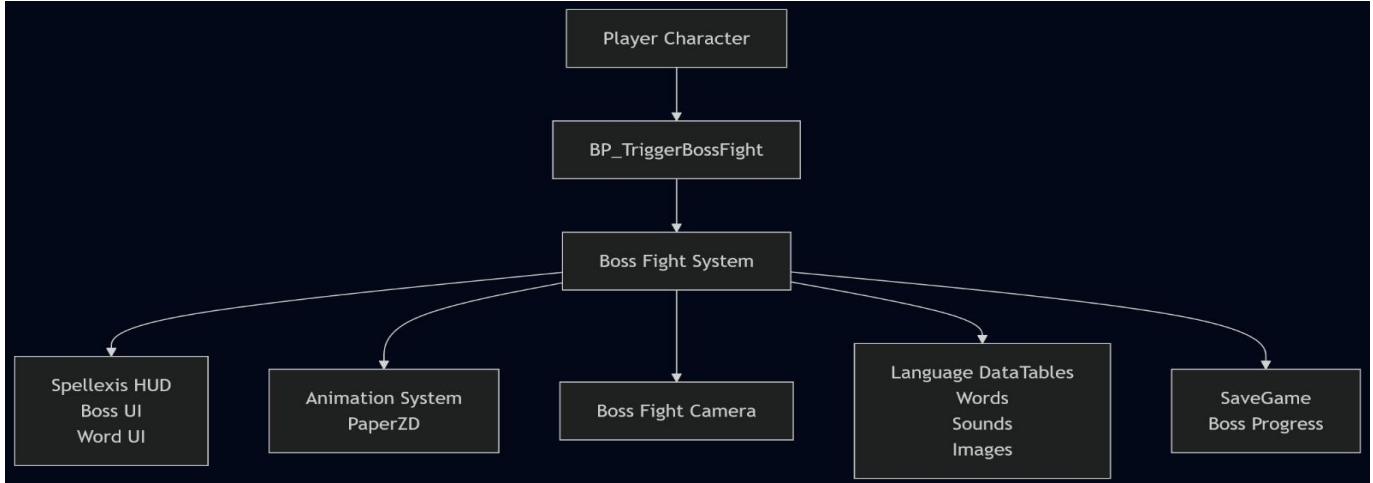


Figure F. Boss Fight System Architecture

9.7 Appendix G - Boss Fight Gameplay Loop

The boss fight gameplay loop is an extension of the spelling mechanic used in mini games. Players must correctly spell words to damage the boss. Incorrect answers provide feedback and allow the player to retry. Each correct word reduces the boss's health until the boss is defeated.

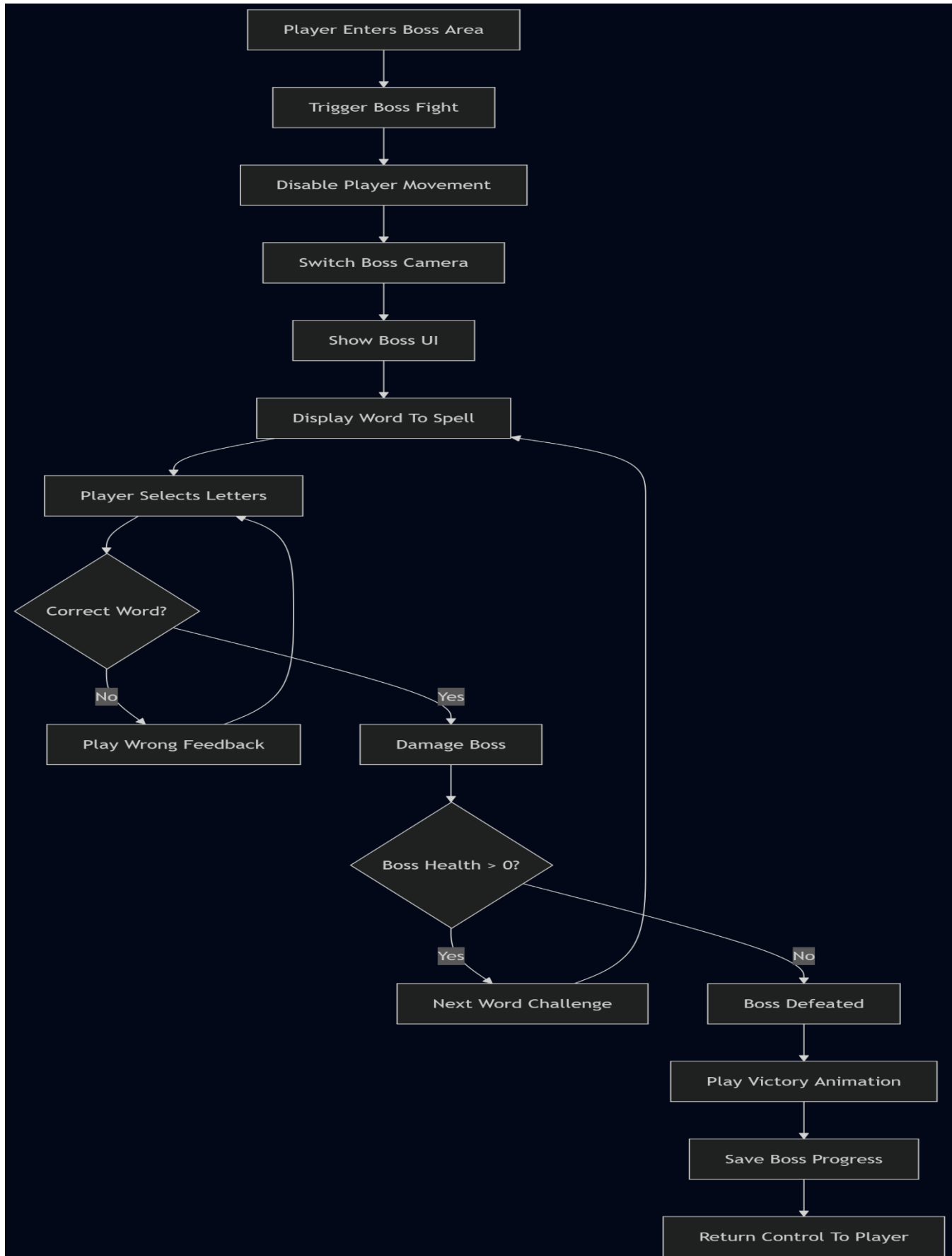


Figure G. Boss Fight Gameplay Loop

9.8 Appendix H - Boss Fight Blueprint Logic Flowchart

The boss fight blueprint begins by initializing references to the Game Mode, HUD, and Player Controller during BeginPlay. When the player overlaps the boss trigger, the system verifies that the overlapping actor is the player character. Movement and input are disabled to lock the player in the encounter. The camera is switched to a boss fight view, the standard HUD is hidden, and the spelling challenge begins.

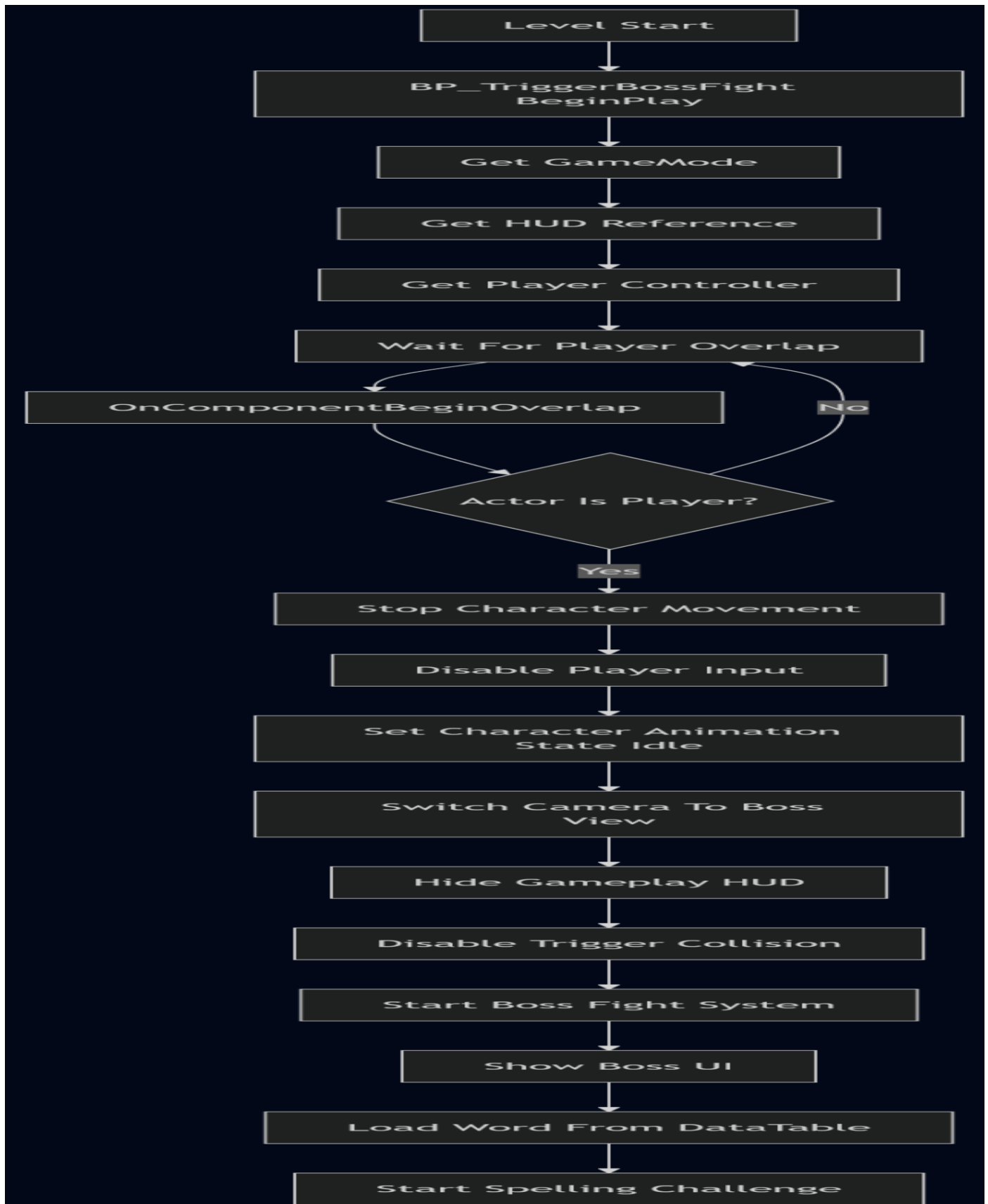


Figure H. Boss Fight Blueprint Logic Flowchart

9.9 Appendix I - Full Game Architecture Diagram

The architecture of Spellexis follows a modular system design implemented using Unreal Engine Blueprints. The Player Character interacts with the game through the input system, which is processed by the Game Mode that manages gameplay rules. The player primarily interacts with the Exploration System, which allows navigation through levels and discovery of mini-game triggers. When a mini-game is activated, the system launches the Spelling Mini-Game System, where the player constructs words using letter inputs. At specific points in the game progression, the player encounters the Boss Fight System, which extends the spelling mechanics into combat scenarios. Both systems rely heavily on the Localization System, which provides multilingual support through Data Tables containing words, letter sounds, and associated images. This design enables the game to support multiple languages such as Greek, English, and Estonian. User interaction is handled through the UI System, which manages widgets including the HUD, menus, and mini-game interfaces. Audio feedback, including pronunciation of letters and words, is handled by the Audio System, reinforcing the learning experience. Player progress is maintained through the Save System, which records solved mini-games, collected items, and progression states. Global game settings, including language selection and persistent data, are managed through the Game Instance. This modular architecture ensures scalability, maintainability, and the ability to expand the system with additional languages, levels, or learning mechanics.

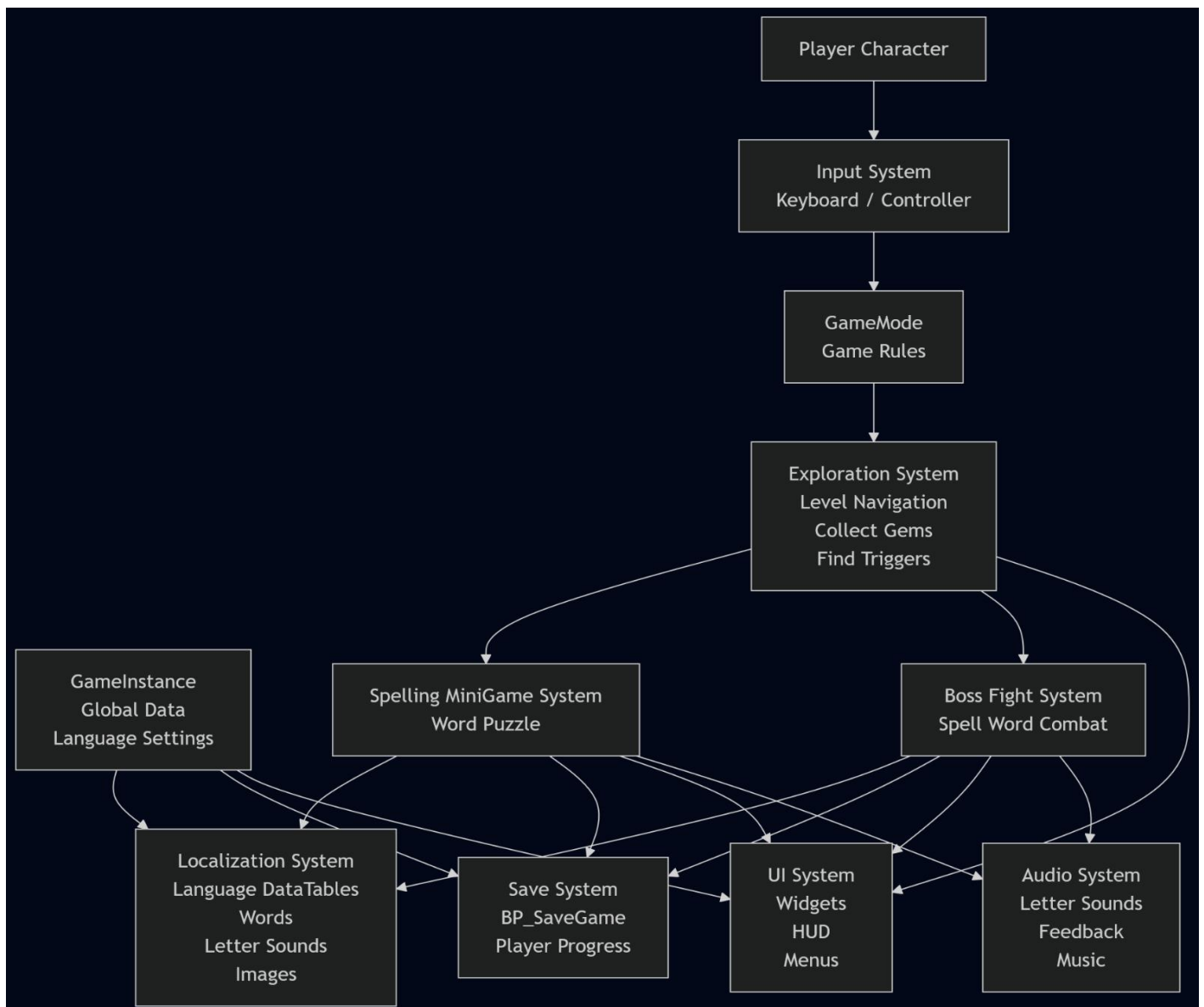


Figure I. Full Game Architecture Diagram

9.10 Appendix J - Character System Architecture

The BP_BasePlayerCharacter blueprint serves as the central gameplay entity controlling player actions, movement, combat, and resource management. It communicates with several subsystems including the animation system, UI, and save system to maintain player state and provide gameplay feedback.

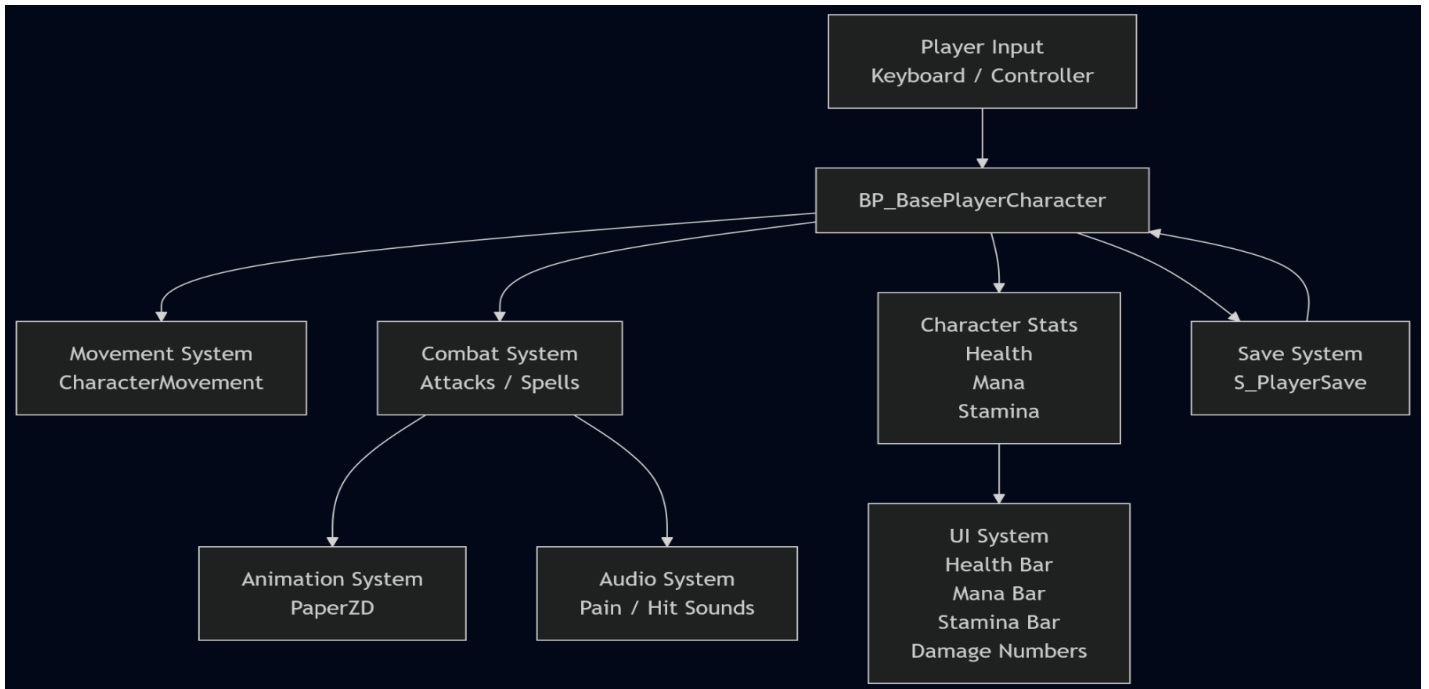


Figure J. Character System Architecture

9.11 Appendix K - Character Gameplay Loop

The gameplay loop of the character system is driven by player input. Actions such as movement, attacks, and spell casting are validated against character resources such as stamina and mana before execution. Combat actions trigger animations and apply damage to enemies.

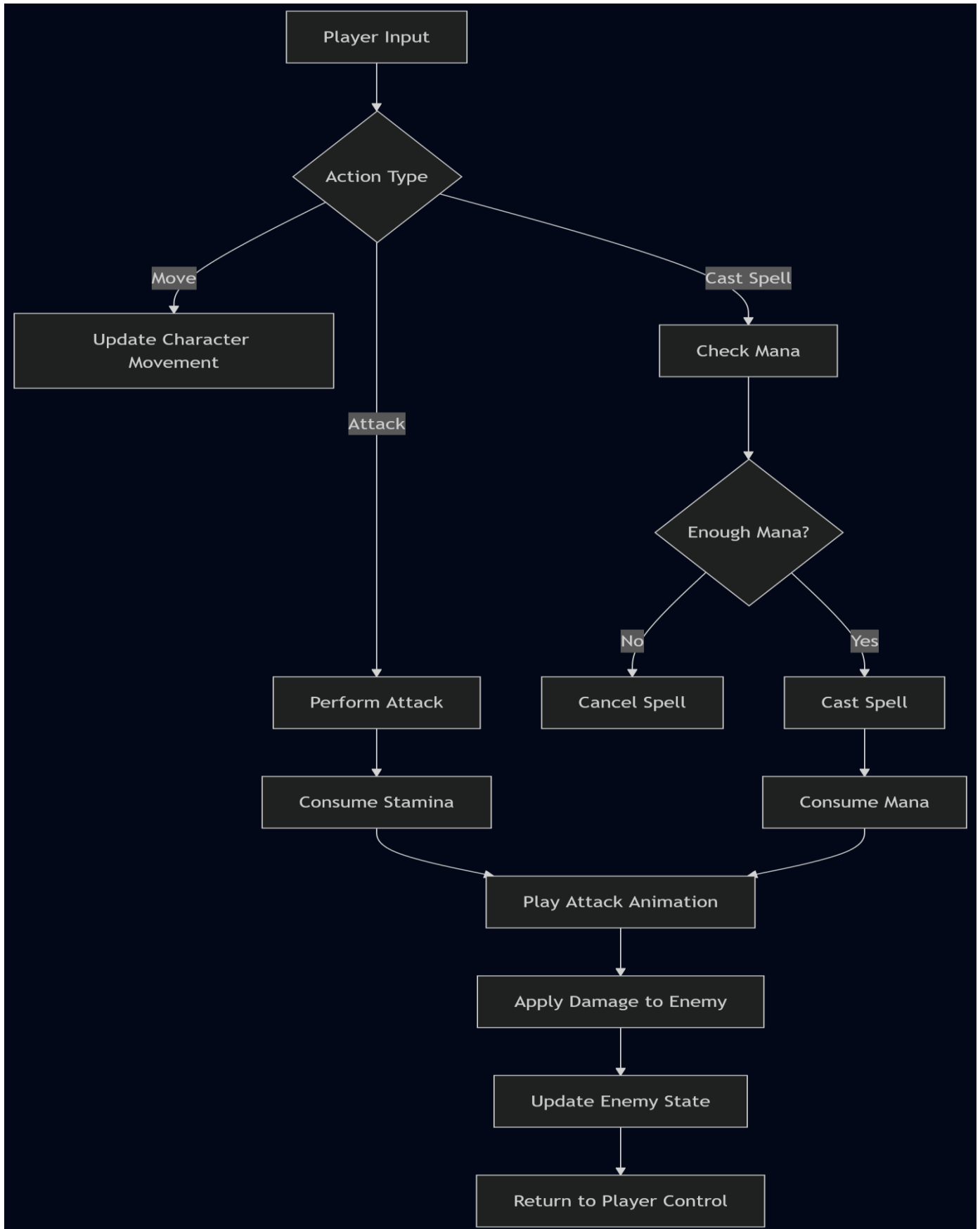


Figure K. Character Gameplay Loop

9.12 Appendix L. Character Blueprint Logic Flowchart

The Player System Architecture of Spellexis is designed using a modular Blueprint structure within Unreal Engine. The central component is the BP_BasePlayerCharacter, which handles player input, movement, combat interactions, and resource management.

The character interacts with multiple subsystems:

The Movement System controls navigation and physics-based character movement. The Combat System manages player attacks and spell casting mechanics, consuming stamina or mana depending on the action performed. The Resource System maintains player attributes including health, mana, and stamina, which are updated dynamically during gameplay and reflected in the UI System through delegates and widgets. During exploration, the player can activate the Mini Game System, which implements the spelling-based educational mechanics of the game. These mini games retrieve data from the Localization System, which stores multilingual words, sounds, and images in Data Tables. At specific points in the game, the player encounters the Boss Fight System, where the spelling mechanics are integrated into combat scenarios. The Save System ensures persistence of player progress, storing solved mini-games, character state, and collected resources. Finally, the Audio System provides feedback through sound effects, pronunciation of letters and words, and combat sounds, reinforcing the educational and gameplay experience.

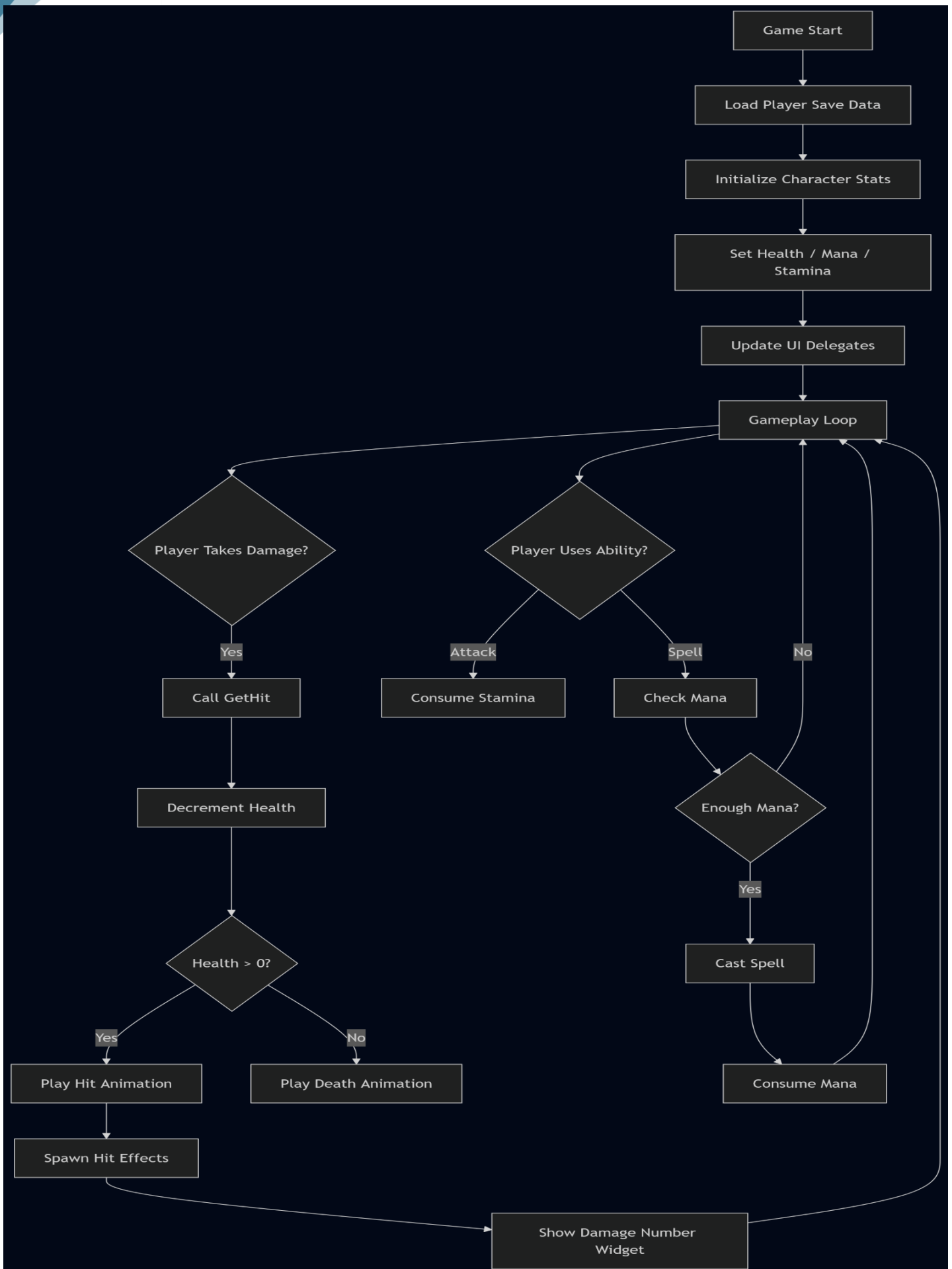


Figure L. Character Blueprint Logic Flowchart

9.13 Appendix M. Enemy System Architecture

The enemy system is built using a hierarchical Blueprint structure with BP_BaseEnemy as the parent class. Specialized enemy types such as skeleton melee units and ranged archers inherit from this base class. The system integrates AI logic through a Blackboard and Behavior Tree, enabling enemies to track the player, perform attacks, and react to combat events.

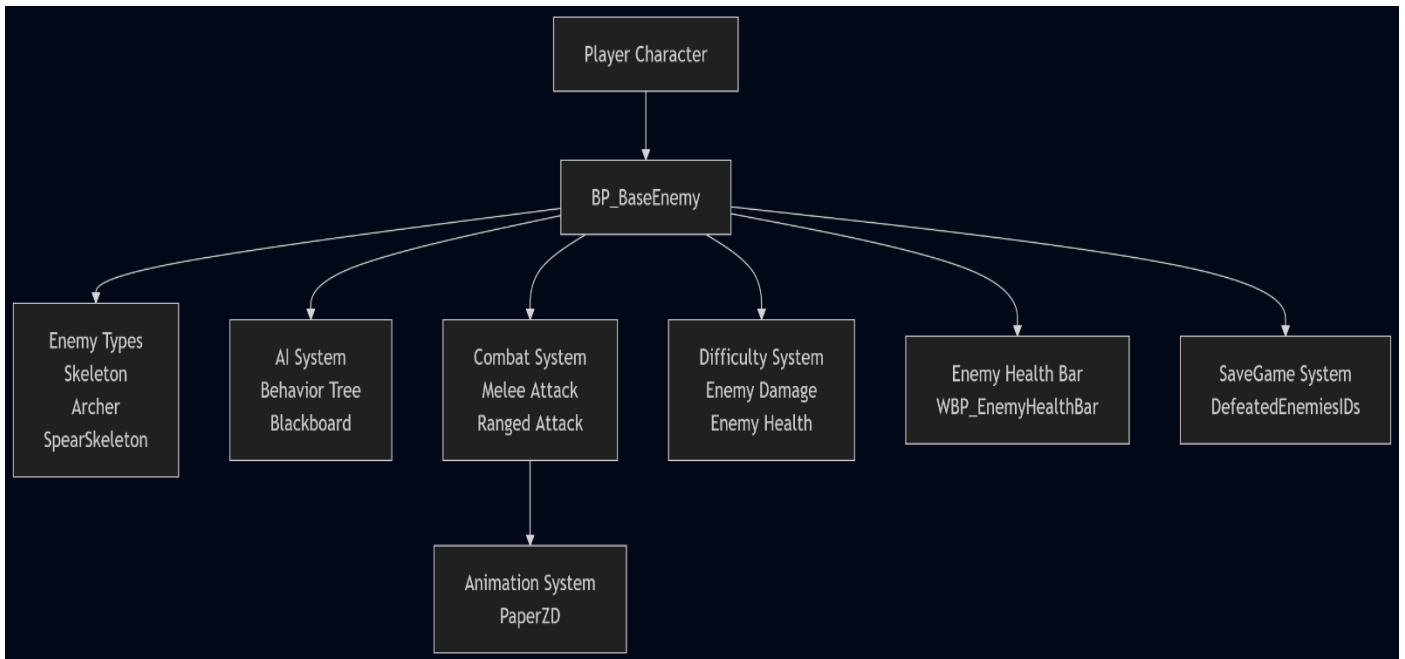


Figure M. Enemy System Architecture

9.14 Appendix N. Enemy Gameplay Loop

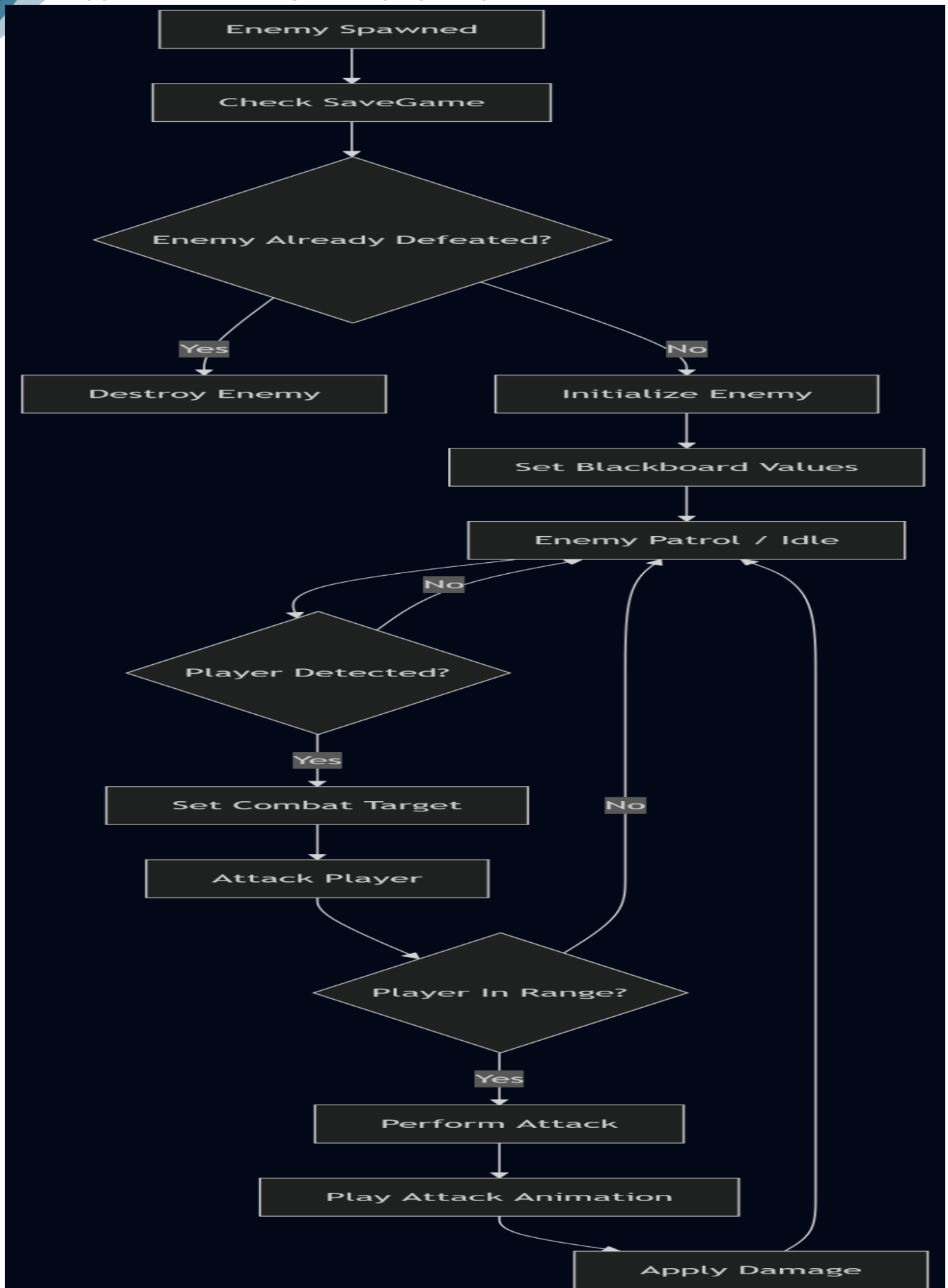


Figure N. Enemy Gameplay Loop

9.15 Appendix O. Enemy Blueprint Logic Flowchart

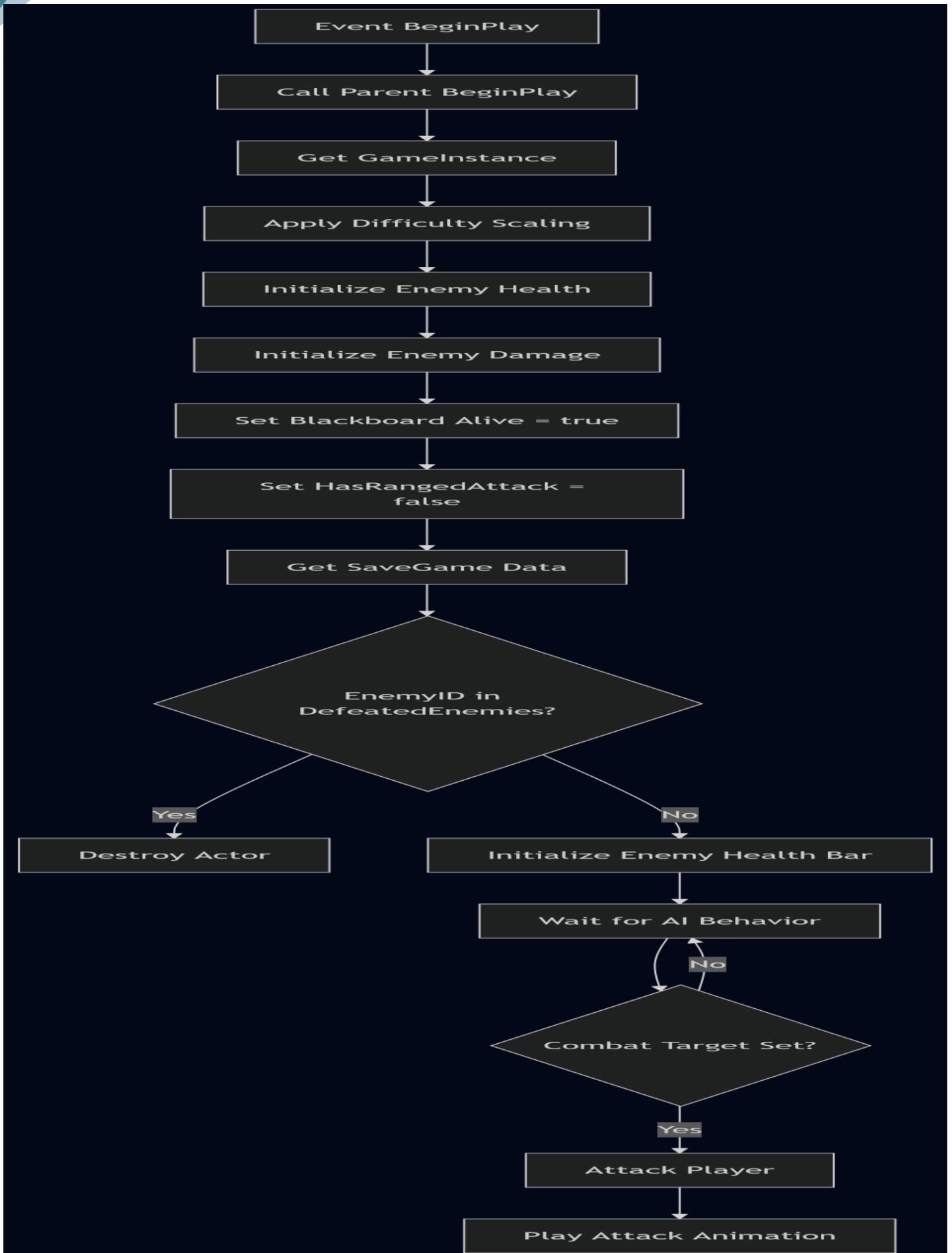


Figure O. Enemy Blueprint Logic Flowchart

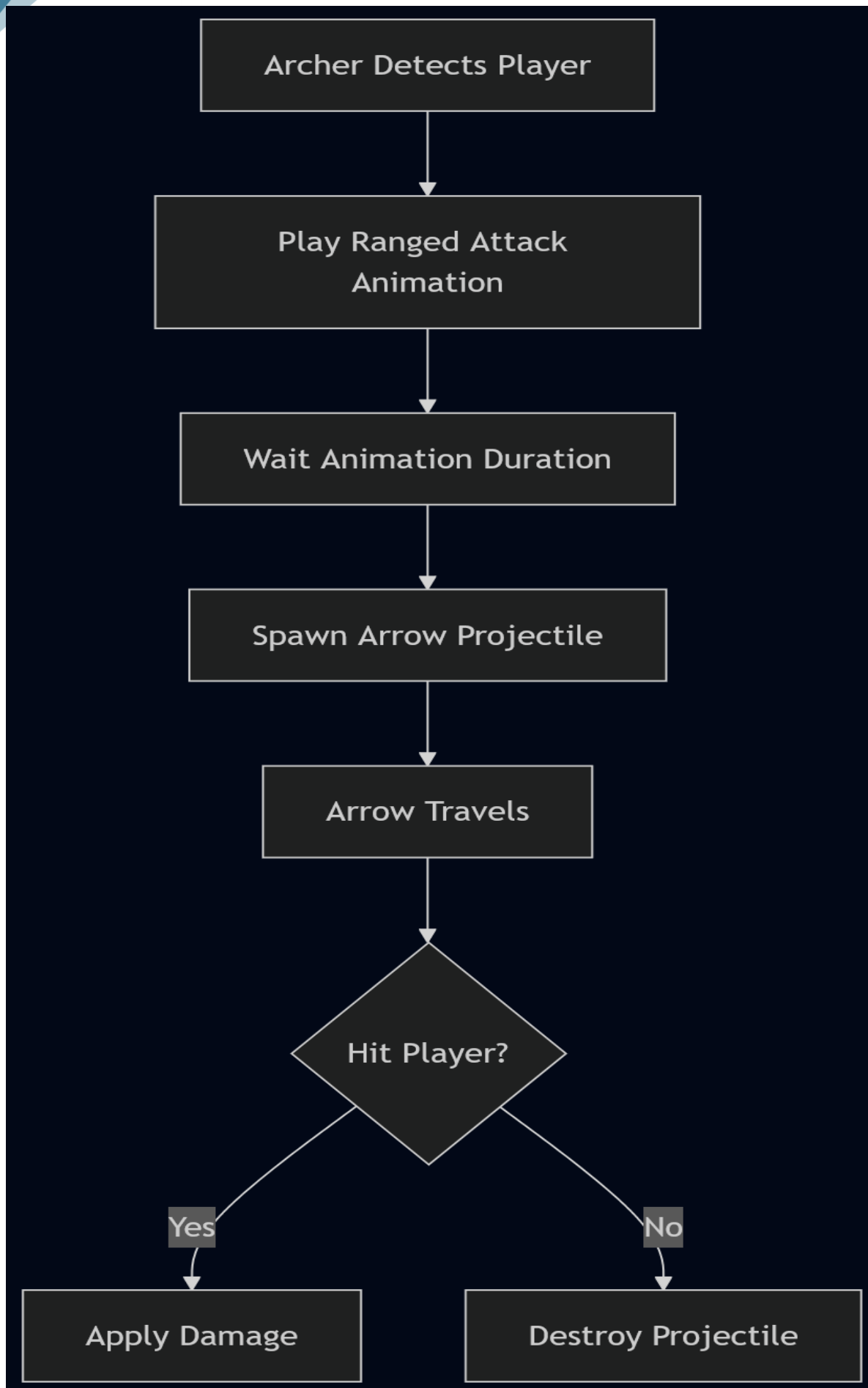


Figure P. Ranged Enemy Attack Flow (Skeleton Archer)

9.17 Appendix Q. Save / Load System Architecture

The save system is implemented using Unreal Engine's Save Game architecture. Gameplay data is stored inside a structured Save Game Data object, which contains player progress variables such as collected gems, defeated enemies, and game progression states. The Game Instance class acts as the central manager, handling both saving and loading operations.

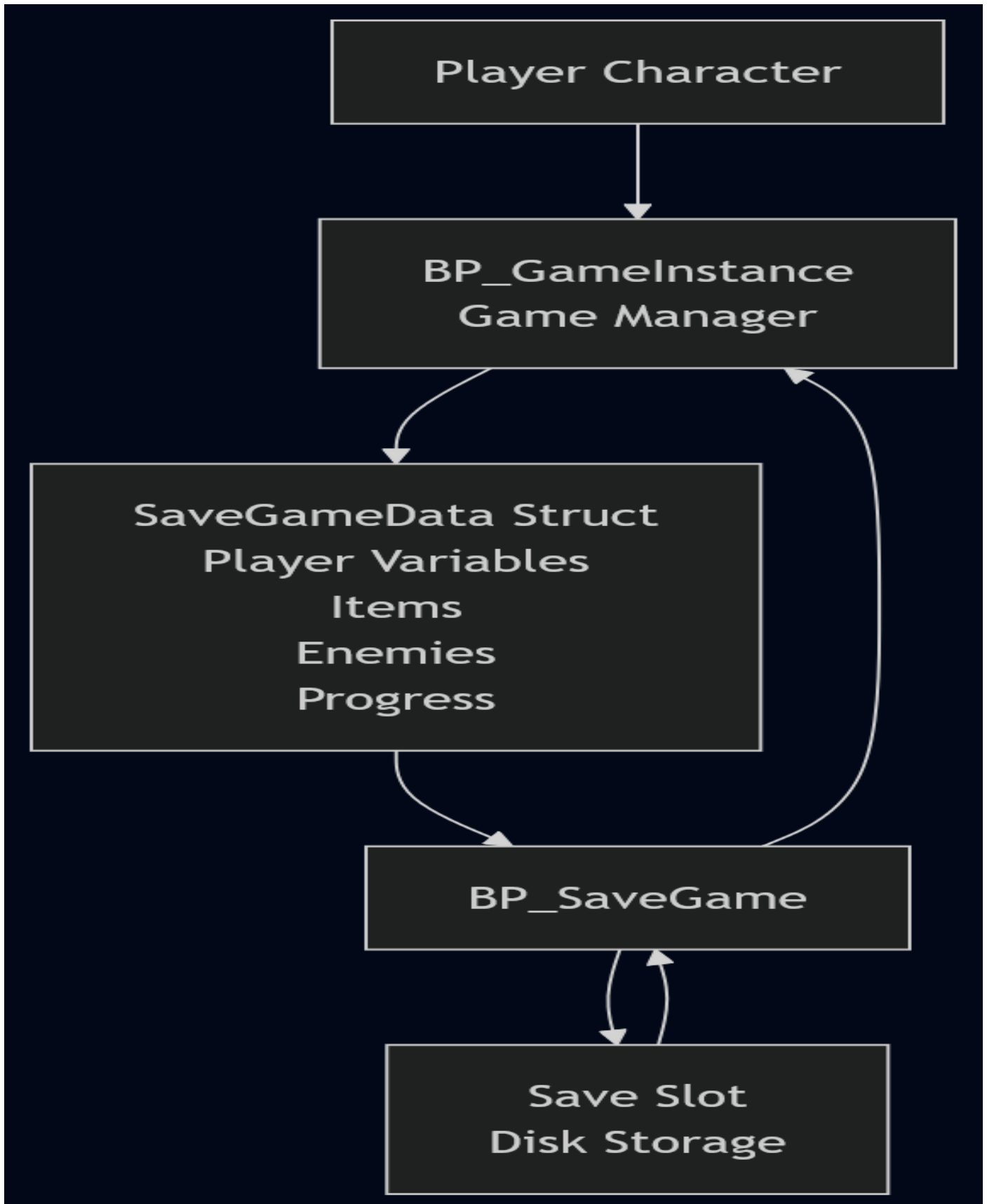


Figure Q. Save / Load System Architecture

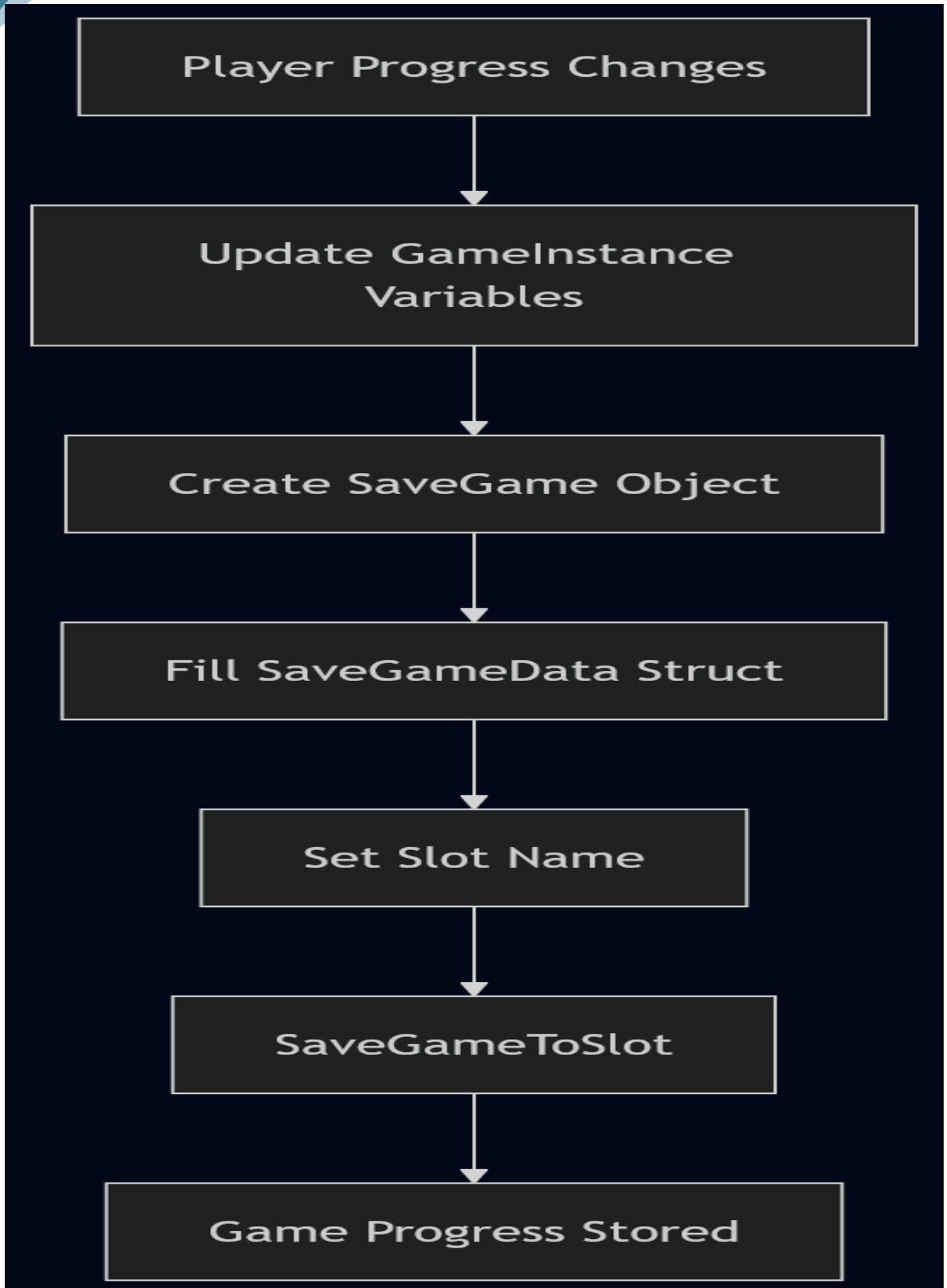


Figure R. Save Game Flowchart

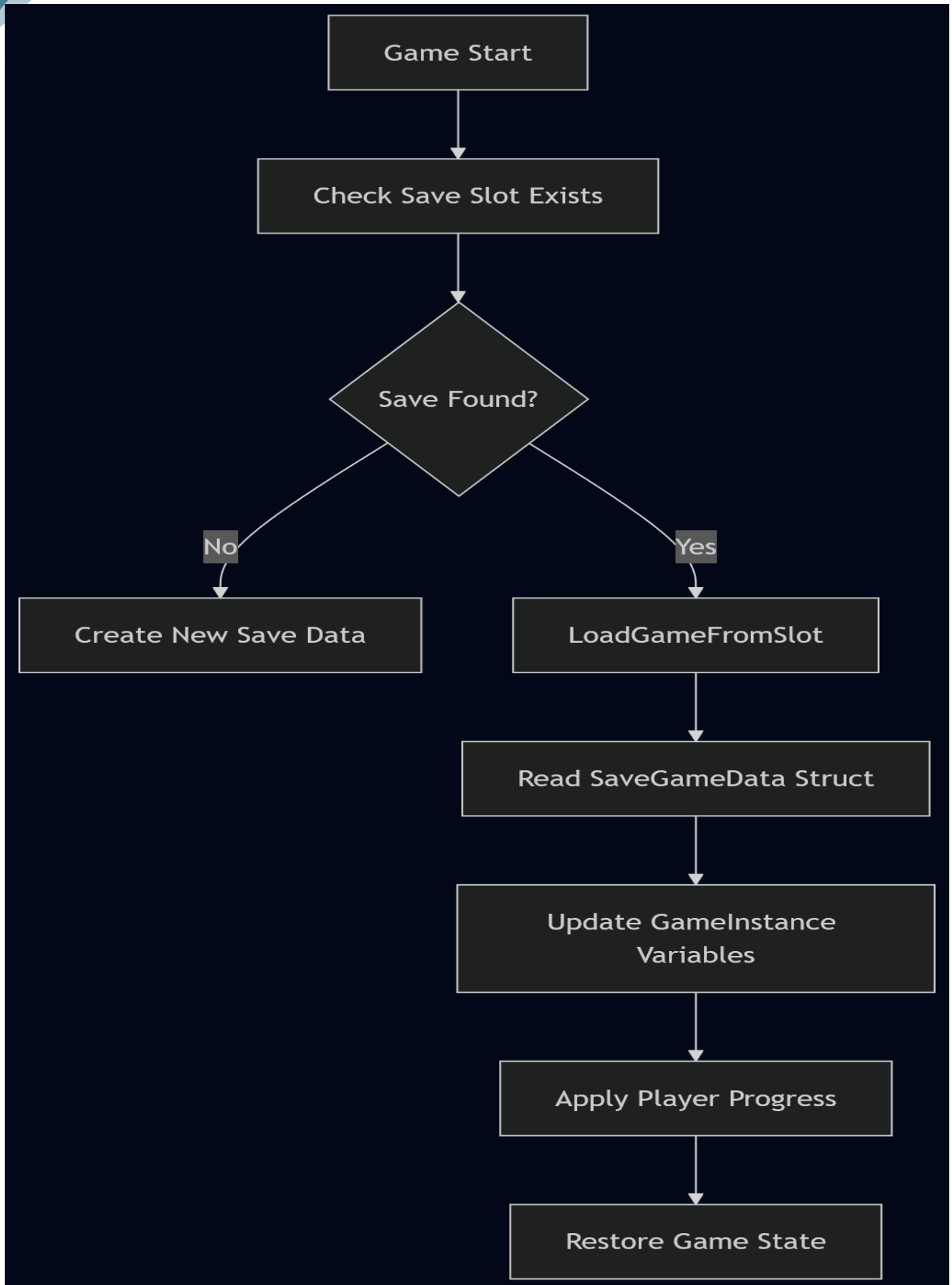


Figure S. Load Game Flowchart

9.20 Appendix T. Enemy Persistence Logic

This ensures enemies do not respawn after being defeated.

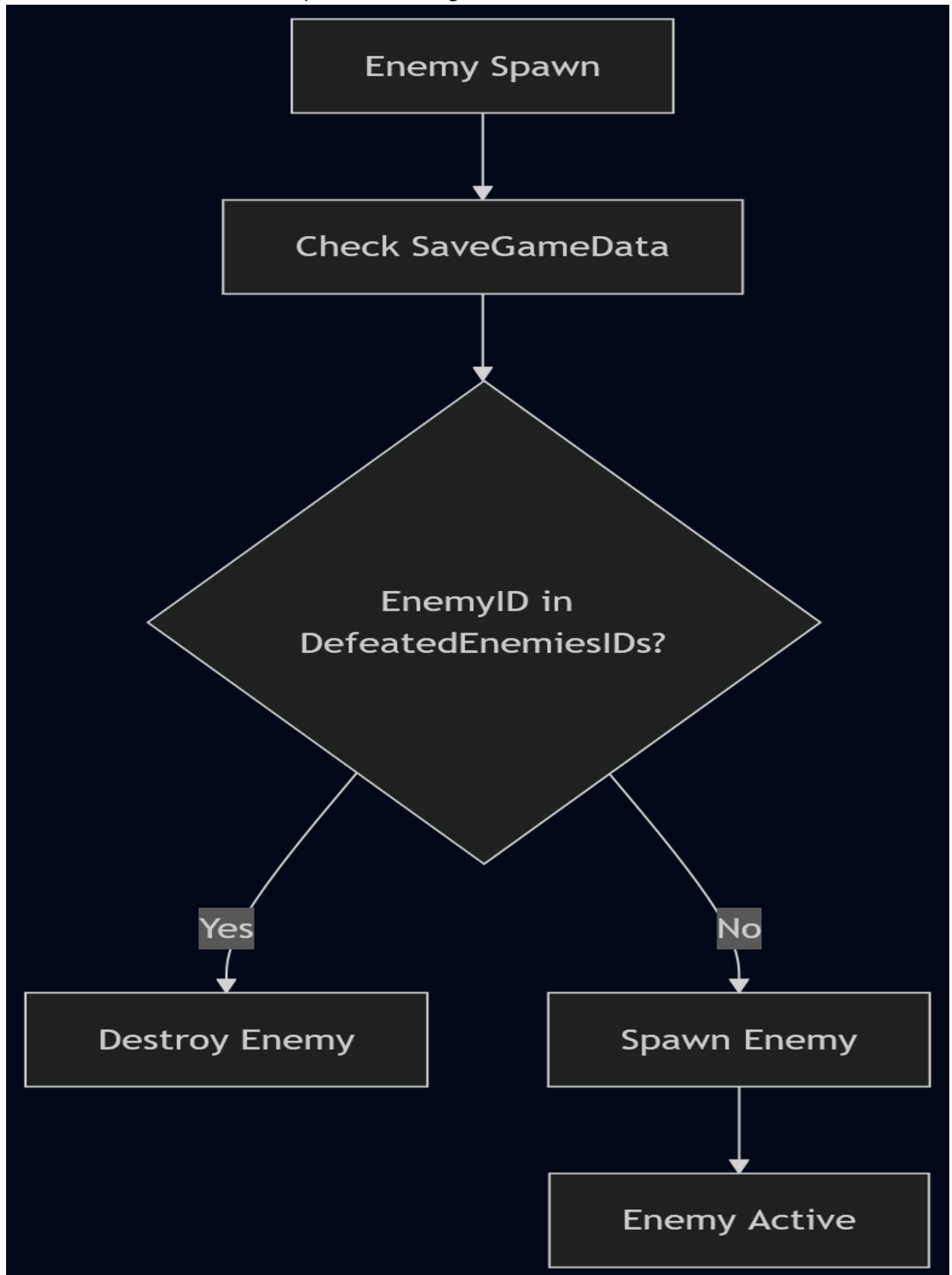


Figure T. Enemy Persistence Logic

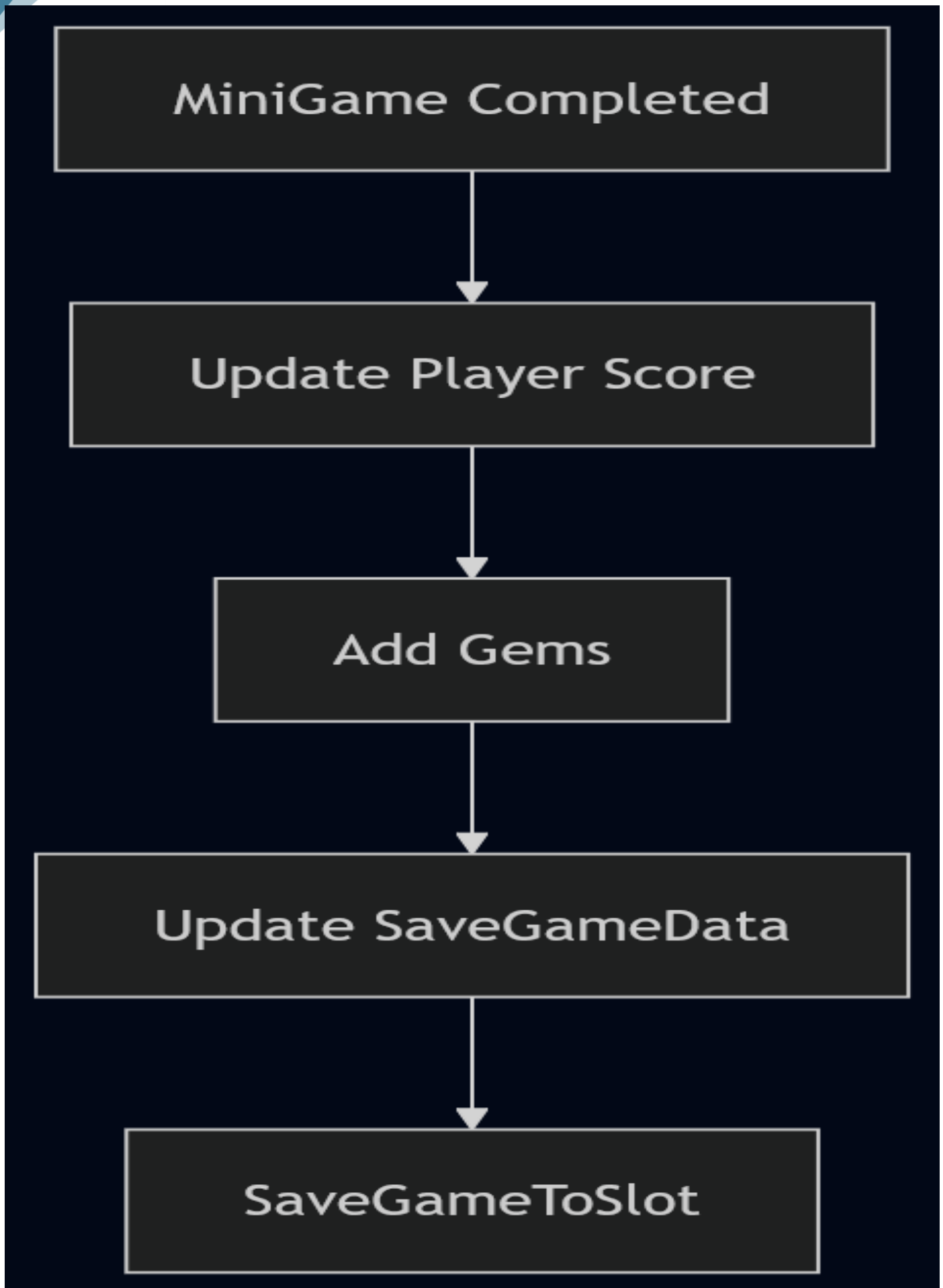


Figure U. MiniGame Progress Saving

9.22 Appendix V - Localization System Architecture

The localization system allows the game to dynamically support multiple languages. The player selects a preferred language at the start of the game. This value is stored in the Game Instance, which acts as a global manager. Based on the selected language, the game loads the appropriate Data Table entries, providing localized text, audio pronunciation, and visual representations used by the educational spelling mini-games.

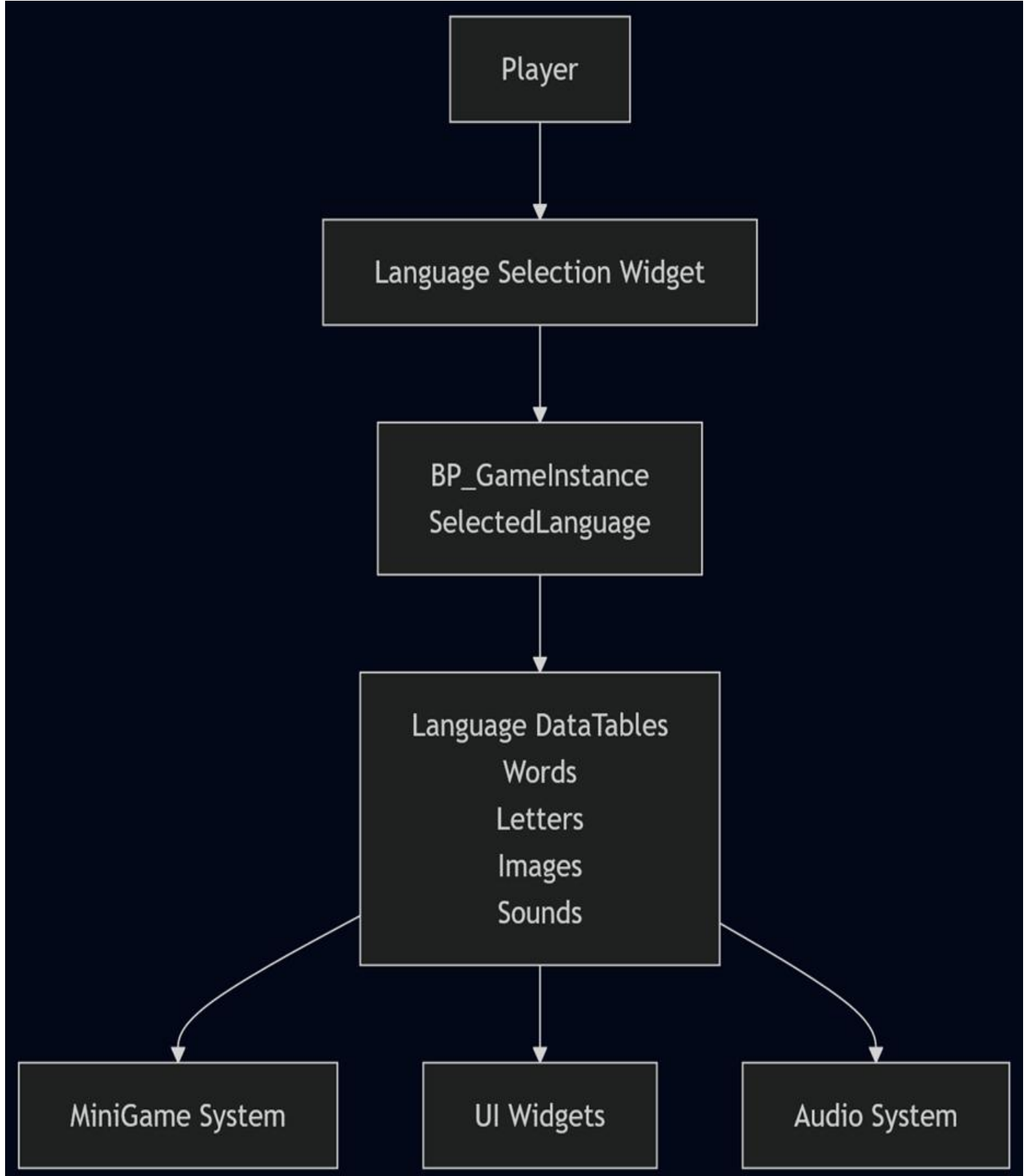


Figure V. Localization System Architecture

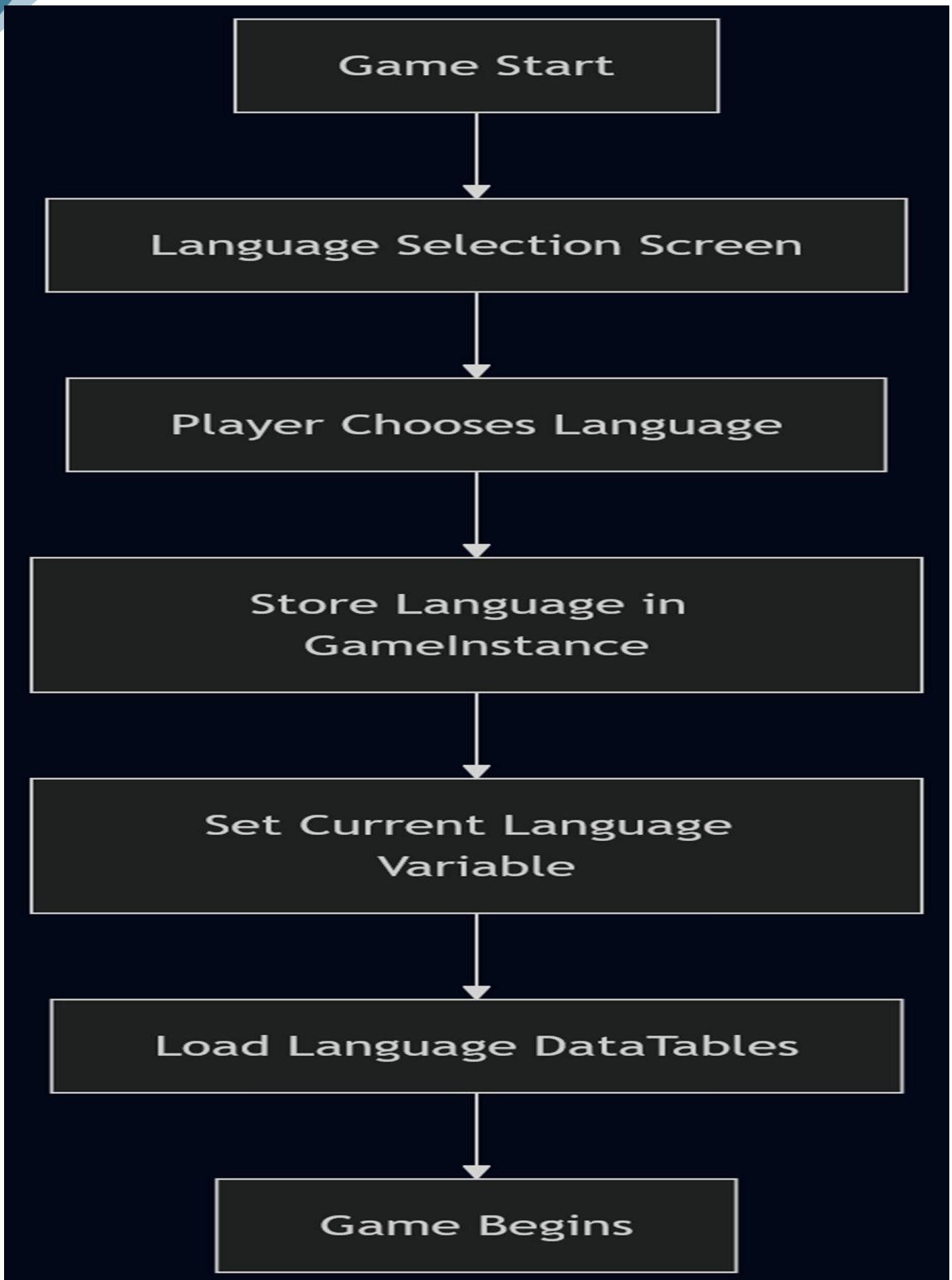


Figure W. Language Selection Flow

9.24 Appendix X - Multi-Language Word Structure

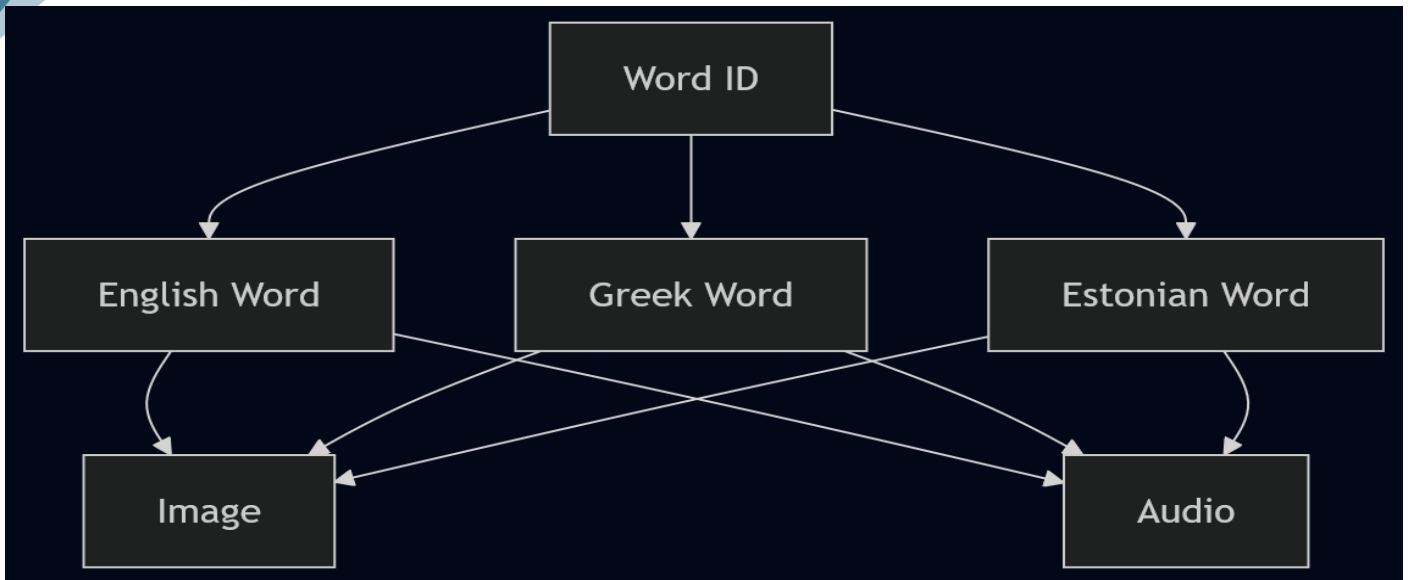


Figure X. Multi-Language Word Structure

9.25 Appendix Y - Educational Content Localization Flow

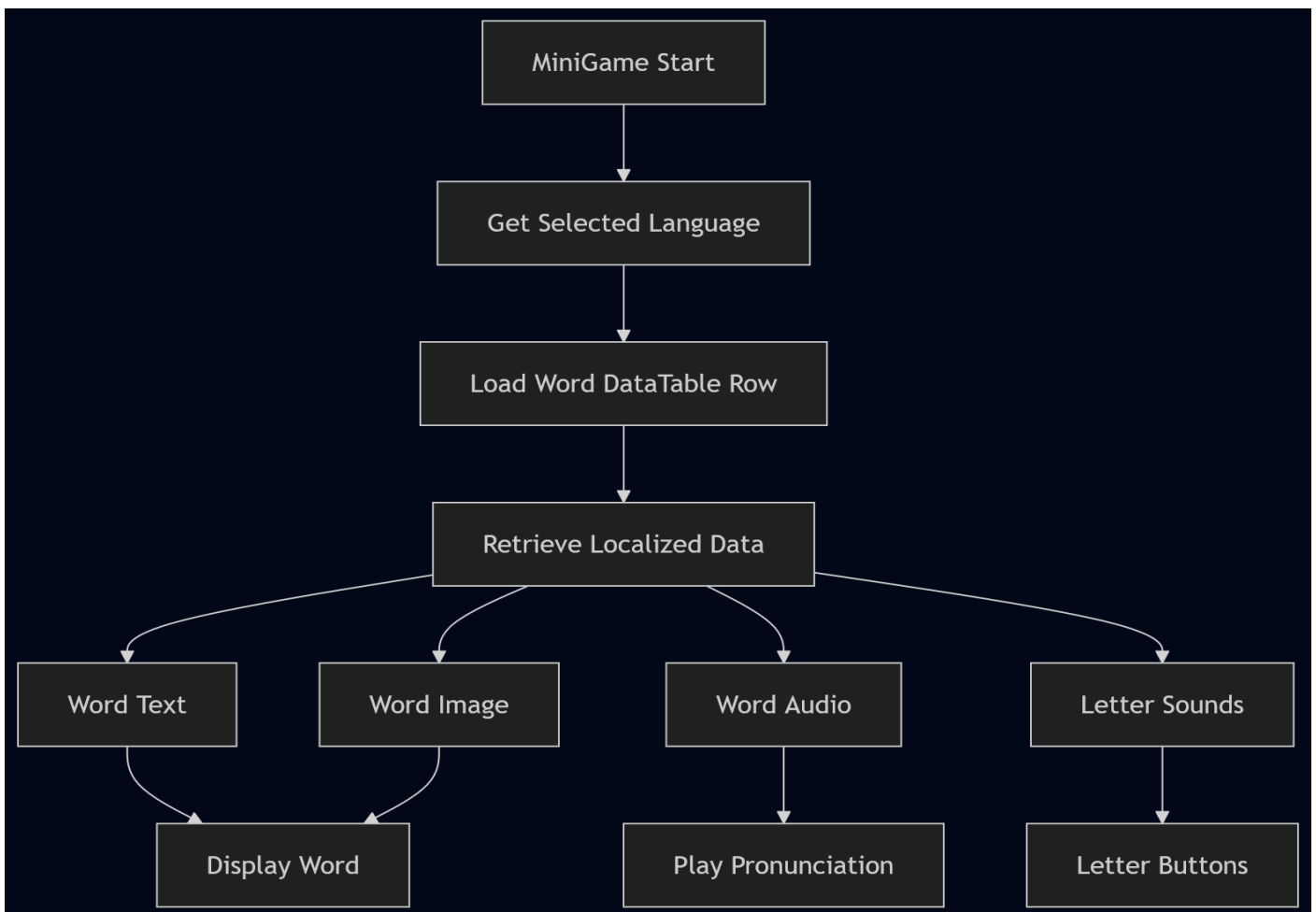


Figure Y. Educational Content Localization Flow

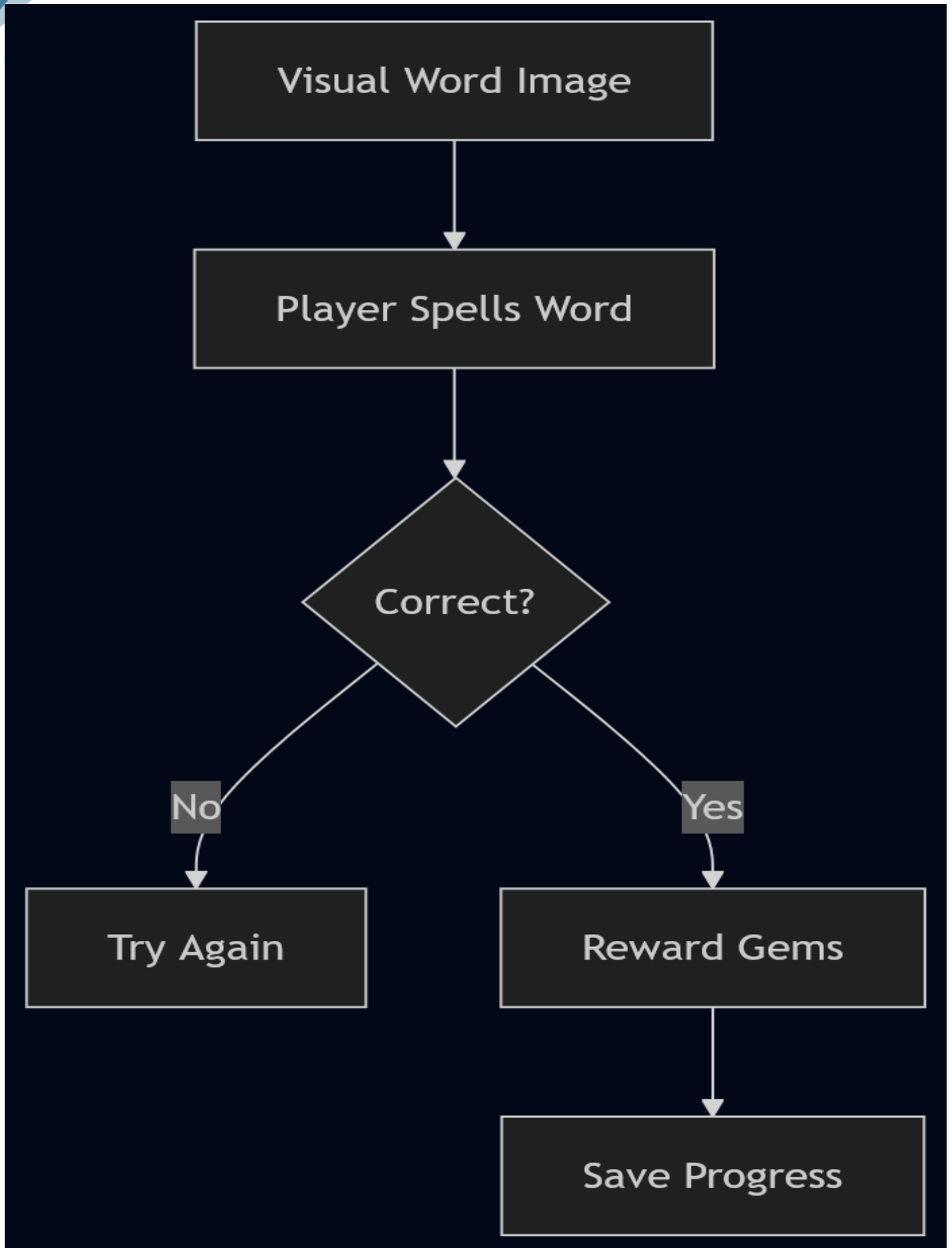


Figure Z. Spellexis Educational Learning Flow

9.27 Figure 1. Dynamic Difficulty Boss Fight System

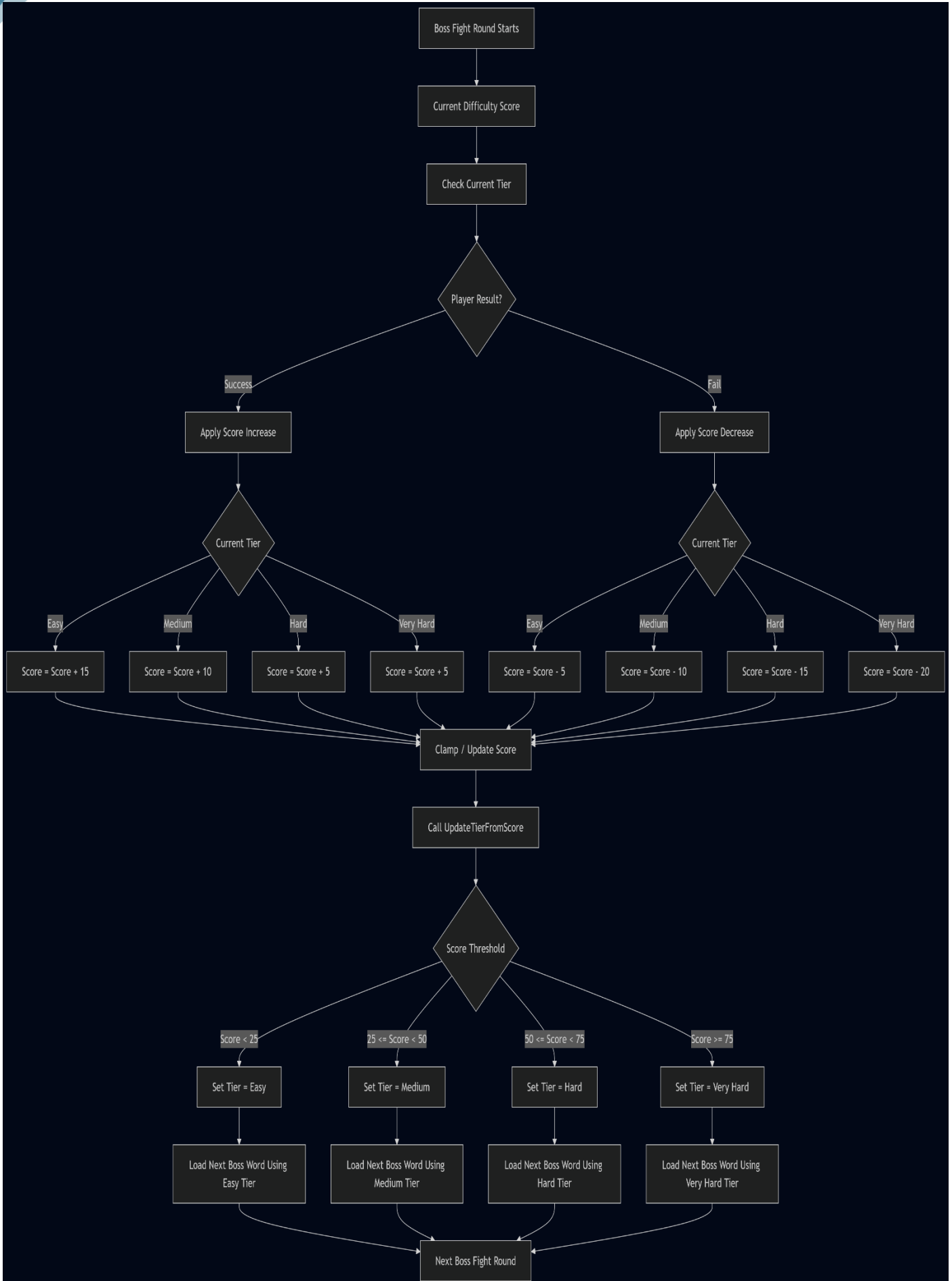


Figure 1. Dynamic Difficulty Boss Fight System

9.28 Figure 2. Experience Point System

The XP system in *Spellexis* is a Blueprint-based progression system that combines combat rewards, class-based character development, HUD synchronization, and save persistence. It is implemented in a modular way using the player character, enemy parent class, HUD, player controller, and save data struct. The result is a robust progression pipeline that remains stable across gameplay, saving/loading, and level transitions.

