The Magic Apprentice Requirements Analysis from 22.5.24

1. Introduction

1.1. Purpose of the system

The purpose of the game is for the player to have fun.

1.2. Scope of the system

The system is a video game developed with Godot 4 that allows the user to control a player character in order to kill monsters in dungeons and to improve their player characters strength through augments and unlocking skills.

1.3. Objectives and success criteria of the project

The goal of this project is the creation of a single player RPG web game.

1.4. Definitions, acronyms, and abbreviations

Player Character (PC): This term refers to the character controlled by the player within the game. The player's decisions and actions dictate the character's behavior and progression.
Hit Points (HP): Represent the health or vitality of entities, such as player characters and enemies. Hit Points decrease when the entity takes damage. An entity is defeated or dies when its Hit Points reach zero.
Augment: A type of item that can be equipped by the player to gain additional statistics or effects. Augments are typically obtained as drops from defeated enemies.
Load-out: The combination of augments and magic skills a player currently equips. A player can equip up to five augments and three magic skills simultaneously.
Area of effect (AOE): Area in which a damaging skill effects enemies or the PC.

1.5. References

We use Miro Board for story boards of the game.

An old version can be found on stormboard

1.6. Overview

2. Proposed system

2.1. Overview

The PC is a magician that explores dungeons. In these they fight slimes with 3 magic spells to get to the boss room, where they fight a boss.

There are 2 types of dungeons. Automatically generated ones and story dungeons, that are hand crafted. Furthermore, the player can choose to curse a dungeon, which increases the difficulty by strengthening the enemies or weakening the player. Cursed dungeons give better rewards. By defeating the boss, the player can unlock new magic skills of the 3 different magic types.

Players also get “augments”, which are used instead of armor. They have between 1 and 3 effects. These effects can be simple stat increases or additional effects (like casting one Skill when another is cast or increasing damaging area). The player can wear a total of 5 augments at a time. Additional augments can be stored in an inventory. Slots are unlocked by playing story dungeons.

Players can only change their load-out (active augments and spells) outside of dungeons in the home town. This is done since the difficulty of generated dungeons is determined by the amount of augments the player is currently using. The game is supposed to be finishable in under 2 hours. The idea is hence not to create a long game, but instead allow great replayability by having many different and interesting choices of playstyles and builds.

2.2. Functional requirements

2.2.1 Entities

There are two types of entities, the PC and enemies.

2.2.1.1 Entity properties

All entities have the following properties:

ID: EP1	**Entity property: Max HP**
Description	Every entity has a max HP value that shows how much damage the entity can take before dying.
Acceptance Criterion	Has to be implemented
Notes	

ID: EP2	**Entity property: Current HP**
Description	Every entity has a current HP value that shows how much damage the entity has already taken and can still take before dying. If the current HP value is smaller or equal to zero, the entity dies.
Acceptance Criterion	Has to be implemented
Notes	The relation of current HP to max HP should be visible for the player for all entities on screen.

ID: EP3	**Entity property: Armor values**

ID: EP3	Entity property: Armor values
Description	Every entity has three armor values for each of the three magic types in game. The armor type for a magic type determines how much the damage to the entity is reduced by an attack of that magic type (30 armor means 30% damage reduction). If an entity has an armor value above 100, part of the damage is reflected back to the attacker. Example: Entity has 120 armor, attack makes 100 damage, then 20 damage is reflected back to the attacker, if the attacker has an armor value of 50, the attacker takes 10 damage.
Acceptance Criterion	Damage of all types is applied correctly to entities depending on their armor values.
Notes	The damage calculation works like if armor <= 100: health = health - damage*(100-armor)/100 Only PC should be able to reach over 100 armor through additional stats, enemies need at least one armor value below 30 unless they are buffed. Case where both entities have over 100 armor of the same type has to be covered nonetheless. In that case both entites take no damage of this magic type.
ID: EP4	**Entity property: Damaging skills**
Description	Every entity has one or more damaging skills. Every skill has a magic type and a base damage value. The base damage value can be modified under certain circumstances (curses for enemies, augments for the PC). A damaging skill only damages the opponent, that means the PC takes no damage from their own spells and enemy attacks only damage the PC.
Acceptance Criterion	Damage from different skills of all magic types is applied correctly to PC and enemies for armor values of 0.
Notes	The area in which a damaging skill applies damage to the opponent and the duration in which the opponent takes damage depends on the specific skill.
ID: EP5	**Entity property: Speed**
Description	Every entity has a speed value that determines how quickly it can move across the game environment. This affects both the player character (PC) and enemies.
Acceptance Criterion	Speed should be accurately reflected in the movement rate of entities in the game.
Notes	Speed may be modified by certain augments or dungeon curses.
ID: EP6	**Entity property: Invincibility Time**
Description	After taking damage, an entity becomes invincible for a short duration during which it cannot take further damage. This is to prevent rapid successive damage from multiple sources.
Acceptance Criterion	Invincibility time is correctly applied after each instance of damage.

ID: EP6	Entity property: Invincibility Time
Notes	The duration of invincibility should be short and consistent across all entities unless modified by specific augments or dungeon curses.

2.2.1.2 Magic types

There are three magic types in the game: Sun, Cosmic and Dark. Skills and enemies belonging to the different magic types are colour coded to allow differentiation by the player. The colours are Sun: yellow - red, Cosmic: blue - white, Dark: black - purple. The magic types work like in Rock, paper, scissors such that they have one other magic type that they are strong against and one against which they are weak. Their effectivity against themselves is in between.
The magic types are:

- Sun, strong against Cosmic, weak against Dark
- Cosmic, strong against Dark, weak against Sun
- Dark, strong against Sun, weak against Cosmic

2.2.1.3 Player character (PC)

The PC is the figure the player controls while playing the game. The PC is a wizard and should wear therefore wizard-like clothing, e.g., a pointy hat, a long robe and a staff.

2.2.1.3.1 PC control

The PC is controled by the player via keyboard and mouse movements. The PC has four states which are described in the following.

ID: EPC1	PC state: Idle
Description	If the player does not enter any input for the PC, the PC remains idle and does not move. An idle animation is shown.
Acceptance Criterion	PC is in idle state if no input is given.
Notes	None

ID: EPC2	PC state: Walking
Description	If the player uses the WASD keys, the PC moves as long as the keys are pressed. The PC can walk in 8 directions: left, right, top and bottom and the diagonal directions inbetween. A specific walking animation for each direction is shown.
Acceptance Criterion	PC walks correctly if WASD is given as input.
Notes	Diagonal walking is achieved by pressing two keys at once and should not be faster than straight walking.

ID: EPC3	PC state: Dashing

ID: EPC3	PC state: Dashing
Description	If the player presses the space bar, the PC moves with increased speed in the direction of the current mouse position for a predefined length. While dashing, the player cannot be hit.
Acceptance Criterion	PC dashes in the correct direction when the space bar is pressed.
Notes	None

ID: EPC4	PC state: SpellCasting
Description	If the player presses one of the keys 1, 2 or 3, the PC casts a spell/uses a PC skill and a spell casting animation is shown. All PC skills that require a position or direction to be cast take the current mouse position for the position or direction.
Acceptance Criterion	PC is in SpellCasting state if inout 1, 2 and 3 is given.
Notes	Only one spell can be cast at a time. All skills use the same spell cast animation. Cast times should generally be short (less than 1 second). Slower cast times are achieved by playing the spell cast animation slower.

ID: EPC5	PC state: Death
Description	When the PC's health reaches 0, it transitions to a death state. The player is informed about the PC's death before returning to the main hub.
Acceptance Criterion	The PC must correctly transition to the death state when its health is depleted and the player can no longer control the PC's actions.
Notes	After the death animation of the PC, a death screen should be shown.

2.2.1.3.2 PC progression

While playing the game, the player can unlock new skills. The player also unlocks additional augment slots to equip up to 5 augments for additional effects when casting PC skills or increased stats.

2.2.1.3.2.1 PC skills

Every PC skill belongs to one magic type and does damage of that magic type. Each magic type has three different skills: a base skill, a supportive skill and an offensive skill. All nine skills have upgraded versions, which are automatically unlocked when the player fulfills a predefined criteria. The PC can have up to three different skills equipped.

ID: EPS1	Skill: Base Skills
Description	Each magic type has a base skill that consist of a colored circular projectile shot from PC in the direction of the mouse.
Acceptance Criterion	Has to be implemented

ID: EPS1	**Skill: Base Skills**
Notes	None

ID: EPS2	**Skill: Sun Beam**
Description	The supportive skill of the sun magic type. The PC emits a ray of ligth from the PC in the direction of the mouse. Enemies hit deal reduced damage and have reduced armor.
Acceptance Criterion	Has to be implemented
Notes	None

ID: EPS3	**Skill: Summon Sun**
Description	PC spawns a sun at mouse location for a few seconds. Enemies close to it take damage depending on how close they are to the sun. The center of the sun deals the most damage. Enemies take damage at predefined intervals as long as they are inside the AOE.
Acceptance Criterion	Has to be implemented
Notes	None

ID: EPS4	**Skill: Moon Light**
Description	A Ray of moonlight shines down on the player increasing the attack value of all their equipped skills and the armor values for all magic types.
Acceptance Criterion	Has to be implemented
Notes	None

ID: EPS5	**Skill: Star Rain**
Description	Multiple single projectiles spawn around the PC with random offset and start homing to mouse position. On collision with enemy they do damage and despawn.
Acceptance Criterion	Has to be implemented
Notes	None

ID: EPS6	**Skill: Dark Energy Wave**
Description	PC creates a black wave that pushes all enemies away from the PC by a predefined distance. The wave pushes away all enemies in the same room as the PC, independently of the distance to the PC.
Acceptance Criterion	Has to be implemented
Notes	None

ID: EPS7	Skill: Black Hole
Description	PC creates a round black void at mouse position that pulls all enemies towards it, if they hit the black void they take massive damage.
Acceptance Criterion	Has to be implemented
Notes	None

2.2.1.3.2.2 Augments

Instead of a traditional armor and weapon system, the game uses augments to enhance the PC by giving additional effects and stats. A maximum of 5 augment slots can be unlocked, with each augment being equipable to any unlocked slot. This feature will facilitate the player's ability to craft their own unique builds.

ID: EPA1	Augments: Equipping augments
Description	The player can equip augments to their unlocked augment slots. Every augment can only be equipped to one slot at a time. The augment effects are then applied to the PC.
Acceptance Criterion	Augments can be equipped and the effects are applied to the PC correctly.
Notes	None

ID: EPA2	Augments: Unlocking augment slots
Description	When the player completes the intro dungeon, the first augment slot is unlocked. When the player clears each further story dungeon, one additional augment slot is unlocked. There are a total of 5 augment slots maximally.
Acceptance Criterion	Augment slots are unlocked correctly.
Notes	None

ID: EPA3	Augments: Obtaining augments
Description	When the PC kills an enemy there is a chance to obtain an augment. Slimes have a low chance of dropping augments and are more likely to drop low quality augments. Bosses are guaranteed to drop one augments and have a chance to drop a second augment in not-cursed dungeons. Augments dropped by bosses also have a higher chance to be high quality augments. If an enemy drops an augment, the PC obtains the augment automatically.
Acceptance Criterion	Enemies drop augments with the correct chances and the PC obtains the augments when they are dropped.
Notes	Every enemy has a chance bigger than zero to drop every possible existing augment.

Each augment will have 1, 2 or 3 effects. Augments can the same effect several times in which case the effect will stack. The amount of effects determines the quality of the augment. The effects are decided randomly

from the list of possible effects by the game when the augment is dropped. The effects will have percentage values. This means that effects of the same type will stack multiplicative.

To allow build crafting for the player, it is possible to destroy one augment and to move one of its effects onto another augment, overwriting one of its previous effects. This is described in more detail in chapter 2.2.2.1.3 Fusing augments.

List of augment effects

The effects of the augments are the following:

- 10 additional armor of a type
- 5 additional armor of all types
- 10% more hp
- 10% extra damage for one skill (one for each damaging ability)
- 5% extra damage for one magic type
- 1% life steal
- 10% bigger radius for one skill (exists for “summon sun”, “black hole”)
- 10% more stars for “star rain”
- Upon casting spell x also cast spell y (specific spells will be determined during balancing)
- Spell x explodes on impact with enemy (for directional skills only, means damage is applied to all enemies in an AOE)
- Plus 10 attack for all spells of one magic type (this way supportive spells can also deal damage)
- 50% longer duration for skills that remain on field (“summon sun” and/or “black hole”)
- Plus 20 attack for skill in slot 1/2/3

Values and effects might have to be changed, added or removed for good balancing later.

2.2.1.4 Enemies

Each Enemy only deals damage of one magic type. It will have a high armor against the damage type that it is strong against and a low armor against the type that it should be weak against. Its armor value against its own magic type is in between. Use color coding to signal the magic type of the enemy to the player.

There are two types of enemies:

1. Slimes (small and big, melee and ranged)
2. Unicorn bosses

Enemies are controlled via their state machine. Most will deal only melee damage. Hence they will track the PC and once they are close attack them. Slimes will come in large groups. Group behavior is used to simulate better movement so not all of them stand on top of each other, but instead keep distance from one another.

2.2.1.4.1 Slimes

Each slime is associated with a specific magic type. They are visually represented by the color corresponding to their magic type. Slimes only inflict damage aligned with their magic type, and their armor is strong against the magic type that their magic type is strong against and weak against the magic type that their magic type

is weak against. The armor against their own magic type is inbetween. Example: A Sun slime could have the following armor values: Sun armor: 30, Cosmic armor: 50, Dark armor: 10 (values might change).

Slimes can have three possible states.

ID: ES1	**Slime states: Idle**
Description	If the PC is outside of the detection range of the slime, the slime is idle. It moves around randomly.
Acceptance Criterion	Has to be implemented
Notes	None

ID: ES2	**Slime states: Moving**
Description	If the PC is inside of the detection range of the slime but outside of the attack range of the slime, the slime moves towards the PC until it is in attack range.
Acceptance Criterion	Has to be implemented
Notes	None

ID: ES3	**Slime states: Attacking**
Description	If the PC is inside of the attack range of the slime, the slime attacks the PC.
Acceptance Criterion	Has to be implemented
Notes	None

ID: ES4	**Slime states: Death**
Description	When the slime's health reaches 0, it transitions to a death state. In this state, the slime stops all actions and animations, and after a short delay, it disappears from the game world.
Acceptance Criterion	The slime must correctly transition to the death state when its health is depleted, and it should no longer be able to perform any actions or affect the game.
Notes	Ensure that the transition to the death state is smooth and that the slime's disappearance is visually clear to the player.

Slimes can differ in two attributes. There are large and small slimes and there are melee and ranged slimes, making a total of 4 different slime types. Large slimes have more HP and higher attack values than small slimes. Large slimes are rarer than small slimes and only appear in small groups of up to 3 large slimes. They are often accompanied by several small slimes. Ranged slimes have a larger attack range and have a different color brightness than melee slimes. The armor values of all slimes of one magic type are the same.

ID: ES5	**Slime types: Melee Slime**
Description	Melee slimes move towards the PC and once they are very close to the PC, they jump against the PC for their attack. Melee slimes can be large or small.

ID: ES5	Slime types: Melee Slime
Acceptance Criterion	Has to be implemented
Notes	None

ID: ES6	Slime types: Ranged Slime
Description	Ranged slimes have a larger attack radius. When attacking, they shoot a small projectile in the direction of the PC. Ranged slimes can be large or small.
Acceptance Criterion	Has to be implemented
Notes	None

2.2.1.4.2 Bosses

The unicorn is the boss monster of the dungeons. It looks like a unicorn but is colored according to its magic type.
Unicorns have no attack and detection range since they can detect and attack the player from every position in the room. Unicorns have three different attacks. Unicorns have a melee attack radius. If the PC is inside of the melee attack radius, the unicorn uses the melee attack, otherwise it uses one of the ranged attacks at random.
In between two attacks the unicorn remains idle for a short while to allow the player to attack the unicorn with their skills.

ID: EB1	Unicorn states: Charge attack
Description	If the PC is outside of the melee radius of the unicorn, the unicorn can use a charged attack. The unicorn charges at the PC and deals a large amount of damage if the player is hit.
Acceptance Criterion	Has to be implemented
Notes	None

ID: EB2	Unicorn states: Shooting attack
Description	If the PC is outside of the melee radius of the unicorn, the unicorn can shoot a set of projectiles at the PC.
Acceptance Criterion	Has to be implemented
Notes	None

ID: EB3	Unicorn states: Stomping attack
Description	If the PC is inside of the melee radius of the unicorn, the unicorn uses a stomping attack. The unicorn stomps on the ground in front of it and deals damage in an AOE.

ID: EB3	Unicorn states: Stomping attack
Acceptance Criterion	Has to be implemented
Notes	None

ID: EB4	Unicorn states: Wait
Description	After every attack, the unicorn remains idle for a short while in which it only moves around slowly.
Acceptance Criterion	Has to be implemented
Notes	None

ID: EB5	Unicorn states: Death
Description	When the unicorn's health reaches 0, it transitions to a death state. In this state, the unicorn stops all actions and animations, and after a short delay, it disappears from the game world.
Acceptance Criterion	The unicorn must correctly transition to the death state when its health is depleted, and it should no longer be able to perform any actions or affect the game.
Notes	Ensure that the transition to the death state is smooth and that the unicorn's disappearance is visually clear to the player.

2.2.2 Areas

2.2.2.1 Main Hub

The first area type is the main hub which is a menu that allows the player to modify their load-out. In this area no PC exists that can be moved. Instead there is a point-and-click visualisation of the magic school. Clicking on specific objects in the image opens the different menus needed to modify the load-out.

2.2.2.1.1 Skill tree

The skill tree is a menu where the player can unlock new skills and read the effects of the different skills. Each magic type has its own small skill tree. The base skill is the first skill of each skill tree. The supportive and offensive skills are the second layer of the skill trees. After the base skill is unlocked, the player can decide whether they want to unlock the supportive or offensive skill first.
For description of the skill see section 2.2.1.3.2.1 PC skills.

ID: AST1	Skill tree: Unlocking the first skill
Description	The player chooses a magic type in the beginning of the game which unlocks that magic types base skill.
Acceptance Criterion	The correct base skills are unlocked after the player selects their magic type.
Notes	None

ID: AST2	Skill tree: Unlocking criteria
Description	The base skill of each magic type has to be unlocked before other skills of that magic type can be unlocked.
Acceptance Criterion	Offensive and defensive skills of each magic type cannot be unlocked if the base skill is not unlocked. They can be unlocked if the player has the base skill unlocked.
Notes	The player chooses a magic type in the beginning of the game which unlocks that magic types base skill. Upon completing the intro dungeon the base skill of a second magic type is unlocked automatically.

ID: AST3	Skill tree: Unlocking skills
Description	The player can use one skill point to unlock one new skill. Skill points are magic type specific, e.g. a Sun skill point can only be used to unlock a Sun skill.
Acceptance Criterion	Skills are correctly unlocked by using skill points.
Notes	Skill points of a magic type are earned by clearing dungeons of that type. Both story and generated dungeons have a magic type.

ID: AST4	Skill tree: Skill descriptions
Description	All skills in the skill tree have a description. If the skills are not unlocked yet, the requirements for unlocking the skill are additionally described.
Acceptance Criterion	Descriptions are displayed correctly.
Notes	None

ID: AST5	Skill tree: Upgrading skills (Optional)
Description	If the player fulfills the cirterion for a skill upgrade, the skill is upgraded automatically.
Acceptance Criterion	Skills are upgraded correctly if the corresponding criterias are met.
Notes	This is a low priority requirement and should only be implemented if there is time. Planned unlocking criteria are clearing a dungeon with only one spell, which gives a version of the skill with better stats (more damage, buffs or debuffs). Additioanlly different criteria for each skill can give additional effects to the skills, e.g. Moon light gets an additional healing effect, slows or stuns for other spells. The properties and critera still need to be determined! Upgrades are hidden in the skill tree until they are unlocked by the player.

2.2.2.1.2 Equipping

The equipping menu allows the player to change the equipped augments and skills. In this menu, the skill slots with the currently equipped skills are displayed. Furthermore, the augment slot with the currently equipped augments and the inventory with all not equipped augments are displayed.

ID: AE1	Equipping: Equipping skills
Description	If the player click on one of their skill slots, they can select which skill to equip to this skill slot from all skills they have unlocked. The player also has the chance to clear the second and the third skill slot. If the player selects a skill that is already equipped to a different skill slot, the skills in the two slots are swapped.
Acceptance Criterion	Unlocked skills can be equipped and swapped.
Notes	The first skill slot cannot be cleared to prevent players from entering dungeons with no skills equipped.

ID: AE2	Equipping: Skill descriptions
Description	If the player hovers the mouse over a skill, the skill name and description is displayed.
Acceptance Criterion	Description is displayed correctly.
Notes	None

ID: AE3	Equipping: Equipping augments
Description	The player can drag and drop augments from their inventory to the unlocked augment slots. If the player drags an augment to an augment slot that is not empty, the previously equipped augment is returned to the inventory. The effects of the equipped augments are applied to the PC.
Acceptance Criterion	Augments can be correctly equipped to unlocked augment slots.
Notes	None

ID: AE4	Equipping: Augment descriptions
Description	If the player hovers the mouse over an augment, the augment effects are displayed. If an augment slot is not unlocked yet, the criteria for unlocking the skill slot is displayed.
Acceptance Criterion	Description is displayed correctly.
Notes	None

2.2.2.1.3 Fusing augments

The fusing augments menu allows the player to modify their augments. To fuse, the player has to choose two augments. The effect from one of the augment can be moved over to the second augment, which destoys the first augment. An effect from the second augment is overwritten with the new effect from the first augment. The player selects both the effect that is to be transferred and the effect that is overwritten.

ID: AFA1	Fusing: Fusing augments

ID: AFA1	Fusing: Fusing augments
Description	The player can select two augments to fuse them. For this they select an effect on the one augment that is transfered to the other augment and an effect on the other augment that is to be overwritten. The augment with the first process is destroyed in the process.
Acceptance Criterion	Augments can be fused correctly.
Notes	The number of effects that an augment has cannot be changed by fusing augments. An augment that is dropped with only one effect cannot gain a second effect through fusing.

2.2.2.1.4 Saving the game

From the main hub, the player can leave the game and save the current game state beforehand.

ID: AS1	Saving: Saving the game
Description	The player can save the current game state.
Acceptance Criterion	The current game state is saved.
Notes	None

2.2.2.1.5 Entering a dungeon

The entering a dungeon menu allows the player to select which dungeon to enter next. First, the player decides whether they want to enter a story dungeon or a generated dungeon. The layout and magic type of the story dungeons is always predefined depending on the magic type the player chose in the beginning. If the player chooses to enter a generated dungeon, they have to select the magic type of the dungeon. Furthermore, they can curse the dungeon to make it more difficult but to gain more rewards. The curses are shown in the menu before entering the dungeon and can be rerolled twice.

ID: AED1	Choosing a Dungeon
Description	The player can decide whether to enter a story dungeon or a generated dungeon. If the player chooses to enter a generated dungeon, they have to select the magic type of the dungeon. Furthermore, the player can curse the dungeon. The curses are shown in the menu before entering the dungeon and can be rerolled twice.
Acceptance Criterion	The dungeon type and all its modifications can be successfully determined.
Notes	The layout and magic type of the story dungeons is always predefined depending on the magic type the player chose when starting the game. Cursed dungeons are more difficult to clear but give better rewards.

ID: AED2	Entering a Dungeon
Description	The player can enter the dungeon they selected from the entering a dungeon menu.

ID: AED2	Entering a Dungeon
Acceptance Criterion	Player succefully enters the right dungeon.
Notes	

2.2.2.2 Dungeons

Dungeons are the areas of the game where the player can control the PC and combat enemies to gain rewards. Dungeons are composed of a number of rooms with slimes and a boss room at the end of the dungeon that contains at least one unicorn. The rooms are connected through doors which only open after all enemies in the room are killed.
Dungeons are not linear. Instead the player is forced to find the boss room. However, only the boss has to be killed in order to clear a dungeon, not every single room.
In the dungeons a camera is used to track the PC and enemy actions. The camera behaviour is different for different parts of the dungeon.

ID: D1	Camera Movement in Regular Rooms
Description	Inside the regular rooms inside a dungeon the camera tries to stay centered on the PC. Movement of the PC is slowly copied in order to not have fast change of the view field. Furthermore the camera is bounded on the walls of the room so that everything in the view field is usefull for the player.
Acceptance Criterion	Camera works as described.
Notes	None

ID: D2	Camera Movement in Boss Rooms
Description	In the boss room the camera is fixed and more zoomed out in order to always show the entire boss room at once.
Acceptance Criterion	Camera works as described.
Notes	None

ID: D3	Opening doors
Description	The player can open doors that leads to other rooms of the dungeon by killing all enemies in the room. If a room has several doors forwards, all doors are unlocked at once when the last enemy is killed.
Acceptance Criterion	Doors unlock when all enemies are dead and remain closed beforehand.
Notes	None

ID: D4	Boss room door

ID: D4	Boss room door
Description	The door to the boss room has to be visibly distinct from other, normal doors. There is only one door to the boss room.
Acceptance Criterion	
Notes	Since the player leaves the dungeon automatically after defeating the boss, and cannot leave the boss room once they entered it, they should know they are about to enter into the boss room.

ID: D5	Clearing the dungeon
Description	When the player has killed all bosses in the boss room, an information about the success and the gained rewards is displayed for the player. When the player closes the information, they exit the dungeon automatically.
Acceptance Criterion	Rewards are displayed correctly and player exits dungeon correctly.
Notes	None

ID: D6	Pausing the dungeon
Description	When the esc-key is pressed by the player a menu is opened and the game is paused.
Acceptance Criterion	
Notes	From the pause menu the player can go to the settings menu or leave the dungeon early.

ID: D7	Leaving the dungeon early
Description	The player can always leave the dungeon before clearing it. All rewards the player already has collected remain in the players inventory.
Acceptance Criterion	
Notes	None

ID: D8	Dying in the dungeon
Description	If the player dies in a dungeon, all rewards the player already earned remain in their inventory an the player is returned to the main hub.
Acceptance Criterion	
Notes	Except for story dungeons, players cannot retry the same dungeon again. If the player enters a generated dungeon again, a new one is generated.

The rooms out of which the dungeon is created are handcrafted and not randomly generated. There should be at least 5 different rooms.
The spawn locations for the enemies are also determined by hand. However not all possible spawn locations must also spawn enemies.
Since there are curses that spawn additional monsters each room, not all spawn locations must spawn an enemy. Instead whenever the room is first initialised the game will determine how many enemies should be spawned and then randomly pick the locations.

Each room is its own instance. The player can go into another room by walking through a door of the room. This will then load the next room instance. Direction is preserved, meaning if the player goes through the door on the left, the player will come out the door on the right in the next room, and vice versa for the other four directions.

The first time the player enters a room, a bunch of slimes are spawned. The player can only exit the room after killing all enemies within it.
The player can also return to a room they have already been to and cleared. In that case no enemies are spawned and the player can immideately leave the room through any door.

2.2.2.2.1 Intro dungeon

The intro dungeon is a handcrafted dungeon and the first dungeon the player has to clear. It serves as a tutorial for the basic mechanics and the magic types in the game. Because of this the magic types of the slimes in the dungeon change based on which magic type the player has chosen when starting the game. The magic type of the intro dungeon is the type that the chosen magic type of the player is strong against, e.g., the player chose Sun, then the intro dungeon is of type Cosmic. When the player completes the intro dungeon, they receive a skill point of that magic type, in the example, a Cosmic skill point. This is teaching the player how to interact with the skill tree after clearing the intro dungeon.

ID: DI1	**Adapting the Intro Dungeon**
Description	The magic types of the enemies inside the intro dungeon will be adapted according to the magic type the player has chosen.
Acceptance Criterion	Intro dungeon is adapted correctly.
Notes	The first enemies will have the type that the magic type is strong against. For example if the player chose Sun as their magic type, most the dungeons enemies will be of type Cosmic. Other enemies will teach the player about the weaknesses of their chosen magic type.

ID: DI2	**Layout of the Intro Dungeon**
Description	The intro dungeon consists of 4 rooms in a linear way. The first room contains only small melee slimes. The second room contains only small ranged slimes. The third room has both small melee and small ranged slimes. The fourth room is the boss room and contains one large melee slime.
Acceptance Criterion	

ID: DI2	Layout of the Intro Dungeon
Notes	Slimes have to correspond to different magic types to teach about strengths and weaknesses. The layout might have to be adapted according to player feedback later.

2.2.2.2.2 Story dungeon

There are five story dungeons. The bosses of the story dungeons are unicorns. The magic type of the story dungeons depends on the magic type the player chose at the start of the game. The unicorns have the same magic type as the dungeon type.

ID: DS1	Layout of Story Dungeons
Description	Each Story dungeon has a fixed layout that is handcrafted. The bosses of the story dungeons are unicorns. Each story dungeon also has an magic type. At least 50% of all slimes are of this magic type and the boss is also of this magic type. This magic type is determined by the starting magic type the player chose at the start of the game. The first story dungeon will be the same magic type as the intro dungeon. For the other story dungeons the magic type is the magic type that is weak against the magic type of the previous story dungeon. The fourth story dungeon has two bosses and the fifth and last dungeon has three bosses, one of each magic type.
Acceptance Criterion	
Notes	For example if the player chose Sun as starting magic type, then intro dungeon and the first story dungeon will be of type Cosmic. The second story dungeon will then be of type Dark, the third will be Sun, the fourth Cosmic and the fifth Dark.

2.2.2.2.3 Generated dungeons

The player can enter additional generated dungeons for additional rewards to level up their character.
Before entering the generated dungeon, the player can choose which magic type the dungeon should have. This choice determines the magic type of the final boss and guarantees that at least 50% of all slimes in the dungeon are of this magic type.

2.2.2.2.3.1 Generation

The dungeon layout is created using the possible rooms when the player first enteres the dungeon.
The layout is generated in a grid like pattern, where each room is one cell.
There should be at least 2 room between the entrance of the dungeon and the boss room.
Furthermore there should not be more then 10 rooms in total.

ID: DGG1	Generating a Generated Dungeons
Description	When a player enters a generated dungeon, a new dungeon is generated.

ID: DGG1	Generating a Generated Dungeons
Acceptance Criterion	TODO
Notes	There is no option to return to a previously generated dungeon if the player failed to clear the dungeon successfully.

ID: DGG2	Layout of Generated Dungeons
Description	If the player decides to enter a generated dungeon, a dungeon is generated. Every generated dungeon has between 5 and 10 rooms. These rooms are generated in a grid like pattern, where each room is one cell. There should be at least 2 rooms between the entrance of the dungeon and the boss room. The rooms themselves are not randomly generated but randomly selected from a list of designed rooms.
Acceptance Criterion	Dungeons can be generated correctly according to the criteria.
Notes	

ID: DGG3	Difficulty Scaling of Generated Dungeons
Description	When a player generates a generated dungeon, the amount of augment effects the player has equipped when generating the dungeon changes the difficutly of the dungeon. The more augment effects are applied to the PC, the more slimes spawn in each room and the stronger the slimes are (more HP and more damage).
Acceptance Criterion	Dungeon difficulty is adapted to augment effect amount correctly.
Notes	This allows for the player to lower the difficulty of the dungeons if the dungeons are otherwise too difficult. Exact numbers have to be determinied during developent to ensure good balancing.

2.2.2.2.3.2 Rewards

Clearing dungeons gives rewards to the players.

ID: DGR1	Skill Point Reward
Description	Killing the boss of a generated dungeon, and thus clearing the dungeon, rewards one skill point of the type of the dungeon.
Acceptance Criterion	
Notes	

ID: DGR2	Augment Reward

ID: DGR2	Augment Reward
Description	Killing the boss of a generated dungeon, and thus clearing the dungeon, the player is rewarded with one random augment guaranteed. There is a chance for a second augments. The quality of the augment is influenced by the difficulty of the dungeon. If the dungeon was cursed the player is rewarded with two augments guaranteed, with a chance for an additional third augment.
Acceptance Criterion	
Notes	Drop rates might have to be adjusted later.

2.2.2.2.3.3 Curses

Dungeons can be cursed before starting the dungeon. The dungeon will then be harder by strengthening enemies or weakening the player.
Upon dying the player has the choice to either retry the previously generated dungeon or to create a new one.
If the player decides to leave the dungeon, they cannot try the same dungeon again. Instead, a new one will be generated.

ID: DGC1	Curse Selection
Description	When the player curses a dungeon, a set of curses is drawn randomly from a list of curses. The player can view the current set of curses. The player can reroll the curses twice to obtain new sets of curses. If the player fails to clear a dungeon, the curses are not changed.
Acceptance Criterion	Curses are drawn and can be rerolled correctly.
Notes	Upon rerolling the player cannot return to the previous set of curses.
ID: DGC2	**Regaining rerolls**
Description	When the player clears any generated dungeon, the number of rerolls is updated to two again. If the player fails to clear a cursed dungeon and dies, one reroll is restored to the player.
Acceptance Criterion	Rerolls are restored correctly.
Notes	None
ID: DGC3	**Generating a cursed dungeon**
Description	When the player enters a cursed dungeon, a new dungeon is generated. The curses applied to the dungeon are the last drawn set of curses.
Acceptance Criterion	Cursed dungeons are generated with the correct curses.

ID: DGC3	Generating a cursed dungeon
Notes	If the player fails to clear a dungeon, the curses are not changed for the next dungeon unless the player rerolls them, but a new dungeon with different rooms and spawn points is generated.

Possible Curses

- player cannot use skill 3
- player can only use skill 1
- player takes x % more damage
- monsters have 20/40/60/80/100 % more hp/damage
- x % more monsters
- dungeon contains 2 bosses in the final room

2.2.2.2.4 Tile-Based System and Collision Detection

The game utilizes a tile-based system for both the macro-scale dungeon layouts connecting the different rooms, as well as for the in-room environment. Each room in the dungeon corresponds to a tile in a grid, ensuring structured navigation and interaction within the environment. This system facilitates the procedural generation of dungeons and supports a variety of room configurations.

2.2.2.2.4.1 Macro-scale dungeon layouts

Dungeons are composed of 5 to 10 rooms (with the exception of the intro dungeon, which is shorter). They have one entry room, one boss room and normal rooms. The entry room has to be on one side of the macro-scale layout of the dungeon and there have to be at least 2 rooms between the entry room and the boss room.
The rooms in the dungeon correspond to tiles in a grid, wherein all neighboring tiles have doors to connect the rooms. The only exeption to this is the boss room. Even if the boss room has several neighboring tiles, the door to the boss room is only in one normal room.
All rooms are similiar enough in size that the tiles that represent rooms can be quadratic, with four possible neighboring tiles.

2.2.2.2.4.2 In-room environment

- set of predefined rooms, consisting of
    - tiles
    - enemy spawn points
    - entry point (one per dungeon)
    - exit points (TODO: does this refer to doors between rooms or points from where the dungeon is left?)

The tilemap consists of three layers:

- **Background**: The first layer is the background layer. This layer is the layer the non-interactable background tiles are on.

- **Middleground**: The second layer is the middleground layer. This layer is the layer that the walls, doors and other obstacles are on.
- **Foreground**: The third layer is the foreground layer. This layer is for decorational or special interactable tiles.

Entities such as the player, enemies, augments are visually placed between the middleground and the foreground layer, however they are not treated as tiles.

2.2.2.2.4.3 Collision Detection

Collision detection is integral to the gameplay, ensuring that players and enemies interact with the environment and each other in a predictable manner. The game engine checks for collisions between entities (player, enemies) and environmental obstacles (walls, doors) to determine valid movements and interactions. This system is crucial for implementing gameplay mechanics such as combat, movement restrictions, and accessing different areas within the dungeons.

2.2.2.2.4.3.1 Player-Enemy Collisions

The player and enemies can pass through each other, with damage applied to the overlapping entities as necessary.

2.2.2.2.4.3.2 Player-Wall and Enemy-Wall Collisions

The player and enemies can not pass through walls.

2.2.2.2.4.3.3 Enemy-Enemy Collisions

Enemies should not pass through each other, however the interaction can be defined a bit loose, such as a repelling force when enemies overlap, pushing them away from each other.

2.2.3 Main menu and Tutorials

2.2.3.1 Main menu

If the player opens the game, the main menu is the first interface the player can interact with. The player has several options for interacting with the main menu.

ID: MM1	**Main menu: New Game**
Description	The player can start a new game from the main menu. When a new game is started, the player first has to decide with which magic type they want to start playing the game.
Acceptance Criterion	
Notes	None

ID: MM2	**Main menu: Continue**
Description	The player can continue playing the game from a previously saved game state.

ID: MM2	Main menu: Continue
Acceptance Criterion	Loading saved game states works.
Notes	None

ID: MM3	Main menu: Settings
Description	The player can change settings such as music and sound volume, setting the resolution or toggling a fullscreen mode. The settings menu can be accessed through a sub-menu that appears when the player presses the esc-key from the main hub and from inside dungeons as well.
Acceptance Criterion	
Notes	None

ID: MM4	Main menu: Exit
Description	The player can exit the game. In the standalone version of the game, the game closes itself.
Acceptance Criterion	Exit closes the game.
Notes	None

2.2.3.2 Tutorials

Tutorials are a set of explanatory texts that describe the features of the game. Tutorials exist for player movement (walking, dashing, spell casting), enemies (magic types and enemy types), the skill tree and the fusing of augments for example.

ID: T1	Tutorials
Description	When a player encounters a new game mechanic for the first time, a text is displayed for the player that explains the mechanic.
Acceptance Criterion	Tutorials are displayed at the correct times.
Notes	When possible, the tutorial is interactive.

2.3. Nonfunctional requirements

Coding Style: Adhere to the GDScript style guide and use a component-based architecture for improved maintainability, code reuse, and easier future expansion.

2.3.1. User interface and human factors

Outside the dungeons, the user interface will be fully controllable via mouse and keyboard for menu navigation, spell/augment selection, skill point allocation, and dungeon selection.

Furthermore every menu has to be selectable with not more then 3 clicks.
And each action, like selecting a dungeon or merging two augments, has to be doable with less then 10.

2.3.2. Documentation

Every non-trivial function within the codebase will have clear comments explaining its purpose, parameters, and return values.

We will use the Godot internal documentation feature in order to automatically generate the documentation.

A comprehensive user manual will be developed alongside the game to aid players.

2.3.3. Hardware considerations

The game is intended for personal computers that meet the recommended system requirements to run the Godot 4 game engine effectively.

- **CPU**: x86_64 CPU with SSE4.2 instructions, with 4 physical cores or more
- **GPU**: Dedicated graphics with full OpenGL 4.6 support or full Vulkan 1.2 support
- **RAM**: 8GB
- **OS**: Latest version of Firefox, Chrome, Edge, Safari, Opera or Windows 10 for native export

2.3.4. Performance characteristics

The game should maintain an average frame rate of at least 55 FPS at 1080p resolution with no more than 10% dips below 60 FPS during gameplay.

2.3.5. Error handling and extreme conditions

All methods that can potentially encounter errors (e.g., missing file, invalid user input) will be explicitly marked with error handling code.

Errors will be communicated to the player through clear on-screen messages. Additionally, a log file will record all encountered errors for debugging purposes.

2.3.6. Quality issues

The development process will involve thorough quality checks, including functionality testing, bug fixing, and performance optimization to ensure a polished gaming experience.

2.3.7. System modifications

A modern browser has to be installed in order to play the web version of the game.

For the standalone version no additional software installations will be required beyond the game itself.

2.3.8. Physical environment

The game will run inside a modern browser supporting html5, javascript and webGL.

2.3.9. Security issues

Due to its single-player nature, the game will not implement any online features or user accounts, eliminating security concerns related to player data.

The game will be restricted to reading and writing data within its designated folder, ensuring no security risks to the player's computer.

2.3.10. Resource issues

The game's memory usage and disk space requirements will be optimized to ensure smooth performance on a wide range of PC hardware. Specific limitations will be determined during development based on testing.

2.4. Pseudo requirements

The game should minimize visual clutter. There is no need for unneccessary visual effects if they do not add much to the enjoiment of the player.

The game should also not contain large empty spaces devoid of any form of player interaction.

2.5. System models

2.5.1. Scenarios

1. **Scenario** The player starts a new game. They are then asked to choose an magic type with which they want to start.
2. **Scenario** The PC enters a room in a dungeon. Close enemies then target the PC, forcing them to figth their way through.

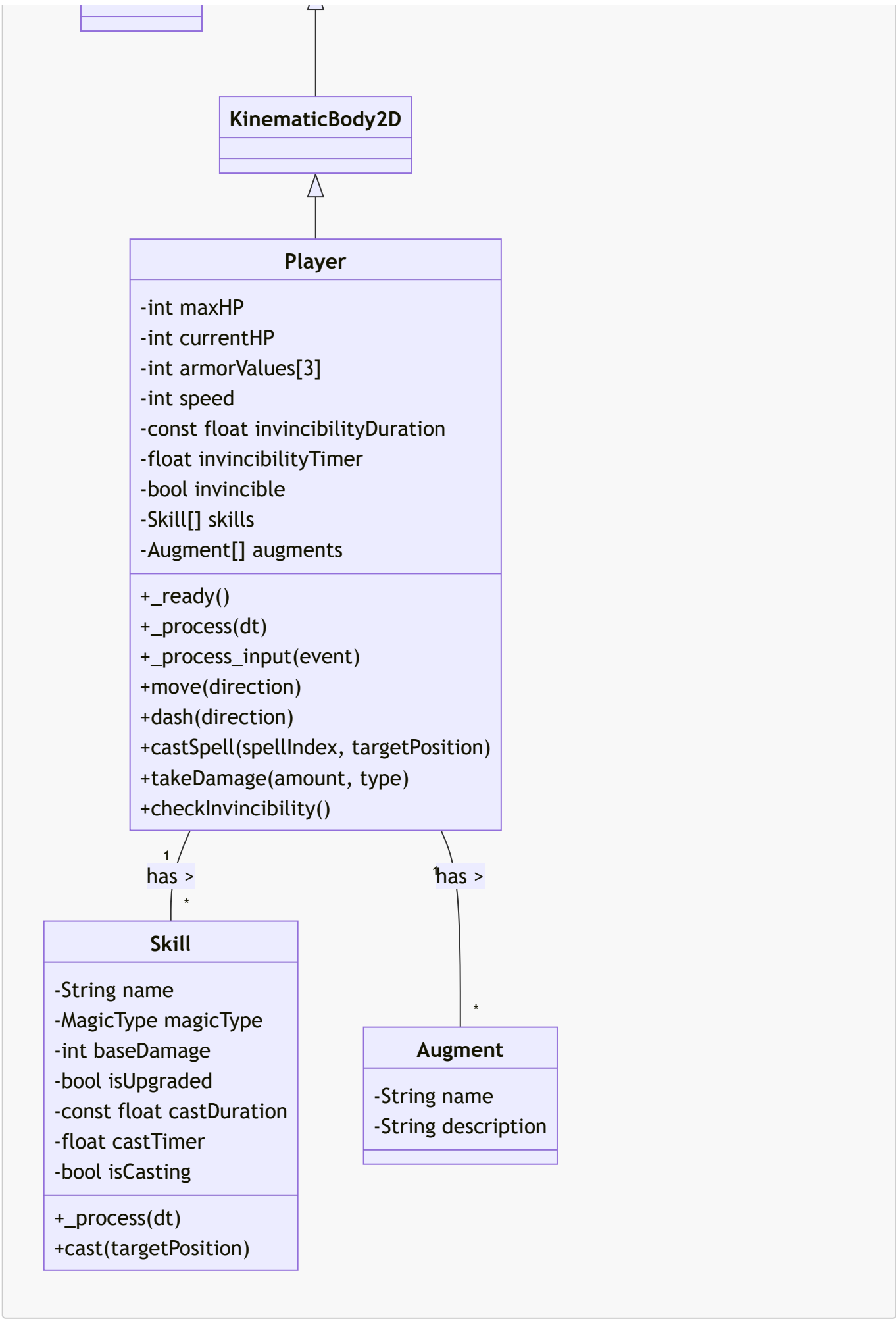
2.5.2. Use case model

- **Use case:** Player unlocks a new skill
    - **Precondition:** The PC has a skill point to spend in an magic type and an unlearned skill in that magic type
    - **Steps:**
        1. The player selects the skils menu
        2. The player selects the skill they want to unlock
        3. The player clicks unlock
    - **Postcondition:** The PC has now learned the skill and can select it

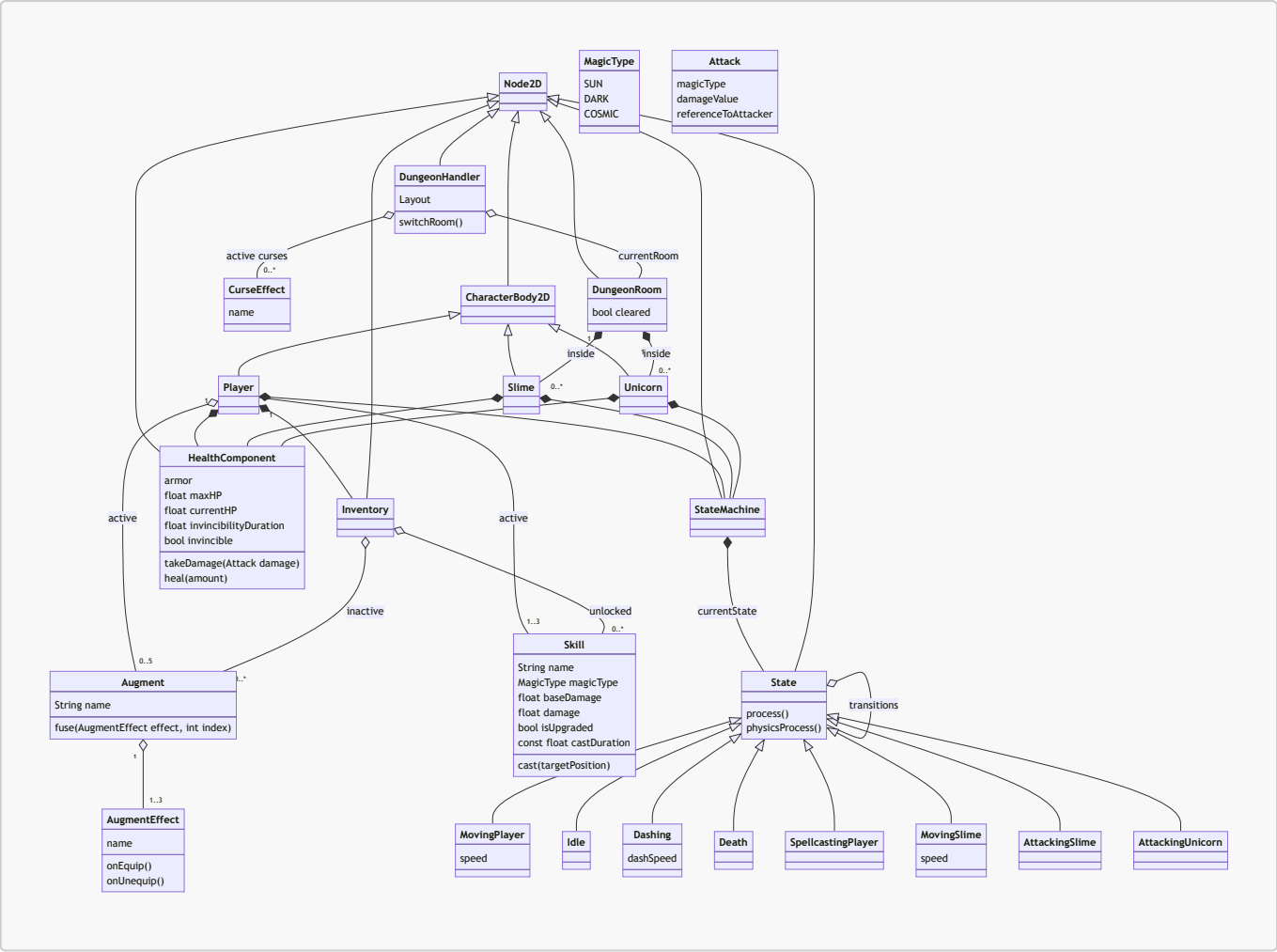
2.5.3. Object model

2.5.3.1. Data dictionary

2.5.3.2. Class diagrams

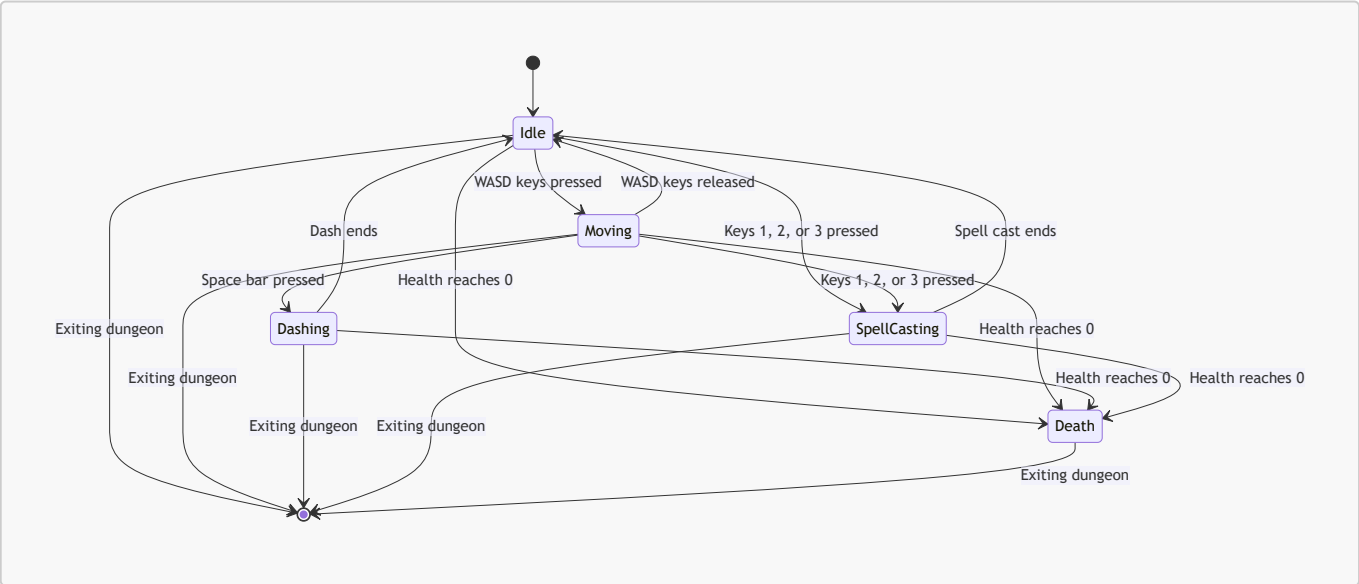

KinematicBody2D
Player
-int maxHP
-int currentHP
-int armorValues[3]
-int speed
-const float invincibilityDuration
-float invincibilityTimer
-bool invincible
-Skill[] skills
-Augment[] augments
+_ready()
+_process(dt)
+_process_input(event)
+move(direction)
+dash(direction)
+castSpell(spellIndex, targetPosition)
+takeDamage(amount, type)
+checkInvincibility()
1
has >
*
1
has >
*
Skill
-String name
-MagicType magicType
-int baseDamage
-bool isUpgraded
-const float castDuration
-float castTimer
-bool isCasting
+_process(dt)
+cast(targetPosition)
Augment
-String name
-String description

New class diagram with less details

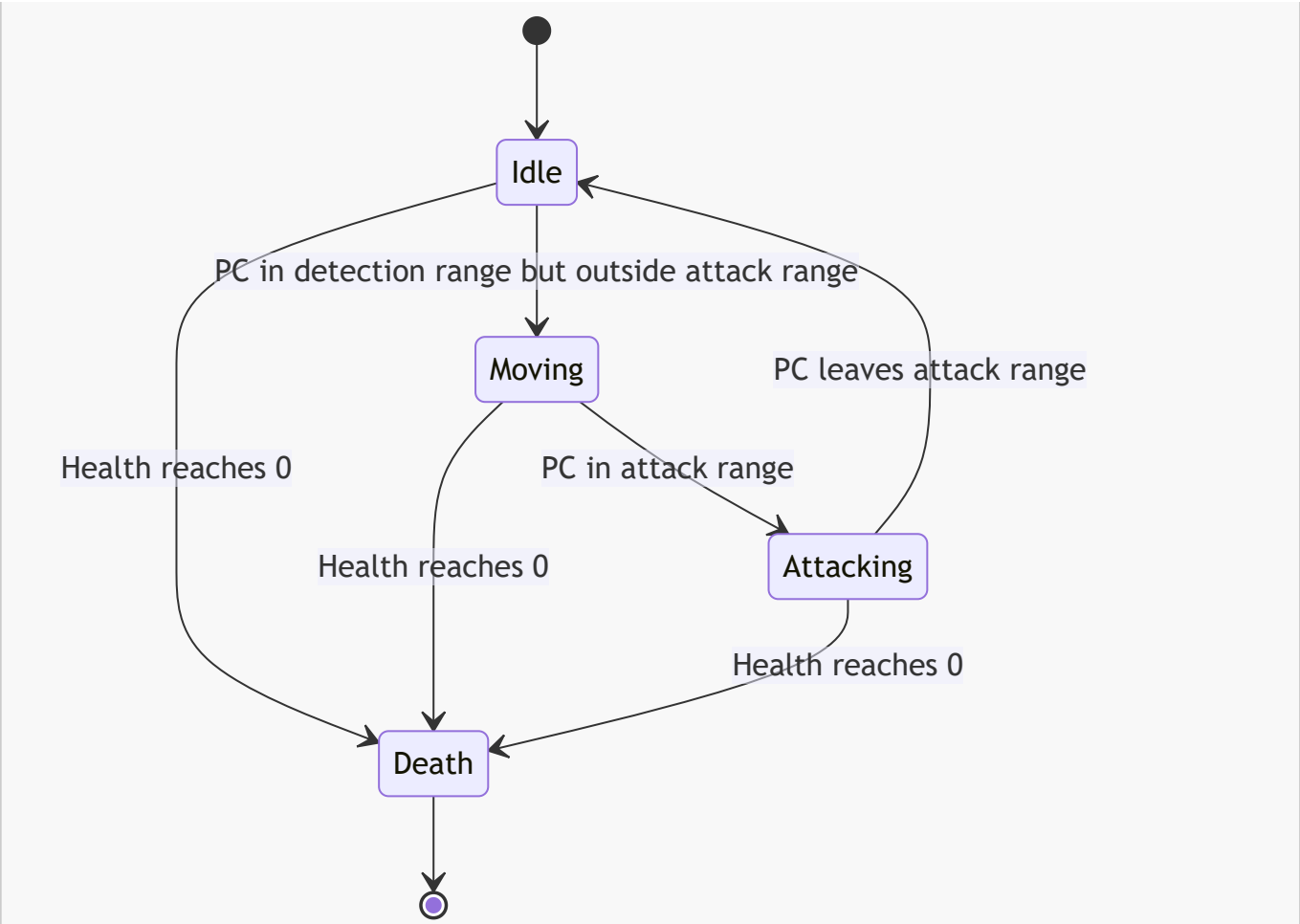


2.5.3.3. State machines

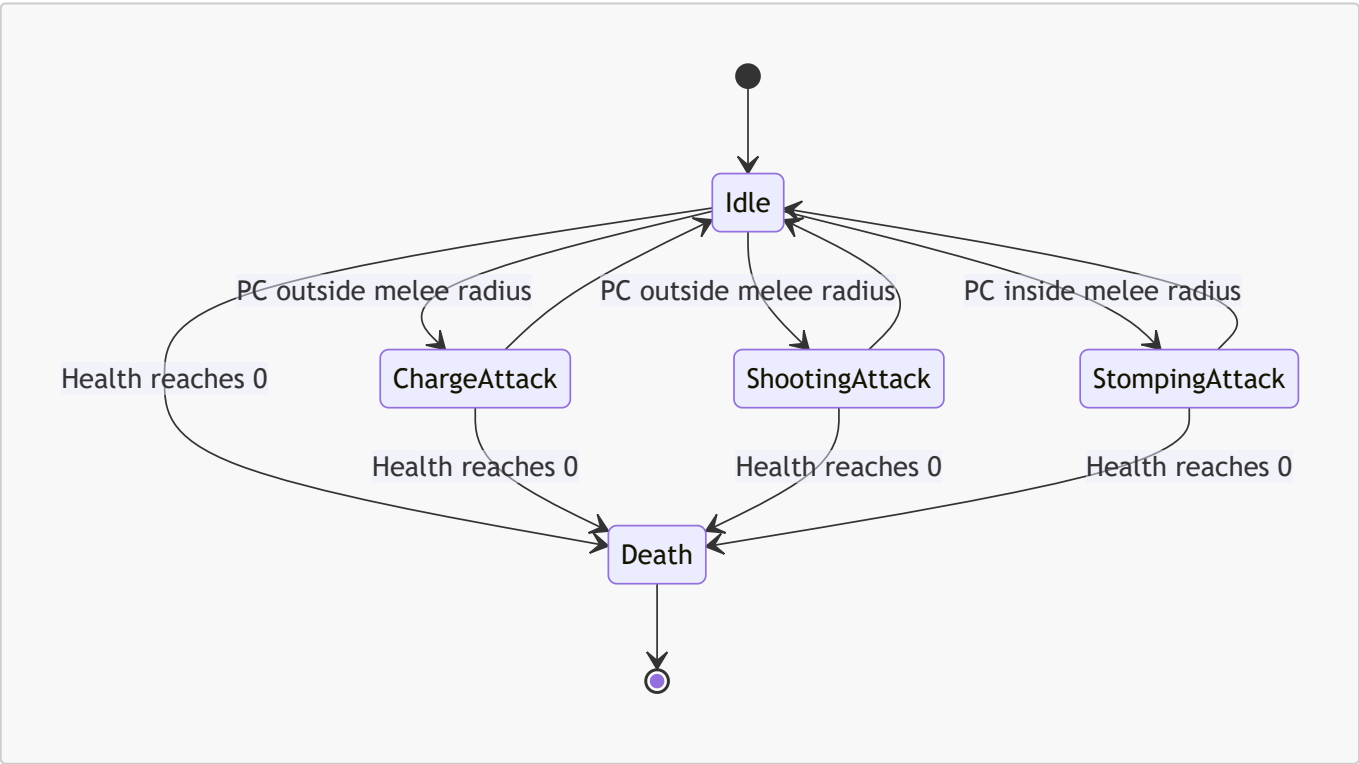
- **Player character state machine**



- **Slime state machine**



- **Unicorn state machine**



2.5.4. Dynamic models

2.5.5. User-interface -- navigational paths and screen mock-ups

3. Glossary