

**AKDENİZ UNIVERSITY
ENGINEERING FACULTY
DEPARTMENT OF COMPUTER
ENGINEERING**

SENIOR PROJECT INTERMEDIATE REPORT

Students' Name Surname : Mert KARABABA/Kaan KANATLI /Enes Salim ERDEM
Students' ID Number : 20160807017/20160808062/20160808033/
Supervisor Name(s) : MUSTAFA BERKAY YILMAZ
Date: 20 /12 / 2020

- **List of Group Members and Their Roles in the Project**

To complete this project, we first need character physics, then we need a map design that this character can play interactively, and finally, we need music-integrated algorithms to play this game in a rhythm-dependent manner, which is the main goal of the project.

So we divided that task to 3 main categories as we can see in below;

First category-) Mert Karababa

All physics of the game.

Second Category-) Kaan KANATLI

Music and rhythm adjustment algorithms.

Third Category-) Enes Salim ERDEM

Design of the game; Game interface, graphic design, map design, character design.

Let's see what those categories include in detail.

First Category -) All Physics of the Game

The primary purpose of these physics in the game is to make the character make movements that are related to the reality, for example; we want to jump, and when we press the jump button, the character takes off and lands correctly. To do this, we need to define the following physics rules.

1- Character main physics: basic movement physics like ,going left,right,up and down sides.

These physics will be active throughout the game regardless of the music.

2- Character play physics: Jump, hit, slash etc. physics.

These physics will be active when **Music-Rhythm Algorithm** kicks in.

3- Object physics: The speed of arrival of objects and their interaction with the character while playing the game

Second Category-) Music and Rhythm Adjustment Algorithms

Keeping certain rhythms of the music with the help of algorithms, activating the objects at these points and activating the **character play physics** accordingly.

- 1- **Music adjustment:** Music adjustments of the game like music start point, change point and end points.
- 2- **Music-Rhythm Algorithm:** The progress part according to the rhythm, which is the main purpose of the game, will be activated. This part will primarily divide the music playing into its rhythms. Selections from these rhythms will be assigned to the parts where **Character play physics** will be activated.
- 3- **Music-Object Adjustment:** Gather informations from **Music-Rhythm Algorithm** and according to that informations it selects object sender times. With the help of that adjustment now we can have rhythm based sended objects while playing.

Third Category-) Design of the Game

The part where the game is visualized. Such as Character design, map design, objects design, user interface. Basicly all visual things in the game.

- 1- **Game interface:** Game login screen, with menu includes start the game, logout, options etc.
- 2- **Graphic Design:** Character , object and map design and drawings.
- 3- **Map Design:** The part where the designs of the area where the game is playing. such as, map difficulties, map backgrounds, environment of map, colour and the shape of the objects.

- **Definition of the Problem and Difficulties**

Most of the difficulties we are going to experience and problems that will occur will be in the rhythm part of the game. Since the base game going to have it's own tracks for original designed maps, it will be easier to balance the game together with the rhythm it is going to have for the specific map.

Some difficulties may occur during the part where we set the perfect timing for the player to act based on rhythm of the track. Other than synchronizing the game with the current track being played, the most difficult part will be applying the player's chosen track to our endless run since there must be lots of handling with the track like key signature and time signature changes in the middle of the song or some songs having intros with unauditable time signatures etc.

a) Player's Action Timings

While this is not being the actual problem of the project, it is something that must be worked on since it is what makes the game fun. We know that no human can time any button action perfectly since that includes both human reflexes and input lag delay. So, delayed actions must be accepted at a certain point while still making the player feel they are being part of the rhythm that is going on.

We can get around it by leaving player enough time to act or giving them some kind of indicator to follow the rhythm of the track. The most appropriate way will be found by trying some different action times and indicators or maybe different approaches to make the player involved to the rhythm as much as possible.

b) Player Chosen Tracks

This is the part where we are going to have lots of difficulties from playing the player chosen track in game to synchronizing the game with any kind of genre. There are so many things that we need to be careful about implementing of this system. Even it seems like players do not have any limitations about this part, there must be some limitations of player chosen track to make it still playable.

First of all, the algorithm we are going to use must check the whole track since there can be more than one time signature in a song. If the player wants to use a song that starts with 120 bpm but later on the song continues with 150 bpm, action time must change in game at that part of the song as well. Even if we can implement this as it is, it may occur some other problems like player not noticing the timing difference or the game might get too fast to keep the pace with or just too slow.

Other than that, there are songs that has long intros with unauditable rhythms we should take care of to not lose the pace of the game. Not for only intros but this includes for some music genres as well. Some limitation for the bpm (beats per minute) might be needed since there are lots of fast or too slow songs. There are couple ways to work around with it by including the 8th notes to the player actions to make it playable even the song is too slow (doubling the bpm) or doing the opposite which is using half notes to keep up with the pace of the song if it is too fast.

c) Character Interaction

The game physics are another part of the project where we will experience some difficulties. Game object and character boxes must be well taken care of otherwise, there will be lots of issues about interactions between character and game objects or while a game object colliding with other game object etc.

- **Comprehensive Survey**

The main goal of the design of the game yields the player to explore the world in a fun and efficient way and in an effective mechanic-driven form.

As a consequence of this principle, the priority of the level design is a crucial part of the game.

This paper expounds, how to acquire this principle by analyzing the existing games of the genre.

Examples such as Sonic the Hedgehog, Super Mario, Super Meat Boy, Celeste, Dead Cells... on the 2D platformer side. On the other hand, in the Rhythm-based gameplay-side: BPM (Bullets Per Minute), Crypt of The Necrodancer, Rhythm Doctor, etc.

That much of gameplay elements led us to focus on level design physics constraints, object structures.

There are many books that we benefit from, concentrated on basis of the level design: *Rules of Play* by Eric Zimmerman and Katie Salen, *Beginning Game Level Design* by Marc Scattergood and John Fiel, *Level Design for Games: Creating Compelling Game* by Phil Co, etc.

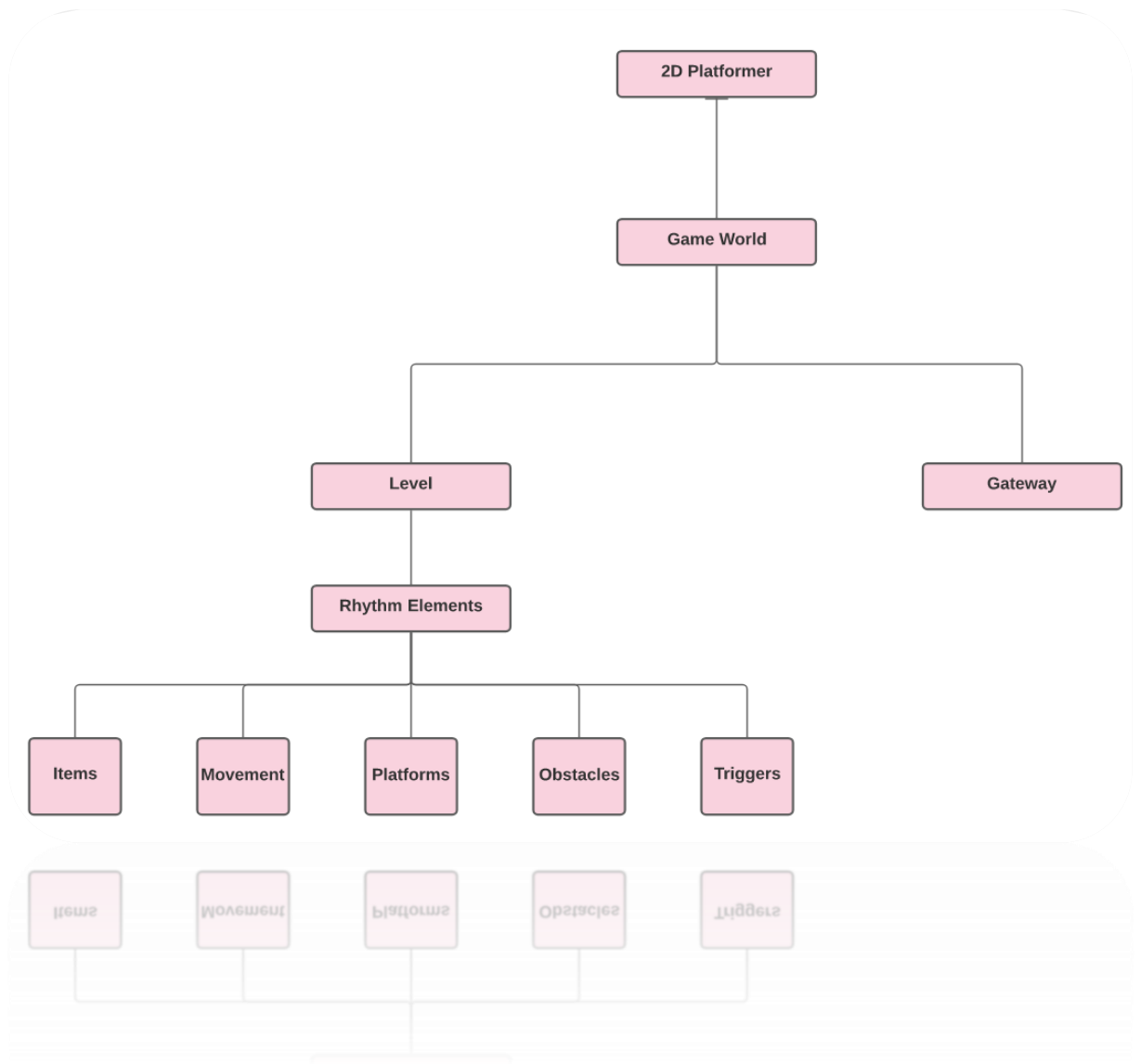


Fig. Conceptual Model of the Game Components.

Level Components and Rhythm Elements

There are certain components of the game categorized by their functions as shown in the figure.

- a) **Items:** In the game as in the many existing examples of the genre, we'll have items that provide diverse benefits when player acquired. Not just particularly weapons but bonuses like gold, health, powerups or of course weapons which have various fun features according to rhythm system.
- b) **Movement:** Besides the game character's core movement system, there will be alternative features that bring diversity in character movement-wise. Such as, ladders as in Super Mario or Donkey Kong, ropes, bouncy surfaces which gives moderate jump boosts, etc.
- c) **Platform:** Maybe the main element of the game, Platform contains any ground surface that the game character can move on it and it moves interactively with other objects.
- d) **Obstacles:** Those are the objects that can affect the player's movement in a good or bad way (most likely the second one). The player should avoid them by dodging, destroying, or jumping over them. Of course according to the rhythm system and also some obstacles are capable of move and they move in a most rhythmic way.
- e) **Triggers:** Some of the objects that were previously mentioned in the Movement section are an example of the Triggers. For instance, Buttons, surfaces that give jump boost, doors that'd be opened by keys, pressure plates, etc. Those triggers bring more interactivity to the game and it changes the level's current state actively. Those triggers also can be functional elements for puzzle-focused levels.

Rhythm

In the game player actions like jump or shoot are corresponding to the rhythm. There will be specific time intervals for those events to start and end. To determine those time intervals criteria can be the length, density and the type of the beat.



40s, low density, regular type



40s, mid density, regular type



40s, high density, regular type



30s, mid density, swing type



20s, high density, random type

References

<https://mad-gfx.com/news/2018/7/15/10-principles-of-good-level-design>

[https://www.gamasutra.com/blogs/DanTaylor/20130929/196791/Ten Principles of Good Level Design Part 1.php](https://www.gamasutra.com/blogs/DanTaylor/20130929/196791/Ten_Principles_of_Good_Level_Design_Part_1.php)

<https://users.soe.ucsc.edu/~ejw/papers/Smith-Launchpad-TCIAIG-2011.pdf>

<https://dl.acm.org/doi/abs/10.1145/1536513.1536548?download=true>

<https://www.bulletsinperminute.com/presskit>

[https://www.reddit.com/r/gamedev/comments/13y26t/how do rhythm games stay in sync with the music/](https://www.reddit.com/r/gamedev/comments/13y26t/how_do_rhythm_games_stay_in_sync_with_the_music/)

Beginning Game Level Design, John Feil, Marc Scattergood, 1592004342, 9781592004348, 2005.

[https://www.researchgate.net/publication/337109314 Procedural Content Generation of Rhythm Games Using Deep Learning Methods](https://www.researchgate.net/publication/337109314_Procedural_Content_Generation_of_Rhythm_Games_Using_Deep_Learning_Methods)