

Game Development with Optical Illusion and Artificial Intelligence

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Abstract - Gaming industry is arguably one of the most important and innovative sectors in tech today. Its importance to culture, social networking and entertainment cannot be understated. The term entertainment industry is no longer reserved for Hollywood and the movie industry because gaming is now providing one of the most immersive and awe-inspiring forms of entertainment to more than two billion people around the globe. Most of the games practice the theme of war and other puzzle games are based on simple tasks but bringing the concept of optical illusion in games is still new. This game is inspired by the concept of Penrose triangle and Escher's paintings. The Levels use Breadth first search algorithm for pathfinding.

Index terms- Game development, Penrose triangle, Optical Illusion, Breadth first search algorithm.

I. INTRODUCTION

Gaming Industry has seen a significant increase in revenue and demand in past few years. Demand for new games, new concepts has increased and every single day there is a new game that is released either on play store or web for installation. There are millions of games involving war concepts, cooking shows, sports, and action but just a few that stand out from the list. Monument valley, Manifold gardens and Limbo are few of them. The aesthetic design of Monument valley, Monochrome concept of Limbo gave the players a different experience of emotions. Players are fond of these games and unique concepts. This paper shows the involvement of optical illusion in the level design of a game. Here, the orthographic view of camera tricks the player into thinking that the architecture is on 2 floors but just one bridge can make it seem like its just one floor with different access. The player is controlled using breadth first search algorithm used for pathfinding and this is developed in Unity platform.

II. RELATED WORK

In the paper [1], the authors are depicting their approach toward a new game development life cycle which is different from a Software development lifecycle. It presents a new Game development Life Cycle with guidelines to successfully deliver a good quality game. A few of the GDLCs are picked and compare with the developed GDLC by the authors. This GDLC involves six steps being Initiation -> Pre-Production -> Production -> Testing -> Beta -> Release. Following these six steps will allow a developer to create a proper game without facing difficulties in debugging the errors and queries later. So in conclusion, Its stated tht a software cycle do not consider engineering and arts as combined element, hence a game development lifecycle needs to be different than that of software development life cycle.

In the paper [2], authors study about the Unity Game development engine and give a survey on the usage and benefits of it for game development. It can be used for virtual reality, augmented reality, two-dimensional and three-dimensional games along with simulations along with other purposes. This paper focuses on the benefits of unity engine, the problems that can be faced while using the engine and the best approaches to enhance the skills of game developers.

In paper [3], authors have implemented two programs – and intelligent camera system and pathfinding in 3D application. Traditionally, AI was always left till the last stage in a game's development cycle as most programmers know that it is almost impossible to develop game AI until one knows how the game is going to be played. As the use of AI in games matures, more time and energy were spent on developing AI system. This project involves the study of existing use of AI in games, the concepts behind them and how they are applied into games.

In paper [4], the authors implement Breadth first search for finding the shortest path in cartesian area. This paper attempts to show some of the path solutions from the initial location to the destination location, using the Breadth First Search algorithm. The given solution can consist of many solutions with the path meet the criteria of the problem already mentioned, Research conducted by previous research Yan ZHOU, this research not only provides the shortest path solution but also provides another form of optimal search if there are obstacles that block the process of the path being traversed.

In the paper [5], the authors create a game applying the rules of optical illusion in the design. It shows that the impact of optical illusion on the gaming experience is to bring a sense of novelty. Adding an operationally or visually brand-new content to 3D game arouse the interest of players in game and produces a good gaming experience. The game Alice in Wonderland has different types of illusion in each level design and shows the variance of optical illusions that can arouse the interest of players in the game and can produce a good gaming experience. Application of Spatial Optical illusion in the first level, Mirror optical illusion in second and Bounded and unbounded concept in third level makes it an interesting game.

In the paper [6], the authors depict the importance of online games for therapeutic purposes. Offline games have always been a part of therapies, but online video games are still under-researched. Research into online video game therapy for mental health concerns might focus on two broad types of game: simple society games, which are accessible and enjoyable to players of all ages, and online worlds, which offer a unique opportunity for narrative content and immersive remote interaction with therapists and fellow patients. Both genres might be used for assessment and training purposes and provide an unlimited platform for social interaction. The mental health community can benefit from more collaborative efforts between therapists and engineers, making such innovations a reality.

In the paper [7], the author has written about the research done on Penrose triangle and similar figures that follow the rules of optical illusion. Exploration and illustration of the paper revolves around example that are drawn from a family of figures of Penrose Triangle. Huffman's account of the Penrose triangle was used to show that not every adequate mechanism is psychologically plausible or can be used to predict a class of perceptually similar figures.

In the paper [8], the author presents the design and implementation of the game called cognitive arenas. It is a very common game and was developed keeping the Mac OS X and Windows Operating System. The aim behind the project was to promote education via innovation. The students playing the game can learn their given material in one of the modules and answer the questions asked in the game where simultaneously he play the shooter game. The player can move to three levels of scenes depicted in Unity3D Game Engine to play the game interestingly.

In the paper [9], the authors introduce a system called Lume for procedural narrative generation that combines the best of two approaches that is a large emergent possibility space with less focus on narrative structure, or toward greater structure with smaller possibility space. These two approaches are combined through a novel combinatorial scene architecture in which stroylet scenes are comprised of parametrized node-trees. This system still exists in a prototype phase. This system is currently being used to develop a full-scale narrative game.

In the paper [10], authors review the Turing's Test and some of its key criticism. They try to prove that Turing's test can be applied in game development process. The human conference in 2003 competition scored in the range undecided to probably human which may itself prove that something about how the Turing's test limits human ability to recognize intelligence when we do encounter it.

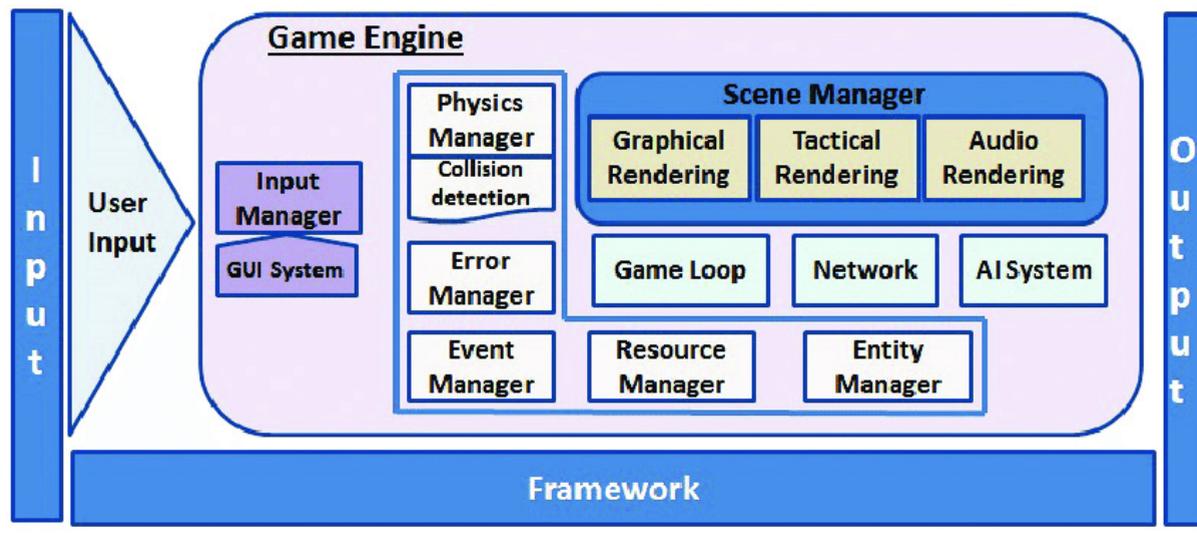
S.No.	TITLE	AUTHOR	YEAR	ADVANTAGES
1	Game Development Lifecycle Guidelines(GDLC)	Rido Ramadan, Yani Widayani	2013	This paper brings to light the importance of having a different game development cycle that the software development cycle. The author tries to show the importance of game development cycle while creating a game and also compare different cycles used in recent times.
2	Unity Game Development Engine: A Technical Survey	Afzal Hussain, Haad Shakeel , Faizan Hussain, Nasir Uddin , and Turab Latif Ghouri	2020	This paper describes the Unity game engine and its functions which made it the most used engine to create games easily. It combines the design and programming fields and gives the user one place to work on all the needed components.
3	Game ai: artificial intelligence for 3d path finding	Yee Chia Hui, Edmond C. Prakash and Narendra S. Chaudhari	2004	They have emphasised on use of AI for Game development. Not only can AI cleverly control characters in game, but it can also be used in implementing an intelligent camera system that can handle a diverse and dynamic three-dimensional environment.
4	Breadth First Search Approach for Shortest Path Solution in Cartesian Area	Robbi Rahim, Dahlan Abdullah , Saiful Nurarif , Mukhlis Ramadhan , Badrul Anwar , Muhammad Dahria ,	2018	In this paper, BFS is used to find the shortest path in cartesian area. In BFS every node is checked before moving forward. This creates an advantage of finding the best path in limited time. This also gives us multiple routes of same distance and same time, so any one can be chosen as the correct path.
5	Research on the Application of Optical Illusion in Game Design	Yingfang Zhang, Shiyun Li	2017	This paper briefly introduces the principle of visual illusion and analyzes the classic works of visual illusion. The impact of the optical illusion on the gaming experience is to bring players with a sense of novelty. Adding an operationally or visually brand-new content to 3D game arouse the interest of players in game and produces a good gaming experience.

6	Online video game therapy for mental health concerns	Nathan wilkinson, rebecca p. Ang & dion h. Goh	2008	This paper is a research on how video games and the internet can now be combined in therapeutic interventions. Mental Health is not a part of game developers plan, but when the game is launched in society, its affects and actions can be therapeutic or violent in each player.
7	The penrose triangle and a family of related figures	Stephen W Drape	1978	This paper has explained types of Penrose triangle and the logic behind each design. He also explains the Escher's paintings which led to the discovery of Penrose triangle like optical illusion and supports the game design for my project as well.
7	3d game development using unity game engine	Pa.Megha, L.Nachammai, T.M.Senthil Ganesan	2018	The aim of the paper is to promote education via innovative platforms. The functions supported by Unity game engine are autonomously very abundant. All game development are possible such as, shader, physics engine, visual studio compatibility for programming, runtime functions, audio ,video and animation.
9.	Lume: A System for Procedural Story Generation	Stacey Mason, Ceri Stagg, Noah Wardrip-Fruin	2019	Having a story behind the game attracts players and increases interest towards the game.
10.	Turing's test and Believable Games	Daniel Livingstone	2006	If the objective is proved gaming can become an extremely real experience as difference between computer and real player will be minimal.

III. PROPOSED MODEL

In this paper, we propose a model to predict the outcomes of football matches. We train the final data-set on various machine learning classifiers. We compare the performances of each classifier and choose the one that returns the best result. Then, we optimize the classifier using Hyperparameter tuning that yields the best result to further enhance the model accuracy in making predictions. Our final result is labeled as Full-Time Match Result (FTR). This label will indicate a Home team win (H), an Away team win (A), or a Draw (D).

In this paper, I have implemented the rules of optical illusion to design the two architectures. I am using breadth first search for pathfinding for the character and implementing the code on Unity 3D engine. This paper focuses on showing that optical illusion can be a part of game development and can bring a change in the storyline concepts of games. Here an adjacency list is used to save the nodes and since the distance between every node is unit distance, BFS is the best choice for path finding.



Architecture Diagram

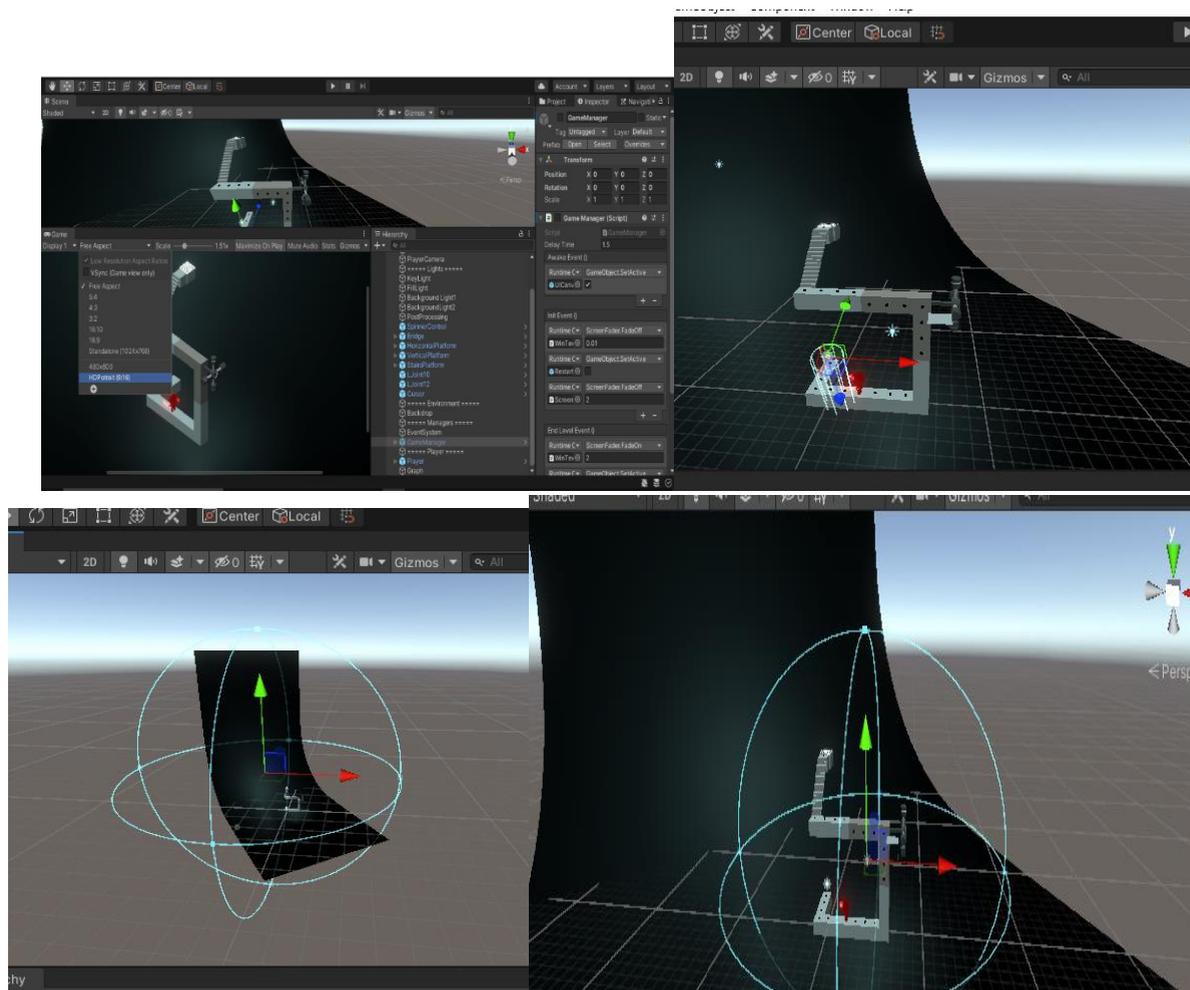
Our project is divided into 2 modules:

- Module 1: Game Design
 - Setting up Game View
 - Building Platforms
 - Creating Camera Stacks
- Module 2: Game programming
 - Adding Graphs, Nodes and Edges
 - Pathfinding Algorithm
 - Controlling Player
 - Completing Game Manager

Module 1: Game Design

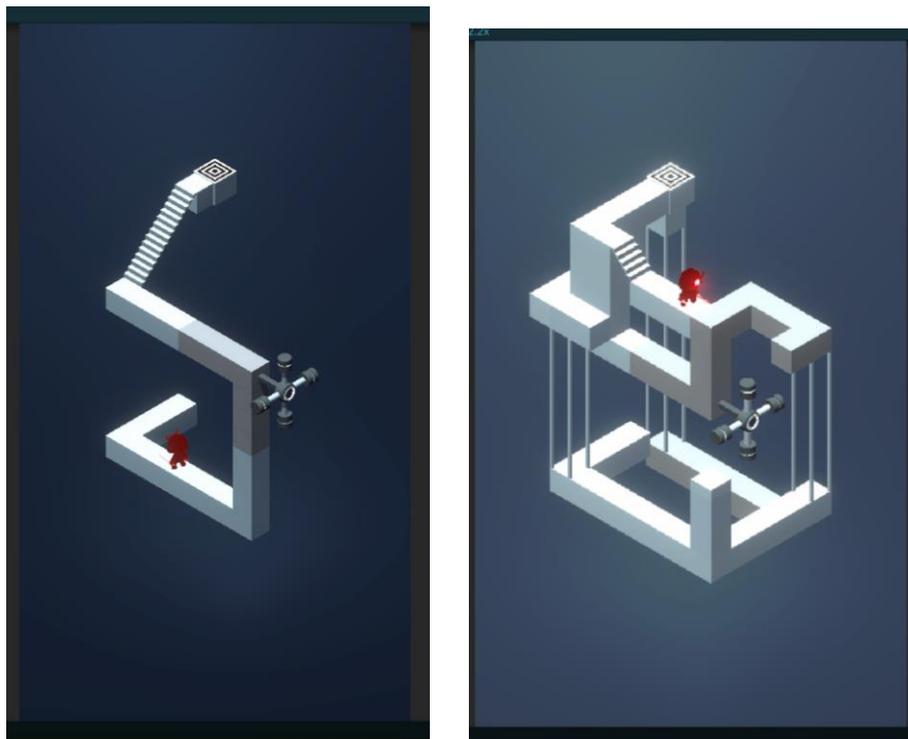
1.1) Setting Up The Game View

This level is for Android and will need a game view which is comfortable on phone. The common aspect used for developing games for phone screen size, it is set at 9:16 ratio. The lights need to be inserted at every angle for perspective clearance and game visibility.



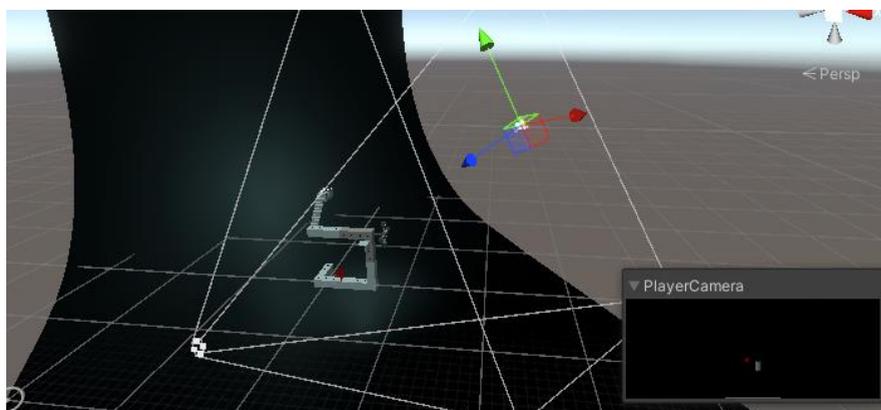
1.2) Building Up the Game Platform

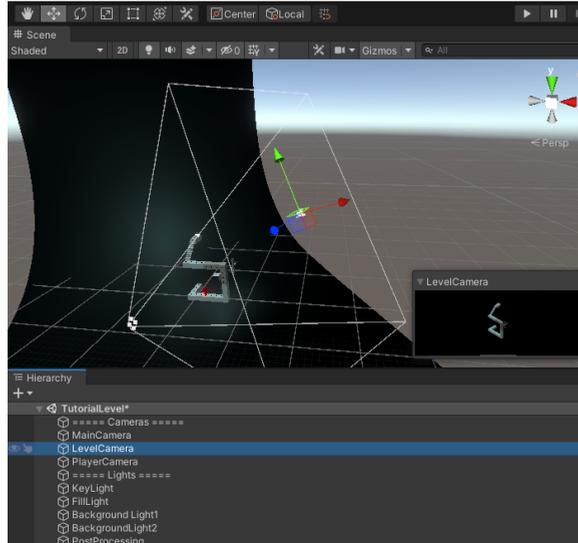
In this the architecture is brought together. Since there are platforms here which will be dynamic during the game, every platform is set on different layers. The bridge will have movement at 90 degrees. Other three platforms are vertical platform, horizontal platform, and the stairs platform.



1.3) Creating Camera Stacks

In the Universal Render Pipeline (URP), you use Camera Stacking to layer the output of multiple Cameras and create a single combined output. So here the base camera is the main camera set on background. Other two cameras are the layer camera and player camera set on architecture and player, respectively. The Layer and Player camera are in overlay mode on the base camera. Overlay enables the camera to ignore the background and focus on the layer it is selected for. Camera stack overrides the output of the base camera with the combined output of all the cameras in camera stack. Universal Render pipeline performs several optimisations within camera including rendering order optimization to reduce overdraw. But Camera stack effectively defines the order in which the camera rendered.

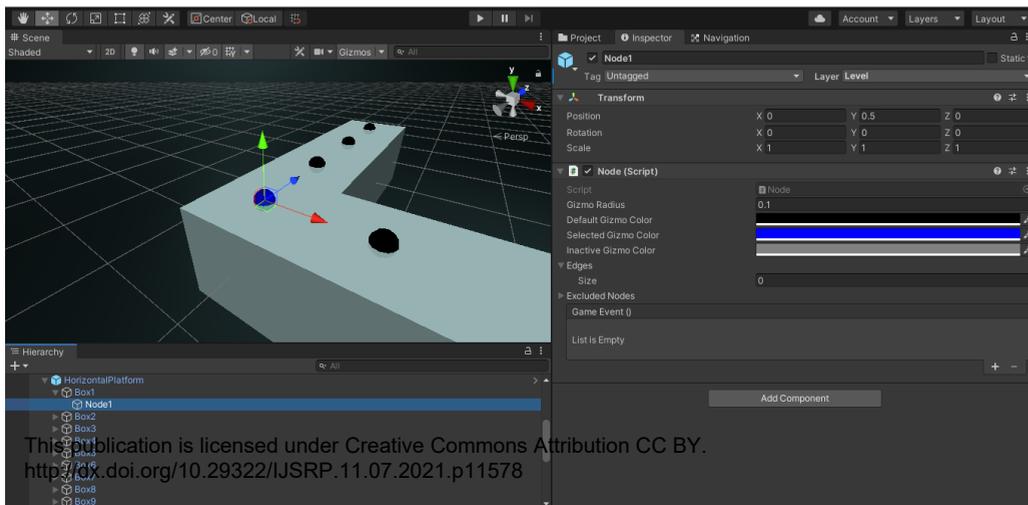
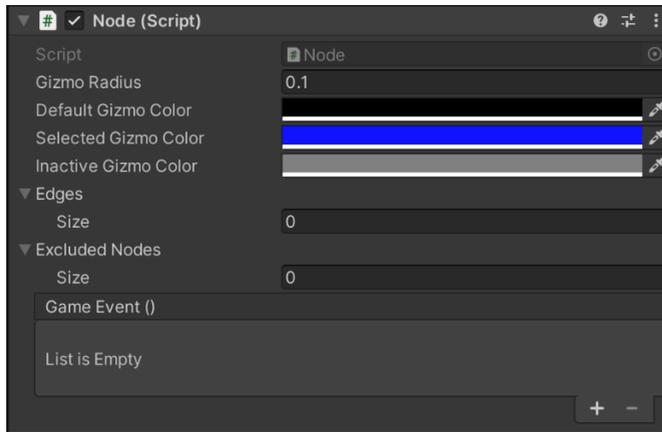




Module 2: Game Programming

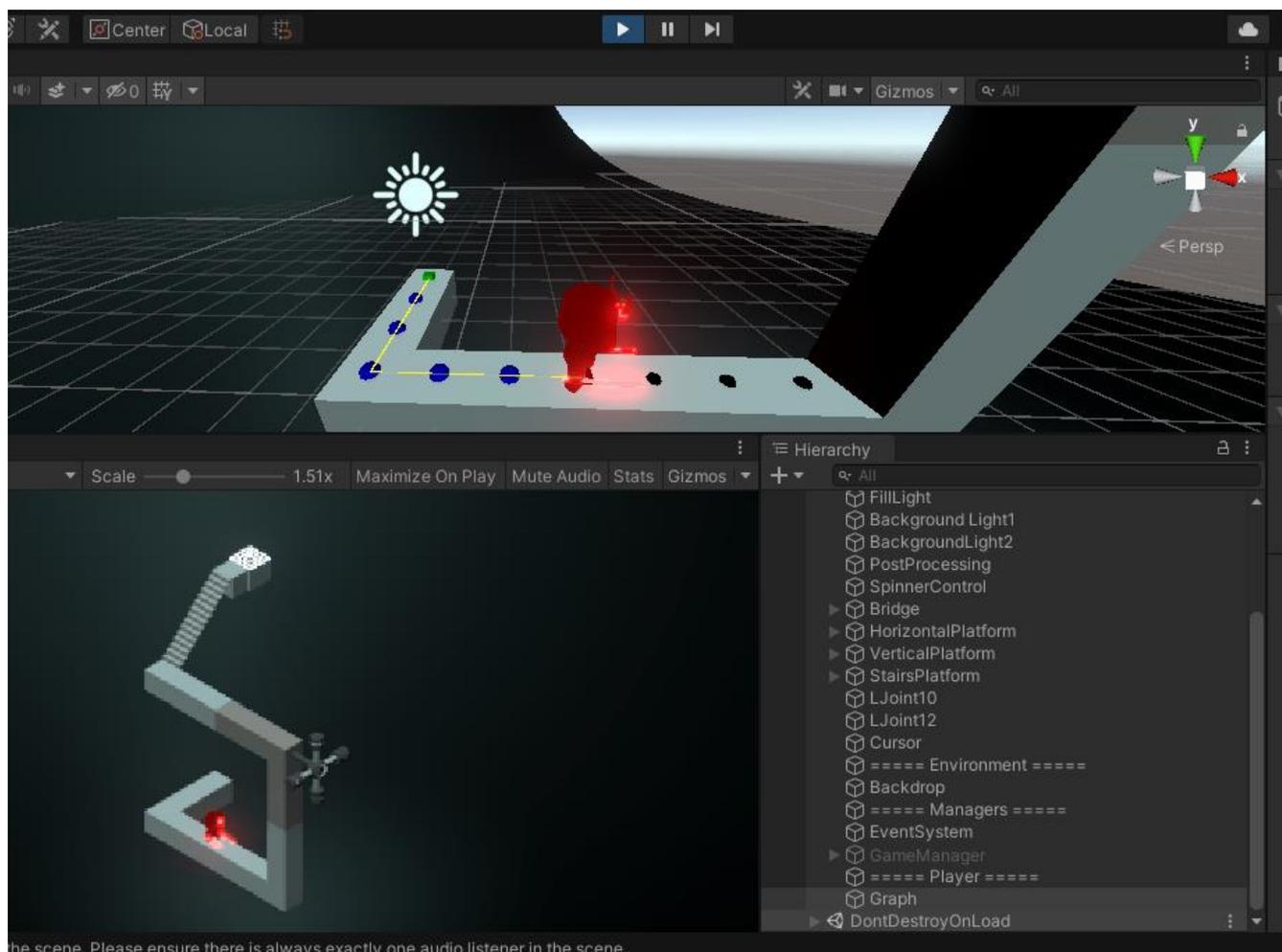
2.1) Adding Graphs, Nodes and Edges

A waypoint, or node, forms one unit of the path. It describes a three-dimensional location. The helper Edge class allows a node to connect to its neighbouring nodes. You can toggle each edge on and off, which will be useful later. The node Script attached to the layer creates nodes on every box. Here the Gizmo helps in drawing and describing the look of the nodes when they are at rest or active and clicked. The end node and the start node is also defined with different colours.



2.2) Pathfinding Algorithm

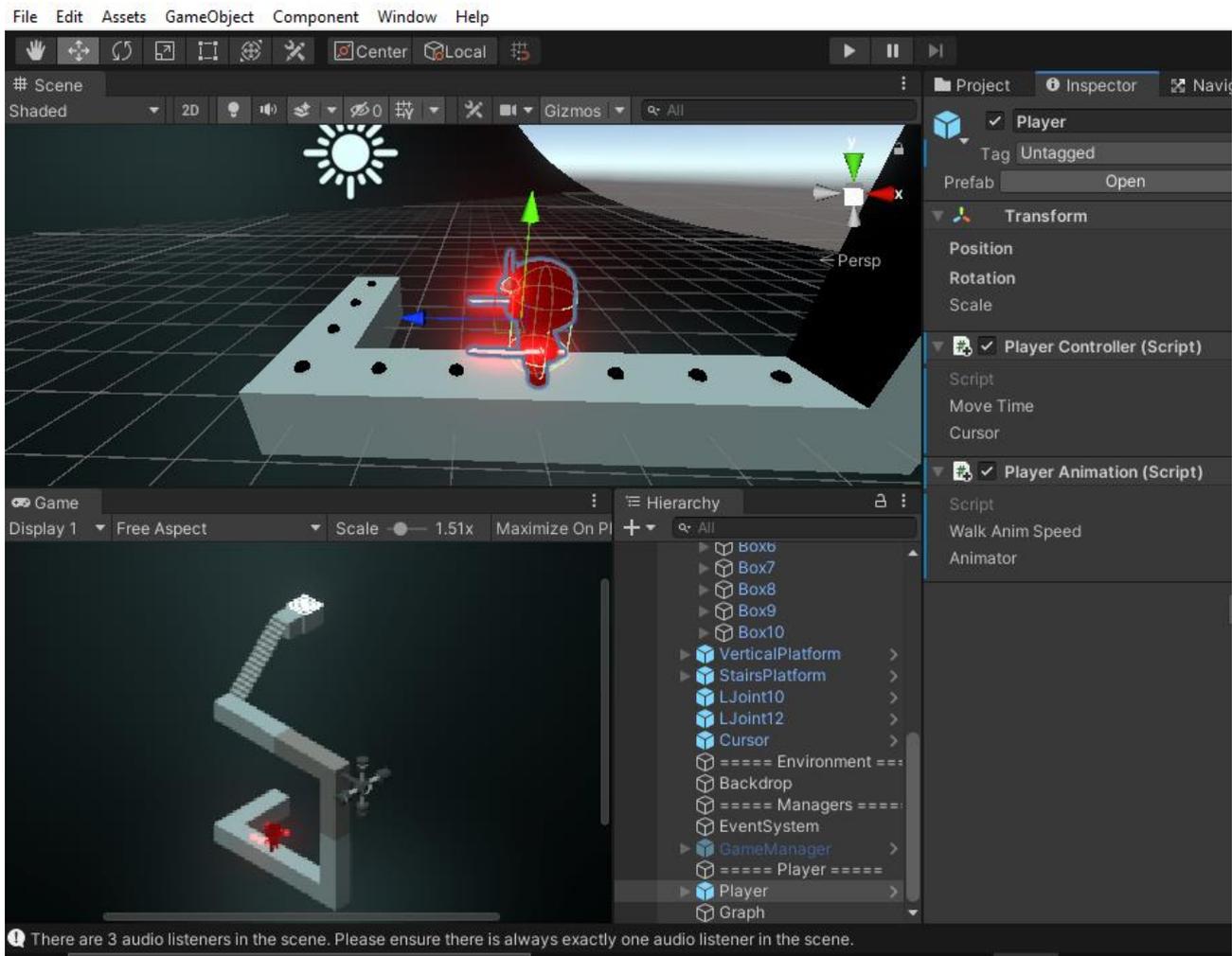
Breadth First Search is used for pathfinding algorithm here. Every node is connected to adjacent nodes in the inspector tab and a path is created. Once the player clicks on destination point, in the Scene view, the path is created with yellow line and the blue nodes show the appropriate path. In the algorithm, the graph is unweighted and bidirectional and an adjacency list is used to save the node for creating the unordered list which is used to create a finite graph.



the scene. Please ensure there is always exactly one audio listener in the scene.

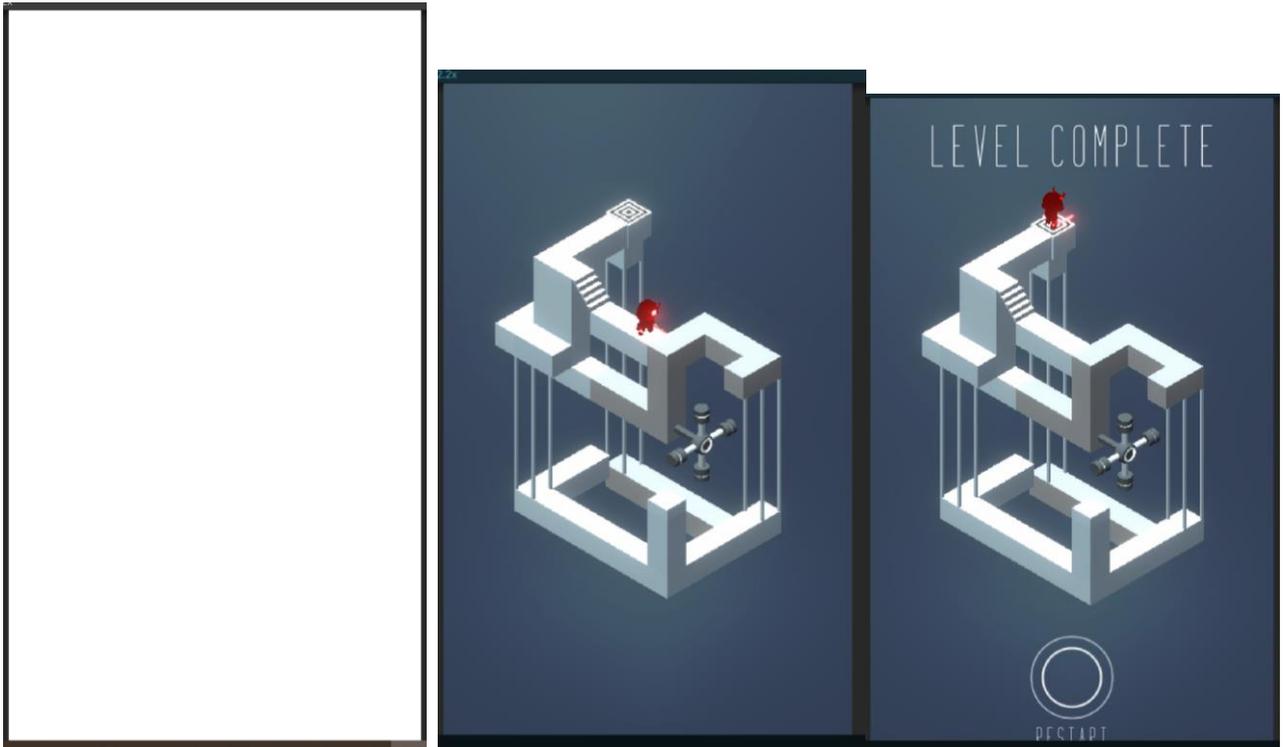
2.3) Controlling Player

Once the path is setup, the agent needs to follow the path suggested through BFS, for this animation is added. Two C# scripts are added which include the controller and animator. Controller commands the player according to the actions clicked by the player. Animator contains a small code giving command of walking back and forth when clicked at one point.



2.4) Game Manager

Once the pathfinding algorithm is implemented and all the functions are running with no error, Game manager is set up. Here the Screen Fader is activated. When the game starts it need a good introduction, so the white fader is added so when the level starts, the white screen fades away revealing the architecture and player. In the end the player gets an option of restart or the player can just exit the game. These functions are all controlled by the game manager.



IV. CONCLUSION AND FUTURE WORK

The level design is inspired by Escher's paintings and these are just two basic models to explain the involvement of optical illusion in the architecture and implementation of BFS for pathfinding. Not being a grid based game other pathfinding algorithms like A* algorithm cannot be implemented for pathfinding. In the future I would like to extend the levels and create a game out of this concept. It can help in survey of effects it has on mental health as the aesthetics of this game will be peaceful and the colour range can lead to emotional changes. The impossible geometry and the aesthetic feel of the game can increase the demand and can bring in players who like to explore new worlds.

REFERENCES

- [1] Ramadan, R., & Widyani, Y. (2013, September). "Game development life cycle Guidelines". In 2013 *International Conference on Advanced Computer Science and Information Systems (ICACSIS)*
- [2] Afzal Hussain, Haad Shakeel , Faizan Hussain , Nasir Uddin , and Turab Latif Ghouri."Unity Game Development Engine: A Technical Survey".In *University of Sindh Journal of Information and Communication Technology (USJICT)*
- [3] Y. C. Hui, E. C. Prakash and N. S. Chaudhari, "Game AI: artificial intelligence for 3D path finding," *2004 IEEE Region 10 Conference TENCN 2004.*, Chiang Mai, Thailand, 2004, pp. 306-309 Vol. 2, doi: 10.1109/TENCN.2004.1414592.
- [4] Robbi Rahim, Dahlan Abdullah , Saiful Nurarif , Mukhlis Ramadhan , Badrul Anwar , Muhammad Dahria , Surya Darma Nasution, Tengku Mohd Diansyah, Mufida Khairani."Breadth First Search Approach for Shortest Path Solution in Cartesian Area".*Journal of Physics: Conference Series, Volume 1019, 1st International Conference on Green and Sustainable Computing (ICoGeS) 2017 25–27 November 2017, Kuching, Sarawak, Malaysia*
- [5] Zhang, Y., & Li, S. (2017, September). Research on the Application of Optical Illusion in Game Design. Retrieved from 2017 *5th International Conference on Mechatronics, Materials, Chemistry and Computer Engineering (ICMMCCE 2017)*
- [6] Wilkinson, N., Ang, R. P., & Goh, D. H. (2008). Online Video Game Therapy for Mental Health Concerns. *International Journal of Social Psychiatry*, 54(4), 370–382.
- [7] Draper, Stephen W. "The Penrose Triangle and a Family of Related Figures." *Perception*, vol. 7, no. 3, June 1978, pp. 283–296, doi:10.1068/p070283.
- [8] Stacey Mason, Ceri Stagg, and Noah Wardrip-Fruin. 2019. Lume: a system for procedural story generation. *Proceedings of the 14th International Conference on the Foundations of Digital Games*. Association for Computing Machinery, New York, NY, USA, Article 15, 1–9. DOI:<https://doi.org/10.1145/3337722.3337759>
- [9] Daniel Livingstone. 2006. Turing's test and believable AI in games. *Computer Entertain.* 4, 1 (January 2006), 6–es. DOI:<https://doi.org/10.1145/1111293.1111303>