

Fire Ball

Project Proposal



Submitted to:
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Customer:
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ASE Section 1 Group 5

**Object:**

The document underlines the development pipeline of the game Fire Ball. It denotes the scope of the projects and elucidates the technology to be used for the development supported with a market study.

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Analysis of needs:

This document is a proposal for the game: Fire Balls. The planning to develop this game has been done by keeping in mind the things that were required by the customer and our analysis of how the game could help other people. The requirement of having a game in metaverse or omniverse, it was decided to make a game in Augmented Reality (AR). The game should be a stress buster for those who are not able to go out due to the pandemic, it should also involve physical activity and interaction with the outside world digitally. So, we propose to make a game that will solve all of these problems. The game will be played on windows devices and can be played solo or multiplayer and even in localhost and online. To score in the game, the user will have to dodge the fireballs and collect the in-game currency.

Market Study:

For a very long time, the gaming industry was sprinting towards hyper-realistic graphics for games. With massive budgets and development times crossing more than a decade, it has reached a point of diminishing returns with now the capabilities of the available hardware also being the limitation. On the contrary, it is evident from the recent releases in the gaming industry that the most important is engaging gameplay with fun graphics. The game “Fall Guys: Ultimate Knockout” is a prime example of such a phenomenon. Based on the report of firm Superdata, the game’s first-month earnings on PC was \$185 million, making it the most successful launch since Overwatch [1]. The success of Among Us is also an example of such games that have seen recent success. Among Us recorded a total of 500 million monthly active players in just a month of November 2020, [2]. Since 2012, Candy Crush has been a revolution in the mobile gaming industry, setting the precedent for freemium gaming, a free-to-play game that earns its revenue through micro-transactions. Being the first to reach a billion dollars in revenue [3], Candy Crush truly set a benchmark. It is still one of the most successful games of Activision Blizzard, now owned by Microsoft, and is comparable to industry-leading games like Call of Duty and World of Warcraft.

AR has also seen a massive influx in popularity. With the inception of “Meta” as Facebook’s parent company, the phrases “Metaverse” and “Omniverse” are buzzwords in the industry, and AR is at the forefront of all these conversations. With all the major companies, including the Big 5, investing heavily in AR hardware and



software, it is evident that AR will be the future of computing. The success of Pokemon Go is a benchmark for the future of AR gaming, with estimated earnings of \$900 million through in-game purchases in just a year 2019 [4].

After examining the numerous existing market possibilities for customers, we discovered the following games:

Rainbow: In this game, the player's objective is to control a smiley with eyebrows. Where we lift our eyebrows to move upward, frown to move downward, and remain expressionless to keep stationary.

Wacky Face: The player's objective is to Wink eyes or open mouth to attack enemies.

Nose Zone: It uses the direction you point to your face to control a laser projected from your nose. And the player's objective is to destroy the targets by pointing at them with your nose.

Drawbacks of the above games:

Because none of the games described above use a real-time user environment, they are less appealing. Furthermore, because it is a facial-controlled game, individuals cannot play it for extended periods and it does not promote any physical movement. Interaction with other players is also limited, with no multiplayer mode. Another difference in all the above games is that they use facial landmark tracking for simple user inputs, whereas the proposed game uses facial landmark detection as the game character itself, making it much more intuitive.

Beat Saber: Beat Saber is a popular VR exclusive experience. It features the player slicing blocks representing musical beats with a pair of contrasting-colored sabers. It uses the player as a character and the hand movements of the user are recorded using VR controllers and external cameras. However, It too does not incorporate the real environment of the user and also requires specialized hardware that is expensive and inaccessible to a large section of the population.

One of the main features of our game is to integrate the game's visual and audio content with the user's environment in real-time, hence using the concept of AR. As we want to develop a game that is more engaging, interactive, and simultaneously easy to play for all age groups none of the applications mentioned above incorporate all of these features as a whole in their game.

Users can visualize their face as a new character face which makes it more interesting. By using beloved characters as "Avatars" and the user's environment in real-time it makes the player feel they are inside the game leading to more immersion



during the gameplay. The “Avatars” have the potential to provide a more dramatic and fulfilling gaming experience. Furthermore, In the party mode and the online multiplayer mode, users can satisfy the need to feel connected to other people as they will compete against their favorite characters making it more fun and engaging.

The gameplay is suitable for any user, regardless of skill level or available free time due to the format of the game. As the players collect more in-game currency, they can buy our favorite character, giving the opportunity of monetization.

Project Scope and Definitions:

The purpose and idea of this project are to develop a game where the players can have physical movement and play in competition with their friends. Following are the development scopes and definitions involved with the project.

1. **Room:** It is defined as a virtual session where at most 2 people can connect using a single 6-digit code. The code must be generated by one of the game participants and the room code must be communicated to other game participants explicitly.
2. **Action Reflection:** When the players are in a room, their score and body movement will be reflected on each game participant’s screen.
3. **Avatars:** For the detected body in the video feed, the face can have a filter from a given list of filters already provided by the game. Each individual face filter is termed an Avatar. The number of avatars is limited to 10.
4. The game will provide three modes of play:
 - a. **Single Player:** This mode is defined as one person playing the game standing inside the bounds of the camera frame.
 - b. **Multi-Player (Online):** This mode is defined with a maximum of 2 people joining into 1 room and playing together. Action Reflection will perpetuate to all the participants.
 - c. **Party Mode (Local Multiplayer):** This mode is defined with a maximum of 2 people standing within the camera frame and playing the game together.



- d. **Multi-Player (Random)**: This mode is defined by the pairing of a user with another user randomly online.
5. **Menu**: The menu of the game is defined as the options visible to the user where he can navigate to choose the **game mode, create a room, see the high score, choose an avatar**.

Main Features and Elements of the game:

1. **Game Environment and Application**: Fire Ball is a free-to-play game that will be launched on Windows PC and ported to iOS and Android in later stages of the development. It works in an Augmented Reality setting.
2. **Pick your Look and Customize your character**: Players enjoy having a say in how they look, and this is something that can be seen in this game. Players have the option of selecting their favorite character as an “Avatar”. The player can use their in-game currency to unlock/purchase their favorite character, which can be a fun way to spend money on something they truly desire.
3. **Promotes physical Health**: This game is a simple and inexpensive technique to encourage physical activity, Players can manage their stress in a better way and can enjoy the game.
4. **Helps to socialize while self-isolating**: This game serves as a potent opportunity for players to socialize with new friends.
5. **Language and framework used**: This game will be created in Unity using the C# programming language.
6. **Target users**: Fireball will be played by users of all age groups.
7. **Levels of the game**: The game is an endless genre game. The difficulty gradually increases with the player's score.
8. **Start camera**: The game can be accessed through the camera, which can be the webcam or the front camera, depending on the user's device.

Functional Requirements:

1. The game must include a component of “metaverse” or “Omniverse”.
2. It must allow users to interact with the real world.
3. It must have the functionality to interact with other players.
4. It should be able to access a live video feed of the user’s environment using a webcam or camera for the AR component.
5. It should allow and encourage users to move around in their environment.
6. It should be fun and engaging.

Non-functional Requirements:

1. **Performance:** The game should function smoothly without any errors, meeting the demands of the majority of users, and the processes will be monitored to maximize performance.
2. **Compatibility:** Initially, the game will be a PC standalone version and later followed by mobile platforms like iOS, Android. Updates will be issued on a regular basis, and compatibility with the majority of versions will be ensured.
3. **Quality:** The application must deploy all the features listed in the game menu without latency or glitches, and it must be extensively tested by the testing team.
4. **Availability:** We don't require any specialized, expensive, or difficult-to-acquire devices for this game, so users may play it simply on a PC or a mobile phone.
5. **Usability:** This game is very easy to learn and doesn't create any difficulty in using this game, all age groups can use this game without any issues.

Technical Constraints: We are a group of six engineers that will be working on this game for eight weeks, putting 500 hours altogether on the project. Any adjustments or requirement changes that go beyond this document will take a longer time.

Prototype:

Prototype for selecting the Avatar

We propose to use Deep Learning-based Face mesh to detect facial landmarks of the player and overlay 2D and 3D filters.





As the game progresses and the player collects more in-game currency, they can unlock more such filters as their avatars.

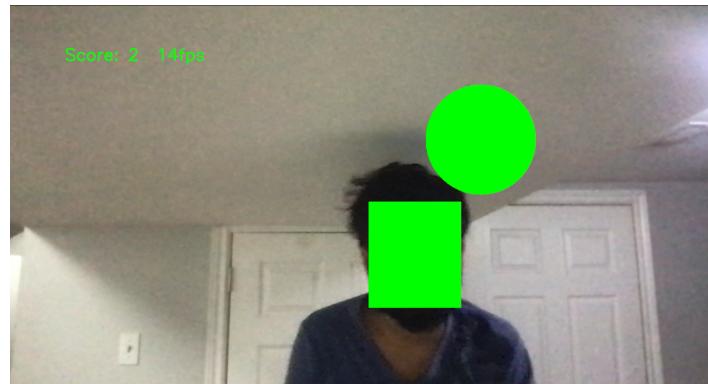
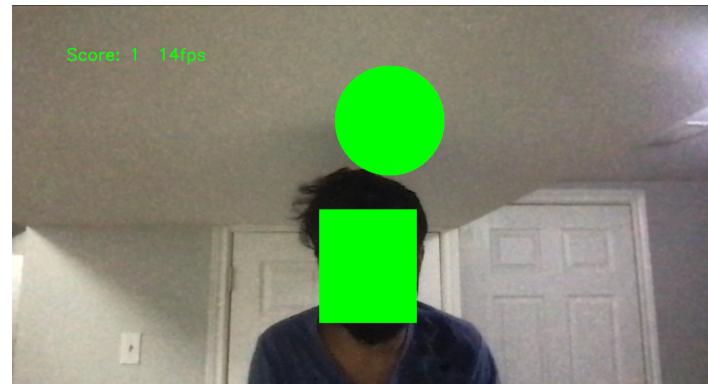
Prototype for Gameplay

The game has perpetually falling objects. The green rectangle in the screenshots below depicts the “Avatar” chosen by the player. During the game, the face of the

player is replaced with a filter of their chosen character. These are both “good” and “bad” objects. The red balls in the screenshots below depict the “bad” objects, e.g. the fireball, that the players must dodge and protect their “Avatar” from by making appropriate movements using their head and body.

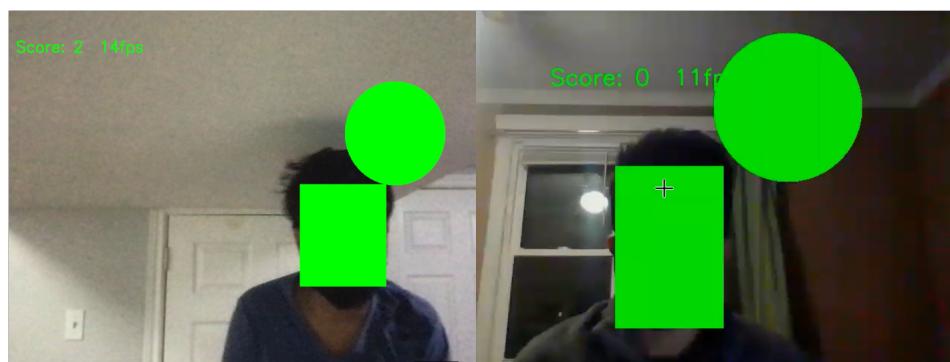


The green balls depict the “good” objects that users can collect. These can be the in-game currency that can be collected in the game and used to unlock more avatars.



Prototype for Multiplayer

We propose a split-screen multiplayer format, allowing players to match up and play against each other in a 1v1 setup.

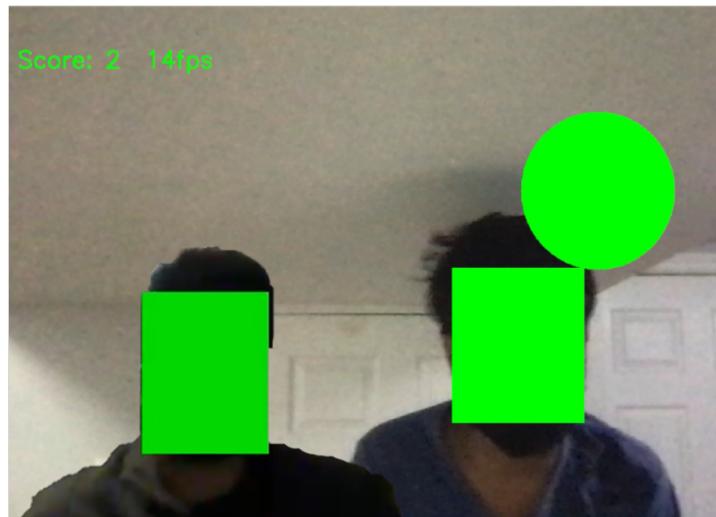


This gives players the ability to meet new people and provides a virtual hangout session.



Prototype for Party Mode

Party mode is a local multiplayer mode where two players can play together as a team. It provides a way to improve mental health by promoting teamwork and shared activities. It allows players to partake in physical activity together in the post-pandemic era.



Technology Used:



AR is the future of gaming and media. Therefore, we propose the use of AR for the development of this game. The AR environment provides a more immersive



experience and so, it overshadows virtual reality as the main interface for metaverse and would also replace the current popular interfaces like smartphones and computers.

For the development of the proposed game, we would use Unity Engine. Unity is a versatile game development platform that provides the appropriate tools to work with Augmented Reality. One of the most successful AR games, i.e. Pokemon Go was also developed using Unity. It allows for the port of the game to PC, android, and iOS, which comprises the top three gaming platforms.

Furthermore, we would use Blender for the 3D modeling of in-game objects. Unity provides a native option of importing blender objects and also is an open-source and versatile tool for 3D and AR applications.

The game involves Facial Landmark detection for the “Avatar” of the player. To achieve this, we plan to use Mediapipe for Unity or Barracuda for achieving the same.

Cost Analysis:

	UNITS	COST PER UNIT	TOTAL
Engineering Cost			
6 engineers	6	100000	600000
Documentation	2	30000	60000
Software Licensing			
Unity (20 users license)	12	4000	48000
Database Digital ocean (24 months)	24	480	504



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AWS requests (1\$ a month for 3 million requests)	24	1	24
Apple Developers Enterprise License (for 2 years, 99\$ per user per year)	12	99	1188
Windows Developer license (for 2 years, 99\$ per user per year)	12	99	1188
Google Developers license	6	25	150
Capital Equipment			
Apple Development Machines	6	1800	10800
Windows Development Machines	6	1800	10800
Operational costs	6	2000	12000
ART Assets copyrights (from marvel/disney etc)			
per asset	5	50000	250000
			994654

Project Timeline:

Start Date: 31st January 2022

End Date: 10th April 2022

Deployment ready: 12th April 2022



Tentative Sprint Planning:

31st January to 13th February Sprint 1 - Development

- Single Player mode
- Fireballs and other 3D in-game objects.
- Reward display
- Customer review on basic game design
- Research and learning on multiplayer online game development.

14th February to 6th March Sprint 2 (19th to 27th is a reading holiday)

- Party mode
- 3 Avatars
- Room Creation for multiplayer online mode
- Customer review on Single-player and multiplayer local mode.

7th March to 27th March Sprint 3

- Multiplayer online mode
- 4 Avatars
- Multiplayer random online mode

28th March to 10th April Sprint 4

- Final Integration
- Game navigation menu
- 3 Avatars
- Component checks



- Final Checks
- Performance testing

Quality Assurance Plan:

1. Introduction

The Software Quality Assurance(SQA) plan sets forth the process, standards and procedures that will be used to perform the Software Quality Assurance for the Fireball project.

1.1 Purpose and Scope

The purpose of Software Quality Assurance plan is to establish goals and responsibilities required to implement effective quality assurance functions for the Fireball project.

This plan :

- (i) Identifies the SQA responsibility of the project team and the SQA consultant.
- (ii) Defines reviews and audits and how they will be conducted for the fireball project.
- (iii) List the activities and processes that the SQA consultant will review and audit.

1.2 Reference Documents

[https://elsmar.com/Cove_Premium/Software%20Quality%20Assurance%20\(SQA\)%20Plan.doc](https://elsmar.com/Cove_Premium/Software%20Quality%20Assurance%20(SQA)%20Plan.doc)

<https://www.energy.gov/cio/downloads/software-quality-assurance-plan-example>

1.3 Project Checkpoints(Stage Exits)

Our project will follow scrum methodology. Each sprint will last 2 weeks and we have 4 sprints. All the functionalities required by the customer will be implemented in this sprint and it will be tried to avail customer satisfaction.



2. Software Development Lifecycle

For our project, we use the Agile methodology and the team decided to run about 4 Sprints of 14 working days each. SCRUM is a software development method that teams use to complete specific products faster. Break each section of your project into smaller parts that can be completed in less time. term. SCRUM performs the following roles:

- (a) **SCRUM Master** - A SCRUM Master is an expert who leads a team on a specific project. It uses an agile methodology. He/she also promotes communication and collaboration.
- (b) **Product Owner** - Product owners help maximize the value of the products created, development Team. He focuses on anticipating clients and prioritizing what's important. Necessity and evaluation of the progress of each sprint.
- (c) The development team is a major entity in the SCRUM process. From conception to deployment it is responsible for the entire process.

Why SCRUM?

- I. It helps to create smaller development cycles and can adapt to changes.
- II. It helps in faster testing and validation.
- III. It focuses on creating deliverables rather than extensive documentation.
- IV. The customer will have a testable subsystem in their environment at the end of each iteration.

3. Description of the proposal

This project is based on the multiverse, we will be developing an AR game that helps people to connect with other people, help people in performing physical activities by staying at home. The name of the game is Fireball and it can be played in single-player, multiplayer, local multiplayer modes. The main task would be to dodge the fireballs, the difficulty of the game will increase as the game time increases. The players can compete with other players in multiplayer mode and to do that they will have to collect coins.

4. Roles and responsibilities Of Team members



Name	Roles
Rohan	Scrum Master/ Product Owner
Manak	Object/ models designer
Aishwarya	Tester
Aneerban	Developer
Rakshana	Developer
Aniruddh	Developer / R&D

Required Skills:

- C#, Unity, Blender modelling and texturing, Github, Jira.

5. Regulation Tools

Jira
Github
Microsoft Teams
Microsoft Project professional

6. Verification and Validation Of Requirements

All the features are validated and verified in different environments. The purpose of this is to make sure that when the deliverable is presented to the user, the presentation goes smoothly.

6.1 Verification

- (i) Verify that the actual output is similar to the expected output given in the specification document.
- (ii) Verify manually the products in AR in different environments and compare with previous sprints for any changes.



6.2 Validation

- (i) Validating that the final product satisfies the expectation of the user in the specification document.
- (ii) Performing integration testing to ensure that all the functionalities are working together.

7. Communication Processes

The main source of communicating with the team will be microsoft teams channel. Daily 10-15 minutes meeting will be held to discuss the progress in the sprint, and if anyone is facing any issues. The Scrum master will be the one who should make sure that everything is communicated properly and that all the team members have the specific knowledge of the procedures they should follow.

8. Review Procedures

The code or the models or any documentation for the project that will be made, will be reviewed by atleast two members of the team before merging it in the Github repository. The two people could be volunteers or could be assigned by the person who is committing to the repo, if any problem is found out during the review, it would be taken back.

9. Risk Analysis

- (i) The knowledge of Face detection is very crucial for our project, all the team members have less experience in that place, so it will be necessary to tackle this problem and reduce the risks.
- (ii) It happens many times that between the sprint a customer has new requirements which were previously not part of the deliverables, in that case, the team will have to set up a meeting with the customer and discuss the functionalities and in what time it could be delivered.

- (iii) Sometimes it might be possible that due to some reason a member of the team is not available and not able to complete task, which would lead to customer not getting the deliverable at the stipulated time. In that case communication between the members should be done on teams and other members of the team who might be flexible to complete the task should vouch for that person.
- (iv) If due to software or hardware failure, code is lost then to overcome this code should be maintained all-time in the team's Github repository.
- (v) If there is any conflict or risk to the data of the user, then it should be encrypted.

Risk Id	Description	Probability	Impact	Mitigation
R1	Project failure due to lack of knowledge	Very High	Project Failure	Keep targeting highest valued features to drive down probability of project failing
R2	Requirements change	Medium	Increase in development time If entirely new requirements project is scraped	Set up meeting with Customer and communicate new budget and time estimates

R3	Developer not available	Medium	Incomplete tasks for an iteration	Reschedule tasks and communicate to the customer of any time changes
R4	Hardware Failure	Low	Loss of code	Clone repositories to be maintained on Github
R5	Data stealing from the server	High	User feed being used by intruders Cheating in the game	Create Mechanism to identify malicious users Create Mechanism to kick a user from the server

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