



# O! Fish - A Merged Reality Game

PROTOTYPING INTERACTIVE SYSTEMS H-564



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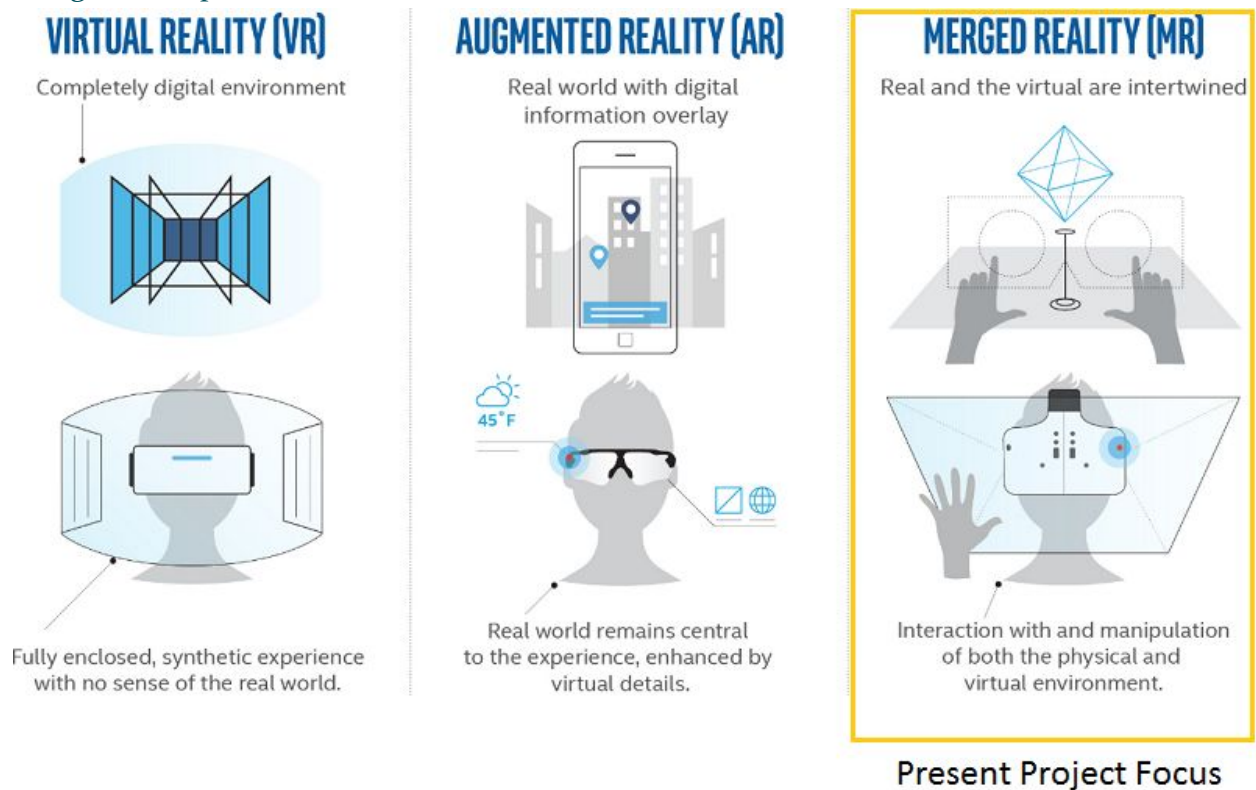
## INTRODUCTION

### Product Definition and Scope

We intend to make use of merged reality (VR + Real World) technology. The concept of merged reality is combining of real and virtual world objects and interfaces and produce a game experience where the physical and digital co-exist and interact in real-time. Our idea is to prototype a game to engage users in accomplishing a specific task. We named our game 'Oh Fish!' where the user will be holding holocube to simulate a fishbowl in the merged environment. The goal of the user will be to collect water droplets in the fishbowl to save the fish inside the bowl. In this project, we made use of MergeVR product to achieve our intended prototype.

This our small attempt to make use user-centered design process in mixed reality area. We believe that UX for merge reality must be approached differently but the core UX principles remain the same. The challenge for us in this project was to come up with different design heuristics for UX design of this product and evaluations. Going out of the way from traditional UX design for web and mobile, this project offered us more flexibility and freedom to introduce new methods for prototyping and testing for merged reality.

### Design Concept and Functions



## MergeVR Headset



We used MergeVR headset with smartphone app to project virtual content onto the holocube.

## Holocube



We will be using holocube as a physical object. Holocube uses the camera on the phone to turn the cube into an Augmented reality playground. Holocube will turn into a fish bowl. The user will see a fishbowl in his hand while he is holding the holocube.

## DESIGN EXPLORATION

## Brainstorming

Our brainstorming session was initiated with ideas that involved using a cube to simulate the virtual word object wearing a VR headset. We brainstormed around various ideas for coming up with situations where we could involve multiple users to use cube along with VR headsets to control objects in augmented world. We made use of post-it notes to write down all the crazy things possible. Few interesting ideas were having a multiuser game for treasure hunt in a social gathering, making use of VR headsets to play games throwing rings in a stick, a first-person shooter game where the cube will be the weapon to be played with opponent player having same settings. We also made use of whiteboard to sketch the user flows for various situations. We tried to incorporate all the scenarios possible.

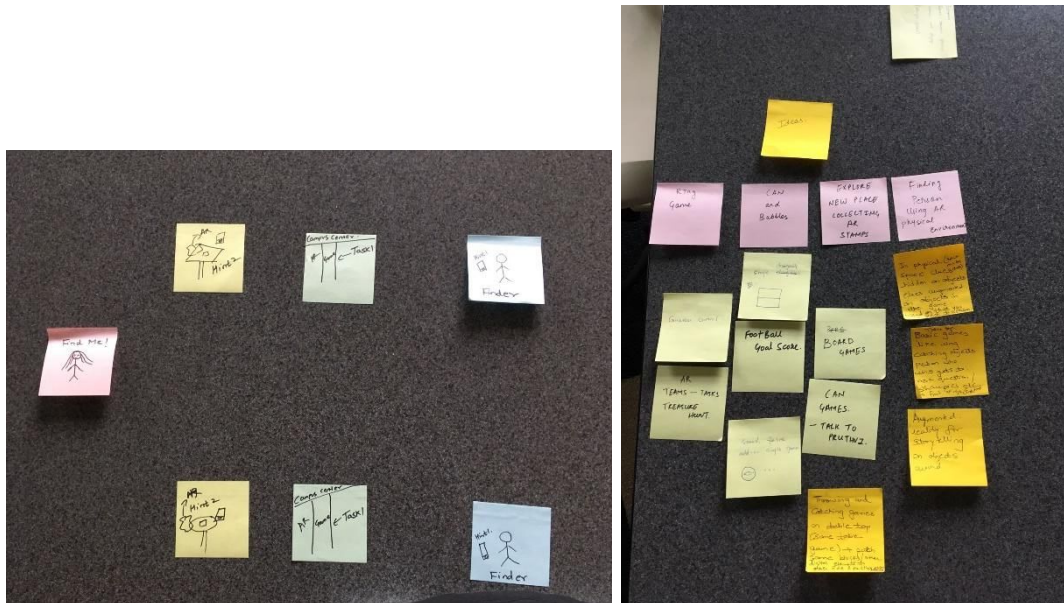


Figure: Sticky notes for ideating as many crazy ideas as possible within the team

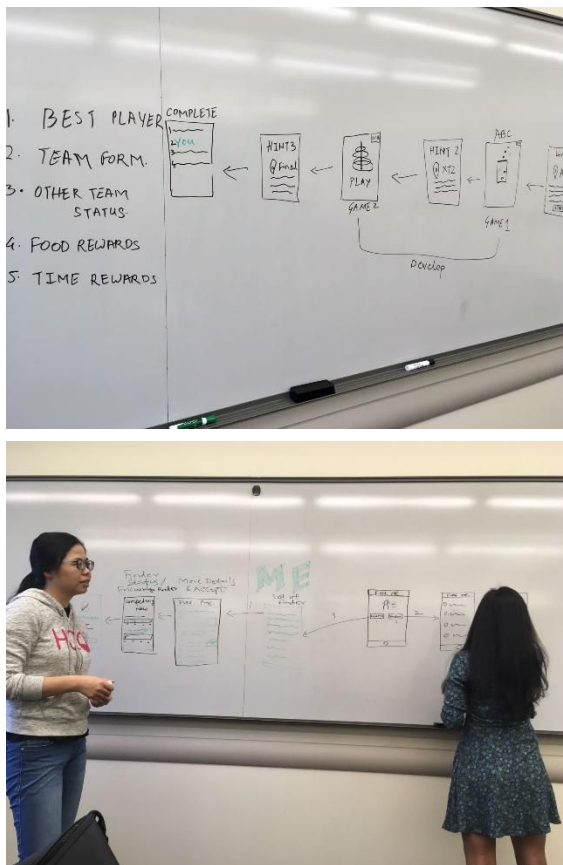


Figure: Whiteboarding for initial sketches

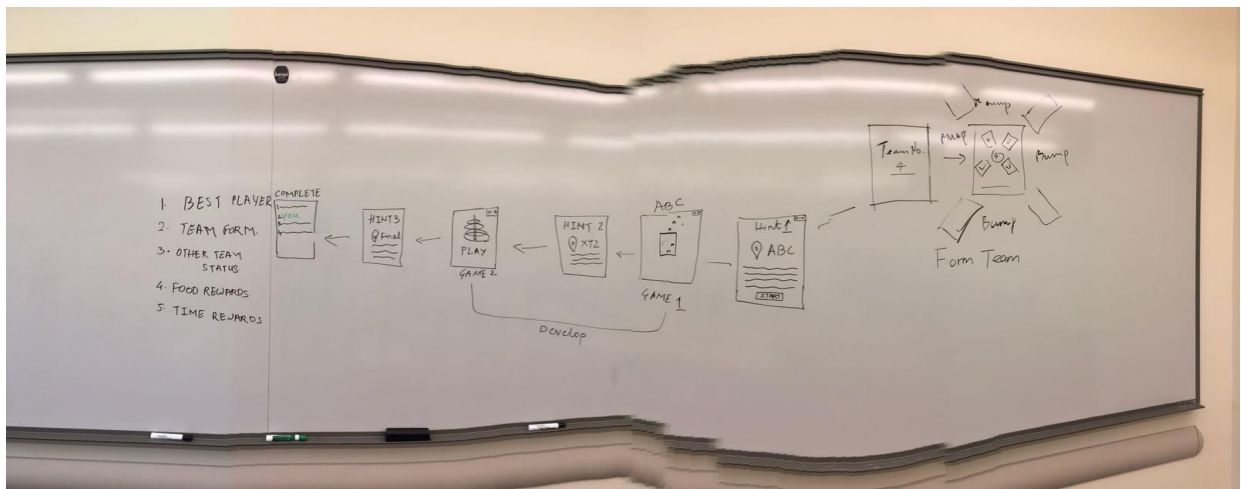


Figure: Whiteboarding to sketch the user flows all the actions possible in various scenarios

## Early Ideation

Sketching out few initial potential ideas allowed us to deeply understand the concept and

every team member was able contribute individual thoughts.

### *Paper sketches to explore the VR screens*

We narrowed down to the concept of fish-bowl game. In this game, the user will be holding the cube. The cube held by the user is augmented as a bowl with fish inside. The goal of the user will be to collect water inside the bowl to keep the fish alive. The water can be collected by moving the bowl to gather droplets falling from top. Every drop dripping from the top will have certain points based on the color and shape of the drops. The challenge for user will be to collect droplets with maximum points. We also introduce some drops with negative points, collecting these drops will reduce the user's core and water inside the fish-bowl. We have imagined this to be multi-player game where multiple players can compete. The player collecting more water in the bowl with maximum points wins the game.

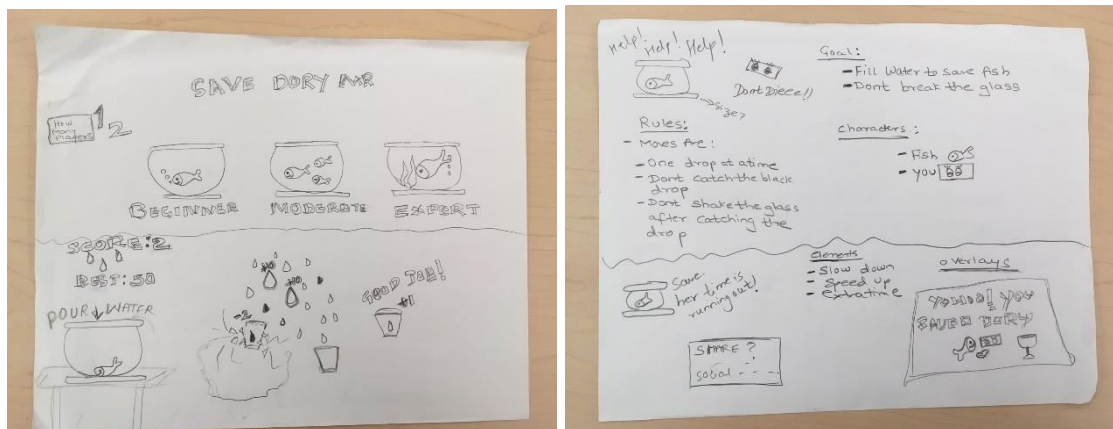
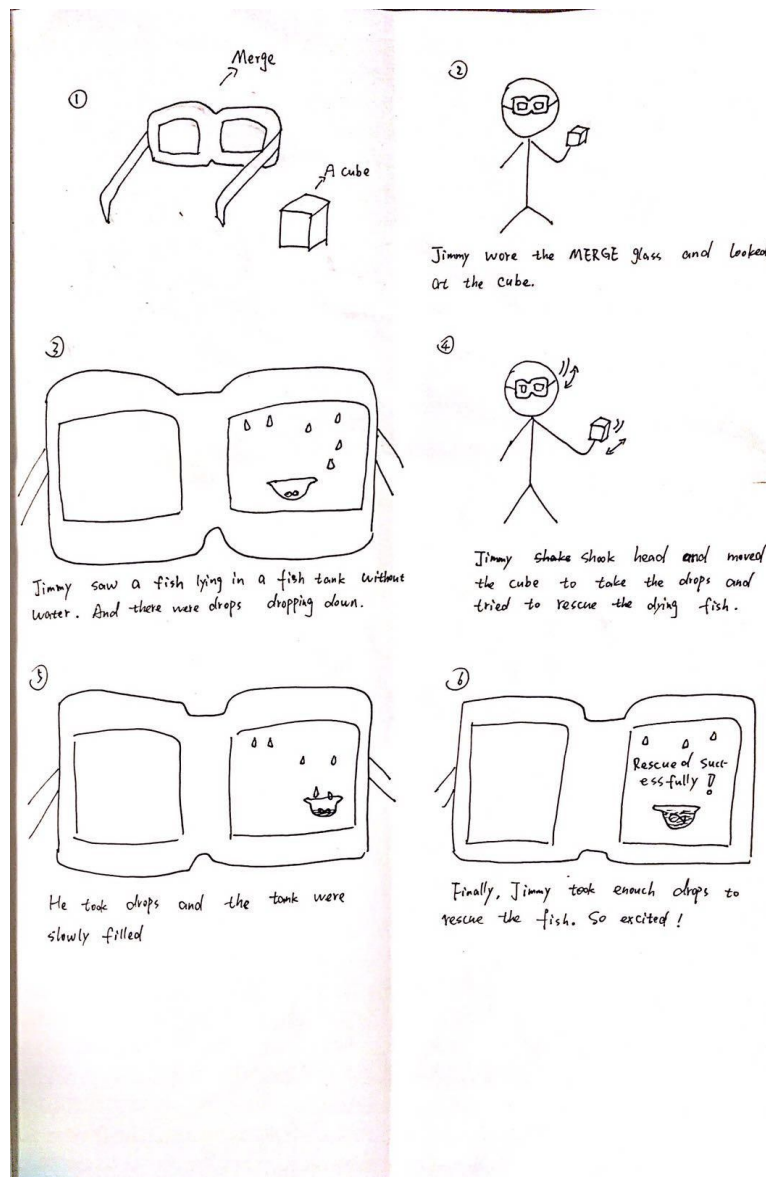


Figure: Initial sketches for fish-bowl game

### *Storyboards*

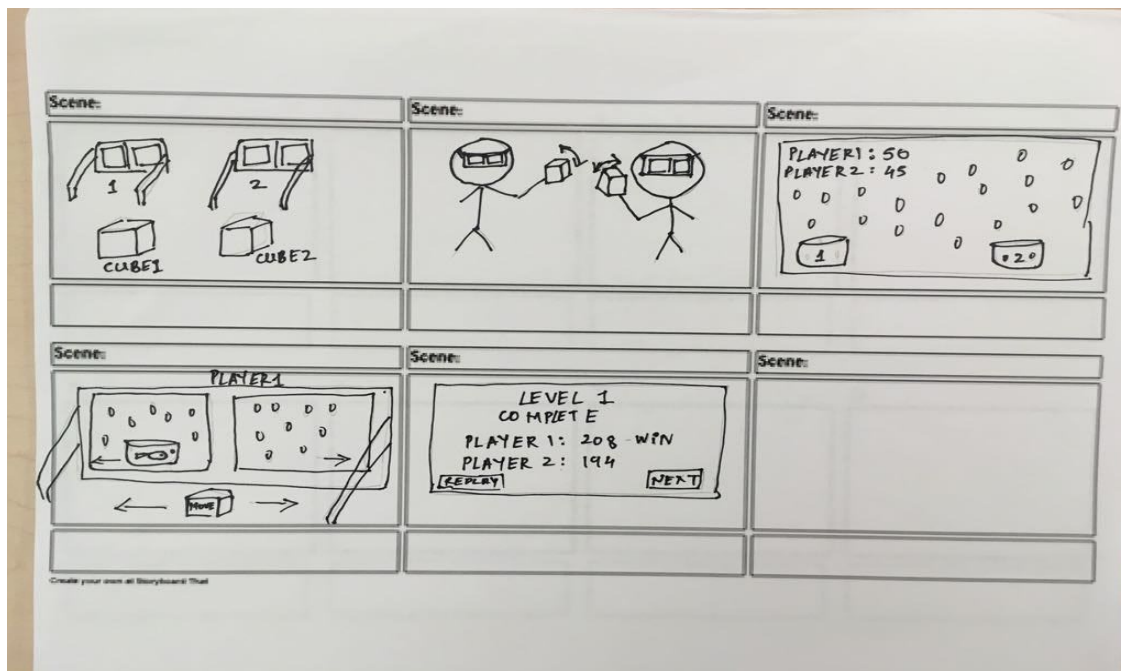
We explored two scenarios using storyboards. These scenarios were gameplay for single player and gameplay for multiple players.





Storyboard 1 for single player game play



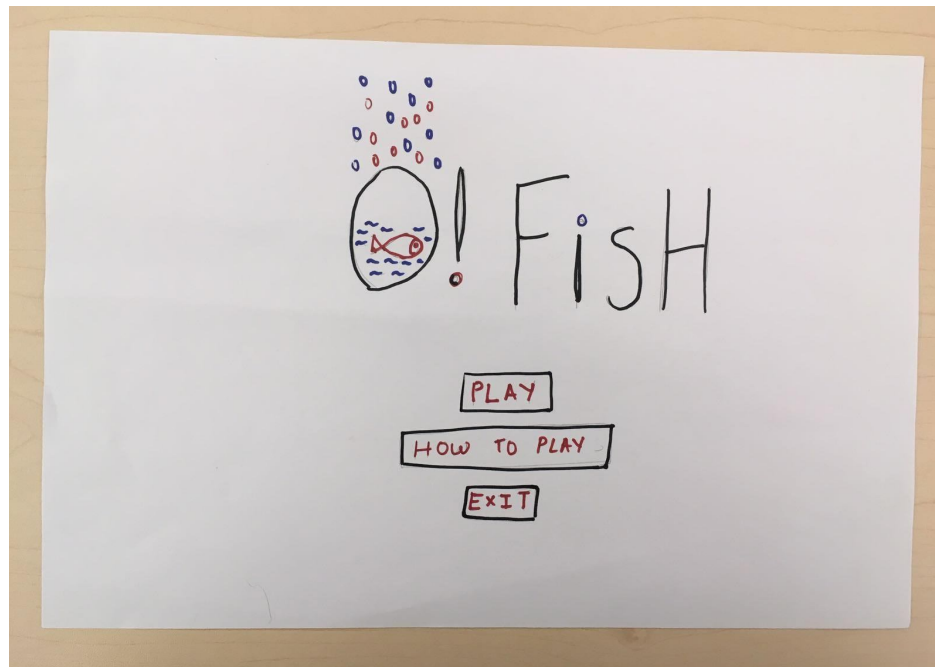


Storyboard 2 for showing multi-player game collaboration and game play

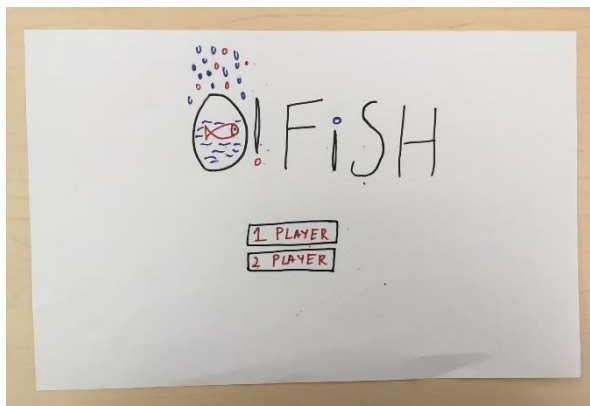
## Final Concept

The final concept selected was to design the game for one player in the first round of development. Considering the timeframe, we have, we decided to conceptualize the idea for first round of iteration. For this we needed screens for allowing user flow. Below the requirements for sketching the user flow:

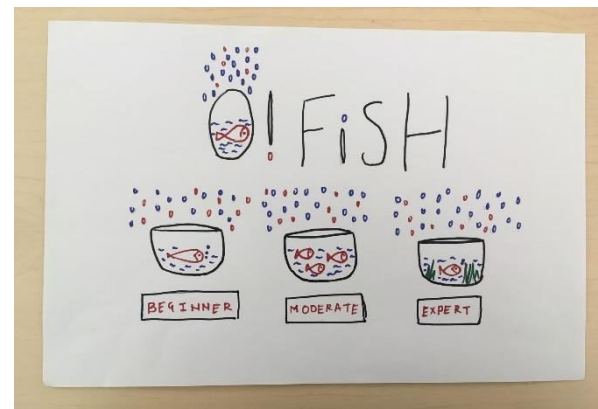
- Welcome screen
- Introduction of game
- Select Game
- Select difficulty level - easy, medium, difficult
- Game Play
- Interruptions - pause screen
- Going to next stages
- Settings screen - customizing the game play
- Help options
- Exit



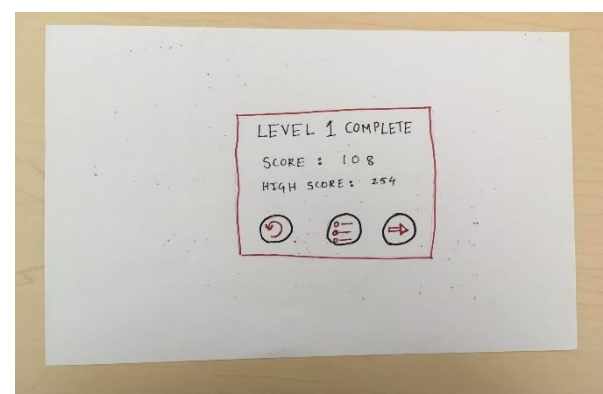
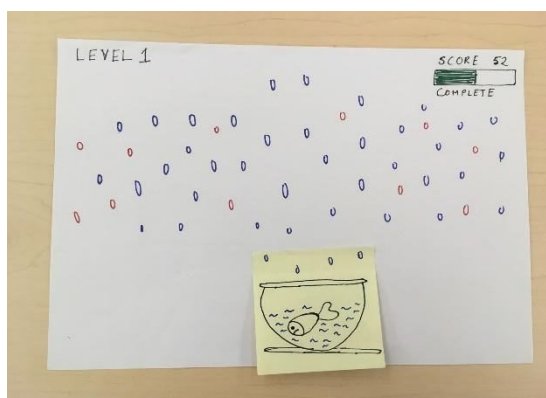
Welcome screen



Select player options



Select difficulty level

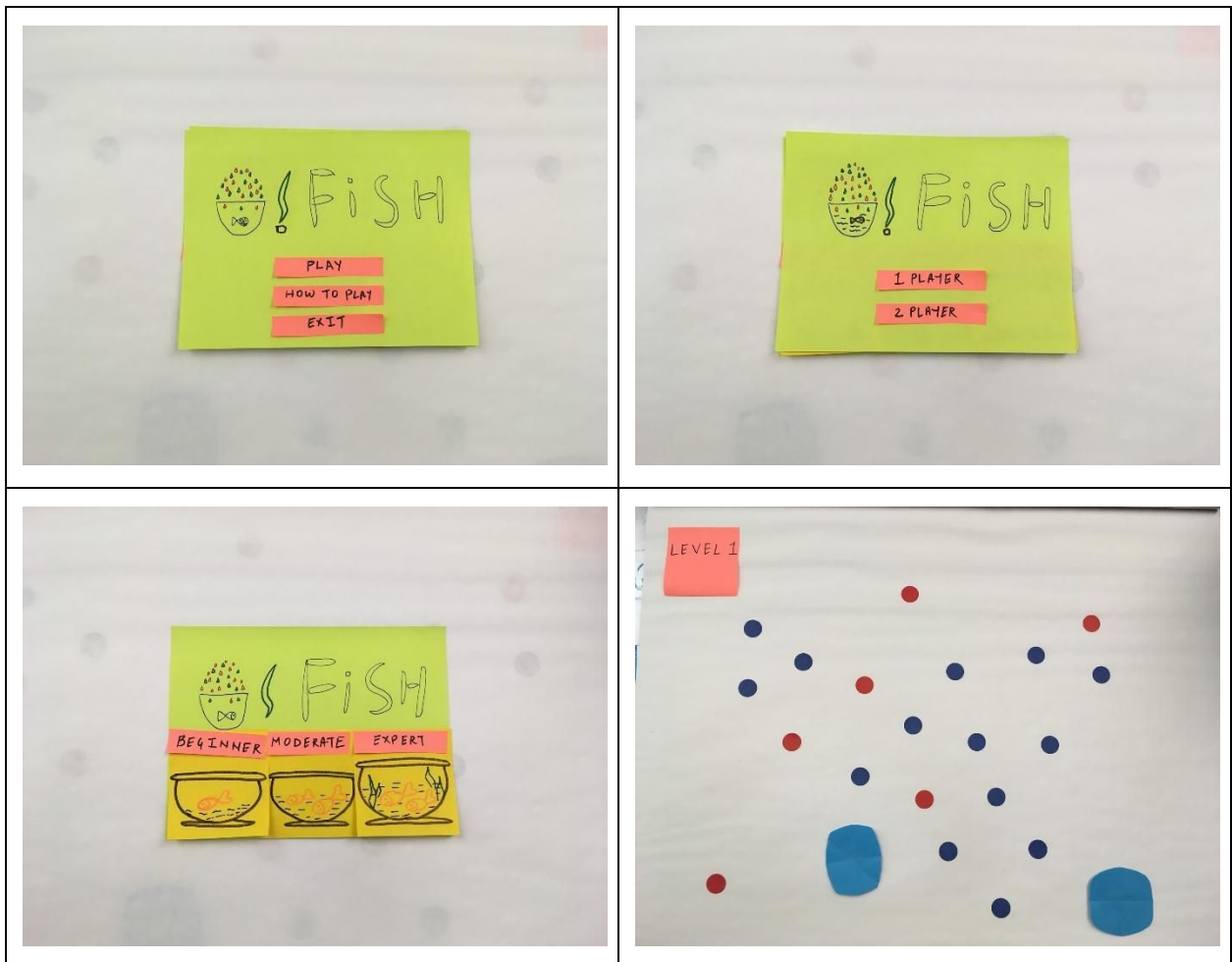


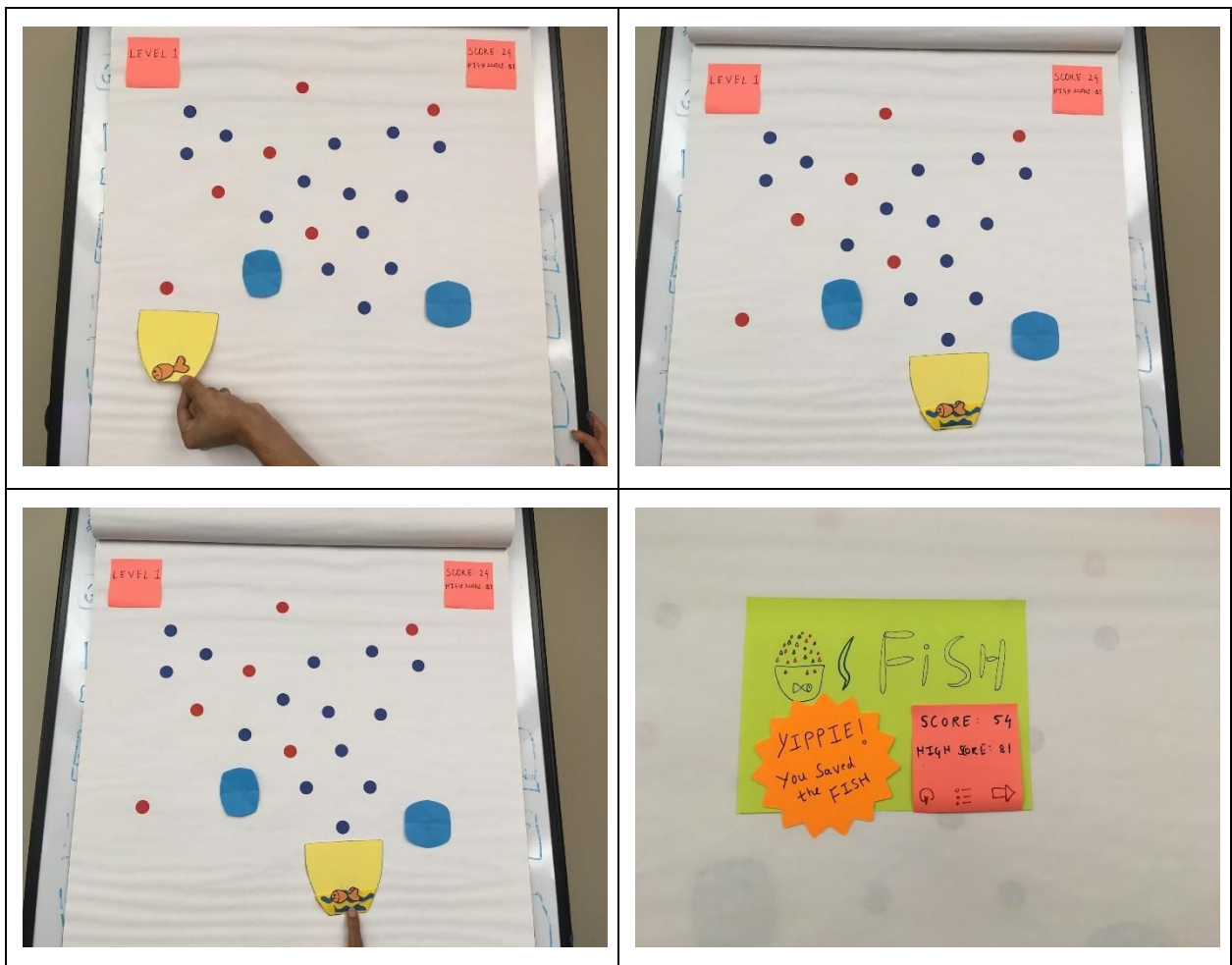
*Gameplay**Continuing to next level*

## IMPLEMENTATION

### Paper Prototype/Physical Sketch

We explored possible interactions for the Augmented VR screens making use of stickies and paper. We involved users at early stages of development by making them interact with paper mockups. There is no concrete tool available to build Lo-Fidelity prototypes for VR screens. Hence, we selected paper mockups since it is cost-effective and cheap. We believe that making use of paper, sticky, color pens, and other sketching tools boosts creativity within the team and helps sharing of variant ideas within the team. We created a video with stickies and paper mock-ups to run through the game events.





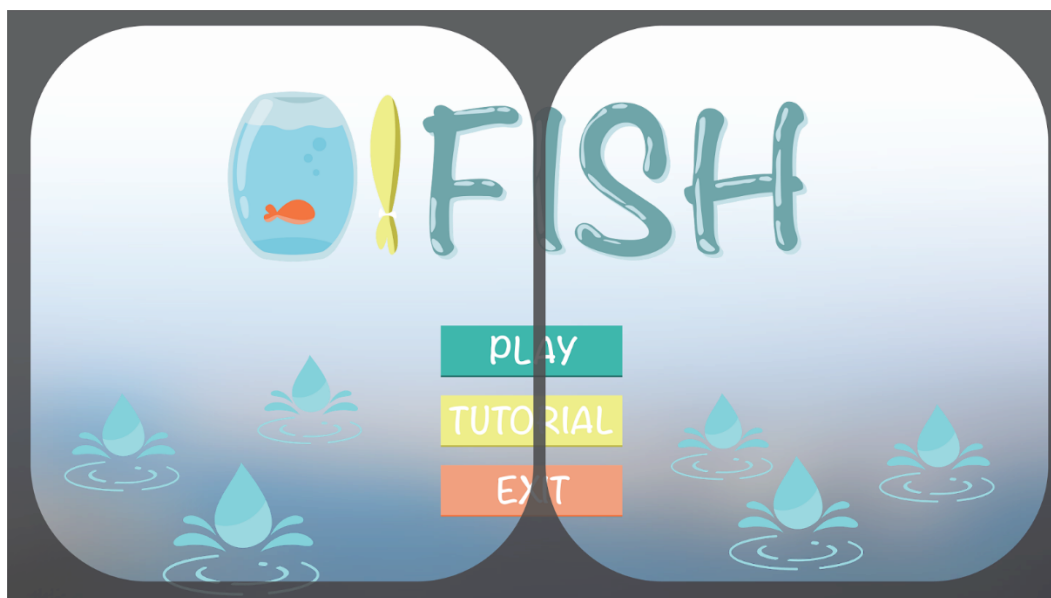
*Paper Prototypes*

Paper prototype video link: [Click to view the video](#)

## High Fidelity Screens



*Figure: Welcome screen - splash screen*



*Figure: Gameplay*



Figure. Gameplay - collected droplets in the bowl

### Hybrid Sketches

With our high-fidelity mockups, we proceeded to understand the orientation aspects of the cube and interaction in immersive space. We took a simple approach of projecting the virtual cube onto the holocube to achieve our hybrid sketches.



Figure: Hybrid sketch 1



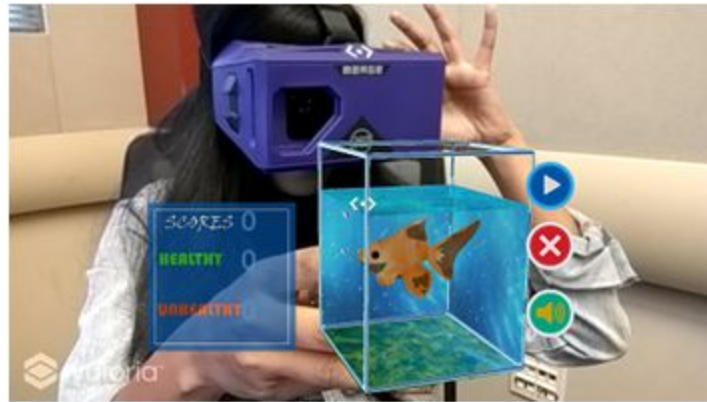


Figure: Hybrid sketch 2

### Physical Prototyping - Interactive Version

A final prototype was implemented using Unity. A fish bowl was augmented on the holocube. The fish bowl could then be used to gather water droplets. The interactive prototype was created using unity.

## EVALUATIONS

### Cognitive Walkthrough

The team performed a cognitive walkthrough on paper prototypes and interactive prototype. Some of our key findings and recommendations are listed below.

Key Finding	Recommendation
Needed more feedback for the results of actions.	Indication of positive and negative results with sound.
When the game ended, story was incomplete.	A summary of the game results at the end should be displayed.
Continuous feedback was not available to indicate the water level which was confusing.	An indicator displaying the water level with some visual cues in the form of colors can be shown in the environment.

### Usability Tests

#### Method

The team conducted evaluations with 3 participants in their home setting. We evaluated the game interactions in merged reality environment. A usability test plan including the



test script was created for evaluating the interactive prototype. We used our unity prototype for the merged reality game evaluations and asked the Participants to perform the following tasks.

**Task 1**

Please wear the Merge VR and hold this cube. Adjust the cube's position to see the O! Fish welcome screen.

**Task 2**

Starting the game

**Task 3**

Catching the good drops to save the fish. Catch healthy drops, unhealthy drops and bonus drops.

We used the think out loud method to gather insights. Users were asked to give their feedback on the game experience and a short interview was conducted to capture insights from users.



## *Usability Evaluations*

### *Results*

Some of our key findings from user tests.

#### **Feedback**

- Haptic feedback in cube: Users wanted a haptic feedback in the holocube or on the headset indicating a result of an action.
- More visual feedback in score: Users needed a pop score to appear with every drop that they collect.
- Continuous progress indicator: A continuous progress indication was needed by users to know their status in game at any point of time.

#### **Music**

- Positive and negative reinforcement with music was appreciated by users.
- Users wanted the music to stop when the game is stopped.

#### **Game Elements**

- Users wanted the fish to move around in the bowl once the water level is increased.
- Users expected the score to be clearly visible in the environment or on cube.

#### **Quotes**

“Nice experience in the beginning”

“I like moving my head and not the cube”

## **LESSONS LEARNED**

### **Game Design**

Designing the game experience was totally new for all of us. We had freeze our scope to a simple game so that we achieve this in short period of time. Designing the screens, user flow, micro interactions, buttons, motion, and audio/video response was iterative process for us. We learned how to freeze the design using paper mockups and then testing the design on the actual unity holocube for user feedback.

### **Merged Reality Concepts**

Our paper prototype consisted of traditional 2D interfaces for the gameplay. But since the merged reality offered us the potential to have immersive interaction, we learned designing interfaces inside immersive space and how they could be designed to orient

automatically facing the user always during the gameplay. The interface adapted to the user rather than user adapting to the interface.

### **Paper Prototyping for Merged Reality**

We learned how we could prototype the screen using paper and sticky notes. There isn't much previous work available in this field. We came up with our own methods for creating characters, design elements, and screen flow. Having a quick through of the conceptual flow helped us to test the rules and gameplay of our game.

### **Need a lighter headset**

It was found that during the testing, our users wanted to play the game for longer time. The game is engaging and keeps user busy in achieving the tasks. Though, the weight of the Merge headsets is light, the users needed some lighter wearable to keep playing the game for longer time.

## **CONCLUSION**

Overall, the prototypes created at various fidelity helped us capture feedback and iterate to achieve a functional and usable prototype. Speaking on the challenges we faced while creating our initial prototypes, we hit some of the hindrances in terms of interaction in immersive space and how to measure relative distance of virtual content from the headset. Also, the immersive menu buttons to enable interaction during the gameplay was not considered during paper prototypes, but the feedback from the cognitive walkthrough conducted using high-fidelity prototype enabled us to consider implementing it. Additionally, the usability test helped us uncover issues such as audio feedback, lack of haptic feedback, visual feedback in terms of type of water drops collected, fish body color change indicating the health factor using our final interactive prototype. In summary, the prototyping using chart paper, sticky notes, hybrid sketches, physical sketches, and the final interactive app helped us learn and understand user-centered design process with respect to merged reality.

## APPENDIX

### USABILITY EVALUATION PLAN

#### GOAL

O! FISH is a merged reality game which is prototyped using Unity. This usability evaluation is about evaluating the game interactions in merged reality environment. We are trying to understand users' behavior habits in merged reality game experience, and the expected interactions that users are comfortable with. Also, we are trying to figure out how the product affects users' game experience from sound and visual.

#### METHOD

Think-Aloud Protocol, Unity Prototype

#### PARTICIPANT WELCOME AND INTRODUCTION

Thank you for coming today. My name is \_\_\_\_\_. We're working on the design for a mixed reality game, and as part of the process we're asking a variety of people to

attempt various tasks using it to see what elements of the design need to be changed. I'd like to stress that we're testing the product, and not your abilities. If you find parts of the product difficult to use or understand, so will other people, and it will be our job to make sure we make the appropriate changes to improve it. As you use the product, there will be other people observing, and I'll introduce you to them now. [Pruthviraj Narayanaswamy, Kartik Rao, Rehab Tambe, Shanglei Zhang, and Yi Zhang.] Today's session will last for approximately 10 minutes. If you want to stop for a break at any time, just say so.

We have a total of [number] tasks, and I'll give them to you one at a time. I'll be asking you to 'think aloud' as you work. For example, if you don't know what something is for, please say 'I don't know what this is for', or something similar. I may also prompt you from time to time to ask you what you are thinking.

## TECHNOLOGY INTRODUCTION

In our evaluation session, we will use Merge VR, a merged reality headset for iPhone and Android which allows users to interact with both physical objects and virtual content in an immersive space. The holocube acts as a physical object which is tracked and projected with virtual content.

Do you have any questions before we begin?

## SCENARIO

O!Fish is a VR-AR-Reality game that saving dying fish through catching enough water for it. O! Fish has three modes-- single player, multiplayer competition, and multiplayer Cooperation. In the single player mode, the gamer needs to avoid "bad" drops which is polluted and decrease the score, and catch the "good" drop which increases score and fill the fish bowl. Once catching enough good drops, the fish is saved.

## TASKS

### Task 1

Please wear the Merge VR and hold this cube. Adjust the cube's position to see the O! Fish welcome screen.

### Task 2

Starting the game

### Task 3

Catching the good drops to save the fish

Thank you. That completes the tasks.

Once again, I'd like to say thanks for coming today. Do you have any comments or questions about today's session?