UX PROJECT ON VR EDUCATION SYSTEM IMPLEMENTED THROUGH WEBSITE DESIGN & MOBILE APP DESIGN

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Multimedia and Creative Technology

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APPROVAL

This Project titled "UX Project on VR Education System Implement through Website Design & Mobile APP Design", submitted by **Sakibuzzaman Khan (ID: 203-40-722)** to the Department of **Multimedia and Creative Technology**, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Multimedia and Creative Technology and approved as to its style and contents. The presentation has been held on **11 January 2025.**

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I hereby declare that this project has been done by me under the supervision of **Md. Salah Uddin, Assistant Professor & Head, Department of MCT,** Daffodil International University. We also declare that neither this nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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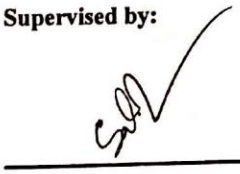

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We are deeply grateful to Allah Ta'ala for the divine graces He bestowed upon us, which empowered us to complete our final year project successfully.

I am truly grateful and would like to express my deepest gratitude to **Md. Salah Uddin**, Assistant Professor & Head, MCT Department, Daffodil International University, Dhaka.

This project requires detailed knowledge and enthusiastic interest on the part of the supervisor in "Website Design VR School." His boundless patience, academic guidance, unabated encouragement, active and continued monitoring, constructive criticism, saga counsel, reading of various mediocre versions, and editing at each step have enabled me to carry out this venture successfully.

I would like to give my sincere appreciation to all our classmates at Daffodil International University who took part in the discussion while performing the academic assignment.

Lastly, I would like to politely thank my parents for their unwavering patience and support throughout my life. They have taught me to be optimistic, learn new things, and never let my passions stop me.

ABSTRACT

The present research represents how Virtual Reality can act as a breakthrough point to change the way practical science is taught in schools and colleges across Bangladesh. Traditional science practicals include biological dissections and chemical experiments, which require access to expensive laboratory equipment and can be dangerous neither are they universally available, especially to students from rural areas. In such cases, students can be able to carry out dissections and observe chemical reactions safely within a virtual yet interactive environment with the use of VR simulations.

It ascertains the views of students, educators, parents, and school administrators on the feasibility, benefits, and challenges of using VR for science education. Qualitative and quantitative data show the likelihood of increased student motivation, improved comprehension of abstract concepts, cost-effectiveness, and the ability to scale up schools facing resource constraints. It also highlights some key issues to be considered for successful integration, which include infrastructure challenges, teacher training, and economic barriers to access. This study concludes by arguing that VR has the potential to democratize access to quality science education in Bangladesh, bridge resource gaps, and offer students realistic, hands-on learning opportunities.

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CHAPTER 1

Introduction

As a UI/UX Designer, I have explored the field of ‘VR EDU’ which is an interactive website with the vision of removing the current norms of the user interface. I have been focused on the education industry and have worked on a VR-based educational tool that works on the student's and teachers' motivation.

This platform never used to cater to students from other disciplines apart from the STEM field where it provided interactive simulations and virtual labs to high school and college students. However, the long-term goal is to develop such platforms which would cover a wider area of subjects. The idea has always been to provide the students with experiential learning rather than theoretical learning. This learning will be so much better than anything they have done, imagine being able to virtually dissect a frog, burn things on a chemistry set, or even hop on a spaceship to visit new galaxies. This is the direction students are headed towards and it shouldn't be too far off.

There is no doubt the rate at which technological devices are changing the world, students of the future will have so many new and advanced ways of learning that the conventional means of learning will be seen through a merger and acquisition lens. Through the use of Virtual Reality (VR), students can easily comprehend any topic at hand regardless of how complicated it may be.

This report outlines the development process followed together with the design of this VR-based educational platform that intends to drastically change the way practical science is taught in Bangladesh. Being immersed in a controlled environment of this platform provides students, mostly in biology and chemistry, with a unique and interesting approach to learning. The platform also contains more advanced interactions in the form of virtual reconstructions of intricate ideas, enabling students to practice without any threat. Some of the main components are 3D artifacts, simulation activities, and individualized education.

This work aims to examine the opportunities created by using virtual reality in a more student-centered approach in the course. If the barriers such approaches are put forward in traditional laboratory rooms are overcome and affordable effective educational methods are developed, this platform can considerably change the science education landscape in Bangladesh.

1.1 Motivation

During my studies in digital media as a Multimedia and Creative Technology student, I engaged in numerous activities. However, for my final defense report, I have resolved to specialize in web development in particular. I have been motivated by my interests and, more importantly, the rapid changes occurring in the internet world. The Fourth Industrial Revolution has set up an era whereby technology is hybridizing the physical and digital worlds. Interactive websites are on top of this technological revolution, allowing pouring and active users to participate in the experience. Thus, by undertaking an interactive website design, I want to be part of this technological shift or revolution and witness how website technologies can change the world. In addition, I also appreciate the fact that a major component of the success of any business or organization is the website. Websites are the first contact points for most users. A good website can therefore influence brand image and customer acquisition within the firm. In particular, I seek to craft an interactive and engaging website to demonstrate the role of design in improving lives of the people as well as enhancing business.

1.2 Objectives

The primary objective of this project is to use an interactive website to tackle a common problem. However, I am unable to get straight to the project. The primary goal is to complete the objectives before achieving the main goal.

I'll now demonstrate the goals I have set to accomplish the aim.

I. Preserving brand identification through logo design.
II. Visualization of products while preserving brand identity.
III. UX studies and research.
IV. Analysis.
V. UI design.
VI. Testing.
VII. Using interactive animation in front-end implementation.

1.3 Expected Outcome

1. The anticipated result will be a website that allows visitors to,

1. Increased Involvement of Students:

I. A rise in students' enthusiasm and drive for scientific courses

II. Increased attentiveness and focus throughout class

2. Better Learning Results:

I. Improved comprehension of intricate scientific ideas

II. Enhanced critical thinking and problem-solving abilities

III. Better academic achievement in scientific courses

3. A more secure educational setting:

I. A lower chance of mishaps and injuries related to conventional lab testing

II. Removing the requirement for biological specimens and dangerous chemicals

4. Inclusivity and Accessibility:

I. Equitable access to top-notch education for students in isolated and rural locations

II. Tailored educational experiences to accommodate a range of learning capacities and styles

5. Positive Impact on the Education System:

I. Increased adoption of innovative teaching methods

II. Improved overall quality of science education in Bangladesh

III. Reduced educational disparities

This website at least will give the user a glance of reality through the website. So that, user can buy their product with just a glance at an interactive website like this.

5. Benefits to the Educational System:

I. A greater use of creative instructional techniques

II. A higher standard of science instruction overall in Bangladesh III. A decrease in educational inequalities

At the very least, this website will provide the user with a glimpse of reality. For a person to purchase their product after merely viewing an interactive website such as this one.

1.4 Project Management and Finance

This project can be overseen by a group of 3D animators, UI designers, and UX researchers. However, only two team members have been used to manage this project. Among them, one is designated as the UX Designer. As the project's UI designer, I created the report to thoroughly highlight the design and development procedures. My responsibilities will be described further in the following chapters:

This project can be published with a small fund. It is sufficient to buy a domain and a hosting service for it to be published.

1.5 Layout of the report

A lot of things have been discussed in this report but the division of these into the following categories has been made:

1.5.1 Chapter 1: Introduction

Discusses the background of the project overview and objectives with the roles and responsibilities of the team members.

1.5.2 Chapter 2: Requirement Analysis

Encompasses research and analysis of user needs, and functional and non-functional requirements for the Bangladesh VR Education System.

1.5.3 Chapter 3: Design Specification

Describes the UI design processes by wireframes, prototypes, visual design choices, and considerations for immersive VR interfaces.

1.5.4 Chapter 4: Development and Testing

Describes how the design has been implemented as well as working together with other developers in building up the VR education platform with the process of testing it to ensure that it has usability and consistency.

1.5.5 Chapter 5: Evaluation and Impact

Focuses on the societal, environmental, and sustainable impacts of the project, as well as through feedback on the users and improvements made.

1.5.6 Chapter 6: Conclusion and Future Scope

Summarizing the results of the project and the role of UI design in achieving these objectives in addition to possible future enhancements to the system.

CHAPTER 2

Background

A thorough overview of the objectives achieved during the project's work cycle is provided in the upcoming chapter. In this project, I was assigned the position of UX research; my team's UI Designer was conducted by **Sahira Mahmood Sabil**. Now, let's talk about the main terms and goals that were determined:

I. Logo Design Maintaining Brand Identity:

Initially, a UI designer's job was to create a logo that embodied the company name and represented excellence and innovation in the IT sector.

i. **Logo Conceptualization:** Create a design idea that aligns with the brand's mission.
ii. **Setting Brand Colors:** Choosing the color scheme that best embodies the brand.
iii. **Finalizing the Logo:** The final version's intricate design.

1. Primary Colors:

Deep Blue & Indigo: Represent Trust, Reliability & Intelligence. Headers, Backgrounds, Main Buttons.

Emerald Green: Growth, education, and safety aligned with the primary values of the cause.

2. Secondary Colors:

Light Gray & Warm White: the areas where both background and type will be placed for good and easy reading and fresh modern layout.

II. UX research

The UX research was organized by MD. Sakibuzzaman Khan intends to obtain the users' needs and expectations about the platform. This includes user behavior and their preferences toward and emotional responses to products to ensure that the design meets their requirements.

In what particular parts did he ask if they would like to see it on a website before proceeding to sign up for that new platform? Do they want to use that website to interact with it? This is also part of the users' research; for them to want to use that site we're going to create it based on getting the users' hit emotions.

Key Research Components:

i. Business
ii. Target Audience
iii. Qualitative Research
iv. Quantitative Research
v. Initial Insights
vi. Goal Settings
vii. Interview Question
viii. Empathy Map
ix. Pain Points
x. Persona
xi. User Journey Mapping
xii. User Story
xiii. Problem Statement
xiv. Hypothesis Statement
xv. Competitive Audit Report
xvi. How Might We?
xvii. Goal Statement
xviii. Sitemap
xix. User flow
xx. Information Architecture
xxi. Low-fidelity Wireframing and Prototyping

The usability study conducted at the end of the UX research ensured that the final design meets user expectations and is intuitive to navigate.

III. UI design

After doing some experiments and finishing my UX research, I began on to user interface design challenges that match the brand identity. Designing a pleasing and practical interface that encourages accessibility and interaction among users was my job. Key UI design tasks were creating wireframes and high-fidelity prototypes. Developing a visual language that flows with the brand identity. Testing and refining the UI design for usability and consistency.

Key UI Design Tasks:

- Designing wireframes and high-fidelity prototypes.
- Developing a cohesive visual language that aligns with the brand identity.
- Testing and refining the UI design for usability and consistency.

2.1 Related Works

In the course of searching for available platforms, I have discovered that no existing websites and apps are devoted to immersive education specifically designed for science students in Bangladesh. Yet the interactive website and app pages by different designers inspired me to take on this challenge.

I reviewed a site named "Umety, 10Min School, Ostad" in my exploratory research, which helped me get some priceless learning on interactive web and app design principles. These principles would also be part of my efforts while rigorously pushing the limits of engagement for this project.

So, I was planning to make the integration to the website & app with only 2 recourse members for developing it.

2.2 Scope of the Problem

In Bangladesh, science education mainly focuses on rural schools and is completely short of any modern, up-to-date laboratory facilities or scientific resources. It is dependent only on theory and textbooks. This has resulted in such inadequate circumstances as:

- **Less Immersive and Interactive:** Current platforms lack the interactive elements that enhance the quality of experiential learning.
- **Outdated Design and Accessibility:** The look of many websites has long gone behind, making these worse for users and completely out of consideration for accessibility.
- **Complexity of Controls**: Navigation and interactivity within these sites are commonly less friendly for beginners.
- **Sensory Limitations in AR/VR:** These tools mostly use visuals and lack other multi-sensory experiences such as auditory and haptic experiences.
- **High Device Requirements:** Advanced machines are needed to use these platforms, making many of them untouchable for users with limited resources.

2.3 Challenges

It was difficult to locate such a novel and untouched subject in Bangladesh. Interactive educational websites, particularly those that use virtual reality technologies, are still in their infancy and are mostly created by large tech businesses. It has been quite difficult to come up with such a product with such a small two-person team development effort, requiring both collaboration and good new thinking.

We took the risk of creating a website that lays the foundation for more interactive education in Bangladesh in spite of the obstacles.

CHAPTER 3

Requirement Specification

This “Interactive Website Design” project is simply following a law of UX, that can make trending websites more usable. The law is the “Aesthetic-Usability Effect”. The book named “Laws of UX” written by Job Yoblonski has some main laws of UX, where I found this law can be the game changer for many websites. So, the business model for this website comes up with the theme we designed for this project.

What we are going to offer in this project? Here I pointed out the offerings,

- Advertisement Concept
- Product Blueprint
- Purchasing Scope

These points in a website simply will reduce some risks or risk-taking sales stunts made by the salesman or sometimes by the owners themselves. Which have to be done physically to the customers. So, hereby this type of interactive website can,

I. Take care of their value proportion in businesses
i. Save money
III. Reduce the number of employees
IV. Bring uniqueness to the brand, which will ultimately help in the business.

3.1 Requirement Collection and Analysis

Bringing this idea from **“Umety Website & App, 10 Minute School Website & App, Ostad Website & App”** and making the surveys and questionnaires made me clearer about its stability in the future. I give all the survey questions to the qualitative and quantitative research sections in Chapter 4.

3.2 Design Requirement

For UI Design, at present, there are very less systems to compare with Figma. But there is Adobe XD, which is also used widely. The reason why Adobe XD is used is because it is centralized by Creative Cloud.

The article of Design Lab about “Figma vs Adobe XD” makes it clearer as they showcase where you can have the advantages of Figma while UX/UI design.

Figure 3.2.1 Figma

Below I showcase some results of my surveys and questionnaires.

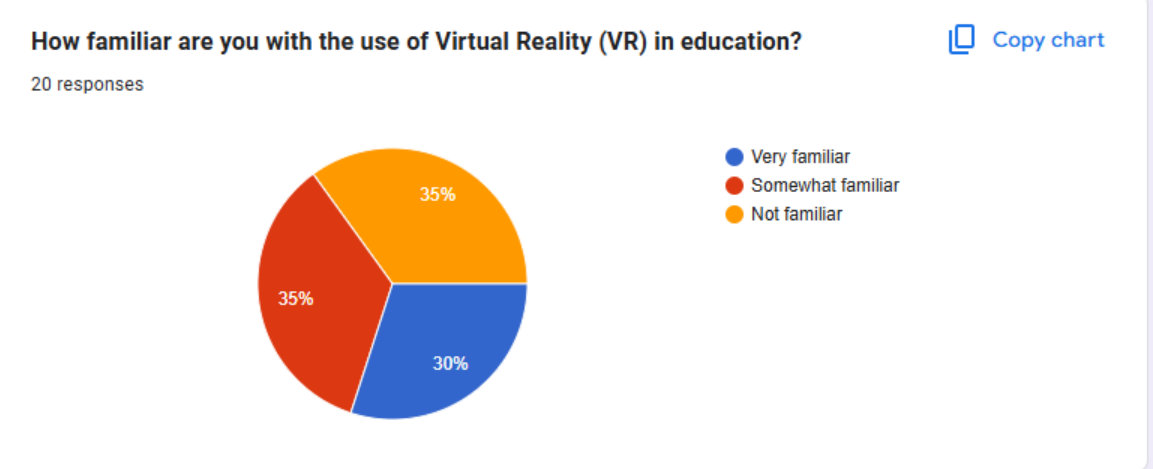


Figure 3.2.2 Analyzed Data

Most of the users are not satisfied with the product visualization to know about any product.

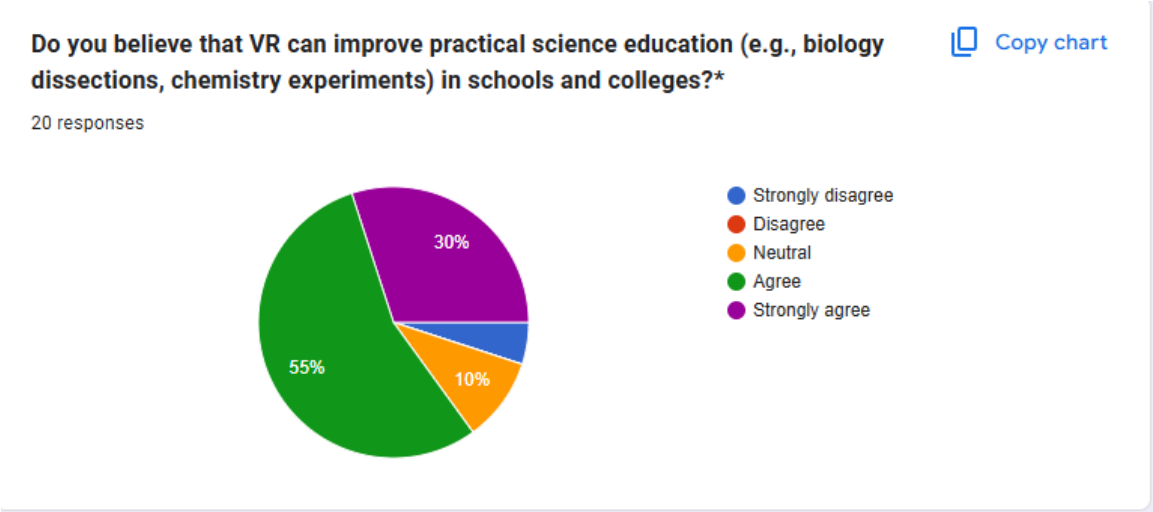


Figure 3.2.3 Analyzed Data

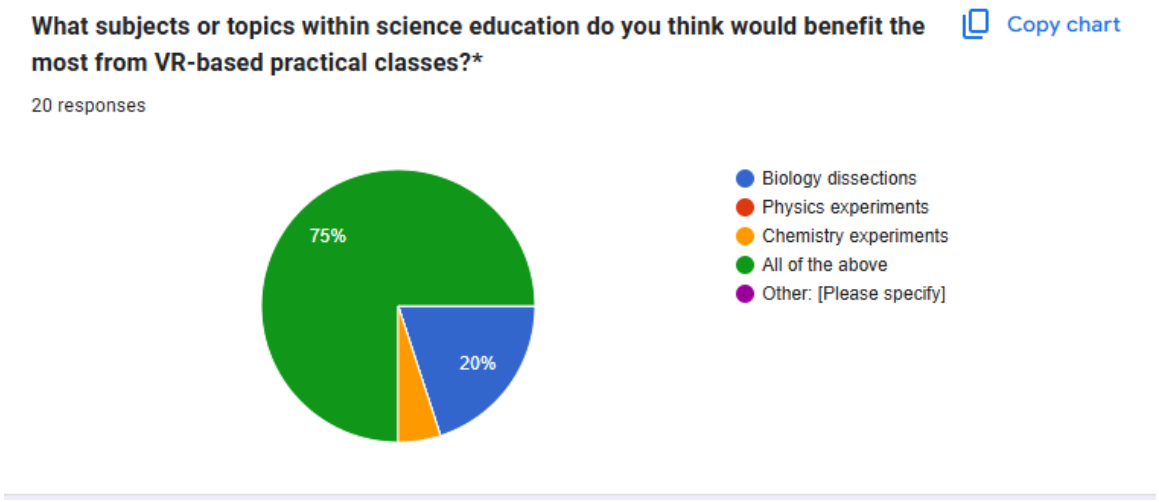


Figure 3.2.4 Analyzed Data

CHAPTER 4

Design Specification

4.1 Logo Design and Brand Color Research

1. Logo Concept

Sketch: At first, I did a rough sketch of how I wanted the logo concept to be. Mixing up a little of the VR Goggles icon and graduation cap, I tried to show what it meant by the words brand name, to be discussed in the **'Finalized Logo'.**

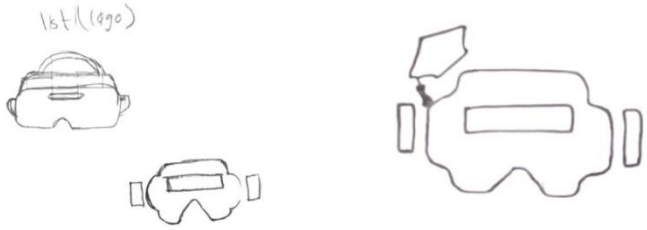


Figure 4.1.1: First concept sketch of a logo

2. Setting up the Brand Colors

For our brand colors, I have picked none other than **"WHITE"**

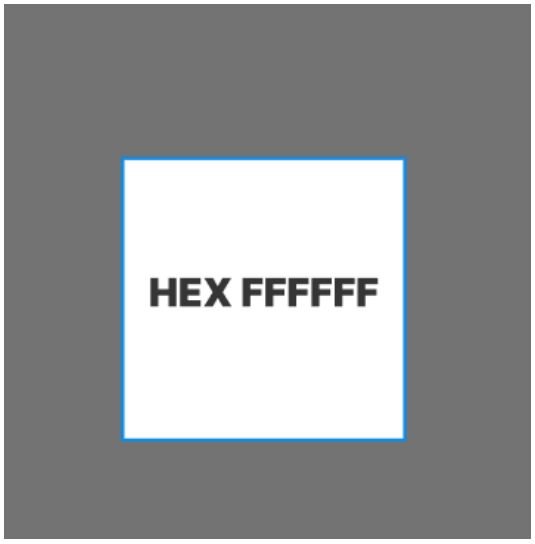


Figure 4.1.2: Color Palettes

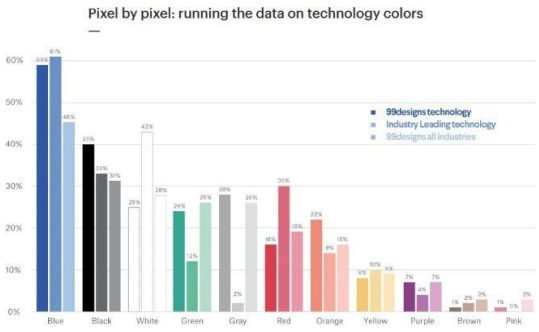


Figure 4.1.2: Running data on Technology Colors

3. Finalized Logo

After finalizing the brand colors, I constructed the concept through illustrations and made a few modifications to it. The next 2 pictures are the elements of the logo and the last logo along with typography. The font I used in the logo is Montserrat.

Breakdown:

VR Goggles: Highlighting a pictorial sketch of virtual reality (VR) goggles, brings the logo into instant connection with immersive experiences and digital learning.

Graduation Cap: The graduation cap placed on the goggles represents education and the acquisition of knowledge, indicating that this platform or company is glad to offer an experience of education.

Cap: The slight cover on the cap may indicate protection or shelter, probably indicating security in a learning environment or the protection of students from the rigors of normal education.

Meanings:

A VR-based educational platform: The graduation cap and VR goggles indicate a concentration on interactive educational opportunities.

A company that uses VR for training and development: The umbrella may signify the protective component of training, which makes sure people are ready for their jobs.

A company that promotes innovation and future-oriented education: This concept is communicated by the modern style and connection of virtual reality with conventional educational symbols.

With everything considered, the logo successfully combines aspects of education and technology, implying a progressive method of instruction. The graduation cap and VR goggles are especially eye-catching and instantly communicate the brand's main message.

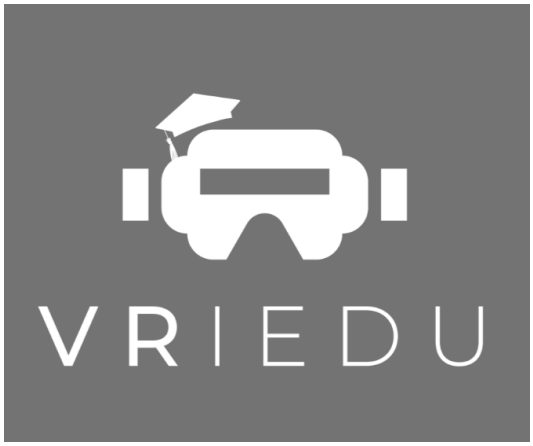


Figure 4.1.4: Final Logo

4.2 UX Research

i. Business

The application of Virtual Reality in education, particularly in that of practical science lessons, appears to have great potential in Bangladesh owing to the following:

1. Growing Demand for Quality Science Education: Because of the large population of youth there is great demand for STEM education that is going to be both efficient and easily accessible. Currently, many students, especially those in rural areas, do not have adequate lab facilities; thus, the need for cutting-edge learning devices such as virtual reality is much more pronounced.

2. Limited Infrastructure in Schools: : Most schools lack the financial base essential for the construction and complete outfitting of modern science labs. A VR-based solution would thus provide a relatively cheaper substitute giving schools the possibility to offer practical science-learning experiences without the usual hefty physical resources.

3. Support from Government and NGOs: There is much effort by the government and different NGOs to enhance education in terms of resources and infrastructure. There is room for collaboration with these entities to incorporate VR solutions in national education campaigns.

4. Increasing EdTech Awareness: The phenomenon of digital transformation in learning is allowing technology in the classroom to become more commonly accepted. Because VR takes learning to a whole new level, it is an instrument for institutions that want to be considered innovative when it comes to new technologies in education.

5. Affordable Technology Options: As virtual reality becomes affordable, many educational institutions (including those not very well endowed financially) may consider it for science laboratories. It provokes amazing opportunities for access development in terms of collaborating with regional VR providers.

6. Scalability Across Educational Levels: Apart from secondary schools, VR science practicals can also be accommodated in higher secondary and college levels, thus widening the market for the educational setup of Bangladesh as a whole.

In conclusion, the business potential for VR-based science education in Bangladesh is encouraging, offering chances to work with the government and non-governmental organizations, meet the needs of underprivileged schools, and take advantage of the expanding digital revolution in education to provide students all over the nation with high-quality, easily accessible science instruction.

ii. This initiative seeks to fill the resource shortages and provide an affordable option for high-quality science education.

4. Educational Policy Makers and NGOs: These organizations all aim to increase access to high-quality education in Bangladesh, mostly for underserved communities. To broaden

the reach, they also play a vital role in sponsoring and supporting cutting-edge teaching resources like virtual reality.

iii. Qualitative Research

- Understanding the Feasibility and Impact of VR-Based Practical Science Education in Bangladesh
- Introduction
- Qualitative research is crucial in exploring the perceptions, attitudes, and expectations of various stakeholders regarding the introduction of Virtual Reality (VR) in practical science education in Bangladesh. By understanding the experiences of educators, students, parents, and administrators, we can gain deeper insights into the feasibility, challenges, and potential impacts of this innovative approach to education.
- Research Objective
- The objective of this qualitative research is to explore the views and experiences of key stakeholders on integrating VR technology into school and college-level practical science education. It aims to assess the perceived benefits, challenges, and practical considerations of using VR for biology dissections and chemistry experiments, particularly in the context of Bangladesh's education system.
- Methodology
- This qualitative study will use
- -semi-structured interviews
- -focus groups, and
- -case studies
- to collect data from various participants. The goal is to gather rich, detailed insights into the following areas:

1. Educators' Perspectives: How do teachers and school administrators view the integration of VR technology? What are their concerns, expectations, and readiness to adopt this innovation?

2. Students' Experiences: What are students' attitudes toward using VR in their science lessons? Do they feel more engaged, safer, and better able to understand complex scientific concepts through VR?

3. Parents' Concerns: How do parents perceive the use of VR in education? Are they willing to support this shift, and what are their primary concerns (e.g., safety, cost, screen time)?

4. Technical Experts' Input: What do technology and VR developers see as the technical requirements and challenges for successfully implementing VR-based education in Bangladesh's schools and colleges?

The research will target a diverse group of stakeholders to ensure a comprehensive understanding of the potential for VR-based education in Bangladesh. These participants include:

1. Teachers and School Administrators: Both public and private school staff will be interviewed to understand the readiness of the education sector for VR adoption.

2. Students (High School and College Level): Focus groups will be conducted with students to explore their attitudes toward traditional vs. VR-based science practical classes.

3. Parents: Interviews with parents will focus on their opinions regarding the impact of VR on their children's learning experience and safety concerns.

4. Educational Technologists and VR Developers: Experts will provide insights into the technical infrastructure required, the cost, and the scalability of such a project in Bangladesh.

Key Research Areas

1. Perceptions of VR in Education

- How familiar are teachers, students, and parents with VR technology?
- What are the initial impressions of VR being used in science education, especially for practical experiments like dissections and chemical reactions?

- How do educators see the role of VR in enhancing or supplementing traditional methods?

2. Engagement and Learning Outcomes

- Do students feel more engaged and motivated in a VR environment compared to traditional labs?
- How do students perceive their understanding of scientific concepts when learning through VR versus traditional methods?
- What specific features of VR (e.g., interactivity, real-time feedback) do students and teachers find most beneficial for practical learning?

3. Practical Challenges and Concerns

- What logistical and financial challenges do schools foresee in adopting VR-based education?
- Are there concerns related to access to VR equipment in rural or low-resource schools?
- How do educators plan to handle potential technical issues such as internet connectivity, software malfunctions, or lack of technical support?

4. Teacher Training and Curriculum Integration

- How comfortable are teachers with using VR technology in their classrooms? What kind of training would they require?
- How do educators see VR fitting into the existing curriculum? Are there concerns about alignment with national standards?

5. Ethical and Safety Considerations

- What are the views on the ethical implications of replacing live dissections with virtual ones? Do educators and parents feel this solves the moral concerns around animal use in education?

- Are there safety concerns associated with using VR (e.g., eye strain, screen time, physical safety)?

6. Scalability and Sustainability

- What are the opinions on the scalability of this project in Bangladesh? Can it be implemented in both urban and rural schools?
- What strategies do schools suggest for ensuring sustainability (e.g., government funding, partnerships with tech companies)?

Data Collection and Analysis

- Interviews and Focus Groups**: Interviews will be conducted with a sample size of 20-30 participants from different backgrounds (educators, students, parents, technologists). Focus groups will be arranged with 4-6 participants per group to discuss specific themes such as engagement, safety, and cost.
- Thematic Analysis: Data from interviews and focus groups will be analyzed using thematic analysis to identify recurring themes, concerns, and opportunities across the stakeholder groups.

Expected Findings

1. High Engagement and Motivation: It is expected that students will express a higher level of engagement and interest in practical science when VR is used, particularly due to its immersive and interactive nature.

2. Safety and Ethical Satisfaction: Teachers and parents are likely to appreciate the safety aspect of VR, particularly in avoiding dangerous chemistry reactions and live animal dissections.

3.Challenges in Access and Training: Educators may express concerns about the initial cost of VR equipment, technical training needs, and the readiness of the school infrastructure to support VR technology.

4. Positive Attitudes Toward Innovation: While technical and financial barriers exist, the overall attitude toward VR in education is expected to be positive, with educators and parents recognizing its potential to transform science education.

Conclusion

- The qualitative research will provide critical insights into the feasibility of introducing VR-based practical science education in Bangladesh. By understanding the perspectives of educators, students, parents, and technical experts, this study will help guide the project's development and address key challenges such as accessibility, teacher training, and curriculum integration. Ultimately, this research will shape a more tailored and successful implementation strategy for the project.

iv. Quantitative Research

The following questions will be included in the survey, designed to gather quantitative data:

1. Awareness of VR in Education

- On a scale of 1 to 5, how familiar are you with the use of VR technology in education?
- 1 (Not familiar at all) to 5 (Very familiar)
- Have you ever used VR technology before?
- Yes / No

2. Perceived Benefits of VR in Practical Science Education

- How much do you agree that VR can improve safety in practical science lessons (e.g., for dissections or chemical experiments)?
- 1 (Strongly Disagree) to 5 (Strongly Agree)
- How likely do you think students are to understand complex scientific concepts better with VR compared to traditional methods?
- 1 (Very Unlikely) to 5 (Very Likely)

3. Challenges and Barriers

- How concerned are you about the cost of implementing VR technology in schools?
- 1 (Not concerned at all) to 5 (Extremely concerned)
- What do you believe are the biggest challenges to integrating VR into schools? (Select all that apply)
- Cost
- Lack of infrastructure
- Teacher training
- Technical issues
- Other: [Please specify]

4. Willingness to Adopt VR-Based Education

- Would you support the use of VR technology in your school's practical science lessons?
- Yes / No / Maybe
- If VR-based practical education was available at your school, how likely are you to advocate for its use? **
- 1 (Very Unlikely) to 5 (Very Likely)

5. Engagement and Effectiveness

- How engaging do you think students would find VR-based practical science lessons compared to traditional methods?
- 1 (Less Engaging) to 5 (Much More Engaging)
- Do you think VR-based practical lessons would improve students' grades in science subjects?
- Yes / No / Not sure
- In your opinion, how effective is VR technology in helping students apply theoretical knowledge to practical scenarios?
- 1 (Not Effective) to 5 (Very Effective)

6. Accessibility and Scalability

- How accessible do you think VR technology would be in schools across Bangladesh?
- 1 (Not Accessible at All) to 5 (Very Accessible)
- Do you think rural schools would be able to adopt VR-based education with adequate support?
- Yes / No / Maybe

7. General Attitude Toward VR in Education

- How excited are you about the potential of VR to transform science education in Bangladesh?
- 1 (Not Excited) to 5 (Very Excited)
- Would you recommend the use of VR in practical science education to other schools or parents?
- Yes / No

v. Set Goals

Goal statement is a sentence which will indicate the target to the designer, who have to fill up the target need to make UI friendly to the users.

vi. Interview Question

1. Did you get a proper practical session during your school period?
2. How much do you know about VR?
3. Why do you think students are not getting proper practical session in school?
4. What are your thoughts on practical sessions through VR?
5. Can you tell me some pros and cons about it from your point of view?

vii. Empathy Map

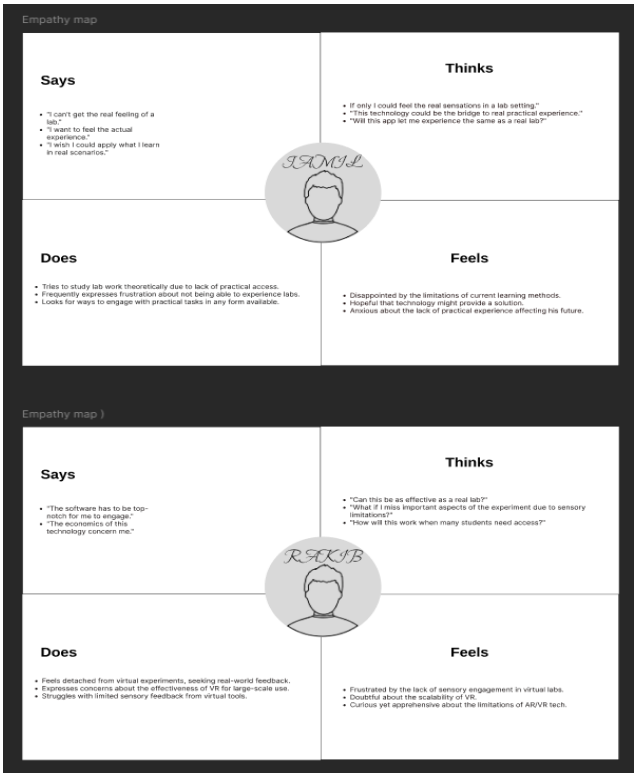


Figure 4.3.1: Empathy Map of Target User

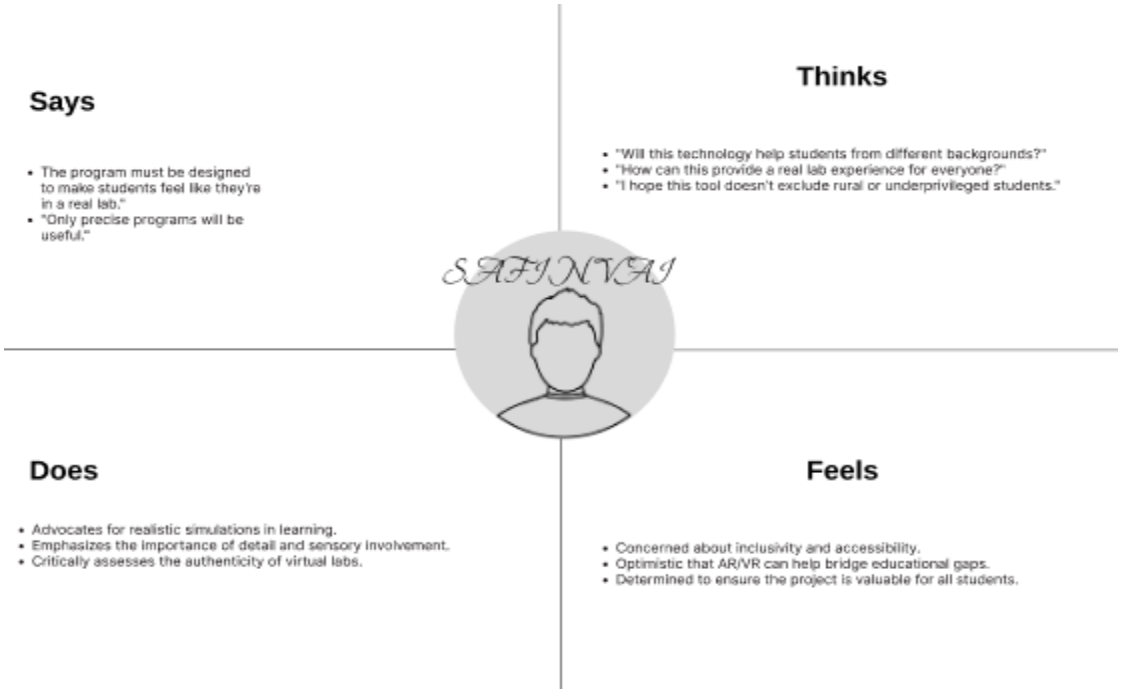


Figure 4.3.2: Empathy Map of Target User

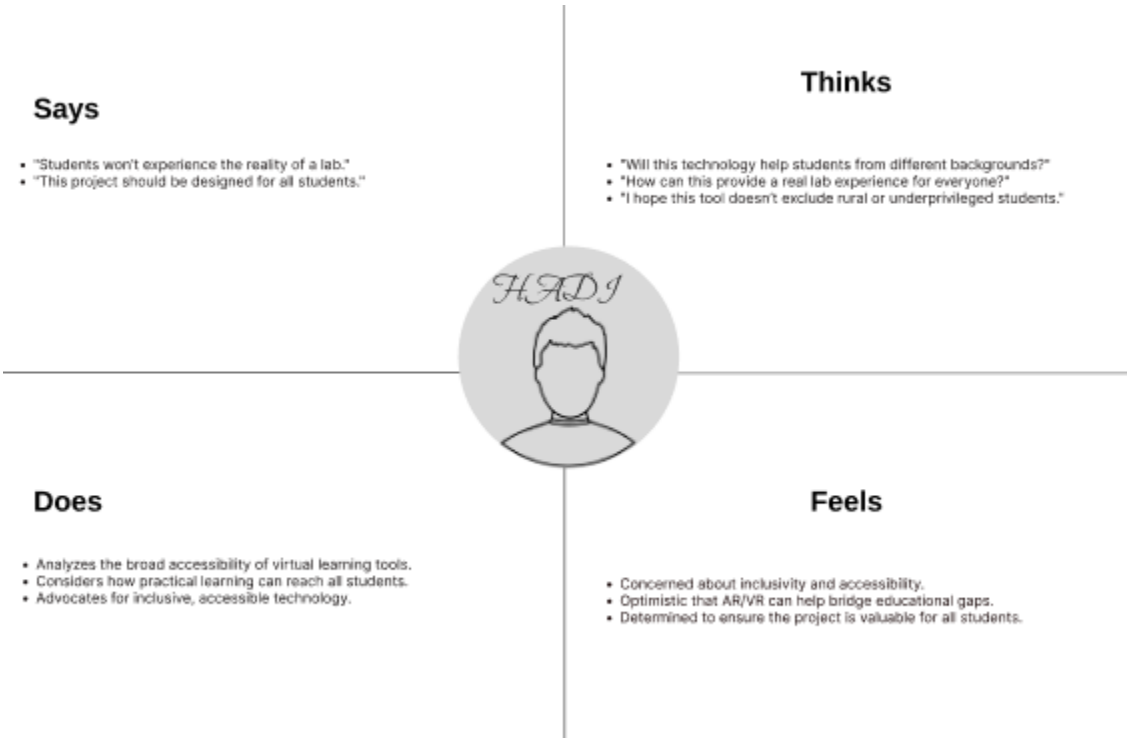


Figure 4.3.3: Empathy Map of Target User

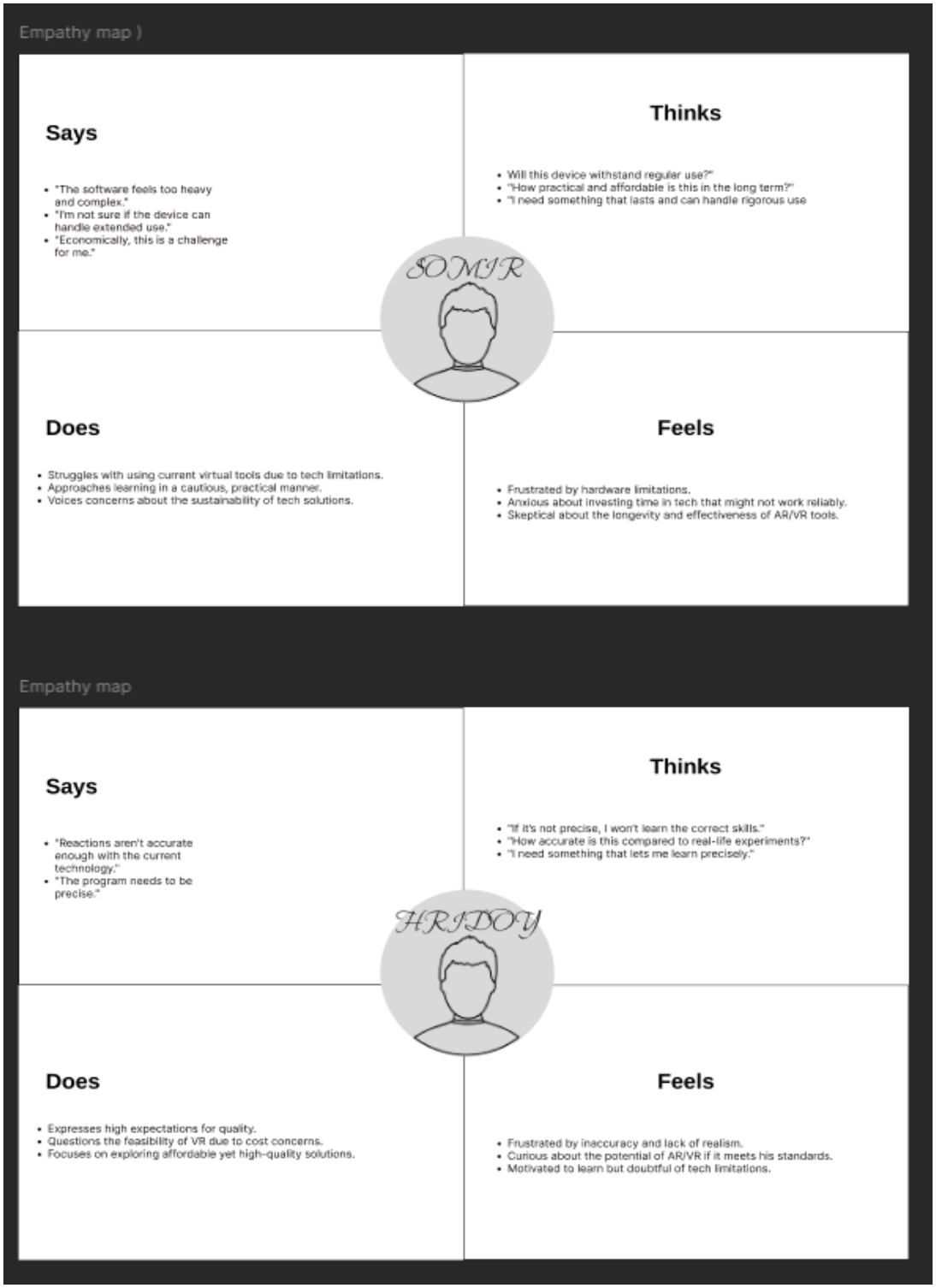


Figure 4.3.4: Empathy Map of Target User

viii. Pain Points

i. Students have very limited hands-on experiences with science in school because of the lack of laboratory resources, and so, it becomes really hard for them to engage and understand complex concepts.

ii. On the other hand, teachers are unable to conduct effective, safe practical lessons as they do not have access to lab equipment or any training.

iii. Budget and infrastructure constraints have stopped the establishment of well-organized science labs.

ix. Persona

Figure 4.3.3: Persona

Figure 4.3.4: Persona

Figure 4.3.4: Persona

X. User Journey Mapping

It outlines user journey mapping of the ways the student, teacher, and administrator would be taking to embed Virtual Reality (VR) into science practical lessons. This whole user journey is the new development of early event curiosity in students experiencing VR-based experiences and the teachers who have an easy and effective channel to interactively

deliver complex science concepts. It also accounted for the satisfaction of administrators finding ways to override budget and accessibility issues in laboratories. This journey has captured every evolution from the first real time when they discovered the possibility of using VR to achieve and impactful learning in science subject.

User Journey Map for AR/VR Project (Similar to Interactive Website)

ACTION	Exploring AR/VR Options	Selecting an AR/VR App	Learning to Use AR/VR Tools	Applying AR/VR Tools in Practice
TASK LIST	- Browse options online for AR/VR learning tools. - Ensure tools provide detailed, hands-on learning experiences	- Read reviews and watch tutorials to understand the app's features. - Compare usability, cost, and device compatibility.	- Follow tutorials or guides to understand controls and interface. - Practice basic navigation within the AR/VR environment.	- Engage in practical exercises and labs through AR/VR. - Interact with realistic simulations and gain hands-on skills.
FEELING ADJECTIVE	Excited to discover immersive learning experiences	Curious and somewhat hesitant about app's effectiveness.	Frustrated while learning complex controls but intrigued.	Engaged and satisfied with realistic experiences.
IMPROVEMENT OPPORTUNITIES	Provide a comparison chart to showcase different tools' features and benefits.	Develop comprehensive tutorials and FAQs for each tool.	Simplify user interface and controls for beginner users.	Add more real-life elements to increase the authenticity of simulations.

Figure 4.3.1: User Journey Mapping

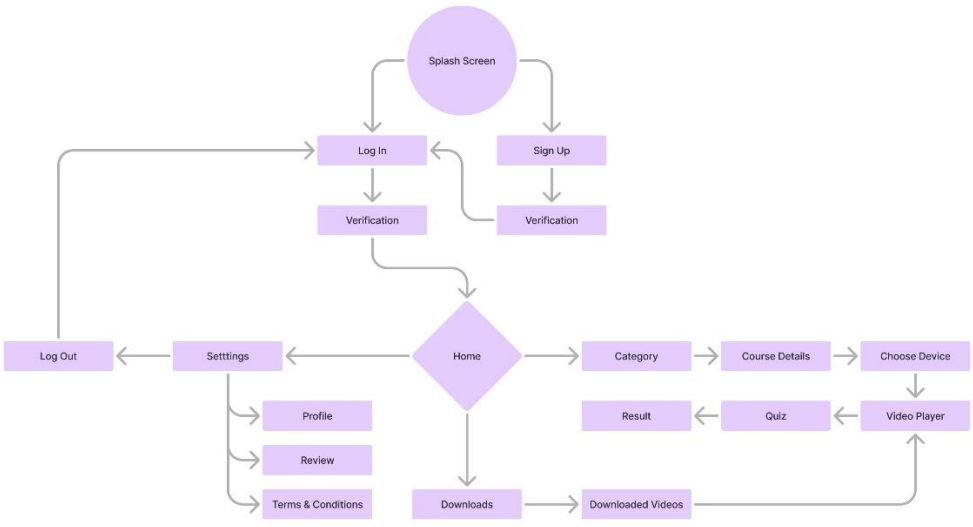


Figure 4.3.2: User Journey Map

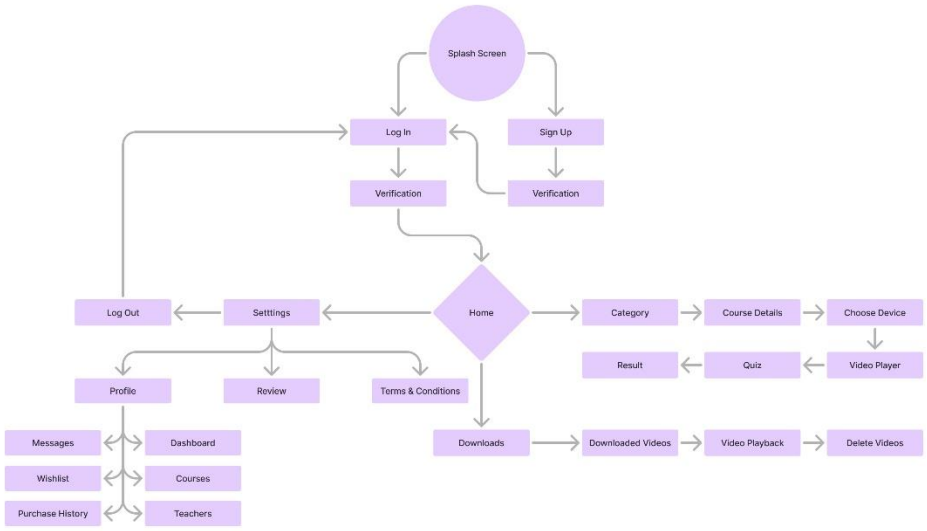


Figure 4.3.3: Information Architecture

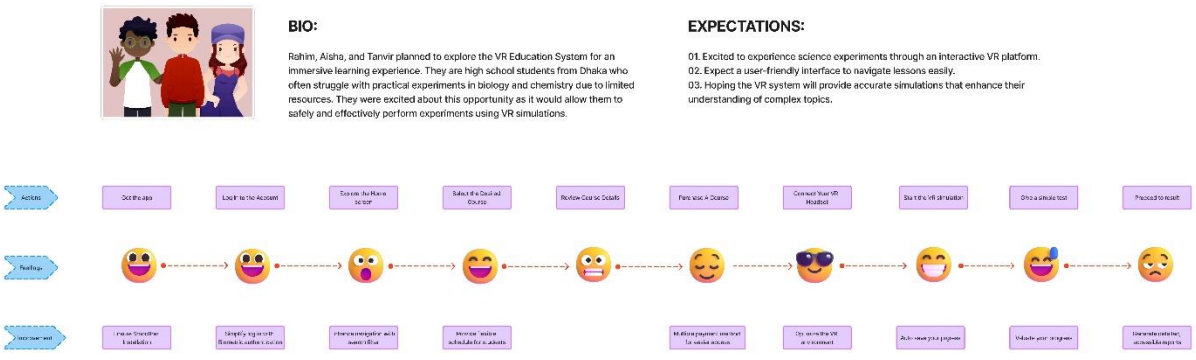


Figure 4.3.4: Journey Map

Xi. User Story:

- As an aspiring scientist studying in a high school in Bangladesh, I experience an unavailability of science labs and want a safe, interactive environment to perform dissections in biology and chemistry experiments. Most of the time, I do not find concepts well understood due to the confinements of textbooks, and there are really no practical experiences that make science feel abstract and challenging. With access to any Virtual Reality (VR) simulation in my school, I can do my learning with engaging more with experiments to get a more realistic understanding and also build my confidence in the science.
- As a science teacher, I would find it much easier to deliver a practical lesson because there is limited access to resources and lack of safety in our lab. Therefore, I would like a tool that provides hands-on teaching in science without the use of hazardous materials so that I can have very stimulating and effective classes. With VR, I could guide students through realistic experiments with everything they need to make the lessons come to life, thus easing the learning of very complex concepts.
- Being an administrator, I know very well the effect of money and logistics on failing to provide those essentials in the science laboratories. I need a scalable, cost-effective solution for providing quality science education for all students as far as possible, particularly rural ones. Integration of virtual reality into our curriculum would help eradicate hurdles of this kind because engaging, affordable substitutes to conventional labs can prepare the students for the necessary knowledge and skills in science.

Xii. Problem Statement

- Almost all schools in Bangladesh, especially rural schools, are void of completely supplied science laboratories for hands-on lessons in biology and chemistry. This dramatically reduced the input of students by engulfing them in scientific concepts since most students tend to find the teaching approach less interesting and dwindles the motivation and curiosity to explore science. These very complex scientific

concepts are unlikely to be understood without experience and interaction, thereby making it impossible for students to fully grasp and apply theoretical knowledge.

- Practical science lessons also have their inherent safety risks in addition to one-on-one activities like dissections and chemical reactions, and this might deter schools from providing students with a complete lab experience. Money and infrastructure constraints would add to this, and, therefore, many are unable to meet that cost since their establishments cannot afford it or find it expensive to create or maintain adequate lab facilities. The other one is the preparedness of the teacher; without proper training and resources, teachers might find it hard to integrate advanced tools used in education, such as VR, in their classes.
- Finally, educational innovations face a very high challenge in scaling diverse types throughout the country due to limited resources, differing levels of infrastructure, and little or no support. Such barriers hinder the mass adoption of tools like VR, which could otherwise provide an affordable, safe, and engaging solution in learning for all science students across the country.

Xiii. Hypothesis Statement

That may be possible if they introduce Virtual Reality (VR) Technology in the science education system of Bangladesh schools and colleges, which will serve as a substitute for practical lessons in safe and immersive environments for students who currently do not have access to a laboratory. This new approach would most probably have a huge impact on student engagement, complexity understanding of some scientific concepts, and economical affordability compared to regular laboratory facilities. It can be trained and equipped to teachers and scaled to reach schools in urban and rural areas, thus ensuring inclusiveness and cognitive diversity within learning experiences all over the country in science education.

Xiv. How Might We?

Decentralizing Science Practicums: How could we use VR to enable students in extremely rural areas of Bangladesh to get access to quality science practicums, eliminating the barrier of labs?

Enrich Student Engagement: How can VR simulations be utilized to make lessons in biology and chemistry more hands-on and engaging, encouraging students to develop an interest in science?

Keeping students safe: In what ways could VR offer students a safe environment to conduct experiments where they could potentially hurt themselves, such as experimenting with chemicals, freeing them up to learn without exposing them to danger?

Cost and Infrastructure Barriers: How can we make VR technology affordable for schools with limited budgets and resources, ensuring it is adopted at both urban and rural institutions?

Support Teacher Readiness and Training — how might we better empower teachers with the skills and confidence to actually use VR effectively in their science lessons — ensuring that ready teachers are able to deploy on-factor VR learning experiences?

Building a Scalable Sustainable Model: How can we build a practical education system based on VR that is scalable in the schools in Bangladesh in a sustainable way?

Xv. Goal Statement

This research intends to prepare an assessment for the feasibility and impact of using Virtual Reality (VR) for effectively enhancing practical science education in Bangladeshi schools and colleges. Specifically, the study investigates if Virtual Reality can make biology and chemistry practicals more interesting and accessible and hopefully safer for students, especially in regions lacking it. With these qualitative inputs from students, teachers, and parents, this research goes ahead to study the relevance of Virtual Reality simulations to learning; democratize access to quality science education; and consequently

address the bottlenecks posed by cost, infrastructure, and teacher preparedness for the successful implementation of the innovation into the education system.

xvi. Low-fidelity Wireframing and Prototyping:

Website:

The first step of low-fidelity wireframing and prototyping for websites is when one is creating low-fidelity sketches. This part adds to the visualization of the interface of an app. These sketches are basic, mainly used to figure out the primary layout and navigation structures via a very simple framework without worrying about detail in design.

It served as a rough sketch on which the app can later be designed.

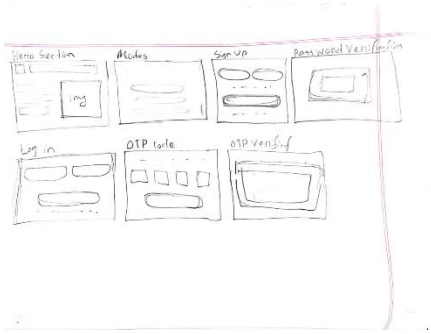


Figure 4.1.5: Low Fidelity Sketch of UI Design (Web)

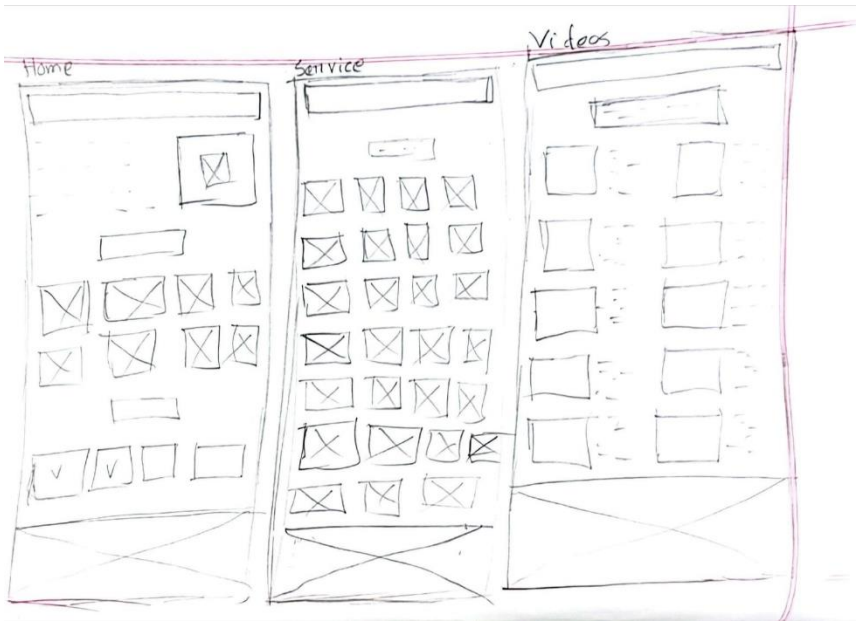


Figure 4.2.1: Low-Fidelity Sketch of UI Design (Web)

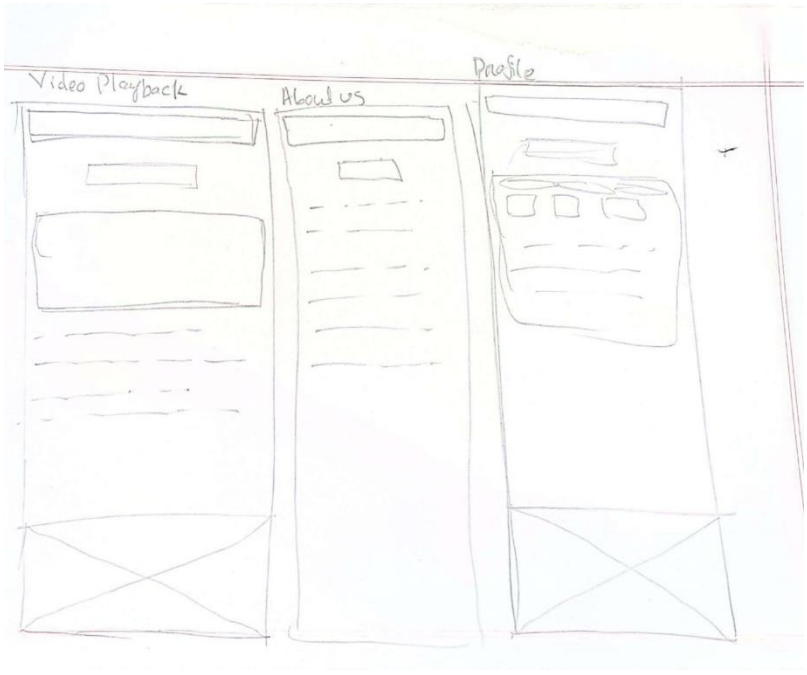


Figure 4.2.2: Low Fidelity Sketch of UI Design (Web)

Mobile App:

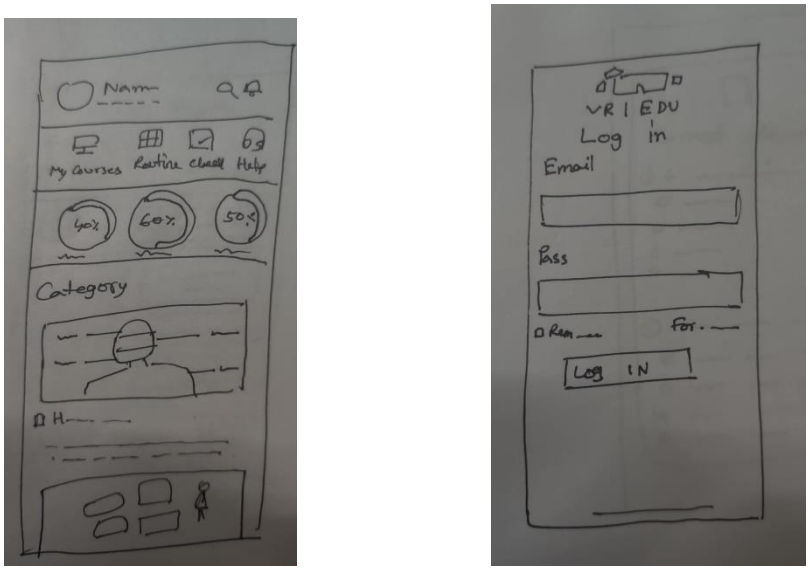


Figure 4.2.3: Low Fidelity Sketch of UI Design (App)

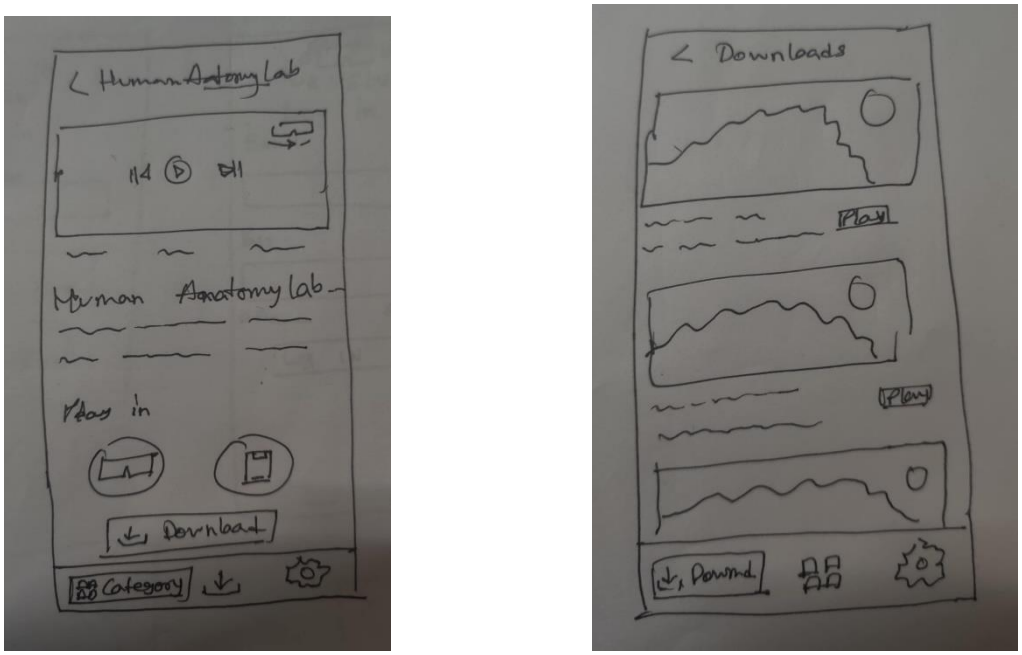
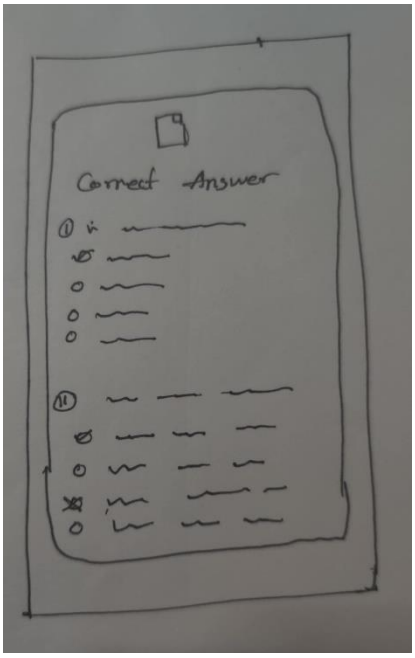


Figure 4.2.4: Low Fidelity Sketch of UI Design (App)



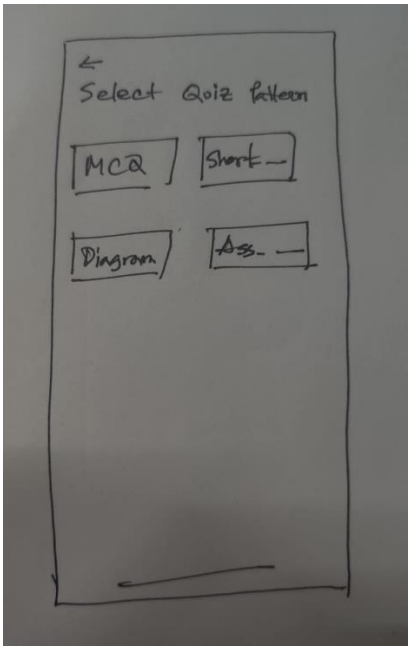
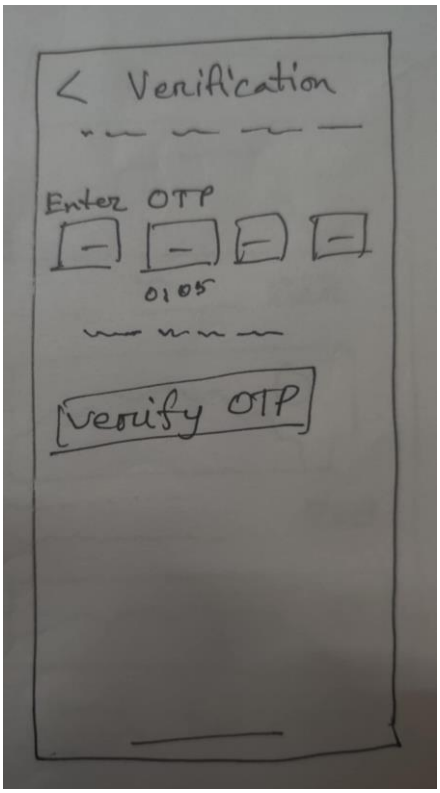


Figure 4.2.5: Low Fidelity Sketch of UI Design (App)



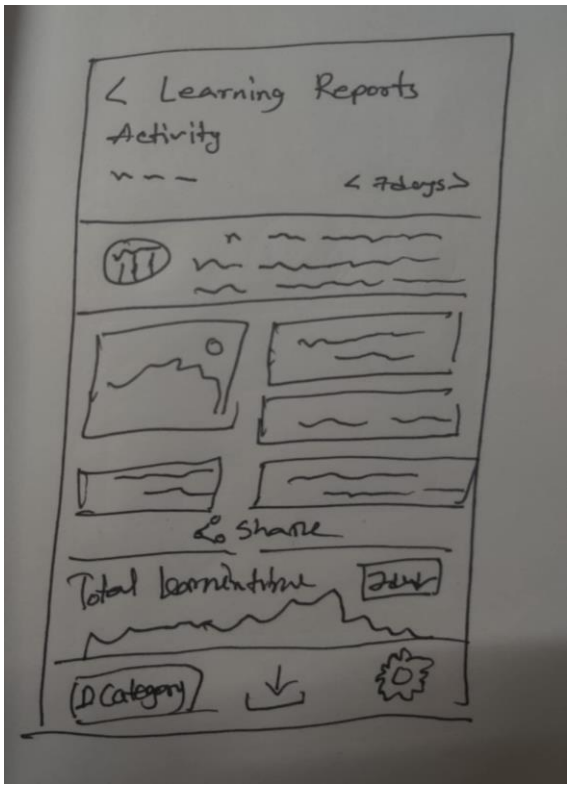


Figure 4.2.5: Low Fidelity Sketch of UI Design (App)

4.3 Mid-Fidelity Design

That is, the mid-fidelity designs are somewhere between low-fidelity wireframes and high-fidelity prototypes. They can go from complex layouts into material and interactions but are still pretty naked from all of these design elements like colors and images. Low-fidelity designing helped user flows and interactions for the VR Education System Website. Yet those designs facilitated more thorough user testing and feedback collection concerning the functionalities of the app, such as digital document storage, real-time verification, and notification systems into what their experiences were with it.

Website:

Figure 4.2.6: Mid-Fidelity of UI Design (Web)

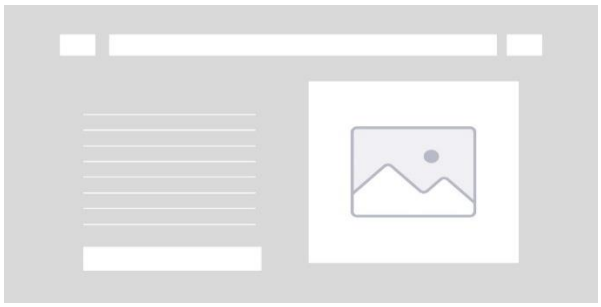


Figure 4.2.7: Mid-Fidelity of UI Design (Web)

Figure 4.2.8: Mid Fidelity of UI Design (Web)

Figure 4.2.9: Mid Fidelity of UI Design (Web)

Mobile App:

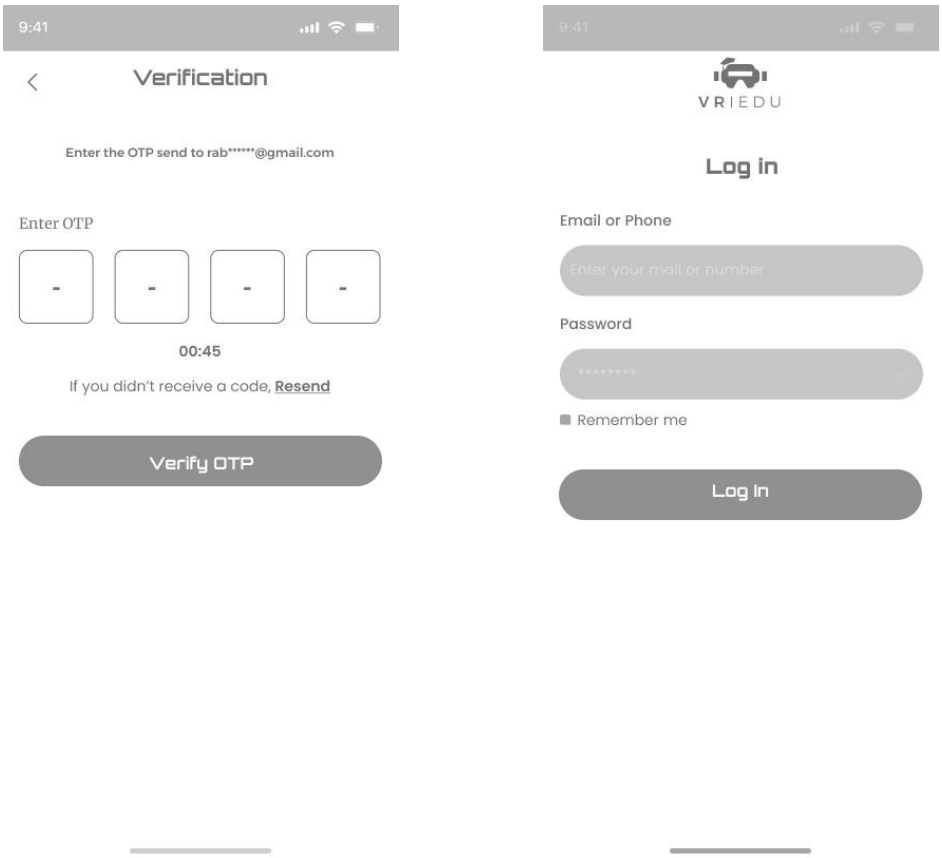


Figure 4.2.10: Mid Fidelity of UI Design (App)

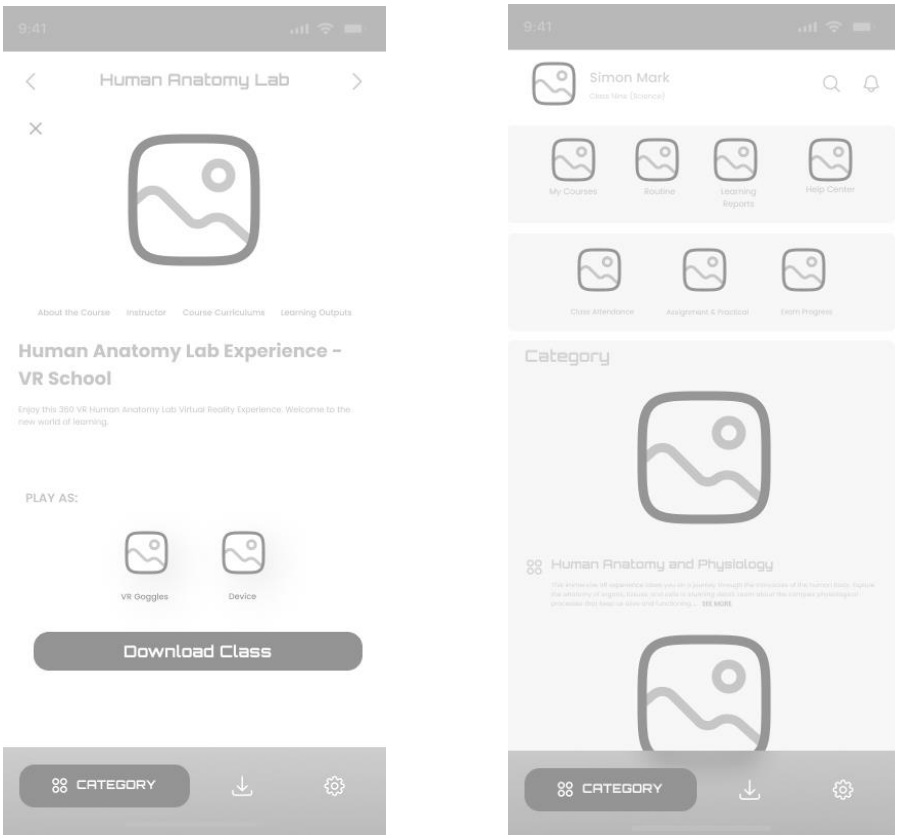


Figure 4.2.11: Mid Fidelity of UI Design (App)

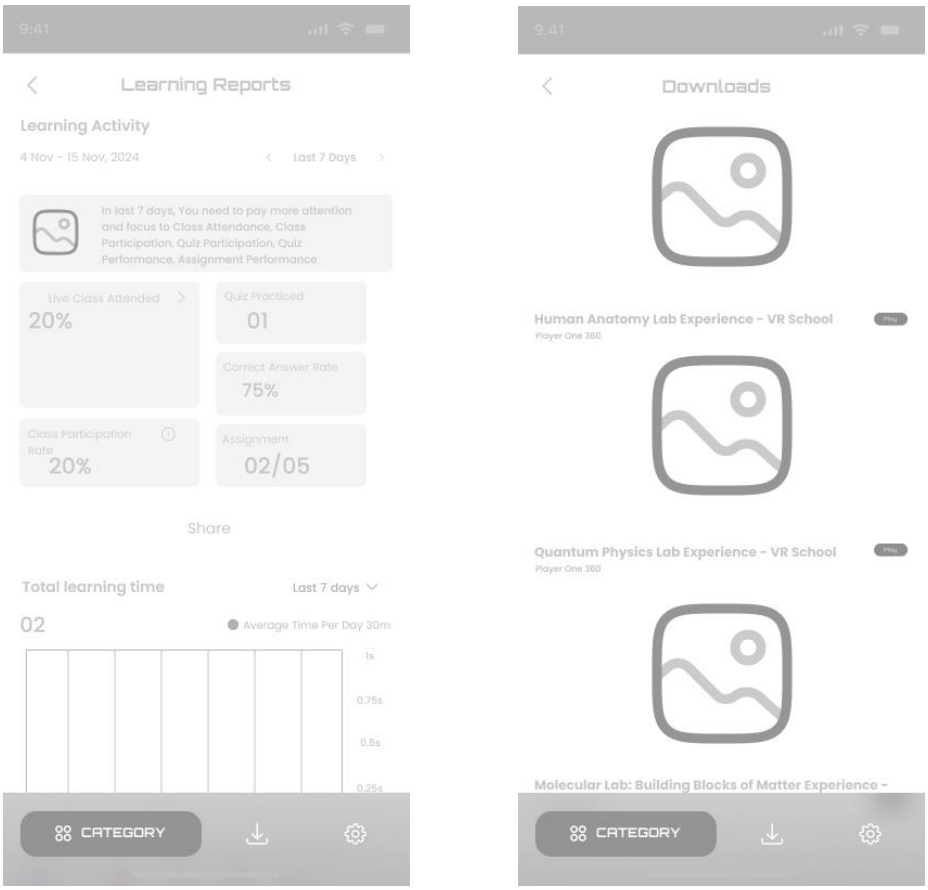


Figure 4.2.12: Mid Fidelity of UI Design (App)

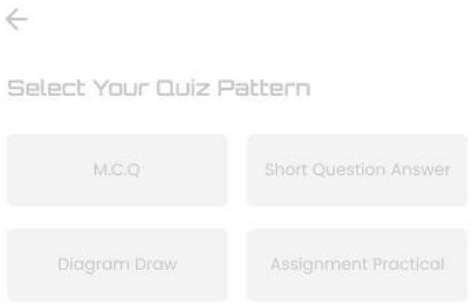


Figure 4.2.13: Mid-Fidelity of UI Design (App)

4.4 User Interface Design

In their portrayal, prototypes have been made interactive and have visually reproduced the end product, with much attention given to details in representing visuals, typography, and interactive elements.

Prototypes validate decisions made about design, engage stakeholders, and as early as possible in the development process, they identify and fine-tune or discover potential issues. Features of high-fidelity UI design usually include visual fidelity, functional functionality, content fidelity, and accessibility. It contains tools for high-fidelity UI design:

Figma ensures that the developed design portrays the final product's appearance, functionality, and accessibility features correctly.

In our project, we have 3 modes a Website platform & a Mobile Application platform.

Website Platform: (Demo Mode)

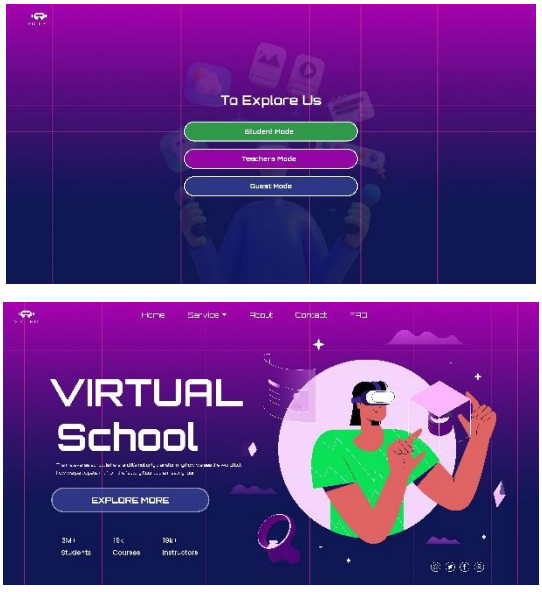


Figure 4.3.1: High Fidelity of UI Design (Web)

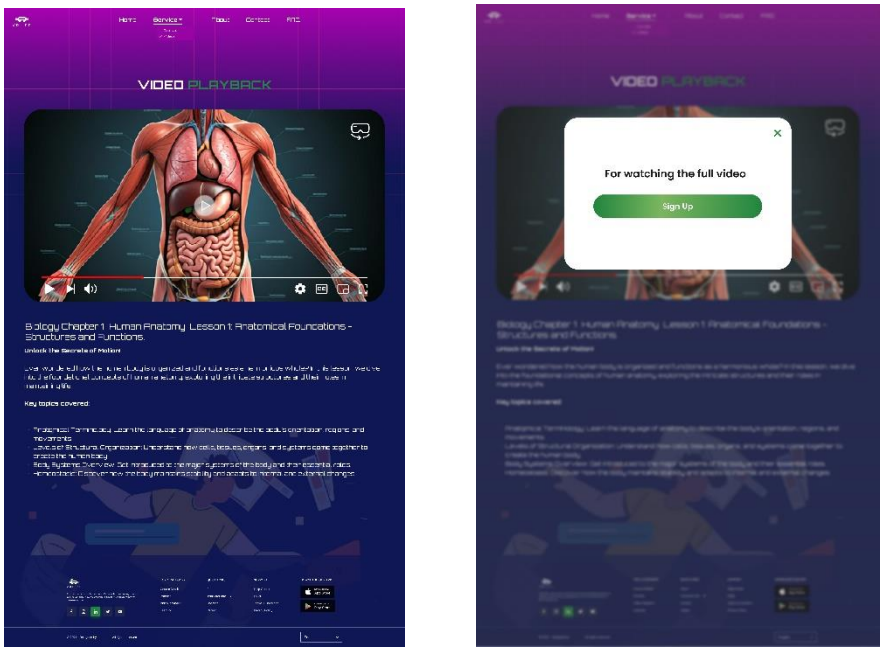


Figure 4.3.2: High Fidelity of UI Design (Web)

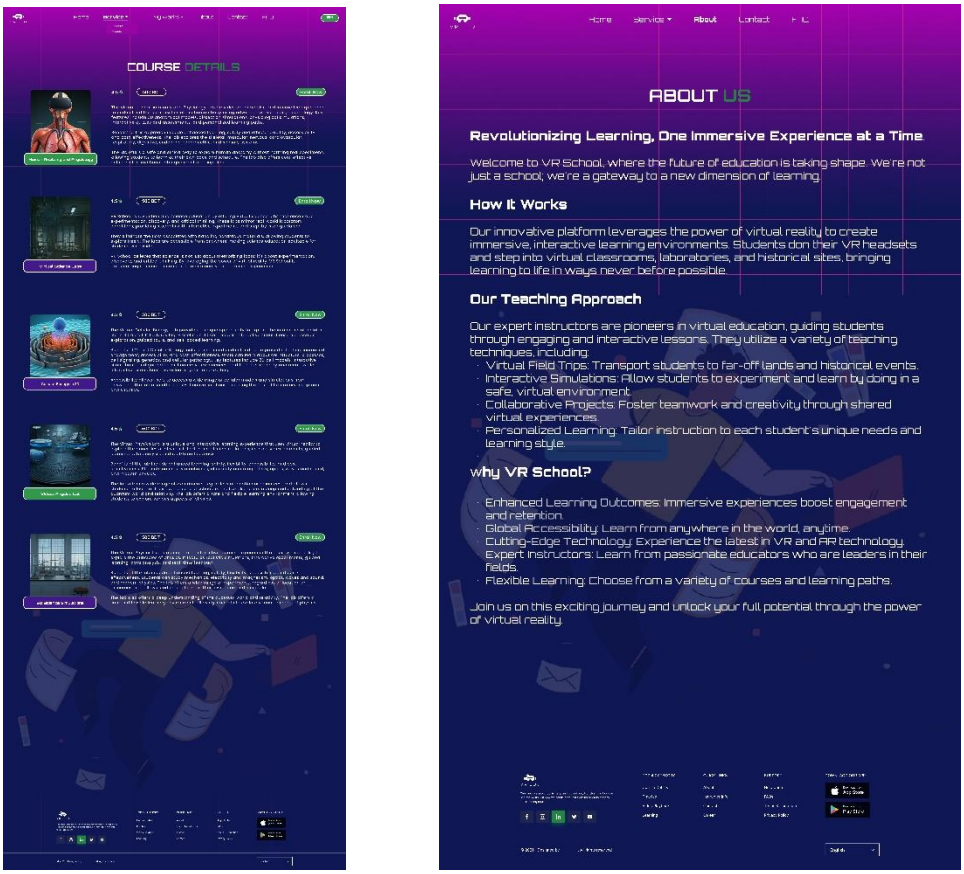


Figure 4.3.3: High Fidelity of UI Design (Web)

Website Platform: (Student Mode)

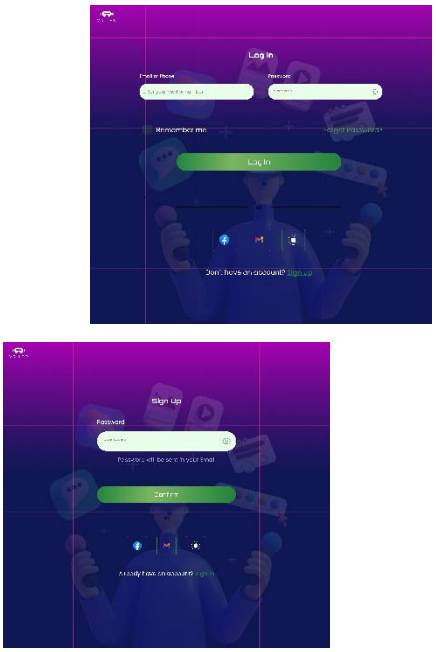


Figure 4.3.4: High Fidelity of UI Design

(Web)

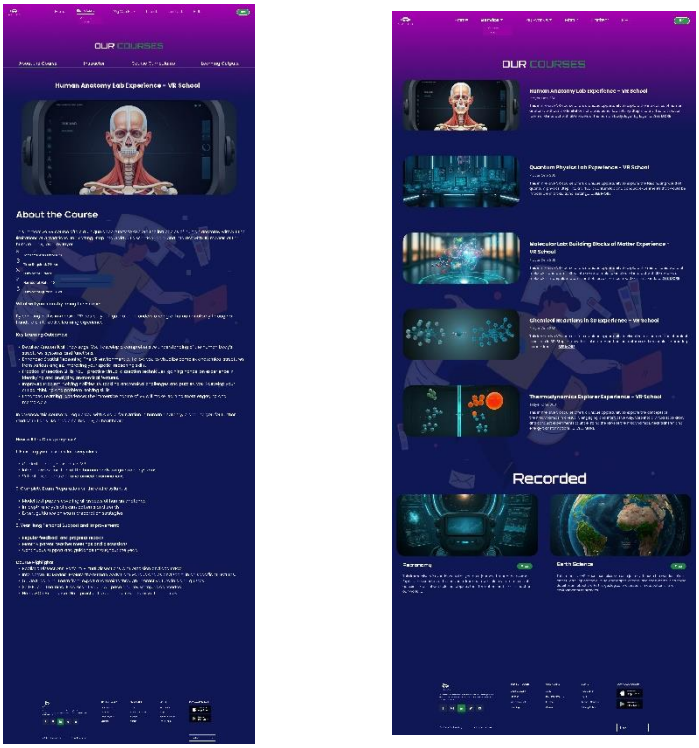


Figure 4.3.5: High Fidelity of UI Design(Web)

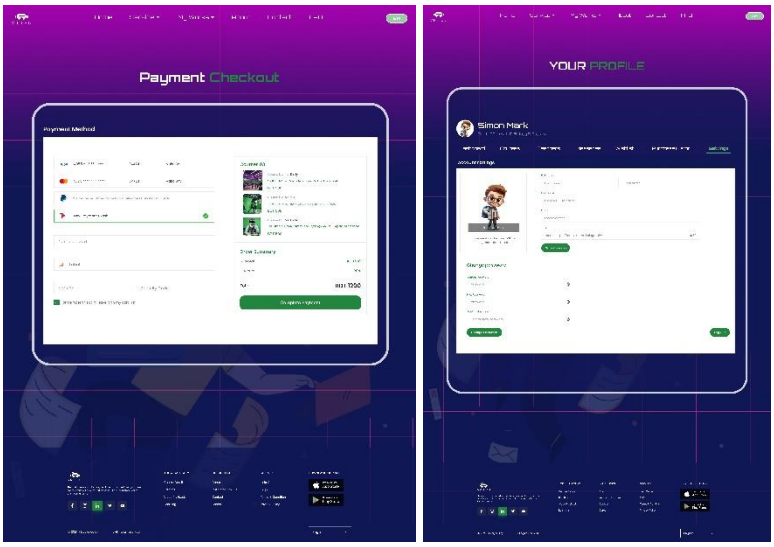


Figure 4.3.6: High Fidelity of UI Design (Web)

Figure 4.3.7: High Fidelity of UI Design (Web)

Website Platform: (Teacher's Mode)

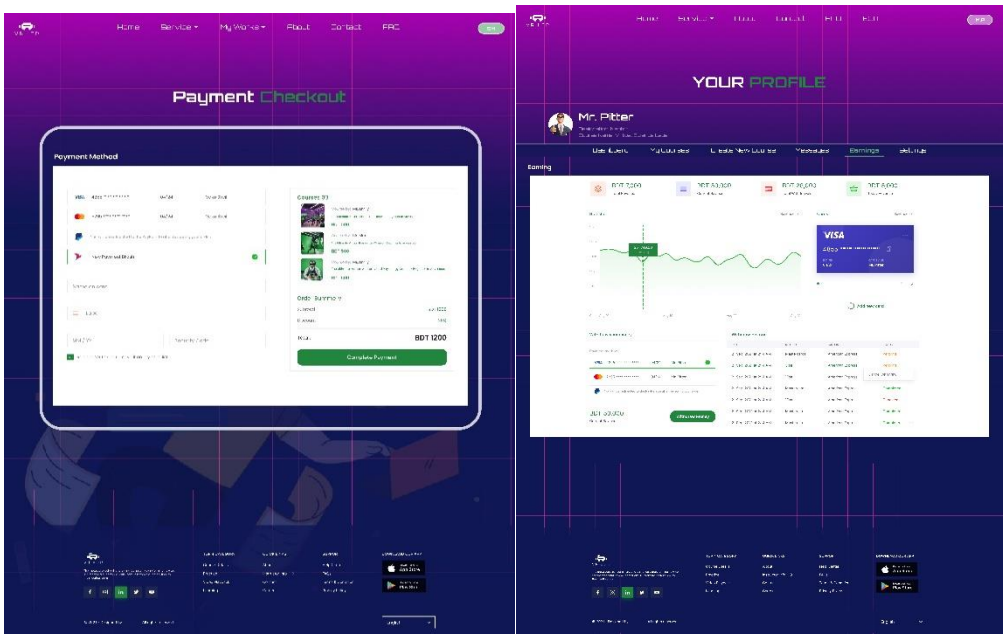


Figure 4.3.8: High Fidelity of UI Design (Web)

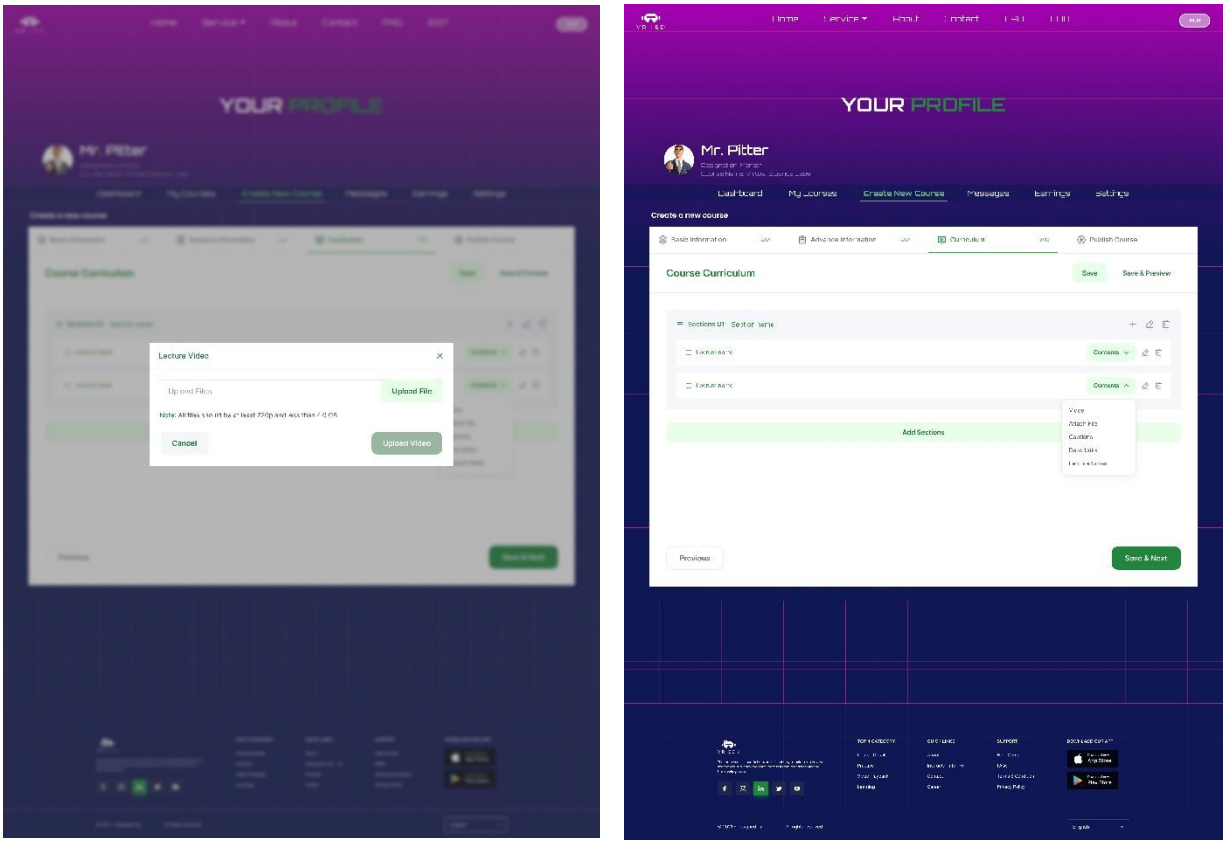


Figure 4.3.8: High Fidelity of UI Design (Web)

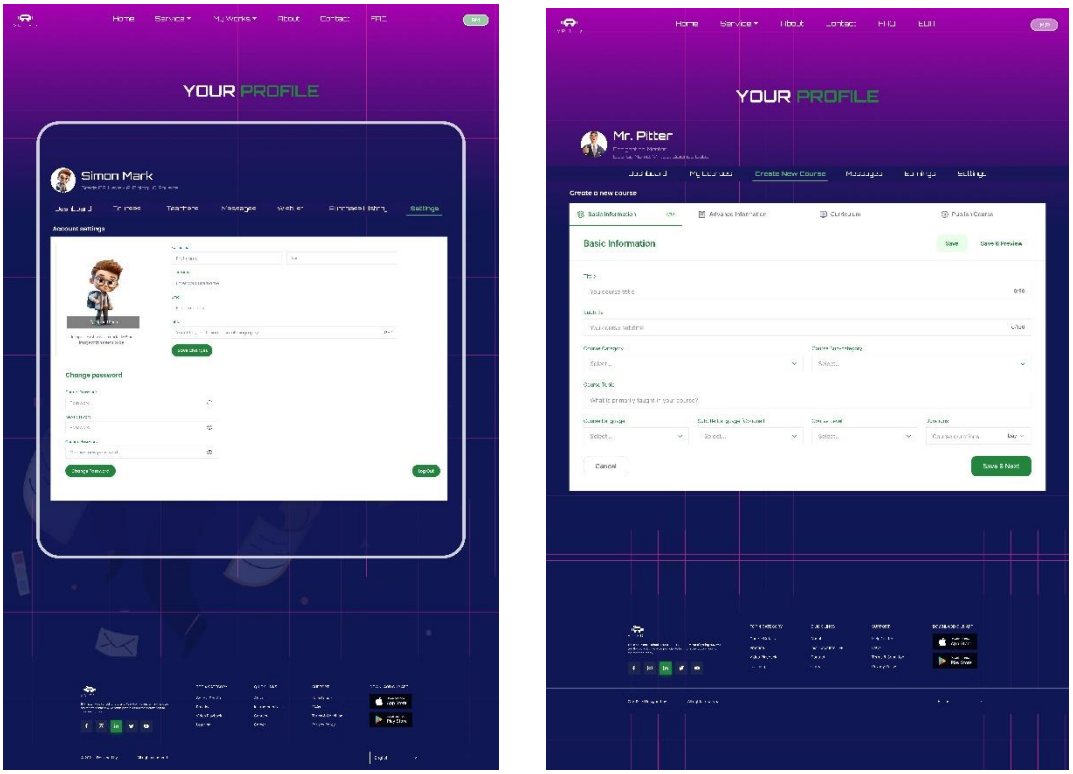


Figure 4.3.9: High Fidelity of UI Design (Web)

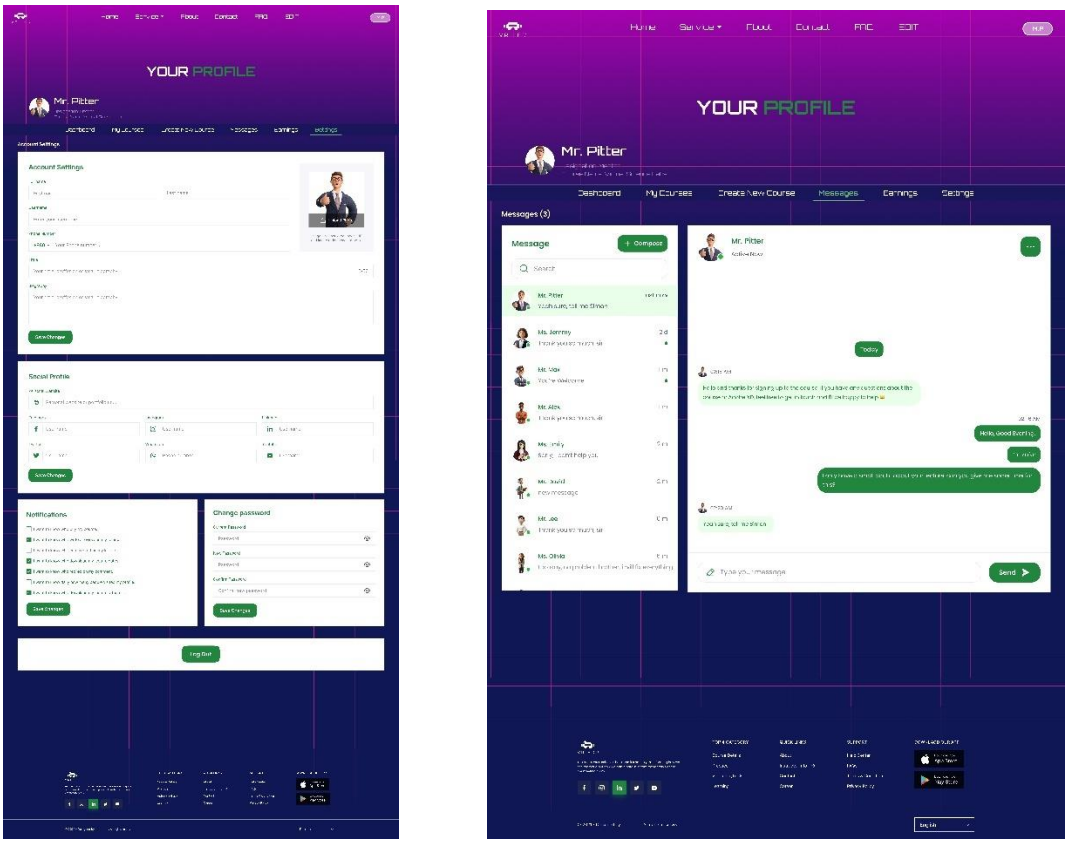


Figure 4.3.10: High Fidelity of UI Design (Web)

Mobile App Platform:

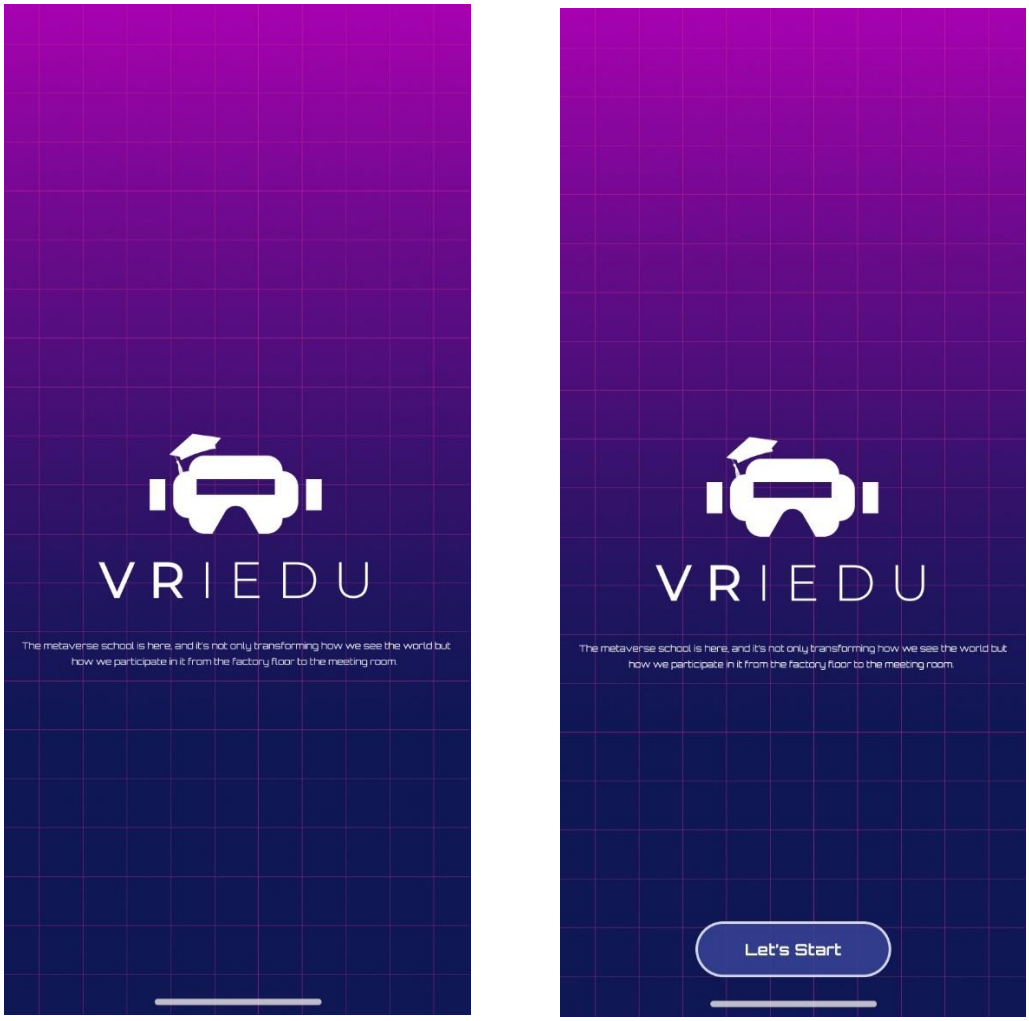


Figure 4.3.11: High Fidelity of UI Design (App)

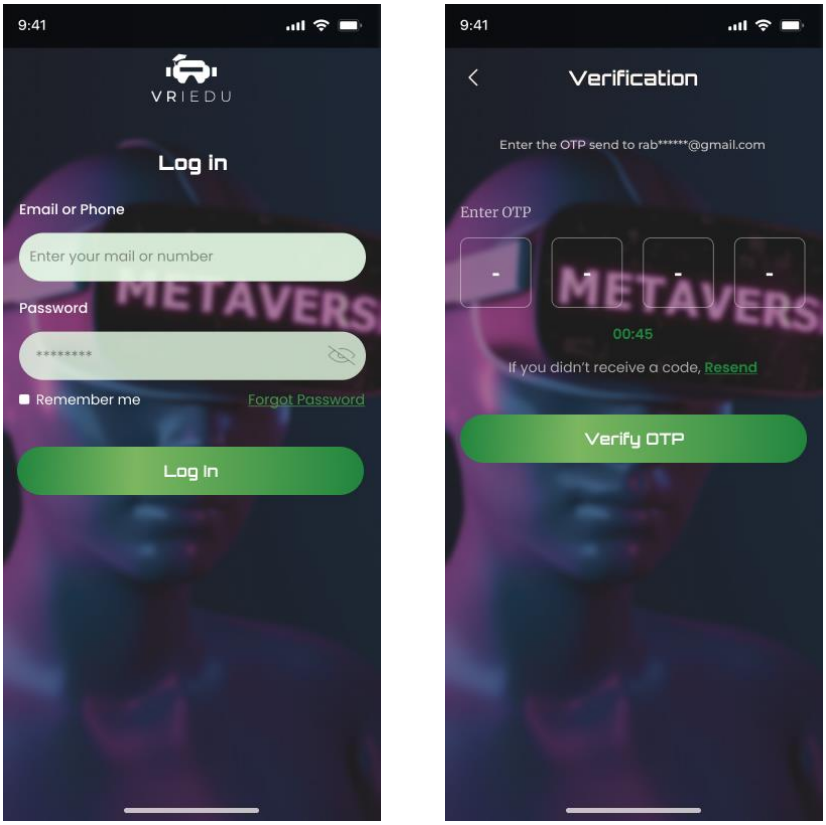


Figure 4.3.12: High Fidelity of UI Design (App)

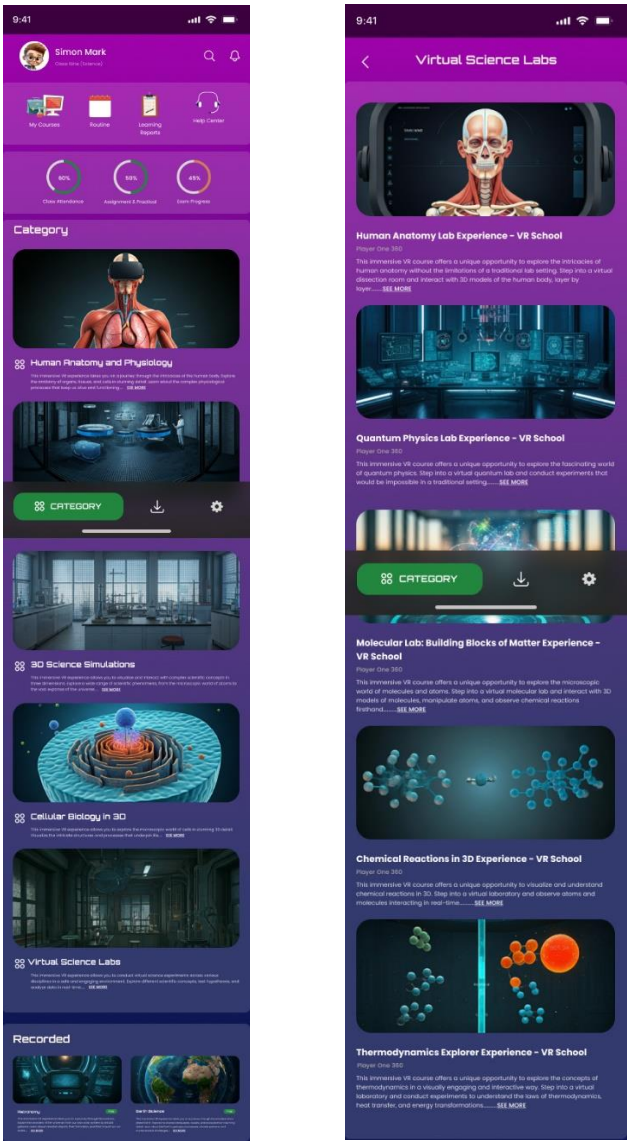


Figure 4.3.13: High Fidelity of UI Design (App)

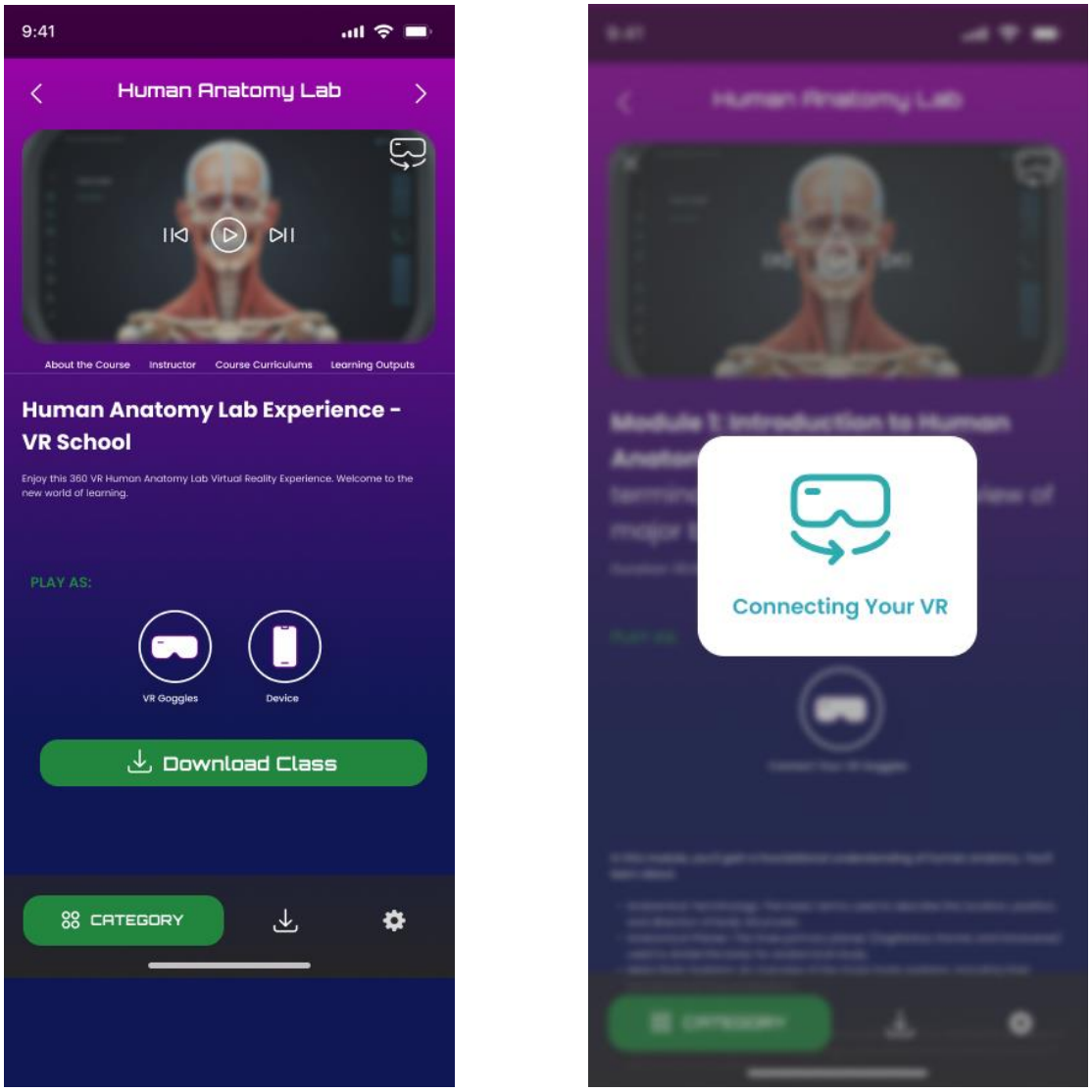


Figure 4.3.14: High Fidelity of UI Design (App)

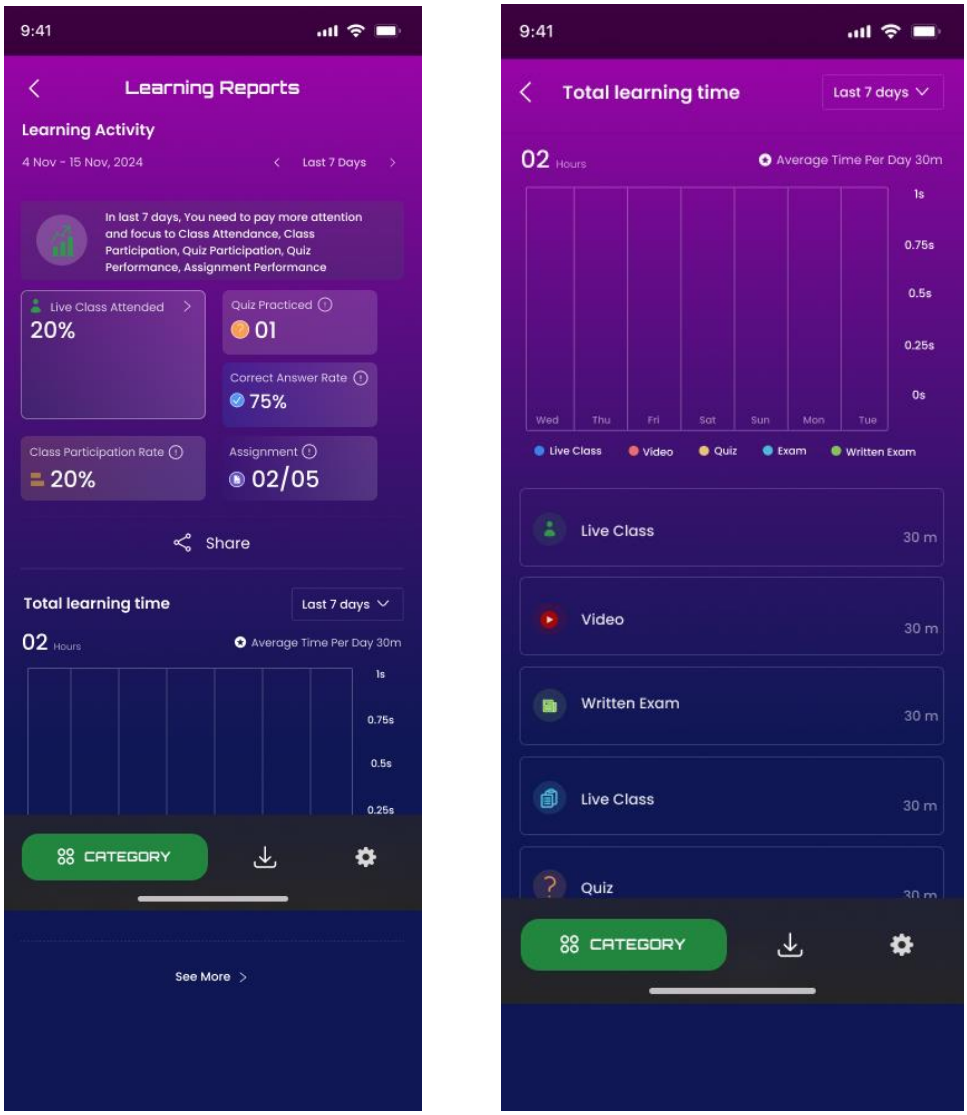


Figure 4.3.14: High Fidelity of UI Design (App)

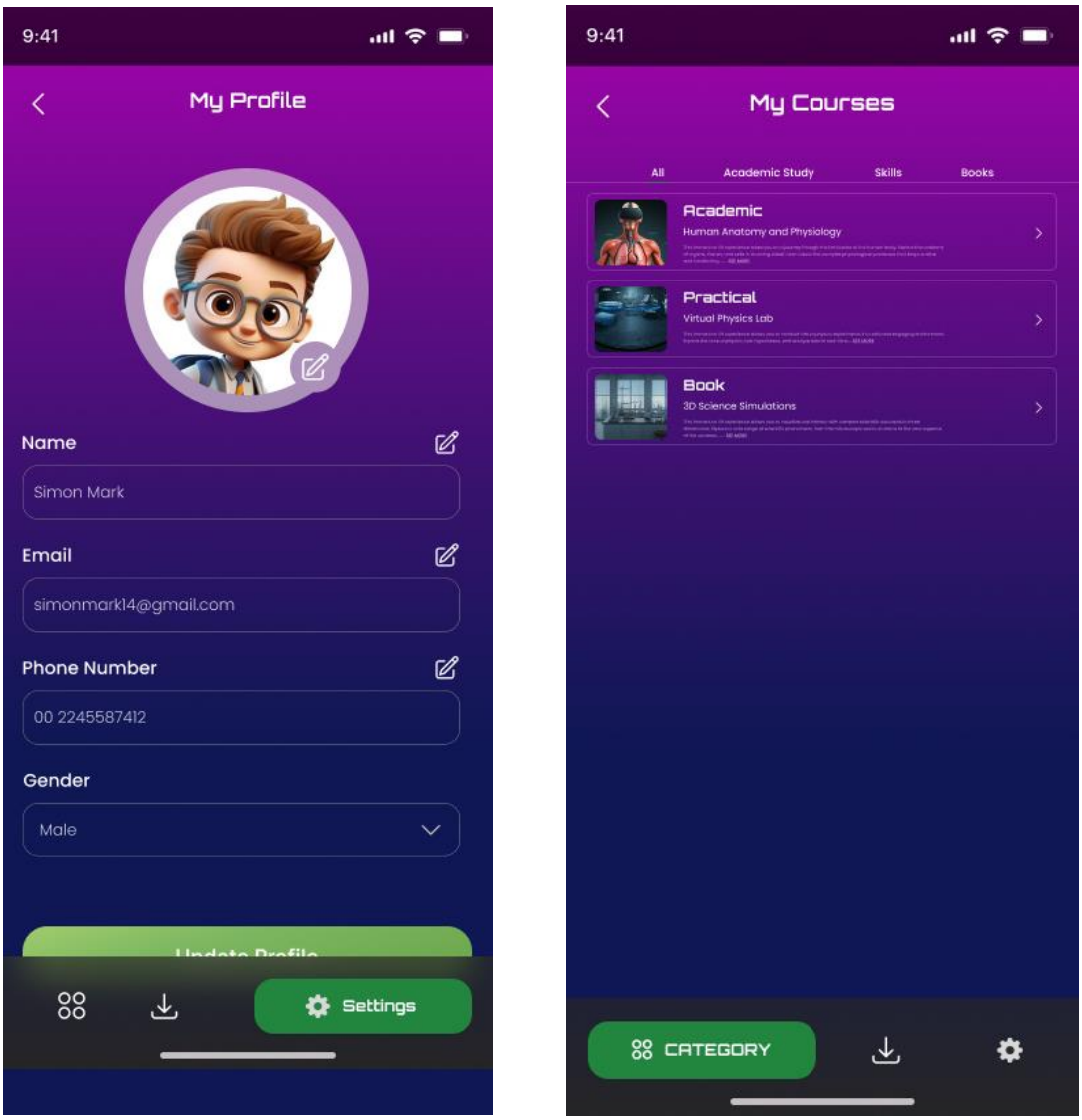


Figure 4.3.15: High Fidelity of UI Design (App)

CHAPTER 5

Implementation & Testing

The process of building prototypes is a very important stage in design where the simulator plays an early version to test and modify its features and functions. The prototypes come low or mid-fidelity and enable visualizing how the user interface and interaction flow look and feel while conjuring the immersive experiences of VR. It allows stakeholders and users to engage and get some real insights into the issue's users will face, which can then be more finely tuned for usability and the overall design.

In prototyping the **"VR education system",** it secures the design to encompass the requirements of users, from making navigation intuitive to encouraging learning. Much of this iterative approach sets a platform for a seamless final product that is going to be effective in achieving the educational goals while keeping in mind the expectations of the users.

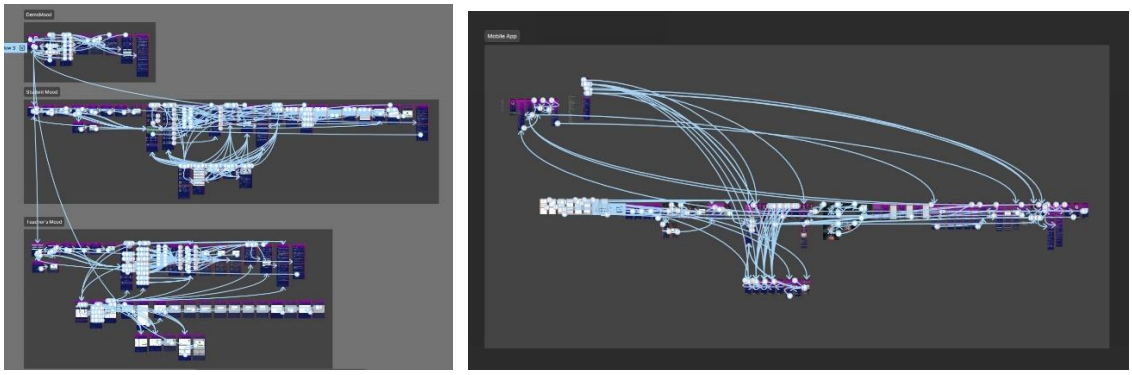


Figure 5.1.1: Prototyping (Web & App)

5.1 Usability Testing

This is one step in the design process, where users see how the System works as much in the real world within the framework of VR Education. This last segment includes observation of the users while performing actions in the virtual environment, completing specific learning tasks, engaging with various interactive features. Evaluation from such activities helps recognize pinpoint usability issues and opportunities for improvement.

Such testing was imperative for a **VR Education System** to check navigation intuitively, how engaged one would be in immersive learning modules, and how well interactive content delivery got defined as user-friendly and accessible. This exercise for prototype testing involving real users of prototypes has fine-tuned interface structure and increased user engagement and helped ensure that the design is diverse enough to accommodate various needs of the students and educators. Of importance was making the entire educational platform user-friendly, reinforcing while adding to the user's learning experience.

5.1.1 Objective

The usability test of the **VR Education System** was focused on determining whether the user prototype could be effective, efficient, and satisfying in use. The alignment of design to user needs through meaningful learning experiences could be as such possible.

5.1.2 Preparation

5.1.2.1 *Recruitment of Participants*

- We selected a diverse group of participants, including students, educators, and individuals interested in virtual reality-based learning.
- Participants were chosen to represent various age groups, technical proficiency levels, and educational backgrounds to ensure a broad spectrum of feedback.

5.1.2.2 *Test Environment*

- We recruited a diversified group of students, teachers, and curious onlookers for learning with virtual reality.
- Participants were recruited to represent varieties of age groups, levels of technological understanding, and educational backgrounds to ensure a full range of feedback.

5.1.2.3 *Scenarios and Tasks*

Sample real scenarios and learning tasks in place of actual use cases such as: Navigating through a virtual classroom.

- Navigate the virtual areas of the classroom.
- Let the interaction with 3-D models help discover concepts in the sciences.
- Complete an immersive learning module answering questions from matrices on such learning.

Then, through all those observations and collection of commenter inputs, one could note improvement areas for overall design and experience in education system VR.

Key Usability Testing Participants

Participant 1:

Name: Hasan Mahbub

Age: 30

Occupation: Developer

Feedback: Pretty much content about the smooth transitions in the virtual classrooms and also over the best of 3D-models; it would certainly be better to have more intuitive icons

for navigation within several learning modules and have even more personalization options of the user interfaces.

Participant 2:

Name: Fatema Hossain
Age: 26
Occupation: Teacher Assistant
Feedback: Surveys indicate that this is a good resource for the VR Education System for gradually moving to opening that kind of immersive, interactive world of experience. Install or initial setup is really complicated. It must be user-friendly onboarding with clear instructions for first-time users to access it better.

Participant 3:

Name: MD. Hasan
Age: 40
Occupation: Mentor

Feedback: Immersive learning modules would be rather beneficial for him during difficult biological concepts to narrate. Then there would be thoroughly complete or full-length guidance through the first-time user probably incisively to the reference in VR controls and navigation. For less-expert users, it was also recommended to have one with voice guided instruction.

Participant 4:

Name: Naimul Islam
Age: 22
Occupation: University Student

Feedback: Fun in dealing with VR environments integrating tests and real-time feedback. It would have been better to have more such features that could permit other users to share the same virtual space for group studies and projects.

Participant 5:

Name: Shaheen Khan
Age: 35
Occupation: High School Teacher
Feedback: That was good. Those were the pretty detailed anatomical models with manipulation of those models in 3D space that is really to be appreciated. Need more guided tours and lesson plans for using this system in teaching through VR.

This newly edited section puts across the angles about participants who interacted using the VR Education System whereby it showcases some of the feedback referring to the audience delimitations, VR functionalities, user experience, and educational effectiveness. This serves as a window into the behaviors of various user profiles in relation to the way they perceive and interact with the system, thus rendering insight toward the future design refinements.

Testing Procedure: VR Education System

5.1.2.4 *Introduction:*

- Participants were informed about the purpose of the usability test and the scenarios they had to perform in the VR Education System.
- They had been told that the test was to check for usability, not their skills at it.

5.1.2.5 *Task Execution:*

• Participants were required to perform the following tasks;

- Setting up the VR system and calibrating headset.
- Going through different modules for education such as Human Anatomy Lab or Molecular Lab.
- Interacting with 3D models, really outstanding quizzes, and just exploring a virtual environment.

• The observers recorded the time taken to execute each task, difficulties faced in carrying out, and reactions of participants in the process.

5.1.2.6 *Think-Aloud Protocol:*

- More than just an encouraging statement, the participant in a think-aloud situation communicates with respect to the VR about how he or she feels and may get frustrated, as towards how much such experience did he or she enjoy.
- This thus gives insight into the cognitive processes involved here as well as pointed out issues pertaining to usability.

5.1.2.7 *Post-Test Interview:*

- The interview was carried out immediately after execution of the tasks with a view to gaining qualitative feedback from participants.
- Such questions were designed in response to the learner's experience, hindrances encountered, and recommendations for modifications.

5.1.3 Data Analysis:

5.1.3.1 *Quantitative Data:*

- Like rates of task completion, time taken on a given task, and error rate were used to clarify the system efficiency and effectiveness.
- Among them, some specific metrics are as follows:

    - Success rates in module navigation

- **Mean times spent on learning activities such as manipulating a 3D model or taking a quiz.**

5.1.3.2 *Qualitative Data:*

- The usability areas of concern and improvement were drawn from interpretation of common usability problems and source for improvements observed and from feedback by the respondents.
- Derived Themes from think-aloud sessions and post-test interviews included ease in navigation, intuitive interaction and satisfaction from using it.

5.1.4 Findings:

5.1.4.1 *Strengths:*

- The holistic system has been acknowledged by all the participants to be very immersive; they loved the realism in the 3D models and simulations.
- The modules of the interactive learning exercise engaging learners in interactive approaches to what are normal difficult concepts.
- **Quizzes and real-time feedback were regarded as good methods to further reinforce learning.**

5.1.4.2 *Areas for Improvement:*

- Some users, especially those shelved in for the first time, show inconsistent feelings about navigation in the VR interface.
- Suggested improvements include, but are by no means limited to:

    - Step tutorial for onboarding.
    - Voice-guided navigation and instructions.
    - Menu structures to simplify selection of modules to be more intuitive.

5.1.5 Conclusion:

The usability testing of the VR Education System revealed that it is an innovative and engaging platform for learning. While most participants found it efficient and immersive, certain areas, such as navigation and onboarding, require further refinement. The feedback and insights gained from this testing will inform future iterations, ensuring the system meets the diverse needs of learners effectively.

5.2 Output

Usability Testing Findings

The usability testing for the **VR Education System** was conducted to evaluate its user-friendliness and identify areas for improvement. By observing real users interacting with the system, we gained valuable insights into its functionality and performance. The testing focused on key features, including module navigation, interaction with 3D models, and immersive learning experiences. The feedback collected helped pinpoint specific strengths and areas needing refinement, ensuring the final product meets the needs and expectations of learners and educators. Here are the key findings:

Key Findings:

Ease of Use:

- Users found the interface intuitive and engaging, though some first-time users struggled with navigation within the VR environment.

- Introducing a step-by-step onboarding tutorial can enhance the learning curve for new users.

5.2.1.1 *Learning Modules:*

- Participants praised the immersive nature of the educational modules, particularly the **Human Anatomy Lab** and **Molecular Lab**.
- However, some users requested more guidance within the modules, such as hints or voice instructions for completing tasks effectively.

5.2.1.2 *Accessibility:*

- Most users appreciated the system's design, but feedback highlighted the need for improvements in text readability within the VR environment.
- Suggestions included offering adjustable text sizes, increasing contrast levels, and adding voice-assisted features to support users with visual impairments.

5.2.1.3 *Immersive Experience:*

- The realistic simulations and quizzes were highly appreciated for making complex concepts easier to grasp.
- Some participants suggested including interactive progress trackers or badges to make learning more engaging and rewarding.

Overall Satisfaction:

- Overall, users were impressed with the system's immersive and interactive approach to education.
- Continuous improvements based on user feedback, such as refining navigation and enhancing accessibility, will ensure the system remains effective and user-centric.

These findings highlight the VR Education System's strengths and areas for enhancement. By addressing usability challenges and incorporating user suggestions, the platform can deliver a seamless, inclusive, and highly effective educational experience.

CHAPTER 6

Impact on Society, Environment and Sustainability

1. Greater Quality Education: With virtual reality, students embrace education that involves exciting, high-quality, hands-on learning experiences for concept understanding and turns out a better-prepared, better-educated individual.

2. Increased Accessibility to Education: For instance, virtual reality would mean putting the academies of new underprivileged schools within the gaps that have been drawn between urban and rural education. Thus, allowing such high-level learning experiences for all students would only serve to make education more equitable across the board.

3. Safe Environment for Learning: They can carry out almost all chemistry and biology practical, which are highly risky without putting their lives in danger.

4. Motivation for going into the STEM Fields: The average student listens to some of the most fabulous stories and gets stimulation in a classroom of priceless excitement, that desire to learn maximal is hottest toward the STEM career paths. Like so, it prepares the graduated skilled workforce while standing alongside the lofty Bangladesh goals in the economy's economic and technological advancement.

5. Another Help to the Teacher: This would make the life of a teacher easier as it would make the learning of complex scientific principles much more interactive and effective when he/she teaches with virtual reality. Such developing scenarios can even inspire the teaching fraternity, in addition to improving the quality of education delivered.
6. Positive Economic Growth: VR-driven education in science invests in future scientists, engineers, and health professionals, thus producing trained human resources that are going to work towards innovations that will have a long-run contribution to the economy.

7. Environmental Benefits: Elimination of the use of physical materials such as animal specimens and chemicals from practical science classroom material.

6.1 Impact on Environment

1. **Reduced Use of Physical Resources:** One of the most beneficial applications of virtual reality technology is in reducing the use of physical resources generally found in science laboratories, such as animal specimens, chemicals, and disposable materials. This way, waste is minimized, and the consumption of resources is lowered to conserve them and save wildlife, as such basic usage generally contributes to much waste generation.

2. **Decreased Chemical Waste**: Last but not least, in an ordinary laboratory, chemicals are constantly being used in tests and experiments, which will create toxic waste to be disposed of properly to not pollute the environment with traces. In this regard, while a student conducts what seems to be an experiment, there is no use of real chemicals; hence, no chemical waste is created.
3. **Less Carbon Footprint:** It helps a lot when a laboratory is not bound to the physical structure of the area. It means that by not maintaining such physical lab facilities, indirectly VR technology does achieve a decreased carbon footprint. Schools can save energy by saving resources that these traditional labs would have consumed, like heating, ventilation, and lighting for lab safety, contributing thus to reduced greenhouse gases as well.
4. **Reduce the Death of Animals:** VR biology practicals will do away with real dissections. This fosters ethical treatment of animals and builds biodiversity by breeding environmental conditions away from the demand for animal specimens.
5. **Waste Reduction in Education Material:** Transitioning to digital VR experiences decreases reliance on single-use lab items such as gloves, pipettes, and glassware, which brings about a shrinkage in plastic and laboratory wastes and thus helps reduce impacts on the environment over time.

6. **Encouraging Sustainable Mindsets:** Schooling students with the use of green technologies impart to them very early sustainable practices. This, therefore, is

likely going to pave the way for a more environment-conscious mindset that will make them make future decisions in favor of sustainability and the environment.

6.2 Impact on Sustainability

1. Resource Acquisition: Virtual reality has become a great source of conserving educational resources over the last few years, with VR science being a particularly well-suited one. The use of VR in place of laboratory studies eliminates the need for resources such as animal specimens, chemicals, and disposable tools. Consequently, the overuse of natural resources is prevented, and their use becomes more sustainable and they are more easily conserved.

2. Reducing the Risk from Dangerous Substances: Online computer software simulations that have replaced hazardous chemical storage can also minimize the danger and risk of using certain chemicals. The only additional step that the clients have to follow is data-entry-in which will include the making of detailed measurements. The loss of chemicals and waste of other kinds will be minimized. This will also help schools to reduce the amount of their chemical bill and thus it will be possible to clean up soil and water ecosystems. This is how their environmental footprint is cut.

3. Energy-Efficient University: Energy savings are one of the most important aspects to be considered when it comes to the sustainable operation of an organization. By minimizing the need to run and maintain laboratories over open spaces, institutions save the energy used for the same purposes. Virtual reality simulators don't require advanced ventilation or air conditioning technologies which drain energy. Also, they are divided into groups. Unfortunately, the response to that has not been as expected. However, there were other complaints about the environment.

4. Fostering Ethical Science Compliance: The use of VR is well accepted in carrying out experiential research as well as field study such that the lives of the animals are saved and in turn the environment by eliminating chemicals when the students use VR. To the leaders, this may also form the basis for peace with the mentioned animals. The students'

perceptions of the importance of maintaining biodiversity would be influenced by such activities.

5. Sustainable Educational Infrastructure: Fitting virtual reality classrooms into the curriculum is a hands-on way of teaching science, an experiment that can exist in a school that lacks resources. Schools can adopt virtual reality as an economical method of teaching science over time without providing laboratory materials regularly, thus ensuring the sustainability of education.

CHAPTER 7

Conclusion and Future Scope

It is scientifically proven that utilizing virtual reality in teaching sciences can lead to a major transformation of the system of how science is being taught in Bangladesh. By providing the learners with immersive virtual realities, the reality can be turned into a lab without the limitations of traditional lab access especially in resource-constrained schools. The technology is so cool now that on the one hand, it can be useful, meaningful, and entertaining to students making it safer, and on the other hand, it is environmentally friendly. It means that coeducation is the best way to provide quality science education to students.

Schools that are equipped with Virtual Reality guarantee equal chances for all students to be educated whether they are in urban or rural areas. Such a technology can be implemented in different subjects in this way. It implies that the technology can also be personal with AI. Consistently, VR becomes more and more affordable for the masses and thus can be expanded, scaled, or customized through government-school partnerships or private companies. In brief, these words are meant to convey that after such a time the prospects for VR being adopted at such a capacity are getting real. A virtual class is thus possible to be taught in all of Bangladesh.

7.2 Scope for Future Development

1. **Extending to Other Domains:** The use of VR could be extended to different subjects such as history and mathematics and the whole system could be supplemented.
2. **Customization via AI-Powered Automated Learning:** For effective learning, circumstances integrate AI with VR, and lessons can be customized for each student.

3. **Exploration of the Consequential Action:** Research could be conducted in the future for the understanding of VR impacts in the area of retention and VR stimulation in STEM fields.
4. **Extending A Reach to The Underserved Population**: The goals should aim at increasing the outreach of VR into rural parts of the country through the use of aid from governmental departments and NGOs.
5. **Amalgamating with AR:** With AR and VR together, virtual and physical could intermingle extending both learning experiences with more engagement.
6. **Training and Integration to Use Best Practices:** Studies on educating the teachers on the best ways to use VR could increase its rate of usage in a class.
7. **Affordable Hardware Alternatives:** The possibility of communicating through affordable means of VR such as mobile systems would place working with more schools in reach.
8. **Content per Geographic Prerequisites:** VR training sessions that fit into Bangladeshi content and activities may lead to greater motivation to participate in lessons.
9. **Interpersonal and Psychological Development:** It would be ideal to explore the role of group activities and how much VR changes social behavior and facilitates teamwork.
10. **Implementation at Scale and Formulation of Adequate Policy**: It would be worth the research to address how to scale up VR in education and move policy in that direction.

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