Project ID - 24-25J-087

Title of the Report

FEASIBILITY STUDY REPORT

Project Name - Virtual Reality for Immersive Training on Handling and Identifying Venomous Snakes in Sri Lanka

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II. Executive Summary

This feasibility study will review the viability of developing detailed VR models and **immersive simulations for snake identification and venom extraction training**, integrated with an **AI-powered virtual assistant**. The project aims to address the lack of practical, hands-on training tools for handling venomous snakes in Sri Lanka, where snakebites are a significant public health concern.

The study assesses **technical, market, financial, operational, and ethical feasibility**, concluding that the project is viable due to access to advanced VR technologies, growing demand for immersive training tools, and the potential for significant public health and conservation benefits. Recommendations include securing funding, conducting user testing, and collaborating with herpetologists and medical professionals to provide accuracy and relevance.

III. Table of Content

IV. Introduction

Background

Snakebite envenomation is a critical public health issue in Sri Lanka, particularly in rural areas where access to medical care is limited. Traditional training methods for handling and identifying venomous snakes are often unsafe and inadequate, leading to poor preparedness and unnecessary deaths. This project proposes a VR-based training platform to provide a safe, immersive, and interactive learning environment for snake identification and venom extraction training.

Objective

The primary objective of this feasibility study is to evaluate the viability of developing detailed VR models and immersive simulations for **snake identification and venom extraction training,** integrated with an **AI-powered virtual assistant** to educate users and answer questions.

Scope

The study evaluates the technical, market, financial, operational, and ethical feasibility of the proposed solution, focusing on the development of VR models, simulations, and AI integration.

V. Problem Statement

Snakebite envenomation is a critical public health issue in Sri Lanka, with an estimated 30,000 to 40,000 snakebites annually, resulting in around 100 deaths per year *[1]*. The majority of these incidents occur in rural areas, where access to immediate medical care is limited, and 70% of snakebite deaths are reported in these regions (Journal of Venomous Animals and Toxins, 2021). Traditional training methods for handling venomous snakes, which rely on theoretical instruction or risky live demonstrations, have proven inadequate, with 85% of farmers and wildlife workers reporting feeling unprepared to handle venomous snakes (Sri Lanka Journal of Medicine, 2020). This lack of preparedness not only endangers human lives but also contributes to the endangerment of rare snake species, such as the Sri Lankan krait, which is now classified as vulnerable *[2]*. To address these challenges, this project proposes the development of a VR-based training platform that provides a safe, immersive, and interactive learning environment for snake identification and venom extraction training, integrated with an AI-powered virtual assistant to enhance user education and preparedness.

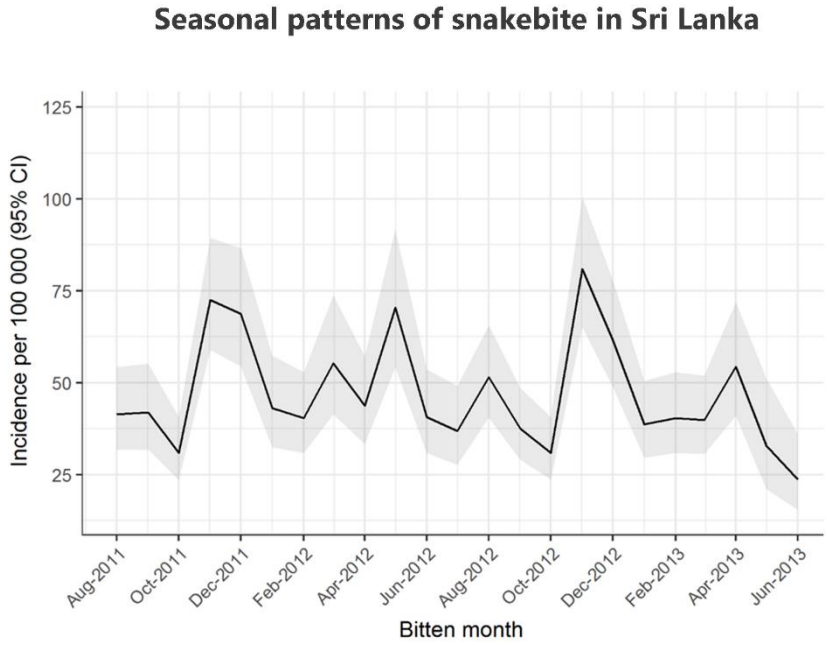

Figure 1 Seasonal snakebites in Sri lanka graph

Key Data Sources

1. **World Health Organization (WHO):**
    - Reports on snakebite envenomation as a Neglected Tropical Disease (NTD).
    - Global and regional statistics on snakebite incidents and their public health impact.
    - WHO Snakebite Envenoming Fact Sheet *[3]*
2. **Sri Lanka Health Ministry:**
    - National statistics on snakebite incidents, fatalities, and regional distribution.
    - Reports on the economic and social impact of snakebites in rural areas. *[1]*
3. **Sri Lanka Journal of Medicine:**
    - Studies on the preparedness of farmers and wildlife workers to handle venomous snakes.
    - Research on the limitations of traditional training methods.
4. **IUCN Red List:**
    - Data on the conservation status of venomous snake species in Sri Lanka, such as the Sri Lankan krait.
    - IUCN Red List Website *[2]*
5. **Journal of Venomous Animals and Toxins:**
    - Research articles on snakebite epidemiology, treatment, and prevention in Sri Lanka.

VI. Project Description

The proposed solution involves the development of detailed VR models of venomous snakes, focusing on their anatomy, venom delivery mechanisms, and safe extraction techniques. The platform will include immersive simulations for snake identification and venom extraction, allowing users to practice in a risk-free environment. Additionally, an **AI-powered virtual assistant** will be integrated to provide **real-time guidance, answer user questions**, and enhance the educational experience.

Key Features

- **Detailed 3D Models:** High-resolution models of venomous snakes, focusing on anatomy (e.g., fangs, venom glands*). (Figure 2,Figure 5,Figure 6**Error! Reference source not found.**)*
- **Immersive Simulation s:** Interactive VR scenarios for snake identification and venom extraction.
- **AI Virtual Assistant:** An AI-powered assistant to educate users, provide real-time feedback, and answer questions. *(Figure 4)*
- **IoT Prototype for Venom Extraction:** A prototype IoT device designed to simulate venom extraction procedures in a real-world context. The device integrates with the VR platform to provide a hybrid training experience. *(Figure 3)*

Methodology

- **3D Modeling:** Use of Blender and Unity to create detailed snake models.
- **VR Development:** Integration of VR simulations using Unity and Oculus SDK.
- **AI Integration:** Development of an AI assistant using Convai API and perplexity AI tools.
- **User Testing:** Conducting pilot tests with target users to refine the platform.

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Figure 2 Detailed 3D Models focusing fangs

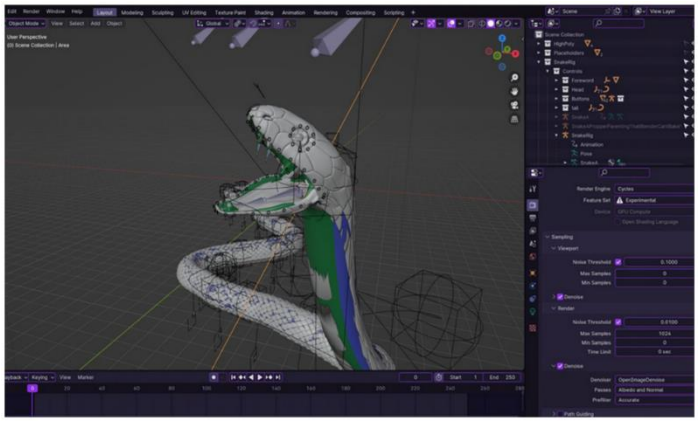

Figure 6 Detailed 3D Models focusing anatomy

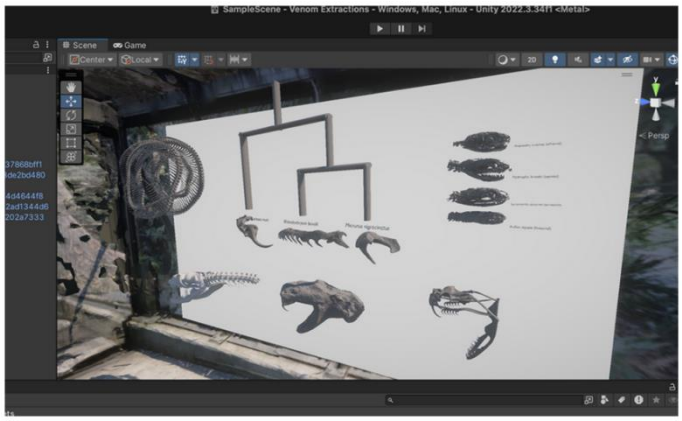

Figure 5 Detailed 3D Models focusing anatomy with animation

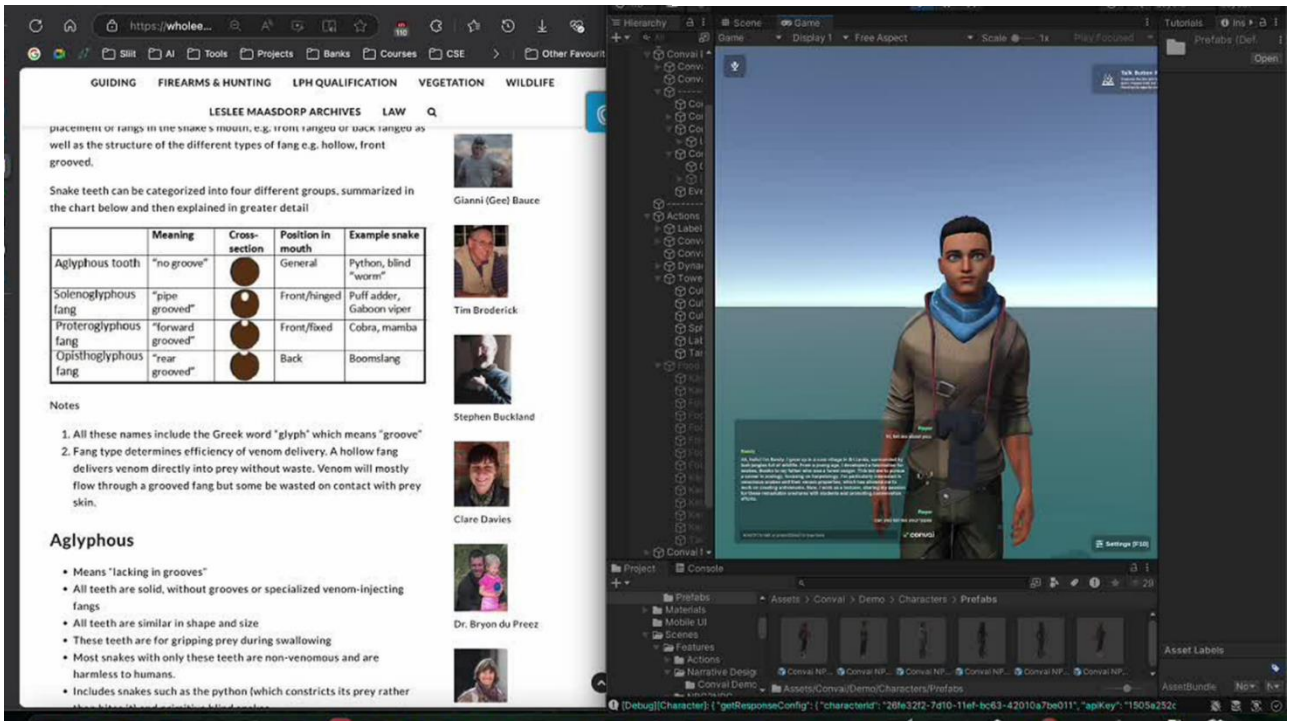

Figure 4 AI Virtual Assistant

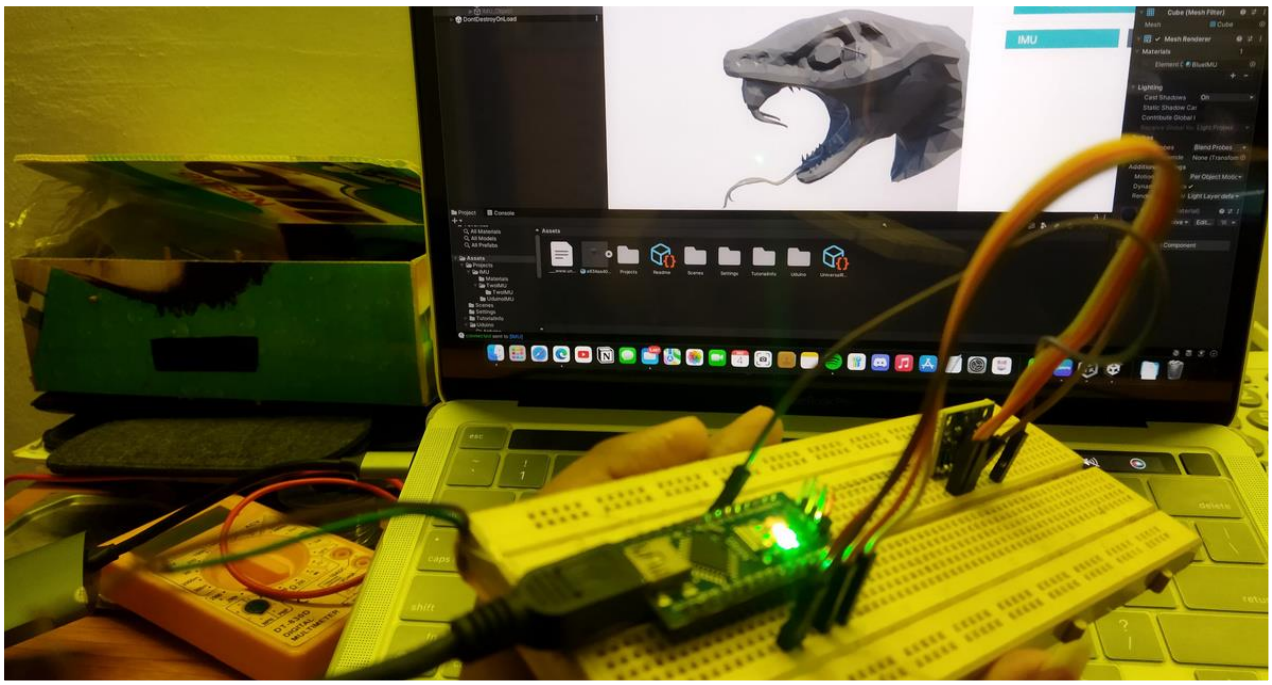

Figure 3 IoT Prototype for Venom Extraction

VII. Feasibility Analysis

a) Technical Feasibility

- **Tools and Technologies:** The project will use Blender for 3D modeling, Unity for VR development, and Python for AI integration. These tools are widely used and well-documented, making them suitable for this project.
- **Development Stages:** The project will follow a phased approach, starting with 3D modeling, followed by VR simulation development, AI integration, and user testing. *(Figure 9)*
- **Challenges:** Potential challenges include ensuring high-quality VR rendering and integrating the AI assistant seamlessly with the VR environment. However, these challenges can be mitigated with proper planning and expertise.

b) Market Feasibility

- **Target Audience:** The primary audience includes zoologists (Young Zoologists' Association), wildlife workers and medical professionals in Sri Lanka.
- **Market Need:** There is a significant demand for safe and effective training tools for handling venomous snakes, especially in regions with high snakebite incidents.
- **Competition:** While there are some VR-based training tools, none are specifically tailored to Sri Lanka's unique challenges or include an AI-powered assistant.

c) Financial Feasibility

- **Cost Estimates:**

Description	Estimate budget (Rs)
Transportation Cost	10,000.00
Arduino Board	4,000.00
Sensors and other parts Cost	20,000.00
Other Cost	5,000.00
Total budget	39,000.00

Figure 7 Cost Estimate Table

- **Funding Sources:** Potential funding sources include private investors.
- **ROI:** The platform has the potential to generate revenue through licensing to training institutions and government agencies

d) Operational Feasibility

- **Resource Availability:** The required tools and technologies are readily available, and the development team has the necessary expertise.
- **Scalability:** The platform can be scaled to include additional snake species and training scenarios.
- **Operational Risks:** Potential risks include delays in development and user adoption challenges. These can be mitigated through iterative testing and user feedback.

e) Environmental/Ethical Feasibility

- **Environmental Impact:** The project has a positive environmental impact by reducing the need for live snake handling, contributing to conservation efforts.
- **Ethical Considerations:** The platform must ensure accurate representation of snake anatomy and venom extraction techniques to avoid misinformation.

VIII. Risk Analysis

Technical Risks

1. **VR Rendering and Performance Issues**
    a. **Impact:** Poor VR performance (e.g., lag, low frame rates) can disrupt user immersion and lead to a negative training experience.
    b. **Mitigation Strategies**:
        i. Optimize 3D models and textures to reduce rendering load.
        ii. Use high-performance VR hardware (e.g., Oculus Quest 3) and ensure compatibility with the platform.
        iii. Conduct rigorous testing to identify and resolve performance bottlenecks.
2. **AI Integration Challenges**
    a. **Impact:** The AI-powered virtual assistant may fail to provide accurate or timely responses, reducing its effectiveness as an educational tool.
    b. **Mitigation Strategies:**
        i. Use a fast and stable internet connection to ensure quick and reliable responses.
        ii. Continuously update the AI's knowledge base with verified information from herpetologists and medical professionals.
        iii. Conduct extensive testing with real users to refine the AI's responses.
3. **Compatibility Issues Across Devices**
    a. **Impact:** The VR platform may not function seamlessly across different VR devices, limiting its accessibility.
    b. **Mitigation Strategies:**
        i. Develop the platform using cross-platform VR development tools like Unity, which supports multiple VR devices.
        ii. Test the platform on various VR hardware to ensure compatibility.

Operational Risks

1. **Delays in Development**
    a. **Impact:** Delays in completing the VR platform could postpone its launch, reducing its impact on public health and conservation efforts.
    b. **Mitigation Strategies:**
        i. Use a phased development approach with clear milestones and deadlines.
        ii. Allocate additional time for testing and debugging to avoid last-minute issues.
2. **Low User Adoption**
    a. **Impact:** If the target audience (e.g., students, wildlife workers) does not adopt the platform, its effectiveness will be limited.
    b. **Mitigation Strategies:**
        i. Conduct user testing early in the development process to gather feedback and improve usability.
        ii. Provide training sessions and user guides to help users understand and navigate the platform.
        iii. Collaborate with local communities and organizations to promote the platform and encourage adoption.
3. **Scalability Issues**
    a. **Impact:** The platform may struggle to accommodate a growing number of users or additional features (e.g., new snake species, advanced simulations).
    b. **Mitigation Strategies:**
        i. Design the platform with scalability in mind, using modular architecture and cloud-based solutions.
        ii. Regularly update the platform to include new content and features based on user feedback.

Financial Risks

1. **Budget Overruns**
    a. **Impact:** Unexpected costs (e.g., software licenses (plugins)), hardware upgrades) could exceed the project's budget, delaying development.
    b. **Mitigation Strategies:**
        i. Create a detailed budget with contingency funds (e.g., 10-15% of the total budget) for unexpected expenses.
        ii. Regularly monitor expenses and adjust the budget as needed.
2. **Insufficient Funding**
    c. **Impact:** Lack of funding could halt development or limit the scope of the project.
    d. **Mitigation Strategies:**
        i. Apply for grants from government agencies, and private organizations focused on public health and conservation.
        ii. Seek partnerships with universities, research institutions, and tech companies to secure additional resources.

Summary of Risk Analysis

Risk Category	Likelihood	Impact	Mitigation Strategies
VR Rendering Issues	High	High	Optimize models, use high-performance hardware, conduct testing.
AI Integration Challenges	Medium	Medium	Use robust NLP tools, update knowledge base, test with users.
Budget Overruns	Medium	High	Create contingency funds, monitor expenses.
Delays in Development	High	High	Use phased development, allocate extra time for testing.
Low User Adoption	Medium	Medium	Conduct user testing, provide training, collaborate with communities.

Figure 8 Risk Analysis table

IX. Recommendations

- The project is feasible overall, as it addresses a critical public health issue in Sri Lanka and leverages advanced technologies to provide a safe, immersive, and interactive training platform. The integration of an AI-powered virtual assistant further enhances the platform's educational value, making it a unique and impactful solution.

  To ensure the successful development and implementation of the VR platform, the recommended next steps are,

  1. **Proceed with Development:**
     - **a.** Begin the development process, focusing on creating detailed 3D models, immersive VR simulations, and integrating the AI-powered virtual assistant.
     - **b.** Prioritize real-time synchronization and user interaction to ensure a seamless and engaging experience.
  2. **Secure Funding:**
     - **a.** Apply for grants from government agencies, private organizations focused on public health, conservation, and technology.
     - **b.** Explore partnerships with universities, research institutions, and tech companies to secure additional resources.
  3. **Conduct User Testing:**
     - **a.** Engage target users (e.g., Zoologist students, wildlife workers, medical professionals) early in the development process to gather feedback and refine the platform.
     - **b.** Conduct pilot tests in rural areas to ensure the platform meets the needs of its primary audience.
  4. **Collaborate with Experts:**
     - **a.** Work closely with herpetologists, medical professionals, and VR/AI experts to ensure the accuracy and relevance of the platform's content.
     - **b.** Regularly update the platform based on the latest scientific research and user feedback.
  5. **Promote the Platform:**
     - **a.** Develop a marketing and outreach strategy to promote the platform to its target audience, including training sessions, workshops, and partnerships with local organizations.

b. Highlight the platform's unique features, such as the AI-powered virtual assistant and gamified learning experiences, to increase user adoption.

6. **Monitor and Evaluate:**
    a. Continuously monitor the platform's performance and user engagement after launch.
    b. Collect feedback and performance metrics to identify areas for improvement and ensure the platform remains effective and relevant.

Final Recommendation

- Given the feasibility of the project and its potential to address a critical public health issue in Sri Lanka, it is recommended to proceed with development. By securing funding, conducting user testing, and collaborating with experts, the project can achieve its goals of enhancing public safety, reducing snakebite incidents, and contributing to conservation efforts.

X. Conclusion

- This feasibility study concludes that the development of **detailed VR models and immersive simulations** for snake identification and venom extraction training, integrated with an **AI-powered virtual assistant**, is a viable and impactful solution. The project addresses a critical public health issue in Sri Lanka and has the potential to save lives while contributing to conservation efforts.

XI. References

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[4]

XII. Appendices

Appendix A: Gantt Chart for Project Timeline

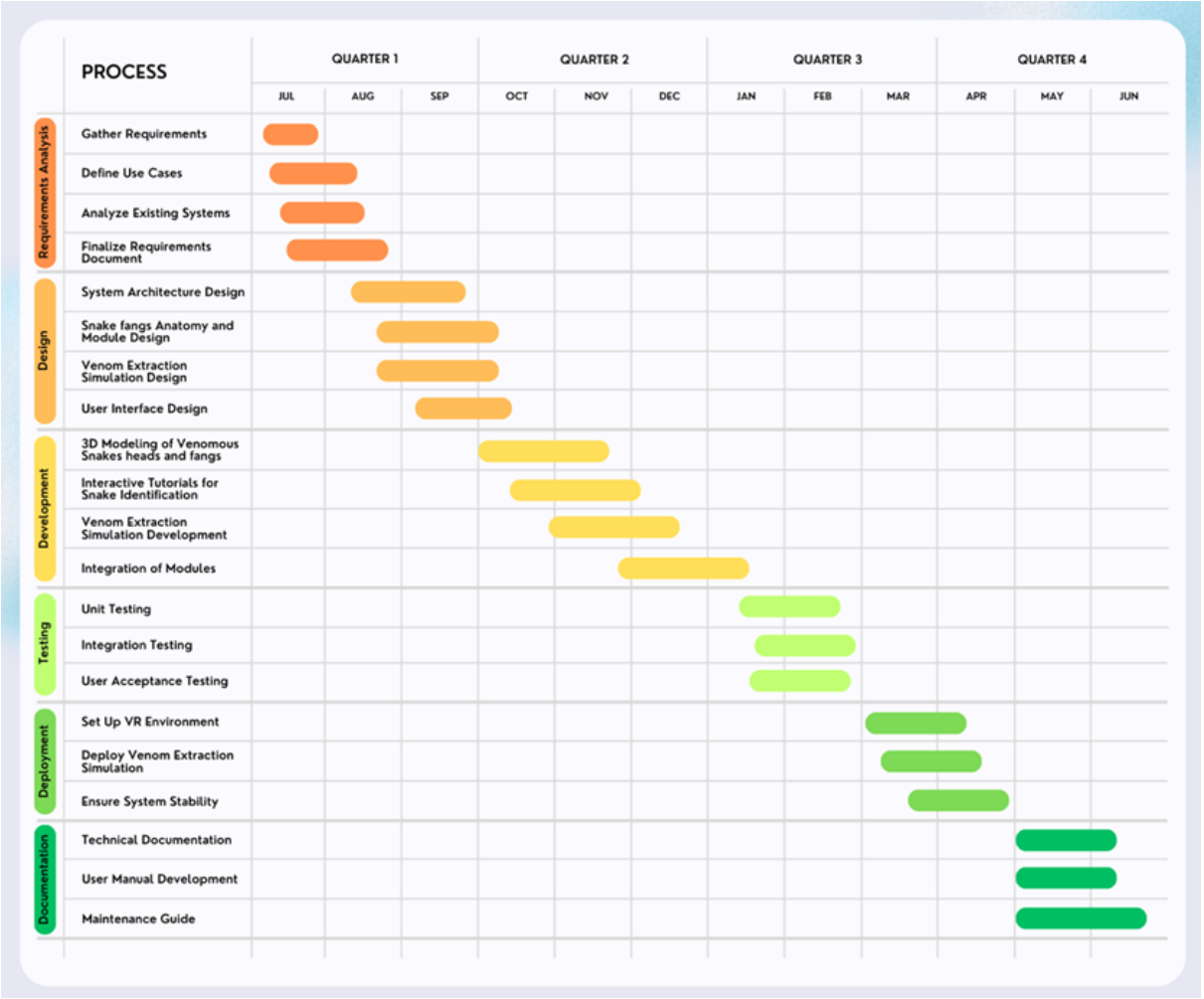

Figure 9 Gantt Chart for project timeline