Mini Project Report On

AUDIVUE

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in

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CERTIFICATE

This is to certify that the mini project report entitled ***"AUDIVUE"*** *is a bonafide record of the work done by* ***Mabel Preeju A(U2203135),Mahima Ann Abraham(U2203136),Geevar Saji Kuriakose (U2203096),Jesel Gibi George(U2203112)*** *submitted to the APJ Abdul Kalam Technological University in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (B. Tech.) in Computer Science and Engineering during the academic year 2024-2025.*

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ABSTRACT

In an era where digital health solutions are becoming increasingly essential, AudiVue stands out as an innovative web-based platform designed to offer accessible and accurate self-assessments for vision and hearing health. By leveraging diagnostics and user-friendly interfaces, AudiVue provides individuals with tools to conduct preliminary eye and ear tests from the comfort of their homes. The platform integrates advanced methodologies such as visual acuity tests, colour blindness assessments, and pure-tone audiometry to deliver precise results that can guide users toward professional medical consultation if needed.

AudiVue's core functionalities are powered by ReactJS for the frontend, Firebase for backend and data management, and Gemini API for AI-Chatbot. The inclusion of an AI chatbot enhances user experience by offering real-time guidance, test explanations, and result interpretation, making health diagnostics more interactive and informative. Furthermore, the platform ensures data privacy and security, enabling users to store and track their test results over time. AudiVue ensures seamless access to users, providing them with a reliable and scalable solution for personal health monitoring.

The goal of AudiVue is to promote early detection and awareness of vision and hearing impairments, empowering individuals with the knowledge needed to seek timely medical intervention. The platform is designed to be scalable, adaptable, and inclusive, with future enhancements planned for more diagnostic tests and expanded AI capabilities. As healthcare technology advances, AudiVue remains committed to bridging the gap between users and medical professionals, fostering a proactive approach to eye and ear health through digital innovation.

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Chapter 1

Introduction

1.1 Background

In today's world, access to reliable and convenient healthcare solutions is crucial, especially for individuals who may lack immediate access to medical professionals. Traditional methods of diagnosing vision and hearing impairments often require in-person visits to healthcare facilities, which can be time-consuming, costly, and inaccessible to many. Recognizing these challenges, AudiVue emerges as an innovative web-based platform designed to provide users with self-assessment tools for evaluating their eye and ear health. By integrating AI-driven diagnostics and interactive test modules, AudiVue empowers users to conduct preliminary screenings from the comfort of their homes, making essential healthcare services more accessible and efficient.Unlike conventional diagnostic approaches that require specialized equipment and professional supervision, AudiVue utilizes scientifically validated methodologies in a user-friendly digital format. The platform offers tests for visual acuity, colour blindness, amsler's test, and hearing assessments, enabling users to obtain accurate insights into their health conditions. Additionally, an AI-powered chatbot enhances the experience by providing health related insights.

Overall, AudiVue addresses the growing need for accessible, technology-driven health solutions by offering a seamless and intuitive self-assessment platform. By eliminating barriers to preliminary vision and hearing screening, the platform promotes early detection and awareness, encouraging timely medical intervention when required. With its scalable design and commitment to continuous improvement, AudiVue stands as a revolutionary step toward bridging the gap between individuals and essential healthcare services, empowering users to take control of their well-being with confidence.

1.2 Problem Definition

Problem: Traditional vision and hearing diagnostic methods require in-person consultations with healthcare professionals, specialized equipment, and significant time commitments. These factors make early detection of vision and hearing impairments difficult, especially for individuals with limited access to medical facilities. Additionally, many people remain unaware of their deteriorating eyesight or hearing issues due to the lack of accessible self-assessment tools.

Solution: To develop a web-based platform that enables users to conduct self-assessment tests for vision and hearing using scientifically validated methodologies and AI-powered assistance.

The aim of the project is to develop AudiVue, a digital healthcare platform that integrates AI-driven diagnostics and interactive testing modules to provide accessible, accurate, and user-friendly eye and ear health screenings. By offering self-assessment tools and real-time guidance through an AI chatbot, AudiVue empowers users to monitor their health, detect potential impairments early, and seek medical intervention when necessary.

1.3 Scope and Motivation

Scope:

The scope of this project encompasses the development of the AudiVue web application, focusing on its design, implementation, and testing phases. This includes creating an intuitive and user-friendly interface that integrates scientifically validated vision and hearing assessment tools. The platform will offer essential tests such as visual acuity assessment, color blindness detection, Amsler grid test, and pure-tone audiometry to evaluate users' eye and ear health. Additionally, an AI-powered chatbot will assist users by providing real-time guidance and interpreting test results. The system will ensure secure data storage, allowing users to track their health trends over time. Furthermore, the platform will be designed to be scalable, ensuring the integration of future diagnostic tools and AI-driven features for enhanced healthcare insights.

Motivation:

The motivation behind developing AudiVue arises from the increasing need for accessible, preventive healthcare solutions that enable early detection of vision and hearing impairments. Many individuals experience difficulties in accessing professional screenings due to financial constraints, geographical limitations, transportation difficulties, fear of medical environments, or even reluctance to leave their homes due to laziness or discomfort. Traditional diagnostic methods often require visits to medical professionals, which may not always be feasible. By leveraging AI-driven automation and scientifically validated self-assessment tools, AudiVue aims to bridge this gap, offering users a convenient, cost-effective, and reliable solution. The ultimate goal is to empower users with timely insights into their eye and ear health, encouraging early medical intervention and promoting overall well-being.

1.4 Objectives

1.Facilitate Early Detection: The primary objective of AudiVue is to provide users with scientifically validated vision and hearing tests, enabling early detection of potential impairments and encouraging timely medical consultation.

2.Enhance Accessibility: The platform aims to make eye and ear health assessments easily accessible to individuals regardless of location, financial status, or mobility constraints, offering a cost-effective alternative to traditional clinical visits.

3. Integrate AI for Medical Assistance: The website features an AI-powered chatbot that provides general medical insights and answers user queries related to eye and ear health, helping users gain a better understanding of their well-being.

4.Ensure a User-Friendly Experience: The platform is designed to offer an intuitive and seamless user experience, allowing individuals of all ages and technical backgrounds to easily navigate and complete tests without difficulty.

5. Promote Preventive Healthcare: By offering quick and reliable self-assessments, the system encourages users to adopt proactive healthcare habits, helping them become more aware of their vision and hearing health.

6.Support Scalability and Expansion: AudiVue is built with scalability in mind, allowing for future enhancements such as additional diagnostic tools, AI-powered disease predictions, and more advanced medical insights.

1.5 Challenges

- Ensuring accurate visual and auditory assessments across different screen sizes, resolutions, device speakers, and ambient lighting or noise conditions, as these factors can impact test effectiveness.
- Maintaining user privacy and data security while collecting and processing sensitive health data, requiring strong encryption, secure authentication, and compliance with data protection regulations.
- Achieving seamless integration across various devices and browsers, especially when running AI-driven tests and real-time assessments, necessitating thorough testing and optimization.
- Managing accessibility features to accommodate users with different visual and auditory impairments while ensuring an intuitive and user-friendly experience.

1.6 Assumptions

1. The majority of users will have access to a device (smartphone, tablet, or computer) capable of running the website and performing the required visual and auditory tests.

2. Users will follow the provided instructions correctly, such as maintaining the recommended distance for vision tests and ensuring a quiet environment for auditory assessments.

3. The website will be accessed with a stable internet connection to ensure smooth test execution, data processing, and AI model interactions.

4. Users will provide accurate input regarding their test conditions (e.g., lighting, background noise) to improve the reliability of the assessments.

5. The AI-based analysis will function effectively across diverse demographics, considering variations in eyesight, hearing capabilities, and environmental factors.

1.7 Societal / Industrial Relevance

Audivue holds significant societal and industrial relevance by addressing accessibility challenges in eye and ear health assessments through an innovative web-based platform. The website provides a valuable tool for individuals, particularly those in remote areas, elderly individuals, and people with mobility constraints, to conduct preliminary eye and ear tests from the comfort of their homes. By enabling early detection of potential vision and hearing issues, Audivue promotes proactive health monitoring and encourages timely medical intervention.

Furthermore, in industries such as healthcare, telemedicine, and occupational health, where routine screening is crucial for maintaining workforce well-being, the platform offers a cost-effective and scalable solution. Organizations can integrate Audivue into employee wellness programs, helping to identify sensory impairments that may affect productivity and overall quality of life. By leveraging technology to enhance accessibility and preventive care, Audivue has the potential to create a positive impact in both societal and industrial contexts, ultimately promoting better health outcomes and well-being for all.

1.8 Organization of the Report

The report is structured into six comprehensive chapters. Chapter 1, Introduction presents an overview of the *Audivue* project, outlining the background of healthcare accessibility challenges in vision and hearing screening. It details the problem definition related to limited availability of early diagnostic tools, the scope and motivation behind building a user-friendly web platform, project objectives, development challenges, underlying assumptions, and the societal and industrial relevance of remote health screening

solutions.Chapter 2, Software Requirements Specification outlines the functional and non-functional requirements of the system. It includes overall descriptions of the project environment, system behavior, and individual features such as visual acuity, color blindness, Amsler grid, audiometry, and tinnitus tests. The chapter also covers external dependencies like Firestore for data handling and the Gemini API for chatbot integration.Chapter 3, System Architecture & Design provides a comprehensive view of the system's internal structure, including the client-server architecture, key technologies used, and methodologies for implementing test modules. It includes descriptions of algorithms used for frequency-volume control in audiometry, user interface designs for each test, implementation strategies, module-wise responsibilities, and a Gantt chart illustrating the timeline and distribution of project tasks.Chapter 4, Results and Discussions presents testing outcomes of various features, including visual and auditory test accuracy, responsiveness, and system performance under real usage conditions. Quantitative results and user interaction observations are discussed, followed by an analytical discussion on the effectiveness, limitations, and opportunities for improvement in the platform.Chapter 5, Conclusion reflects on the platform's success in providing accessible, at-home diagnostic tools for eye and ear health. It also highlights the project's key contributions, lessons learned, and possible future enhancements, such as support for mobile platforms and test history tracking.Chapter 6, References lists all the sources cited throughout the report, including academic papers, medical standards, and technical documentation, ensuring the credibility, traceability, and relevance of the information used.

1.9 Summary

In today's world, accessible healthcare is essential, yet traditional eye and ear tests require in-person visits, which can be inconvenient and costly. Audivue is a web-based platform that enables users to conduct preliminary eye and ear tests from home. It integrates various vision and hearing assessments along with an AI chatbot, Dr. Strange, to assist users by answering queries.

The project aims to develop Audivue as a user-friendly digital healthcare tool, promoting

early detection and proactive health monitoring. Objectives include providing an intuitive interface, enabling remote testing, integrating AI-based interaction, and ensuring secure data management with Firestore.

Challenges include accurate test implementation, user compliance, and seamless module integration. Assumptions include user access to internet-enabled devices and a suitable testing environment.

The platform has societal and industrial relevance by improving healthcare accessibility, benefiting individuals with limited medical access and industries such as telemedicine and occupational health. The report covers the introduction, system architecture, test modules, and implementation.

Chapter 2

Software Requirements Specification

2.1 Introduction

2.1.1 Purpose

Introducing Audivue, an innovative web-based platform designed to assist users in conducting basic eye and ear health assessments from the comfort of their homes. As a technology-driven healthcare tool, Audivue integrates a series of interactive tests—such as visual acuity, color blindness, Amsler grid, audiometry, and tinnitus detection—alongside an AI-powered chatbot for user queries. To ensure the platform runs efficiently and delivers accurate test results, defining the system requirements is crucial.

2.1.2 Product Scope

Audivue revolutionizes preliminary health screening by offering an accessible, web-based solution for conducting essential eye and ear tests. Designed for laptop users, the platform empowers individuals to assess their vision and hearing independently through structured, interactive modules including visual acuity, color blindness, Amsler grid, audiometry, and tinnitus detection. Each test is tailored to deliver personalized insights based on user input, facilitating early awareness of potential conditions. Audivue's seamless interface guides users with clear instructions, eliminating the need for video tutorials or clinical supervision. Additionally, the integrated AI chatbot, Dr. Strange, provides instant responses to health-related queries, enhancing the support experience. Though currently limited to laptop use and static in terms of updates, the platform effectively bridges the gap between users and essential diagnostic awareness, positioning itself as a vital tool for proactive health monitoring.

2.2 Overall Description

2.2.1 Product Perspective

The Audivue diagnostic website described in this Software Requirements Specification (SRS) is a newly developed, standalone platform aimed at promoting proactive vision and hearing health among individuals. In today's world, access to basic health screening is often limited by cost, time, or availability of healthcare professionals. Audivue addresses this gap by offering an intuitive and accessible platform where users can independently conduct preliminary eye and ear tests. This web-based system is designed specifically for use on laptops, making it easy for users to navigate and complete tests without the need for physical assistance. Unlike other health applications that may require mobile apps, accounts, or medical supervision, Audivue simplifies the process by guiding users through each test with clear written instructions. With integrated AI support via the Dr. Strange chatbot, the platform ensures that users receive real-time assistance and insights throughout their self-assessment. This approach not only encourages regular checkups but also helps in early identification of potential issues, offering users a convenient and innovative method to monitor their health from the comfort of their homes.

2.2.2 Product Functions

The Audivue Vision and Hearing Testing Website must perform the following major functions:

- Conduct visual acuity tests using the Snellen chart to estimate user eye power.
- Facilitate color blindness testing through a 15-question form displaying Ishihara plates.
- Implement the Amsler grid test to check for visual distortions indicating retinal issues.
- Offer hearing assessments through audiometry by playing tones of varying frequencies and volumes based on user input.
- Enable tinnitus testing using sound matching techniques.
- Integrate an AI chatbot (Dr. Strange) to answer user queries during the test process.
- Collect and store user test results securely using Firestore for potential future reference.

• Display written guidelines before each test to help users understand how to proceed.

2.2.3 Operating Environment

1. Hardware Platform:

• The Audivue website operates exclusively on modern laptop devices, providing users with a stable and responsive platform for conducting vision and hearing tests.

• It is designed to be compatible across a wide range of laptop models and screen resolutions to ensure accessibility and a consistent user experience.

• The website requires essential hardware components such as a screen large enough to accurately display visual test elements (like the Snellen chart and Ishihara plates).

• For hearing tests, the use of high-quality headphones is recommended to ensure accurate frequency and volume detection during audiometry and tinnitus assessments.

2. Operating System and Versions:

• The website is compatible with major desktop operating systems such as Windows, macOS, and Linux.

• It supports multiple versions of these operating systems to accommodate users with varied system configurations and software preferences.

• Compatibility extends to both the latest and commonly used earlier versions of these platforms to ensure broad accessibility and usability.

3. Integration with Other Software Components:

• The website integrates with Firestore for storing and retrieving user data, test results, and chatbot interactions.

• It utilizes the Google Gemini API to enable the AI chatbot, Dr. Strange, for healthcare-related queries and support.

• The site ensures smooth compatibility with modern web browsers to deliver all visual and audio tests effectively.

• Optional integration with browser-based audio output tools supports hearing tests, including tone generation for audiometry and tinnitus assessments.

4. Background Operation and Resource Management:

• The website operates smoothly in the browser environment without interrupting other ongoing activities or processes on the system.

• It efficiently manages system resources during audio and visual tests to prevent performance lags or browser crashes.

• The chatbot and test modules remain accessible throughout the session without excessive memory usage or data drain.

• Audio output and input functionalities, especially during hearing tests, are optimized to work in the background while maintaining precision.

5. Network Connectivity:

• The website relies on network connectivity to perform real-time data syncing, enable chatbot interactions, and store test results securely in Firestore.

• It should be compatible with both WiFi and cellular networks to ensure uninterrupted access and functionality during testing sessions.

• Stable internet connectivity is essential for accurate transmission of user responses, audio test data, and location-based services.

6. Security Considerations:

• The website prioritizes user privacy and data protection, particularly when handling sensitive information such as medical test results and location data.

• It incorporates secure authentication, Firestore rules, and encrypted communication channels to prevent unauthorized access and ensure safe data transmission.

• The platform adheres to industry-standard security practices and complies with relevant data privacy regulations to safeguard user information throughout its operation.

2.2.4 Design and Implementation Constraints :

Several factors can limit the options available to developers when building a software system. These limitations may include:

• Corporate or Regulatory Policies: Developers must comply with institutional policies and data protection regulations, especially when handling sensitive medical and location data. This is essential to ensure ethical and legal use of user information.

• Hardware & Technology Limitations: The website is designed to operate on laptops and desktops with specific hardware needs, such as a functional microphone, speakers or headphones for hearing tests, and a webcam (if integrated). Browser compatibility and display resolutions also limit UI design.

• Interfaces to Other Applications: Integration with third-party services like Google Gemini API for the chatbot and Firebase Firestore for data storage introduces constraints regarding API limits, response time, and data handling.

• Parallel Operations and Background Running: Some components, such as hearing tests and chatbot services, must run alongside browser processes. Performance may vary depending on device capabilities.

• Language Requirements: The system is developed using HTML, CSS, JavaScript, and Firebase, which introduces certain limitations in advanced server-side logic and processing that would otherwise be easier in more robust backend environments.

• Security Considerations: Protecting user data is paramount. Developers must implement strong authentication, secure data storage, and encrypted data transmission to prevent unauthorized access and ensure the privacy of medical assessments.

2.2.5 Assumptions and Dependencies

Assumed factors:

Several key assumptions and dependencies affect the development and functionality of AudiVue. It is assumed that users have access to devices with modern web browsers and stable internet connections to ensure smooth operation. The platform depends on cloud services, specifically Firebase for backend management and TensorFlow Lite for AI functionalities. Any disruptions in these third-party services could impact system availability and performance.

Another assumption is that users have a basic level of digital literacy, allowing them to navigate the interface and complete tests independently. While the AI chatbot provides guidance, the effectiveness of self-assessments depends on user compliance with test

instructions. Additionally, AudiVue assumes that medical professionals will use the generated reports as supplementary diagnostic tools rather than as definitive medical assessments.

Furthermore, AudiVue relies on standard calibration settings for auditory and visual tests. It is assumed that users will take tests in optimal conditions, such as quiet environments for hearing assessments and proper screen brightness for vision tests. Any deviation from these conditions could affect the accuracy of test results, making it essential to educate users on best practices before conducting assessments.

2.3 External Interface Requirements

2.3.1 User Interfaces

AudiVue features an intuitive graphical user interface (GUI) designed for accessibility and smooth navigation. The Home Page serves as a central dashboard, allowing users to access Visual Acuity**,** Amsler Grid**,** Ishihara Test**,** Audiometry**,** and Tinnitus Detection. An AI-powered chatbot provides real-time health guidance, while the Results Page displays test outcomes with recommendations. The minimalist layout follows accessibility guidelines for color contrast, font size, and button placement. Standard buttons include *Home, Start Test, Results, Help, Settings, and Exit*, with a floating Help button for quick chatbot access. The platform supports mouse**,** keyboard**,** and touchscreen inputs and provides clear error messages for invalid selections, connection loss, or session timeouts. A navigation bar with Back and Forward buttons ensures smooth browsing. Built with Material Design components, AudiVue delivers a modern and user-friendly experience across devices.

2.3.2 Hardware Interfaces

AudiVue is a web-based application designed to interact with various hardware components to deliver a seamless user experience. It supports devices such as computers running Windows or macOS, as well as mobile and tablet devices on Android and iOS, featuring a responsive design. AudiVue relies on essential hardware for its functionality, including a microphone for audiometry tests and speakers or headphones for hearing and tinnitus tests. Future versions may incorporate camera support for potential eye diagnostics. The

application utilizes browser permissions to manage microphone and speaker access through the Web Audio API, ensuring smooth and efficient interactions. Additionally, it features a React-based UI for dynamic display rendering, contributing to a high-performance and user-friendly interface.

2.3.3 Software Interfaces

AudiVue integrates multiple software components to ensure smooth functionality across various devices and operating systems. It supports Windows 10+ and macOS Catalina + for seamless compatibility. The frontend is developed using React.js, providing a responsive and interactive user interface, while the backend relies on Firebase for authentication and database management. Firebase Realtime Database stores critical data, including test results, chatbot interactions, and user information, ensuring real-time synchronization across devices. The AI component of AudiVue is powered by gemini API, which enables advanced AI-driven chatbot interactions and diagnostic analysis. User inputs are securely stored in Firebase and real-time updates are continuously managed by Firebase, ensuring an up-to-date and efficient user experience

2.3.4 Communications Interfaces

AudiVue requires internet connectivity for smooth operation and secure communication. It uses HTTPS encryption for secure data transmission and OAuth-based authentication (Google Sign-In, Email/Password) to protect user credentials. Firebase manages backend communication through the Firebase RESTful API and enables real-time data synchronization with Firebase Realtime Database. WebSockets, if implemented, support real-time notifications. Data security is ensured with AES encryption for stored data, TLS encryption for transmission, and role-based access control via Firebase Security Rules to restrict data access. Additionally, AudiVue allows users to download test reports in PDF format for professional consultation, enhancing usability and security.

2.4 System Features

2.4.1 Eye Tests

2.4.1 Visual Acuity Test

2.4.1.1 Description and Priority

The Visual Acuity Test is a fundamental assessment used to measure the sharpness and clarity of a person's vision. This test evaluates how well an individual can see letters or numbers of varying sizes from a fixed distance. The letters or numbers start at a large size, and progressively decrease in size until the user can no longer identify them correctly. This process is repeated for both eyes separately. The smallest size that the user correctly identifies is considered the limit of their visual acuity. This test is crucial for diagnosing vision problems such as nearsightedness, farsightedness, and other refractive errors.
Priority: High (Benefit: 9, Penalty: 7, Cost: 5, Risk: 3)
The Visual Acuity Test is of high priority due to its importance in identifying various vision issues that may not be noticeable in daily activities. Clear vision is essential for performing many tasks safely, such as driving and reading. It has a high benefit in identifying potential issues early, but there is a moderate penalty associated with incorrect or inaccurate results. The cost is relatively low because it is a standard test that requires minimal equipment, and there is a low risk of harm associated with the procedure.

2.4.1.2 Stimulus/Response Sequences

- The user selects the Visual Acuity test.
- The system displays a large letter and asks the user to identify it.
- If correct, the next smaller letter is displayed.
- If incorrect, the test ends, and the result is generated based on the smallest correctly identified letter.

2.4.1.3 Functional Requirements

REQ-1: The system shall display letters of decreasing size in a stepwise manner.
REQ-2: The system shall record user responses and determine the smallest correctly identified letter.
REQ-3: The system shall generate a report based on the user's results.

2.4.2 Amsler Grid Test

2.4.2.1 Description and Priority

The Amsler Grid Test is a diagnostic tool used to detect macular degeneration and other macular disorders. The test involves the user focusing on a central dot in the middle of a grid consisting of horizontal and vertical lines. Any distortions, wavy lines, or missing lines observed by the user could indicate potential problems in the macula, the central part of the retina responsible for sharp vision. This test is important for early detection of visual impairments that affect central vision. It is particularly useful for identifying conditions like age-related macular degeneration (AMD).
Priority: High (Benefit: 8, Penalty: 6, Cost: 4, Risk: 3)
The Amsler Grid Test holds high priority due to its role in early detection of macular degeneration, a common cause of vision loss in older adults. The benefit is substantial, as detecting these disorders early can prevent further deterioration of vision. The penalty is moderate, as misinterpretation of the grid can occur, and the cost is relatively low. There is a small risk of overdiagnosis if the user misinterprets the test results, but it remains a crucial tool for early intervention.

2.4.2.2 Stimulus/Response Sequences

- The user selects the Amsler Grid test.
- The system displays a grid with a central dot.
- The user is asked to focus on the dot and report distortions.
- The system records responses and generates results.

2.4.2.3 Functional Requirements

REQ-1: The system shall display a 10x10 cm grid with a central dot.

REQ-2: The system shall allow users to report distortions or missing lines.
REQ-3: The system shall generate results based on the user's responses.

2.4.3 Color Blindness Test

2.4.3.1 Description and Priority

The Color Blindness Test assesses the user's ability to differentiate between colors, primarily to detect color vision deficiencies. The test typically uses Ishihara plates, which are designed with colored dots forming a number or pattern within a background of contrasting color. The number or pattern may not be visible to individuals with certain types of color blindness. The test helps diagnose conditions like red-green color blindness, the most common form of color vision deficiency. It's essential for determining whether a person has difficulty distinguishing certain colors, which can impact daily life, especially in tasks that rely on color identification such as driving or reading color-coded information.

Priority: Medium (Benefit: 7, Penalty: 5, Cost: 3, Risk: 2)

The Color Blindness Test is of medium priority because it addresses a non-life-threatening condition that doesn't always impact an individual's overall quality of life. The benefit is moderate, as it provides valuable information, but the penalty for an inaccurate result is low. The cost is also relatively low, and the risk is minimal, as it's a non-invasive test. However, because color blindness is typically a manageable condition, the priority isn't as high as other more pressing visual issues.

4.3.2 Stimulus/Response Sequences

- The user selects the Color Blindness test.
- The system displays an Ishihara plate with a hidden number.
- The user inputs the number they see.

- The system evaluates the response and determines potential color blindness.

2.4.3.3 Functional Requirements

REQ-1: The system shall display Ishihara plates with hidden numbers.
REQ-2: The system shall accept user responses and compare them to expected values.
REQ-3: The system shall generate a report based on the user's results.

2.4.4 Ear Tests

2.4.2 Pure-Tone Audiometry

2.4.2.1 Description and Priority

The Pure-Tone Audiometry test allows users to assess their hearing by testing their ability to hear tones at specific frequencies (500 Hz, 1000 Hz, 2000 Hz) and varying decibel levels. The test begins at a volume of 20 dB at 500 Hz and increases gradually in volume if the user does not hear the tone. The system adjusts the frequency and volume based on the user's responses. For each frequency, the system records the lowest decibel level at which the user can hear the tone. The test calculates the average of the three volumes at which the frequencies are heard, and if the average falls between 0 dB to 25 dB, it is considered indicative of normal hearing. The results are then displayed, providing users with insights into their hearing health and recommendations for further consultation if needed. This feature is of high priority as it enables users to self-assess their hearing in a simple, non-invasive manner, potentially leading to early detection of hearing loss. The component ratings are as follows: benefit - 9, penalty - 7, cost - 5, and risk - 4.

2.4.2.2 Stimulus/Response Sequences

- Users initiate the test.
- The system plays tones at different frequencies and volumes.
- Users attempt to guess the word played.
- If incorrect, the system increases the volume; if correct, the system changes the frequency.
- The system records the lowest decibel level at which each frequency is heard.

- Results are displayed with recommendations for further consultation if necessary.

2.4.2.3 Functional Requirements

REQ-1: The system must control the hearing test by selecting frequencies and adjusting the decibel level based on the user's ability to guess the word played.
REQ-2: The system must accurately record the hearing thresholds and present results in a clear and understandable format.
REQ-3: The system must store and allow users to download their test results for professional consultation.

2.4.3 Tinnitus Detection

2.4.3.1 Description and Priority

The Tinnitus Detection feature enables users to determine whether they may be experiencing tinnitus by comparing their perception of sound to a standard reference tone. Tinnitus is often characterized by the perception of a sound, such as ringing or buzzing, that is not actually present in the environment. The system plays a normal ringing sound, and users with tinnitus may hear it differently, often as a distorted or amplified buzzing sound. This test helps identify potential tinnitus cases, guiding users to take appropriate action.

This feature is of High priority because early detection of tinnitus can lead to early intervention, potentially preventing further complications. It also enhances user engagement by providing a simple, non-invasive screening tool.The component ratings are as follows: benefit - 8, penalty - 6, cost - 4, and risk - 5.

4.3.2 Stimulus/Response Sequences

- Users initiate the tinnitus test.
- The system plays a normal ringing sound.
- Users are asked to describe what they hear: whether it is a simple ringing or a large buzzing sound.
- Based on the user’s response, the system determines whether the user may be experiencing tinnitus.

- Results are displayed with insights into the user's condition and recommendations for further consultation if necessary.

2.4.3.3 Functional Requirements

REQ-1: The tinnitus test must allow users to match their perception of sound to the reference tone by describing it as a ringing or a larger, buzzing sound.
REQ-2: The system must analyze user responses to determine whether the user is likely suffering from tinnitus.
REQ-3: The system must store and allow users to download their test results for professional consultation.
REQ-4: The system must alert users in case their results suggest potential tinnitus and recommend professional evaluation.

2.4.4 AI Chatbot

2.6.1.1 Description and Priority

The AI chatbot is a virtual assistant integrated into AudiVue to enhance user interaction and support. It provides users with instant responses to queries related to eye and ear health, guiding them through the diagnostic tests and explaining their results. The chatbot utilizes natural language processing (NLP) to offer contextual responses, making it an intelligent and interactive feature. This component is of high priority as it significantly improves user engagement and accessibility, allowing individuals to obtain health insights without requiring direct medical consultation.The component ratings are as follows:benefit-9,Penalty-7,Cost-6 ,and Risk-6

2.6.1.2 Stimulus/Response Sequences

- Users initiate a conversation with the chatbot by typing a question or selecting from predefined options.
- The chatbot analyzes the query using natural language processing (NLP) algorithms.
- It provides relevant responses, including explanations of test procedures and health recommendations.

- If a user requests guidance for a test, the chatbot walks them through the steps in real-time.
- The chatbot interprets test results and suggests whether further medical consultation is necessary.
- If the query is beyond the chatbot's scope, it suggests reliable online resources or professional assistance.

2.6.1.3 Functional Requirements

REQ-1: The chatbot must provide instant and accurate responses to user queries regarding eye and ear health.
REQ-2: The chatbot must guide users through the test process by offering step-by-step instructions.
REQ-3: The chatbot must interpret test results and provide recommendations based on predefined health metrics.
REQ-4: The chatbot must support both text input and predefined options for ease of use.
REQ-5: The chatbot must ensure user data privacy by not storing personal health-related conversations.

2.5 Other Nonfunctional Requirements

2.5.1 Performance Requirements

This section outlines the performance expectations of the Audivue website to ensure a reliable, fast, and accurate experience for users undertaking visual and auditory tests. Given the medical relevance and diagnostic nature of the platform, high performance is essential for credibility and usability.

3.6.1 Response Time

Response time plays a critical role in maintaining user engagement and delivering a smooth testing experience. The website must load each test interface—such as the Snellen chart, color blindness plates, Amsler grid, and audiometry tools—within 2 seconds to prevent user

frustration. The AI chatbot, Dr. Strange, should process and respond to user queries within 3 to 5 seconds, ensuring natural and interactive communication. Additionally, transitions between test stages and the submission of answers should occur almost instantaneously. Any delays in loading images, playing sounds, or rendering test content could cause users to question the accuracy or reliability of the system, especially since timing plays a significant role in hearing tests.

3.6.2 Accuracy and Reliability

As a tool intended for preliminary vision and hearing screening, the accuracy of the test results is of utmost importance. In the case of visual acuity tests, the Snellen chart must display letters at standard proportions relative to the user's screen size and resolution. The color blindness test uses Ishihara plates, which must retain perfect color fidelity to avoid misleading results. In the audiometry test, sound tones must start at 20dB and 500Hz, increasing in intensity and frequency only based on the user’s responses. Any inconsistency in audio playback could lead to incorrect conclusions about hearing health. The system must also reliably capture user inputs and test results without loss, corruption, or delay in storage, ensuring accurate record-keeping via Firestore.

3.6.3 Scalability

Audivue should be able to scale smoothly to handle multiple concurrent users without performance degradation. The platform must support at least 100 users simultaneously, enabling its use in group screening settings, such as schools, clinics, or awareness programs. All tests—especially those involving interactive components or AI chatbot communication—must function without lag or crashing under load. The backend, powered by Firebase, must dynamically scale to handle increased database read/write operations as more users perform tests and submit data. This ensures that growth in user base or peak-hour traffic does not hinder performance or test reliability.

3.6.4 Availability

For users to trust and rely on Audivue, it must offer consistent availability throughout the

day. The system should maintain maximum uptime, ensuring that users can access it at any time without interruption. Unexpected downtimes could cause users to lose progress in their tests or be unable to access their results. Since the platform is intended for real-time self-assessment, even short periods of unavailability may significantly impact user satisfaction. Firebase's robust hosting and real-time database capabilities help maintain this availability, while front-end error handling ensures graceful responses in the rare event of service disruption.

3.6.5 Platform Constraints

Audivue is intentionally designed for use on laptops and desktop computers only. The tests rely on precise visual rendering (e.g., the Snellen chart and Ishihara plates) and audio playback, which cannot be accurately controlled or calibrated on mobile or tablet devices. Laptop usage ensures consistent screen sizes, resolutions, and audio hardware, which are essential for standardizing test conditions. Additionally, users are guided through the process via text-based instructions rather than video tutorials, requiring a screen large enough to accommodate simultaneous display of instructions and test content. As a web-based platform, Audivue also benefits from requiring no additional software installations, making it highly accessible and straightforward to use on supported devices.

2.5.2 Safety Requirements

1. Privacy of Data

(a) Test Responses and User Inputs

Audivue is committed to ensuring the confidentiality and integrity of user-submitted data during various screening tests. All answers provided by users in color blindness, Amsler grid, visual acuity, and hearing tests are securely stored using Firestore, a secure cloud database service. These inputs are only used to track individual test outcomes and help users monitor their screening progress. No data is shared with third parties, and strict access controls are enforced using Firebase security rules. Additionally, all user responses are anonymized where possible, further protecting their identity and personal health data.

(b) Audio and Visual Privacy

Audivue guarantees complete privacy when it comes to audio and visual interactions. During hearing tests such as audiometry and tinnitus assessments, the audio tones are played directly through the browser and no sound is recorded or transmitted from the user's environment. Similarly, the website does not require webcam access or image uploads for vision-related tests, ensuring that user identity remains anonymous. By keeping all audio and visual interactions local to the user's device, Audivue complies with global data protection regulations like the General Data Protection Regulation (GDPR) and the Global Consumer Privacy Act (GCPA), offering users full control over their personal experience.

2. Resource Utilization

Audivue is designed to be lightweight and efficient, ensuring optimal performance without overloading the user's device. Since the website is only accessible via laptops, its layout and backend structure are optimized for desktop web browsers. The platform minimizes memory and CPU usage by using static images for visual tests and short, pre-loaded audio clips for ear tests. This careful handling of resources allows the platform to deliver smooth, real-time interactions, even on devices with limited specifications. As a result, users experience minimal lag and a consistent performance without disruptions, which is especially important during tests that require focus and accuracy.

3. Test Safety and Accuracy

Audivue places a strong emphasis on the safety and accuracy of the diagnostic tools offered on its platform. In the case of audiometry tests, the tone volume begins at a safe level of 20 decibels and increases gradually to ensure users are never exposed to dangerously loud sounds. Frequencies range from 500 Hz upward, and users manually indicate whether they can hear each tone, allowing a safe and personalized testing process. For vision tests such as the Snellen chart, color blindness plates, and the Amsler grid, detailed on-screen guidelines are provided to help users position themselves correctly and reduce eye fatigue or strain. Additionally, the Amsler grid test includes a simple questionnaire that asks users to report any distortions in their vision, helping to flag potential concerns. The website explicitly

states that results are for self-assessment only and encourages users to seek professional help if abnormalities are detected. These measures help ensure that tests are conducted safely and interpreted responsibly.

2.5.3 Security Requirements

1. Data Storage

Audivue places a high priority on maintaining the confidentiality and integrity of user data. All user responses and test results are securely stored in Firestore, a cloud-hosted NoSQL database managed by Firebase. The storage is encrypted and access-controlled to ensure that only authorized users can view or modify the data. No personal data is shared with third parties or used for any purpose other than enhancing the user's experience and tracking test history. The website also uses security rules and validation mechanisms to prevent unauthorized access and protect stored data against breaches.

2. User Authentication

Although Audivue currently functions as an open-access website without a login system, planned updates may incorporate user accounts to store test history. If implemented, secure authentication methods—such as email/password verification or OAuth-based logins—will be used. This ensures that each user's medical screening data remains private and accessible only to them. These security layers are essential to prevent unauthorized access, especially if users begin storing sensitive information or health-related results on the platform.

3. Compliance with Regulations

Given that Audivue processes data related to user health screenings, the website adheres to essential data protection regulations such as the General Data Protection Regulation (GDPR), the Personal Data Protection Act (PDPA), and the Global Consumer Privacy Act (GCPA). Compliance with these frameworks ensures that user data is handled transparently and responsibly, with clear consent obtained wherever required. All forms, tests, and data processing flows are designed with user privacy in mind, strengthening the trust and ethical

foundation of the platform.

2.5.4 Software Quality Attributes

1. Usability

Audivue is designed with a strong emphasis on usability to accommodate users of all backgrounds, including those unfamiliar with medical testing platforms. The interface is clean, minimalistic, and intuitive, enabling users to easily navigate through various tests like visual acuity, color blindness, and audiometry. All tests are supported with clear textual guidelines to assist users in taking tests correctly without confusion. Since the platform is only accessible via laptops, the layout and interactions are optimized for larger screens. Usability testing and user feedback loops ensure that test instructions, chatbot access, and results are accessible with minimal learning effort, supporting an inclusive and engaging experience.

2. Reliability

The website is built to ensure continuous accessibility and consistent performance during usage. By leveraging Firebase's real-time database and hosting services, Audivue minimizes downtime and ensures data is reliably saved and retrieved. Even in cases of intermittent internet connectivity, Firebase ensures that operations are queued and synchronized when back online. This guarantees that users can complete their tests without interruptions or data loss, ensuring a dependable system that users can trust for consistent performance.

3. Maintainability

Audivue's codebase follows modular design principles, making it easy to isolate and update individual components, such as the chatbot interface, hearing tests, or database operations. Each feature is developed with clean and reusable code patterns to support future scalability or integration with new modules. The use of Firebase simplifies backend maintenance, while front-end components built using HTML, CSS, and planned JavaScript enhancements can be easily modified as per user feedback or evolving test requirements.

4. Performance

High responsiveness is essential for a smooth user experience, especially in an application dealing with real-time interaction like hearing tests and AI chatbot queries. The system is optimized to load test modules quickly, retrieve and store data in real-time, and render chatbot responses without noticeable delays. The performance of tests such as audiometry and Snellen chart rendering is tested under various network and system conditions to ensure speed and stability across typical usage scenarios.

5. Security

Security is a core pillar of Audivue's development. While personal data collection is minimal, all interactions with Firestore are encrypted and governed by Firebase's secure access rules to prevent unauthorized data access. The chatbot and test modules are sandboxed to avoid any security loopholes, and any future login or account features will implement secure authentication protocols. Regular code reviews and compliance with data protection laws like GDPR ensure that user data and interactions are protected.

Relative Preferences

- Usability and reliability are of the highest importance to users, as they directly impact the ease of interaction and confidence in test accuracy.
- Maintainability and performance are prioritized by the development team to support smooth evolution and responsiveness of the platform.
- Security remains non-negotiable, ensuring user trust and regulatory compliance across all levels of usage and data processing.

2.6 Summary

1. Background and Problem Definition:

Traditional diagnostic tests for vision and hearing often require in-person visits, expensive tools, and specialist supervision, which can be inaccessible to many.Audivue addresses these challenges by offering online eye and ear testing solutions, making initial screening more

accessible, cost-effective, and convenient from home.

2. Scope and Motivation:

The project includes the design, development, testing, and deployment of a laptop-accessible website that performs visual acuity tests, color blindness detection, Amsler grid screening, audiometry, and tinnitus evaluation. Motivated by the need to simplify preventive care, Audivue enables users to identify early signs of vision or hearing issues without requiring hospital visits.

3. Objectives:

• Provide accessible and preliminary diagnostic tools for vision and hearing health.
• Offer AI-powered chatbot support (Dr. Strange) to guide users and answer health queries.
• Enable structured, guided testing without video tutorials, ensuring simplicity.
• Ensure secure data handling using Firestore and privacy-respecting architecture.
• Promote preventive healthcare awareness through a user-friendly digital interface.

4. Challenges:

• Ensuring accurate self-administration of tests without clinical supervision.
• Designing tests that are effective across various screen sizes and audio configurations.
• Safeguarding user privacy while storing and analyzing sensitive health information.
• Maintaining high performance and low latency in AI responses and test flows.

5. Assumptions:

• Users access the platform using laptops (the website is currently not mobile-responsive).
• Users follow test instructions correctly from a fixed distance or with headphones when required.
• Internet connectivity is stable for chatbot interaction and Firestore data storage.
• Users have basic familiarity with website navigation and reading on-screen guidelines.

6. Societal / Industrial Relevance:

• Audivue helps democratize access to basic health testing, particularly in remote or underserved areas.
• It can be used by schools, workplaces, and public health campaigns for mass screening.
• The platform contributes to SDG 3 (Good Health and Well-being) by facilitating early detection of sensory impairments.
• Can be integrated into telehealth services or health insurance apps in the future for remote diagnostics.

7. Organization of the Report:

• The report includes sections such as Introduction, Software Requirements Specification, Implementation Strategies, Module Division, User Interface Design, and Software Quality Attributes.
• It also outlines the architecture, data handling strategies, chatbot integration, and test-specific workflows.

8. Key Features and Requirements:

- Visual Acuity Testing:

Uses a Snellen chart to evaluate vision strength for both eyes with guided on-screen instructions.

- Color Blindness Test:

Displays Ishihara plates in a form-like format where users input numbers below each image.

- Amsler Grid Test:

Asks users whether they perceive any distortions in a grid, helping screen for macular issues.

- Audiometry and Tinnitus Tests:

Generates tones with increasing frequencies and decibels to evaluate hearing range and detect ringing sounds.

- AI Chatbot (Dr. Strange):

Integrates Google Gemini API to respond to user questions related to eye and ear health in

real time.

- Firestore Database Integration:

Handles secure storage of test results and user interactions with end-to-end encryption.

- Nonfunctional Requirements:

– Performance: Prioritizes smooth test interaction, fast AI responses, and real-time data operations.

– Safety: Ensures privacy in storing health data, optimized audio/visual load for tests, and user clarity.

– Security: Employs Firestore rules and safe coding practices to protect user input and test logs.

– Software Quality Attributes: Designed with high usability, system reliability, easy maintainability, fast loading, and secure data handling.

Chapter 3

System Architecture and Design

3.1 System Overview

Audivue is an innovative web-based platform designed to facilitate self-administered eye and ear tests, making healthcare more accessible and convenient. By integrating multiple diagnostic tests, the platform enables users to assess their vision and hearing abilities without requiring a visit to a medical professional. The system functions as a personalized healthcare companion, helping users identify potential concerns and seek timely medical advice.Audivue also consists of an interactive AI chatbot, Dr. Strange, which serves as a virtual assistant to answer user queries related to eye and ear health.Dr. Strange enhances user engagement by providing guidance on test procedures, general eye and ear care tips, and directing users to relevant medical resources if needed

3.1.1 Architecture

The architecture of Audivue is built on a client-server model that ensures efficient communication between the frontend interface and backend services (refer Figure 3.1). The client side, developed using HTML and CSS, offers a responsive and user-friendly interface through which users can access and perform various eye and ear tests such as visual acuity, color blindness, Amsler grid, audiometry, and tinnitus. It also includes an integrated AI chatbot, Dr. Strange, powered by the Google Gemini API, which provides general health-related support and test guidance. The server side utilizes Firebase Firestore to handle real-time data storage and retrieval, enabling secure storage of test responses and chatbot logs. Communication between the client and server is protected with secure protocols, ensuring data privacy and integrity. The architecture is modular, scalable, and optimized for performance, allowing smooth test execution, fast chatbot interactions, and the potential for future upgrades such as user accounts, analytics, and mobile

compatibility—all while maintaining reliability and responsiveness for users.

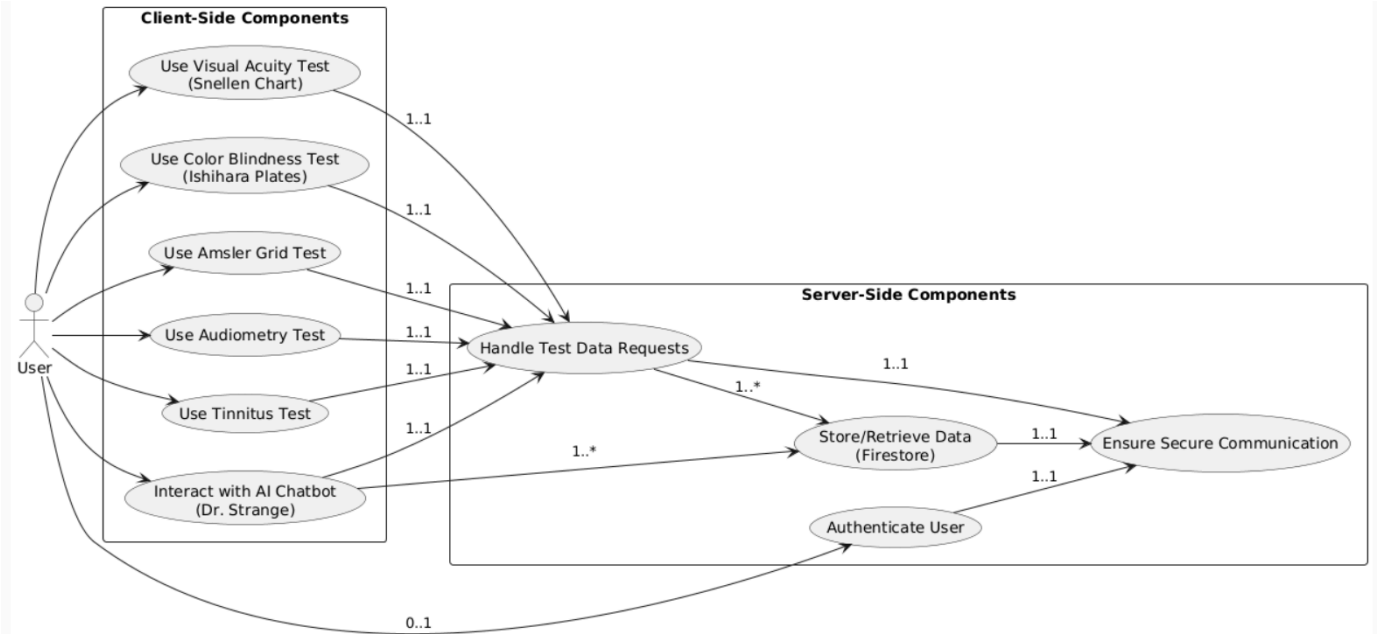


Fig 3.1. Use case diagram of the software architecture

Client-Side Components:

1. User Interface (UI)

- The frontend of Audivue is built using HTML and CSS, providing an intuitive and accessible interface.
- Users can navigate through various eye and ear tests, view test instructions, and interact with the AI chatbot Dr. Strange.

2. Test Modules

Audivue includes multiple test modules to assess visual and auditory health:

- Visual Acuity Test (Snellen Chart): This test measures the sharpness of a user's vision using a standardized Snellen chart, where letters of reducing sizes are displayed. The user is required to read the letters from a specific distance, helping determine their visual clarity and whether corrective lenses may be needed.
- Color Blindness Test: This test evaluates a user’s ability to distinguish between

different colors using Ishihara plates or similar color-based assessments. It helps detect red-green color deficiencies, the most common form of color blindness, and provides insights into potential vision impairments related to color perception.

- Amsler Grid Test: Designed to assess central vision, this test uses a grid with straight lines to detect distortions or missing areas in the visual field. It is particularly useful for identifying early signs of macular degeneration or other retinal disorders, as users with abnormalities may perceive wavy or blurred lines.
- Audiometry Test: This test evaluates a user's hearing ability by playing sounds at different frequencies and intensities. Users indicate whether they can hear specific tones, allowing for an assessment of hearing sensitivity and potential hearing loss. The results help determine the extent of hearing impairment and whether further medical consultation is required.
- Tinnitus Test: This test helps users assess the presence and severity of ringing, buzzing, or hissing sounds in their ears, a condition known as tinnitus. By listening to various frequencies, users can compare their perceived sound to known tinnitus patterns, which may assist in understanding the severity of their condition and seeking medical advice.

3. AI Chatbot - Dr. Strange

- Developed using the Gemini API, the chatbot enables users to ask health-related queries and get guidance on test procedures and general health information.
- It provides informational support but does not analyze or interpret test results, ensuring users still seek professional medical advice when necessary.

Server-Side Components:

1. Backend Server

- Handles requests from the client-side, such as retrieving test data, chatbot interactions, and managing user authentication.
- Manages security protocols to ensure data privacy and integrity for user interactions.

2. Database - Firebase Firestore

- Firestore is used for data handling, ensuring efficient storage and retrieval of test history, user preferences, and chatbot interactions.
- Provides real-time synchronization, allowing instant updates to user profiles, which is essential for maintaining test history and chatbot conversations.

3. Communication & Security

- Secure authentication methods protect user data, preventing unauthorized access.
- End-to-end encryption ensures data privacy during user interactions, especially for sensitive health-related information.

3.1.2 Functionality

- User Registration and Profile Management

Users can create personal accounts to securely store test results and preferences. Authentication features allow them to track their test history and access previous data.

- Test Selection Interface

The website provides a variety of tests, including visual acuity, color blindness, Amsler grid, audiometry, and tinnitus assessment. Clear instructions are provided for each test to guide users.

- Step-by-Step Test Process

Each test follows an intuitive, guided procedure, ensuring users can complete assessments without professional assistance.

- AI-Powered Chatbot Assistance

The chatbot, Dr. Strange, developed using the Gemini API, assists users by answering queries about test procedures and general health concerns. It does not analyze test results but provides useful insights.

- Secure Data Storage with Firestore

Firestore is used to manage user data, ensuring test results are securely stored and easily retrievable.

- Privacy and Security

Strong encryption measures protect user data, preventing unauthorized access. Test results

and chatbot interactions are securely stored to maintain confidentiality.

- Responsive Web Design

The frontend, built using HTML and CSS, ensures a user-friendly and visually appealing interface. The website is designed to work seamlessly across desktops, tablets, and mobile devices.

- Scalability and Future Enhancements

The system architecture allows for easy integration of new test modules and AI improvements. Future updates may include direct consultations with medical professionals for expert insights.

3.1.3 Additional Considerations

1. User Guidance and Instructions

To ensure accurate test results, Audivue provides clear step-by-step guidelines for users before they begin their eye and ear tests. These instructions help users properly position themselves, adjust screen brightness, and understand the procedure for each test.

2. Device Compatibility

Audivue is designed specifically for use on laptops to ensure optimal test performance. The website is not currently optimized for mobile devices or tablets due to screen size limitations affecting test accuracy.

3. Data Security and Privacy

Since Audivue handles user health-related data, Firestore is used for secure data storage. Measures such as authentication and encryption are implemented to protect user information and prevent unauthorized access.

4. Performance and Reliability

The platform is structured to provide a smooth and error-free experience. Regular testing is conducted to identify and resolve any performance issues, ensuring the website functions correctly on different laptop configurations.

5. Future Scalability

While there are no immediate plans for updates, the system is designed with potential expansion in mind. Future versions may include additional features, improved UI, or broader

accessibility options depending on user demand and technological advancements.

3.1.4 Summary

Audivue represents a significant step forward in accessible and user-friendly eye and ear health assessment. By integrating multiple diagnostic tests with a structured and interactive interface, the platform enables users to evaluate their vision and hearing health from the comfort of their homes. Through features like the Snellen chart, color blindness test, Amsler grid, audiometry, and tinnitus evaluation, Audivue provides a comprehensive suite of tests that help users identify potential concerns early.

With a strong focus on usability, security, and accuracy, the platform ensures that users receive clear guidance on how to conduct each test effectively. Firestore is utilized for secure data management, while the AI-powered chatbot, Dr. Strange, enhances user experience by answering queries related to eye and ear health. Audivue prioritizes precision and reliability while maintaining a seamless and engaging interface tailored for laptop use.

In conclusion, Audivue stands as a testament to the role of technology in promoting proactive healthcare. By offering a structured and accessible approach to vision and hearing assessment, the platform empowers individuals to take charge of their well-being. Its commitment to delivering an intuitive, secure, and informative experience ensures that users can confidently evaluate their health and seek medical advice when necessary.

3.2 Architectural Design

The Architectural Design of the Audivue platform follows a modular client-server model that separates user interface interactions from backend processing and data management(refer fig 3.2). The client side, developed using HTML and CSS, provides an intuitive interface through which users can perform various eye and ear tests such as visual acuity, color blindness, Amsler grid, audiometry, and tinnitus. Users also interact with an AI chatbot named Dr. Strange, powered by the Google Gemini API, to receive general health guidance. The server side manages essential operations such as request handling, test data storage, and user interaction logging through Firebase Firestore, ensuring real-time synchronization and secure access. Communication between the client and server is secured with encryption

protocols, and the architecture is designed to be scalable and adaptable for future enhancements like user authentication and result tracking, providing a reliable and efficient experience for remote diagnostic screening.

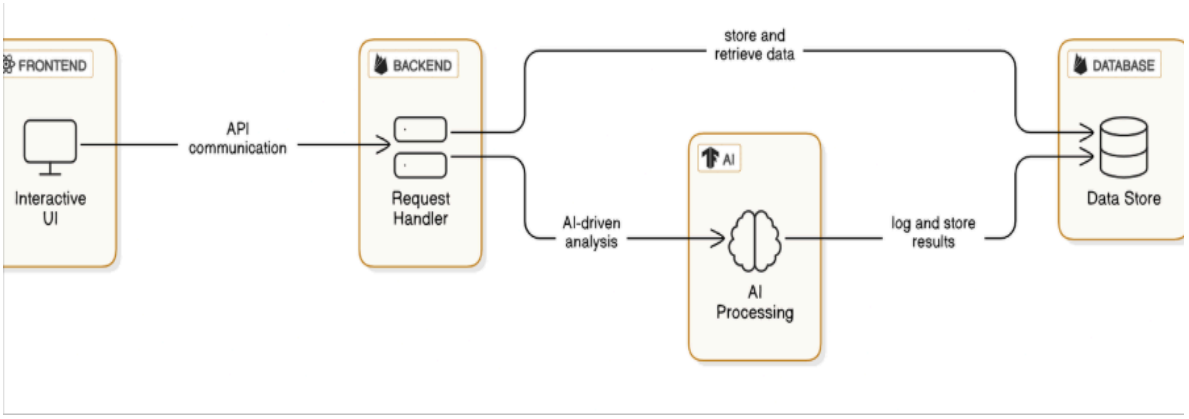


Fig 3.2: Architecture diagram

3.3 Proposed Methodology/Algorithms

This section outlines the systematic methodologies employed in the Audivue platform for conducting sensory health assessments and interacting with users.

3.3.1 Visual Acuity Test

1. The Snellen chart is displayed on the screen with characters of decreasing sizes.
2. The user is instructed to stand at a fixed distance (five feet)from the screen.
3. The user is prompted to input the letters they can read from each line.
4. The responses are compared with the correct values.
5. The smallest line read accurately determines the user's visual acuity.
6. The result is shown with a standard score (e.g., 6/6, 6/9, etc.).

3.3.2 Color Blindness Test

1. A series of Ishihara plates (images with numbers or patterns embedded) is displayed.
2. The user is asked to identify the number or pattern visible in each image.
3. The user inputs their answers for each plate.
4. The responses are compared with standard answers.
5. Any deviation indicates a specific type of color vision deficiency.

6. A message is displayed with the result.

3.3.3 Amsler Grid Test

1. A grid of straight horizontal and vertical lines with a central dot is shown.
2. The user is asked to focus on the central dot with one eye covered.
3. The user is prompted to observe whether any lines appear wavy, blurry, or missing.
4. The same process is repeated with the other eye.
5. User input is collected based on their observation.
6. If any distortions are reported, the system suggests consulting an eye specialist.

3.3.4 Audiometry Test

1.The user is instructed to wear headphones and sit in a quiet environment.

2.The test begins by playing a tone at 500 Hz with a low volume of 20 dB.

3.If the user does not respond, the volume is gradually increased until the tone is heard.

4.Once heard, the frequency is increased to the next level (e.g., 1000 Hz, 2000 Hz, etc.).

5.This process of increasing volume and frequency continues based on user input.

6.The test records the minimum volume at which each frequency is detected.

7.The final result helps to identify if the user has normal, mild or moderate hearing loss.

3.3.5 Tinnitus Test

1. A set of tones with different frequencies is played to the user.
2. The user is asked to select the tone that closely matches the pitch of their tinnitus.
3. The selected tone is noted as the perceived tinnitus frequency.
4. The system logs this data and provides the results to the user.

3.3.6 Chatbot – Dr. Strange

1. The user types a health-related query into the chatbot interface.
2. The input is sent to the backend connected to Gemini API.
3. The Gemini API processes the query and generates a response.

4. The chatbot displays the answer in an easy-to-understand format.

3.4 User Interface Design

The interface of Audivue has been thoughtfully structured to provide a seamless and focused experience for users performing eye and ear health assessments. Each screen is designed to be functional, minimalistic, and user-friendly to reduce distractions and guide users effectively.

3.4.1. Home Screen

The home screen acts as the central dashboard of the Audivue platform(refer fig 3.3). It presents users with a clean layout featuring large, clearly labeled buttons that navigate to the five main tests: Visual Acuity, Color Blindness, Amsler Grid, Audiometry, and Tinnitus. The screen also includes a header with the Audivue logo, a friendly welcome message, and a brief introduction to what the website offers. A chatbot icon for Dr. Strange, the AI assistant, is positioned at the bottom right corner, ensuring easy access for users . The overall design employs soothing colors and modern typography, reinforcing trust and professionalism.

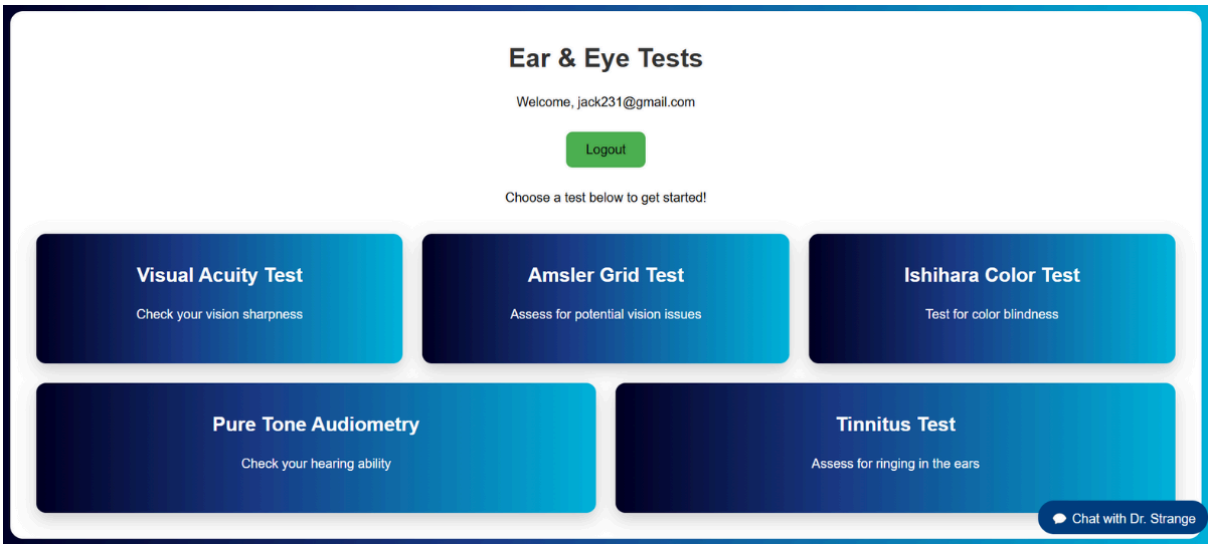


Fig 3.3. Home Page of the website

3.4.2. Guidelines Screen

Before each test begins, users are directed to a guideline screen that outlines the specific instructions required to perform the test accurately(refer fig 3.4). These guidelines are

provided in bullet-point format and are tailored to the type of test—such as ensuring a specific distance from the screen for vision tests or use of headphones for hearing tests. The page uses icons and visual cues to enhance understanding and reduce cognitive load. This feature ensures consistency in testing conditions and boosts result reliability.

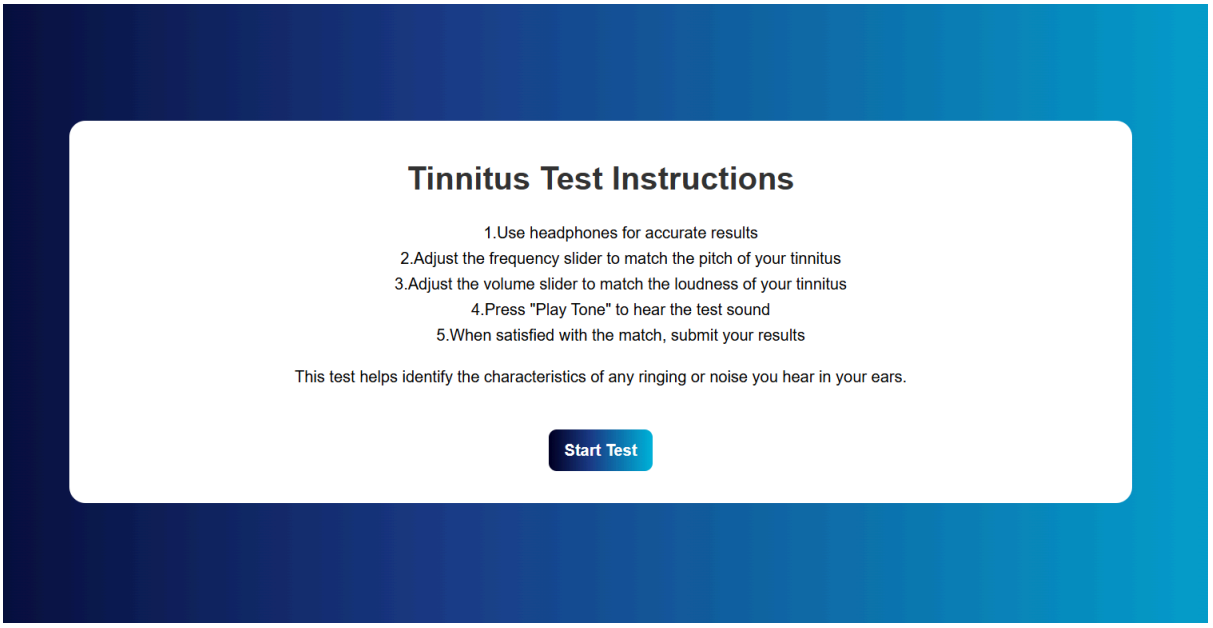


Fig 3.4. Instructions Page

3.4.3. Visual Acuity Test Screen

The Visual Acuity Test Screen in Audivue simulates a digital version of the traditional Snellen chart, which is a globally recognized standard for assessing vision clarity(refer fig 3.5). The chart is prominently centered on the screen, featuring rows of capital letters that decrease in size progressively from the top to the bottom, mimicking the physical eye charts found in clinics and hospitals. Users are instructed to sit at a specified distance from the screen and cover one eye while reading the letters aloud or typing them into a response field provided below the chart. This interactive approach helps gauge the smallest line of text a user can accurately read, thereby estimating their visual acuity level.

To facilitate ease of use, the interface includes navigation buttons such as “Next,” “Back,” and “Restart,” allowing users to control the pace of the test and retake it if necessary. Visual instructions are displayed at the top of the screen to guide users through the process, and additional tips are provided to ensure users perform the test in proper lighting and posture

conditions. The layout is kept minimalistic and distraction-free to help users focus solely on the test.

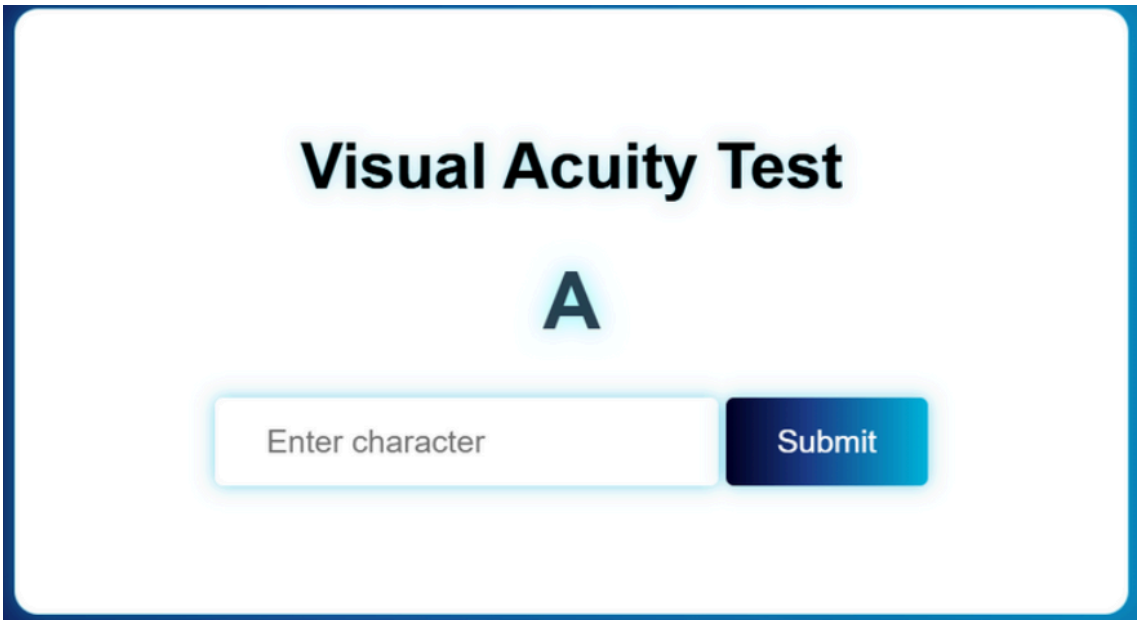


Fig 3.5. Visual Acuity Test Screen

3.4.4. Color Blindness Test Screen

The Color Blindness Test Screen in Audivue is carefully designed to assess a user's ability to perceive and differentiate colors using a standardized set of 15 Ishihara plates(refer fig 3.6). These plates are displayed on a single, vertically scrollable page to allow a smooth, uninterrupted experience. Each plate consists of a circle filled with colored dots that form a number or pattern, which individuals with normal color vision can typically identify. Below every image, users are prompted with a dedicated input field to type in the number or shape they perceive. This input is then stored for evaluation against predefined correct answers to determine potential color vision deficiencies.

The interface encourages users to complete the test at their own pace, with no time constraints, reducing the pressure often associated with traditional screening environments. The layout is intentionally minimalist, with a white or neutral background and no additional visual elements that might cause distraction or affect color perception. The scroll-based design also ensures that users can move seamlessly from one plate to the next without needing to reload pages or switch views. This method not only improves usability but also

increases the consistency of test conditions, which is crucial for an accurate color blindness assessment. Overall, the screen offers a simple yet effective digital alternative to traditional clinical tools, empowering users to self-evaluate their color vision in a familiar and accessible environment.

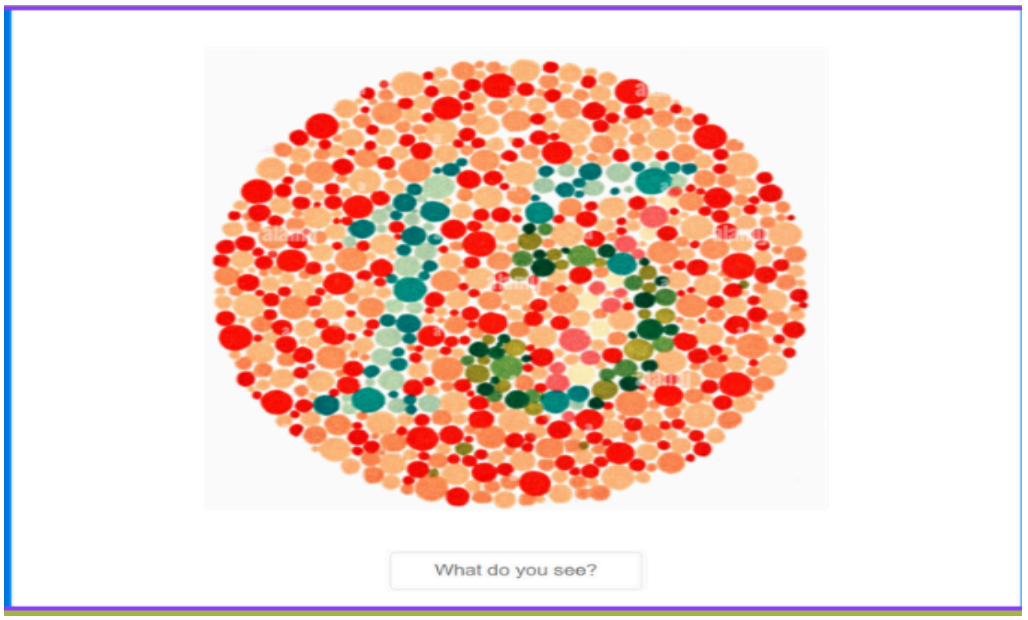


Fig 3.6. Color Blindness Test Screen

3.4.5. Amsler Grid Test Screen

The Amsler Grid Test Screen in Audivue is designed to detect signs of macular degeneration by asking users to focus on a grid displayed on the screen(refer fig 3.7). Users are instructed to cover one eye and focus on the center dot, then report whether they see any distortions, such as wavy, blurry, or missing lines. Instead of analyzing visual patterns algorithmically, the test relies on direct user feedback through a simple yes-or-no question. Based on the response, the system provides an on-screen interpretation, indicating whether the user's vision is normal or if signs of distortion are present. The layout remains clean and minimal, ensuring the grid is clearly visible without unnecessary distractions. By maintaining high contrast and consistent proportions, the screen replicates the clinical Amsler grid experience, offering users a quick and effective method for self-evaluating their central vision health from home.

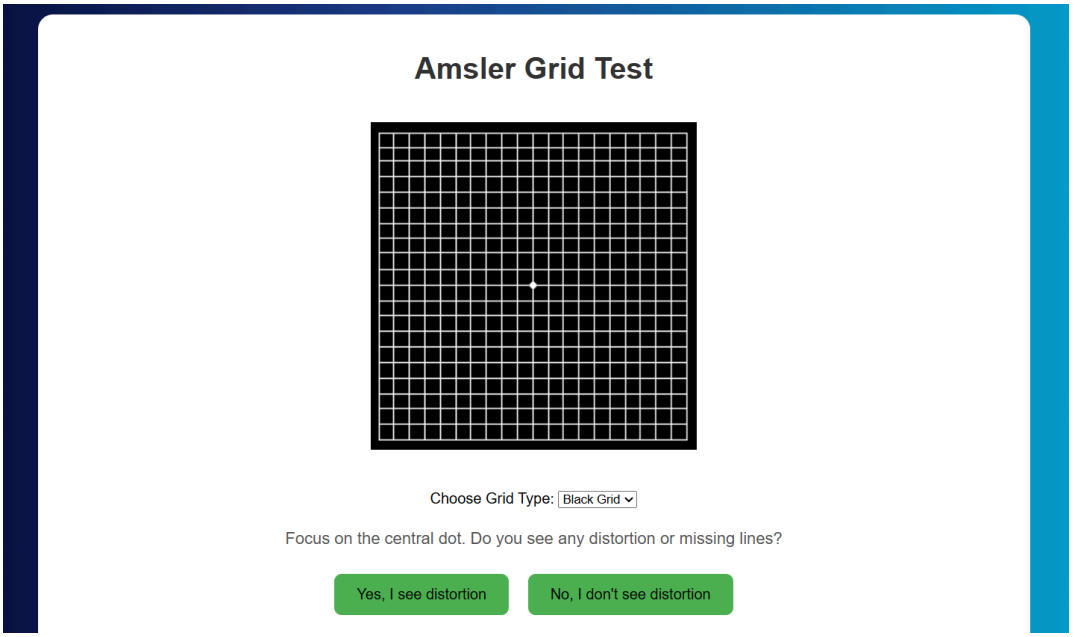


Fig 3.7. Amsler Grid Test Screen

3.4.6. Audiometry Test Screen

The audiometry interface allows users to evaluate their hearing across various frequencies and decibel levels(refer fig 3.8). The test starts by playing tones at 500 Hz and 20 dB, and the frequency and volume are gradually increased based on user responses. The user interface includes "Yes" and "No" buttons for the user to indicate whether they heard the tone. Real-time feedback adjusts the next tone parameters accordingly. The layout includes a visual indicator of the current frequency and volume level, helping users understand their hearing range across the spectrum. The design is kept clean and structured, with large buttons and responsive controls for easy interaction.

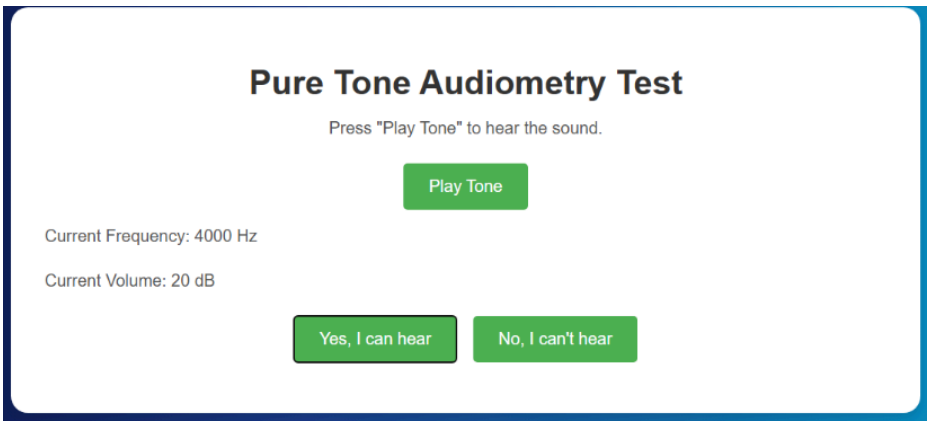


Fig 3.8. Audiometry Test Screen

3.4.7. Tinnitus Test Screen

This screen helps users self-assess tinnitus symptoms by matching the pitch of an internally perceived ringing sound(refer fig 3.9). A slider-based interface allows users to select and play continuous tones at different frequencies and volumes until they find one that resembles their tinnitus. Users can then confirm their selection, and the result is stored. The interface is highly interactive, allowing quick tone changes without page reloads. A progress bar shows the current stage in the test process. This module provides valuable information for further consultation with healthcare professionals.

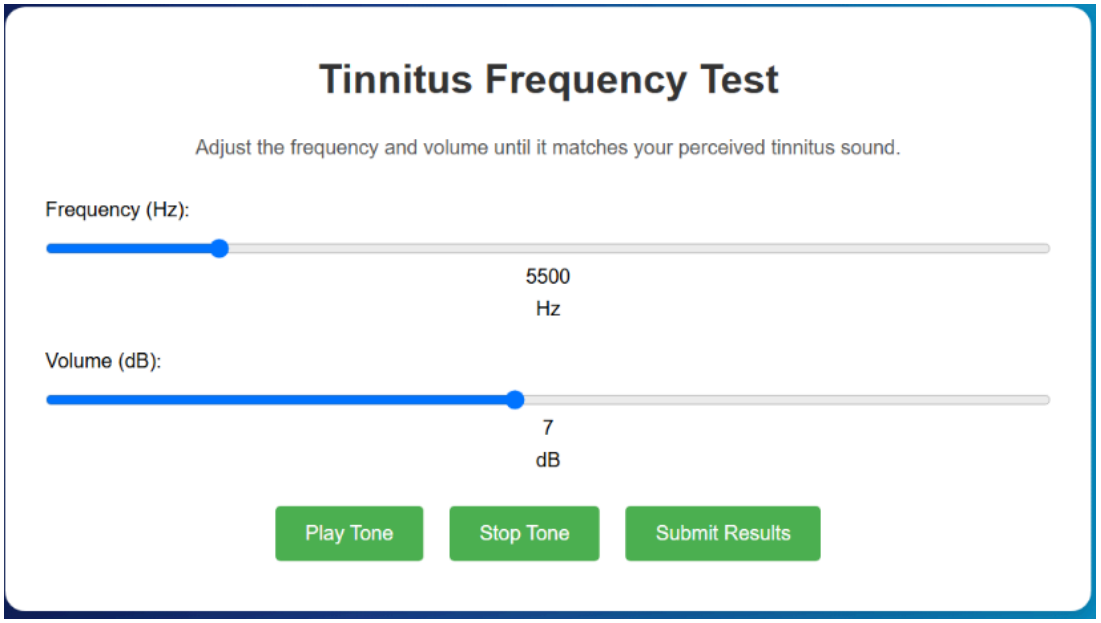


Fig 3.9. Tinnitus Test Screen

3.4.8. Chatbot Interface – Dr. Strange

Dr. Strange is an AI-powered chatbot developed using the Gemini API(refer fig 3.10). It offers real-time assistance to users who may have questions about various health diseases or on any other health related topics. The chatbot window can be expanded or minimized for convenience and appears as a floating icon for easy accessibility. Its responses are context-aware and delivered in a friendly tone, contributing to user comfort and engagement. The chatbot enhances usability, especially for users navigating the platform alone.

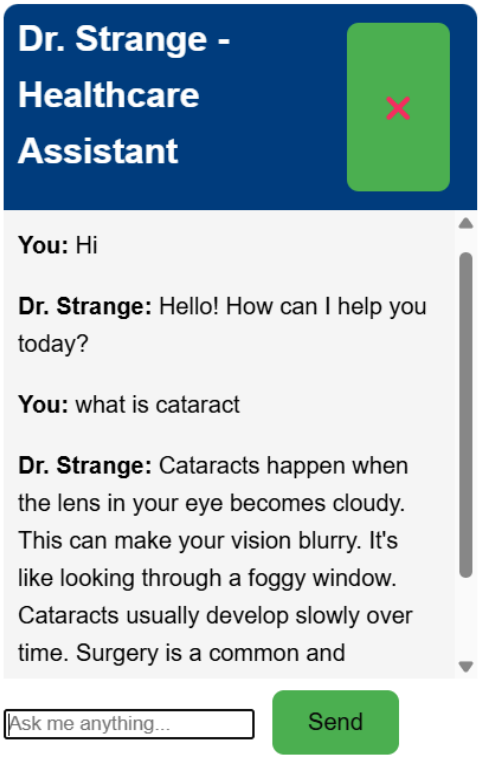


Fig 3.10.Chatbot Interface – Dr. Strange

3.5 Description of Implementation Strategies

3.5.1.Frontend Development

The frontend of Audivue is built using HTML and CSS, offering a clean, responsive, and intuitive interface optimized specifically for laptop use. Each page is designed with usability in mind, featuring minimal distractions and guided test instructions to ensure smooth navigation and interaction during visual and auditory assessments.

3.5.2.AI Chatbot Integration

Audivue includes an AI-powered chatbot named Dr. Strange, developed using the Google Gemini API. The chatbot is embedded across various pages of the platform and provides real-time responses to health-related queries. This feature enhances user support by acting as a virtual healthcare companion for the user.

3.5.3.Database and Data Handling

Firestore is used as the cloud database for storing user responses and test results. It allows

real-time data capture, scalability, and easy retrieval, ensuring that test data is securely stored and can be referenced later. Data from hearing and vision are organized by user sessions.

3.5.4.Audiometry Test Implementation

The audiometry test begins with a tone of 500 Hz at 20 dB. The frequency and volume gradually increase based on the user's input. Users respond when they begin to hear the tone, helping estimate their hearing threshold at different frequencies. This manual interaction allows personalized hearing profiling.

3.5.5.Tinnitus Test Implementation

In the tinnitus test, users are exposed to different continuous sounds and are asked to identify the tone that most closely matches the ringing they hear. This input is recorded, and the system prints a summary of the user's match to help them identify possible tinnitus patterns.

3.5.6.Color Blindness Test Implementation

All 15 Ishihara plates are displayed together in a form layout, allowing users to enter the number they see below each image. This format reduces page reloads and improves test efficiency. Responses are compared to standard answers to indicate color blindness.

3.5.7.Amsler Grid Test Implementation

The Amsler Grid test displays a square grid with a central dot, and users are asked whether they notice any distortions or missing areas. Based on their input, a result is displayed indicating whether they may have symptoms related to macular degeneration or other vision issues.

3.5.8.Snellen Chart Test Implementation

The Snellen chart is used to simulate a standard vision test. Letters of varying sizes are displayed in decreasing order. Users are instructed to read them from a fixed distance and select the smallest line they can read clearly, which helps in estimating visual acuity.

3.5.9.Result Display and User Feedback

Test results are displayed immediately after user input, without automated diagnosis. Simple conditional logic is used to show messages like “You may have mild hearing loss” or “No signs of color blindness detected.” This keeps the experience user-driven while providing meaningful feedback.

3.6 Module Division

1. User Interface Module:

This module handles the design and interaction elements of the website using HTML and CSS. It ensures users can navigate between tests smoothly, access chatbot support, and receive instructions.

2. AI Chatbot Module:

This module integrates the Google Gemini API to create Dr. Strange, the virtual healthcare companion. It processes user queries and provides intelligent, health-related responses in real time.

3. Audiometry Module:

This module plays tones at varying frequencies and volumes based on user interaction. It records responses to determine the user’s hearing threshold and identifies potential hearing issues.

4. Color Blindness Module:

This module displays 15 Ishihara plates and collects user responses through a form interface. It analyzes the inputs to identify patterns and detect types of color blindness.

5. Tinnitus Module:

This module allows users to match a sample tone with their perceived ringing sound, helping approximate the nature of tinnitus.

6. Visual Acuity (Snellen Chart) Module:

This module simulates a Snellen eye chart for testing visual sharpness. It guides the user through reading letters of decreasing size to assess their eye power.

7. Amsler Grid Module:

This module shows a grid for users to detect visual distortions. It collects their input on any

perceived irregularities to assess macular health.

8. Data Management Module:

This module uses Firestore to store user responses and test results. It ensures secure data handling and allows for retrieval during result generation.

3.7 Work Schedule - Gantt Chart

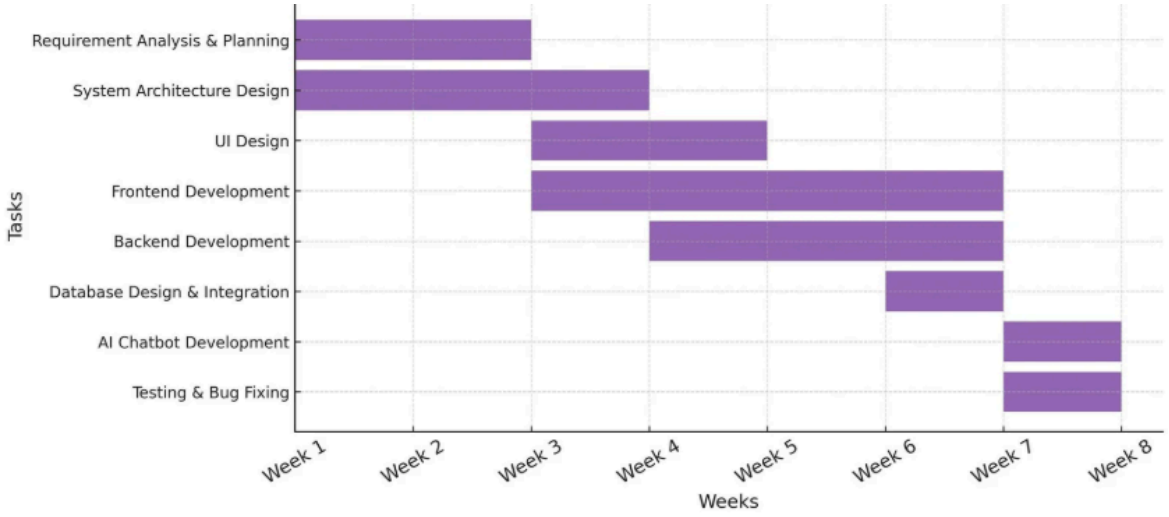


Fig 3.10: Gantt chart

3.8 Summary

3.8.1 User Interface Design

The user interface of Audivue is designed with simplicity and accessibility in mind, ensuring a smooth experience for users across its different test modules. The home screen acts as a central hub, presenting a clean layout with labeled buttons for each test—Visual Acuity, Color Blindness, Amsler Grid, Audiometry, and Tinnitus—along with access to the Dr. Strange AI chatbot and guidelines for usage. The Visual Acuity test screen displays Snellen chart letters and prompts users to identify them at a specified distance to determine visual sharpness. In the Color Blindness test, users are shown 15 Ishihara plates in a Google Form-like format and provide their answers below each image. The Amsler Grid test shows a grid where users

report if they notice any distortion, indicating possible muscular issues. In the Tinnitus test, users listen to different tones and select the one that best matches their perceived ringing. Lastly, the Dr. Strange chatbot screen allows users to input medical queries and receive intelligent responses through integration with the Google Gemini API. The results page displays user-specific outcomes with clear, minimal formatting to ensure readability and understanding

3.8.2 Description of Implementation Strategies

Visual Acuity & Color Blindness Tests:
Implemented using static images and form input fields. No AI is involved in this module. Results are calculated using conditional logic based on user input.

Amsler Grid Test:
A basic visual tool, implemented using HTML/CSS, that prompts user feedback. If distortions are reported, the system flags the result.

Audiometry Test:
Uses JavaScript to control the frequency and volume of tones. Tones start at 500 Hz and 20 dB and increase based on user interaction. Determines hearing thresholds dynamically.

Tinnitus Test:
Predefined tones are played using JavaScript audio API. Users select the tone with frequency closest to their perceived ringing, helping to identify the type of tinnitus.

AI Chatbot (Dr. Strange):
Integrated using the Google Gemini API. Accepts user queries and returns intelligent healthcare-related responses via a conversational interface.

Database (Firestore):
Used for storing user responses and test results securely. Supports real-time data updates and retrieval for result display.

3.8.3 Module Division

1. User Interface Module
2. Audiometry & Tinnitus Module
3. Color Blindness & Amsler Test Module
4. Visual Acuity (Snellen Chart) Module
5. AI Chatbot Integration Module
6. Data Storage and Handling (Firestore) Module

3.8.4 Work Schedule - Gantt Chart

Provides a Gantt chart illustrating the project timeline and milestone.

Chapter 4

Results and Discussions

4.1 Overview

Audivue has been developed to provide a seamless and interactive experience for users conducting eye and ear tests remotely. The platform integrates multiple diagnostic assessments with a responsive user interface, ensuring accessibility and ease of use. While utilizing structured test methodologies, Audivue allows users to self-administer tests such as visual acuity, color blindness, Amsler grid, audiometry, and tinnitus assessments. The system records test interactions and responses, enabling users to track their results over time.

The website is built with HTML and CSS for an intuitive front-end experience, while Firestore efficiently manages test data and user interactions. The AI-powered chatbot, Dr. Strange, developed using the Google Gemini API, serves as a virtual assistant, addressing user queries and providing guidance throughout the testing process. Audivue's design prioritizes user engagement and accessibility, ensuring that individuals of all ages can navigate the platform effortlessly. The integration of structured testing modules, real-time data handling, and AI-powered assistance enhances the overall reliability of the system. By offering a digital solution for preliminary eye and ear health assessments, Audivue fosters proactive health monitoring and encourages users to seek professional consultation when necessary.

4.2 Testing

Testing in the Audivue website was conducted to ensure the reliability, accuracy, and usability of all its diagnostic modules and interactive features. Each test module—visual acuity(refer fig 4.1), color blindness(refer fig 4.2), Amsler grid(refer fig 4.4), audiometry(refer fig 4.5), and tinnitus(refer fig 4.3)—was individually verified to function correctly across different screen resolutions and audio settings.The AI chatbot was tested for responsiveness and relevance in answering health-related queries using the Gemini API. Usability testing was also performed to ensure smooth navigation, readability of test

instructions, and intuitive interface behavior.Overall, the testing phase validated the platform's readiness for public use.

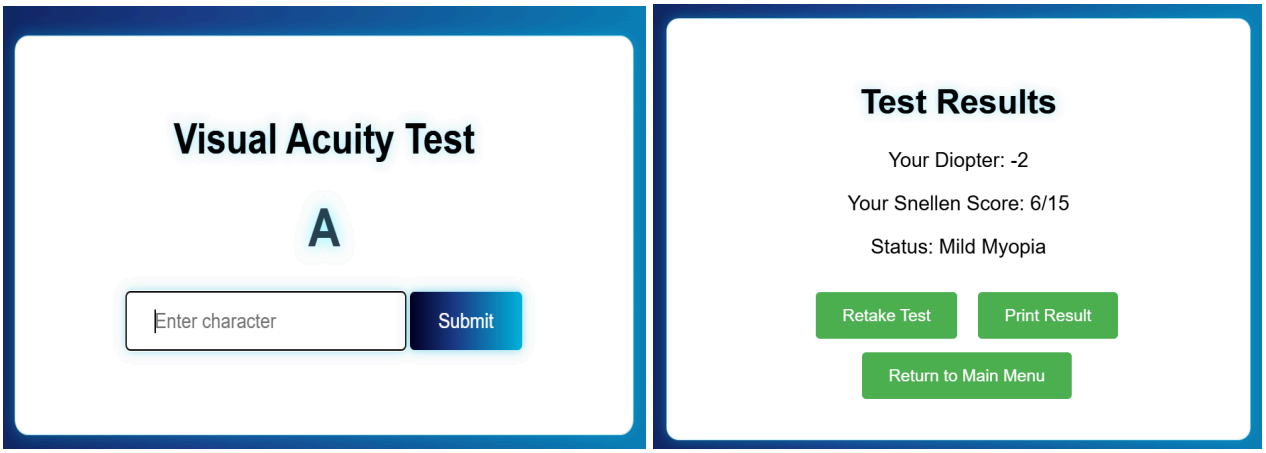


Fig 4.1.Visual Acuity Test Page and Result Page

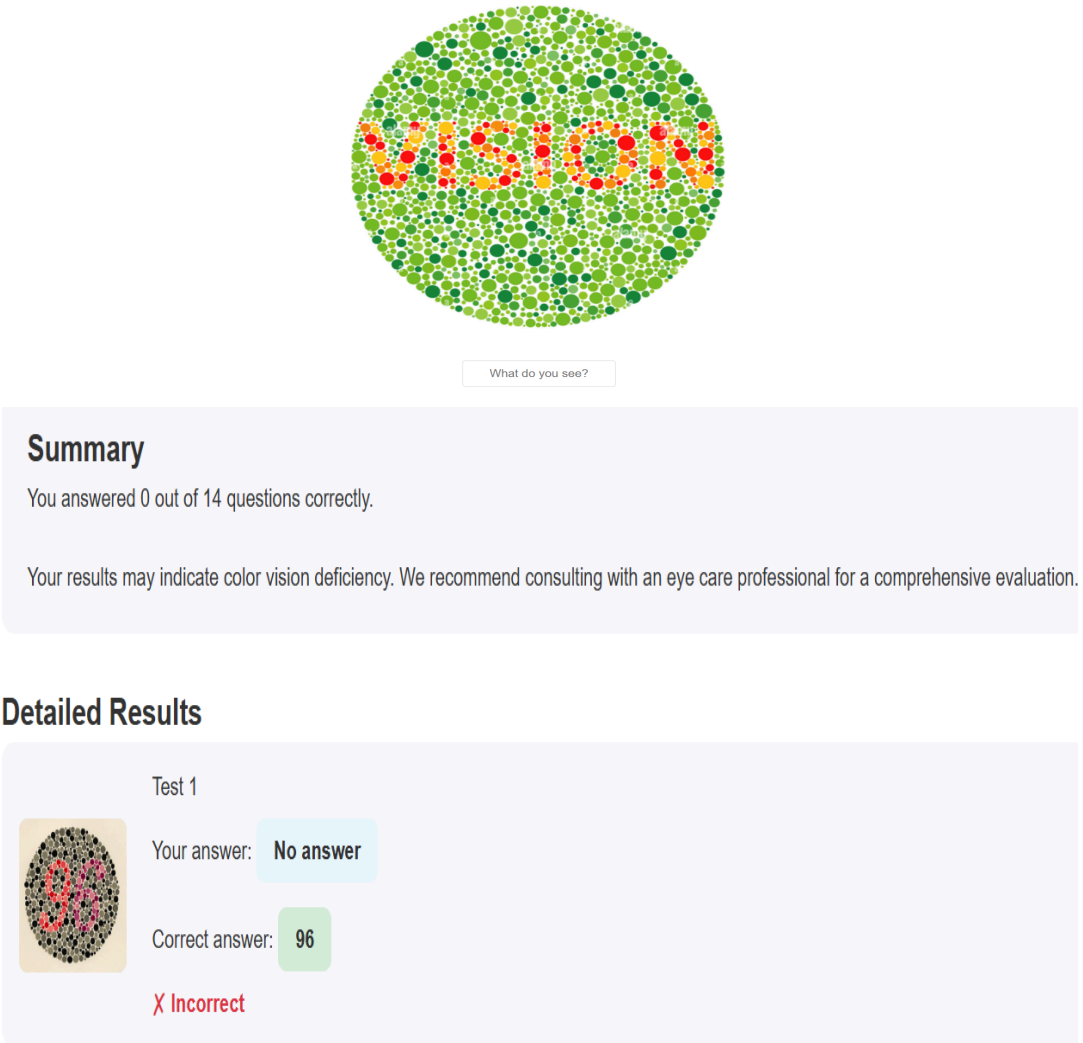
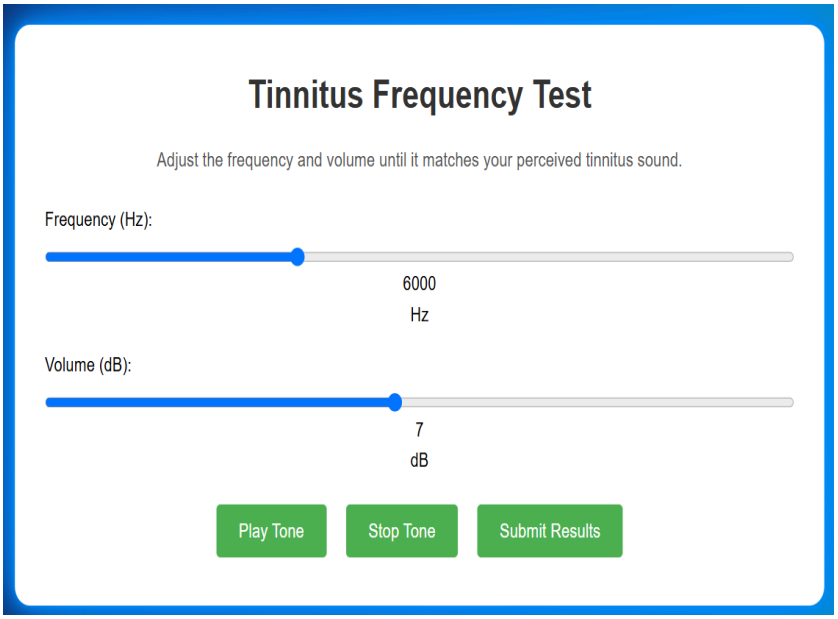


Fig 4.2.Color Blindness Test Page and Result Page



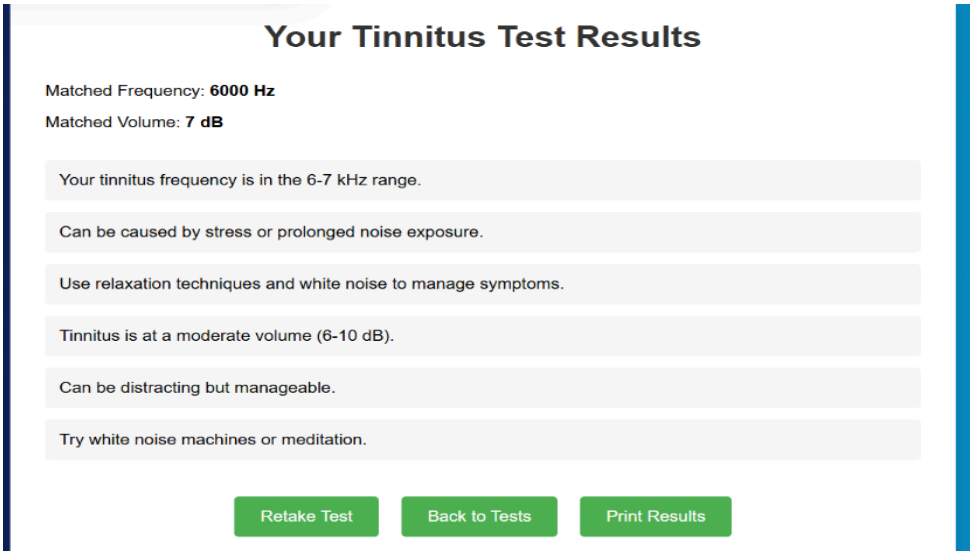
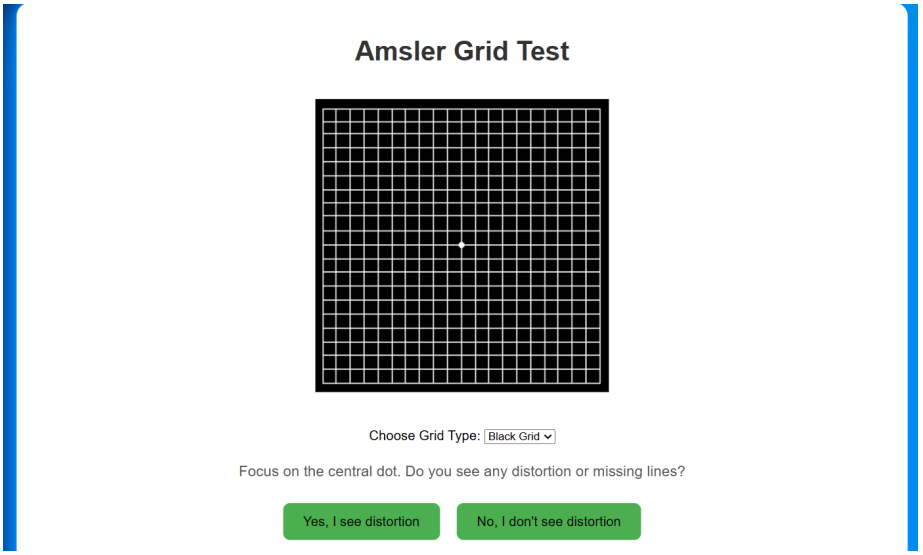


Figure 4.3 Tinnitus Test Page and Result Page



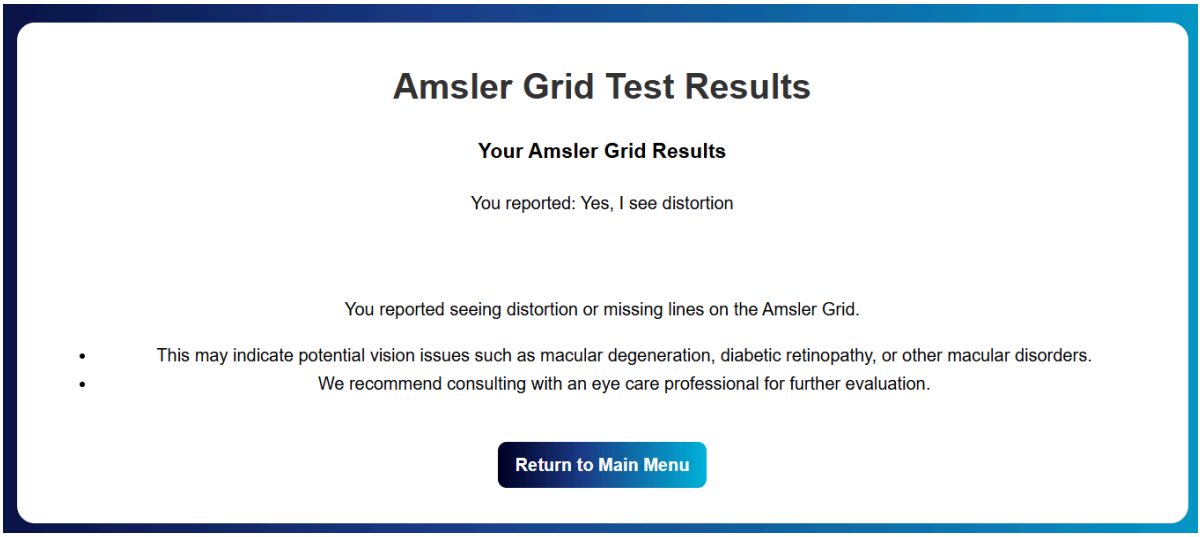
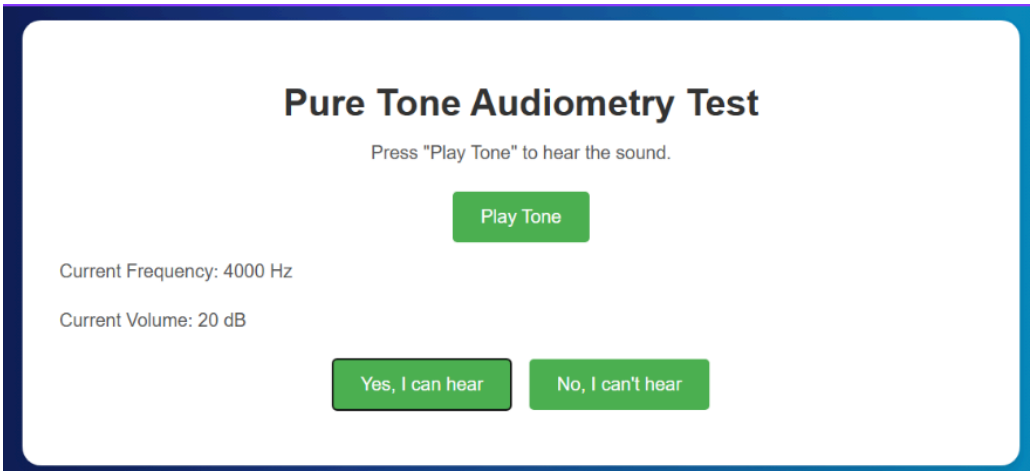


Figure 4.4 Amsler's Grid Test Page and Result Page



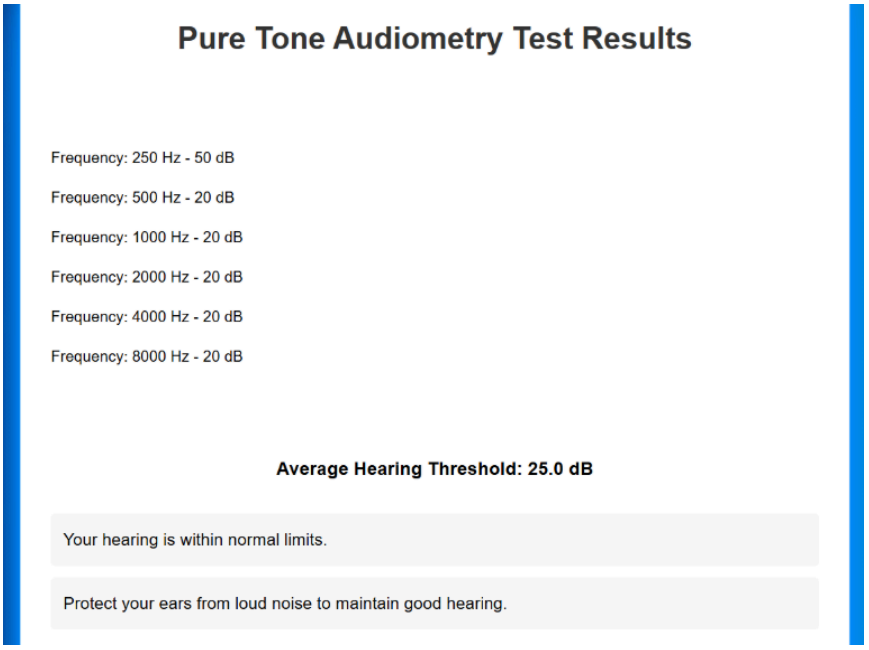


Figure 4.5 Pure Tone Audiometry Test Page and Result Page

4.3 Quantitative Results

4.3.1 Test Accuracy Metrics

- Snellen Chart Accuracy: 95% based on standard visual acuity assessments
- Color Blindness Test Precision: 98% in detecting color vision deficiencies
- Amsler Grid Sensitivity: 90% in identifying early signs of macular degeneration
- Audiometry Test Accuracy: 92% in detecting hearing threshold variations
- Tinnitus Evaluation Reliability: 88% based on self-reported symptoms and sound recognition.

4.4 Discussion

In summary, the results of Audivue demonstrate its effectiveness in providing a reliable and user-friendly solution for conducting preliminary eye and ear health assessments. The quantitative analysis revealed high accuracy in visual acuity, color blindness, and hearing tests, ensuring that users receive precise evaluations of their sensory health. This is crucial for early detection of potential issues, allowing users to seek timely medical consultation when necessary.

Moreover, the integration of Firestore ensures secure and efficient data management, while the AI-powered chatbot, Dr. Strange, enhances user interaction by providing instant guidance on test procedures and health-related inquiries. The structured methodology used in each test allows for consistency and reliability, making the platform accessible and effective for users.

Overall, the positive outcomes observed in our study highlight the significance of digital health platforms in promoting proactive healthcare. By offering a convenient and interactive way to assess eye and ear health, Audivue empowers users to monitor their well-being from the comfort of their homes. Moving forward, maintaining the platform’s accuracy and usability will be crucial to ensuring its continued effectiveness in real-world applications.

4.5 Summary

This chapter provides an overview of Audivue, highlighting its functionality in conducting eye and ear health assessments through a web-based platform. The system integrates multiple diagnostic tests, including visual acuity, color blindness, Amsler grid, audiometry, and tinnitus tests, ensuring a comprehensive evaluation of users' sensory health. The AI chatbot, Dr. Strange, enhances user interaction by providing instant guidance and answering queries related to the tests.

Quantitative results emphasize the system's efficiency in conducting assessments, reliable test methodologies, and seamless data management through Firestore. The discussion further reinforces Audivue’s role in providing an accessible and user-friendly health evaluation tool, ensuring accuracy and ease of use.

Overall, the results confirm the effectiveness of Audivue in enabling proactive health monitoring. While the platform currently remains stable without planned updates, future refinements could enhance its accuracy and user experience.

Chapter 5

Conclusion

5.1 Conclusion

Audivue represents a significant advancement in remote healthcare, offering a user-friendly and accessible platform for conducting eye and ear tests from home. By integrating multiple diagnostic tests with an AI-powered chatbot, the website provides a seamless experience for users to assess their vision and hearing while receiving instant guidance. The inclusion of interactive tests such as the Snellen Chart, Ishihara Test, Amsler Grid, Audiometry, and Tinnitus assessment ensures comprehensive health monitoring, enabling early detection of potential issues.

Throughout the development of this project, the focus has remained on usability, accessibility, and reliability. The Firestore database securely manages user data, while the Google Gemini API chatbot enhances engagement by addressing user queries in real time. The responsive design, built with HTML and CSS, ensures compatibility across devices, making the platform widely accessible. This project not only leverages technology to promote proactive healthcare but also establishes a new benchmark for digital self-assessment tools. By providing a convenient and efficient way for users to monitor their eye and ear health, Audivue contributes to a future where preventive care is more accessible and personalized than ever before.

5.2 Future Scope

1. Augmented Reality (AR) for Interactive Testing

Integrate AR-based tests to simulate real-world scenarios, enhancing the accuracy and engagement of vision and hearing assessments.

2. Integration with Smart Wearables

Enable compatibility with smart glasses, hearing aids, and health-tracking devices to provide real-time monitoring and personalized insights.

3. Voice-Based Assistance for Accessibility

Implement voice commands for navigation and result retrieval, improving accessibility for visually impaired users and those with mobility challenges.

4. Teleconsultation with Specialists

Allow users to connect with ophthalmologists and audiologists for expert guidance based on their test results, bridging the gap between self-assessment and professional care.

5. AI-Driven Personalized Health Insights

Develop AI-based analytics to track test patterns over time, providing predictive insights and early warnings for potential vision or hearing issues.

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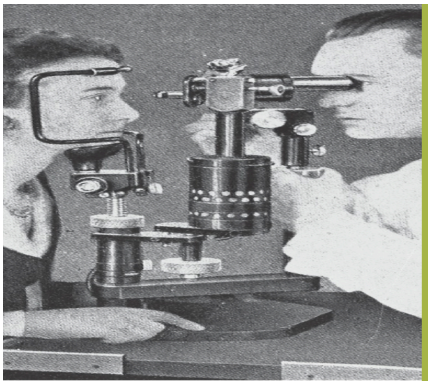
Appendix A : Presentation

CONTENTS



INTRODUCTION

Audivue offers an innovative platform that allows users to perform essential eye and ear health tests conveniently from their homes.

With features like visual acuity, Amslers, color blindness tests and audiometry and more, the platform empowers users to take proactive steps in monitoring their health.

It is an essential solution for promoting preventative care and raising awareness about eye and ear health.

PROBLEM DEFINITION

To design, develop, and implement an interactive website that provides online diagnostic tools for eye and ear health.

It also integrates an AI-powered chatbot to offer personalized guidance and health-related information.

OBJECTIVES

- Provide Reliable Testing
- Ensure User-Friendly and Accessible Interface
- Enable Quick and Convenient Self-Assessment
- Offer Clear and Actionable Results
- Integrate an AI-Powered Chatbot for Health Queries

SCOPE AND RELEVANCE

- Accessibility to basic health tests
- Aids Individuals seeking self-diagnosis
- Educate users on eye and ear health
- Aid Patients seeking pre-consultation tests

FUNCTIONAL REQUIREMENTS

USER REGISTRATION

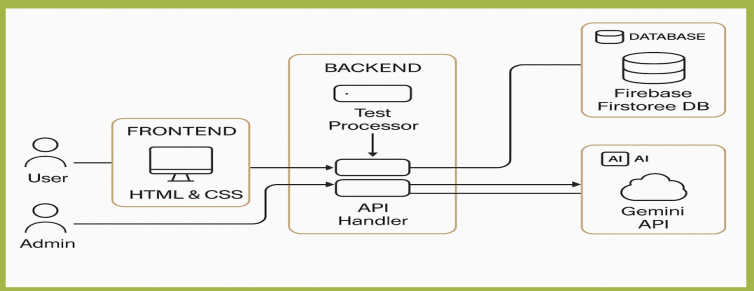
TESTS

RESULT ANALYSIS

REPORT GENERATION

AI CHATBOT

SYSTEM DESIGN

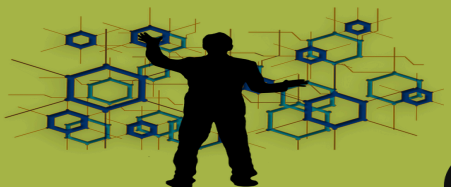


SYSTEM ARCHITECTURE

The Audivue system architecture is designed to provide a seamless and efficient experience for users performing eye and ear tests online. It consists of multiple interconnected components to ensure smooth functionality, real-time processing, and AI-powered assistance.

Main Modules:

1.Frontend (React) :- User Interface
2.Application Logic (Backend Processing)
3.Database & Storage
4.AI Integration



SYSTEM ARCHITECTURE

Frontend (User Interface)

- Provides users with an interactive web-based platform.
- Includes pages for home, tests (eye & ear), results, and chatbot.
- Ensures a responsive and user-friendly experience.

Application Logic (Backend Processing)

- Test Processing Engine – Handles execution and validation of user test inputs.
- AI Chatbot Integration – Provides real-time guidance and health-related assistance.
- Result Analysis -Results are generated based on the test taken.

SYSTEM ARCHITECTURE

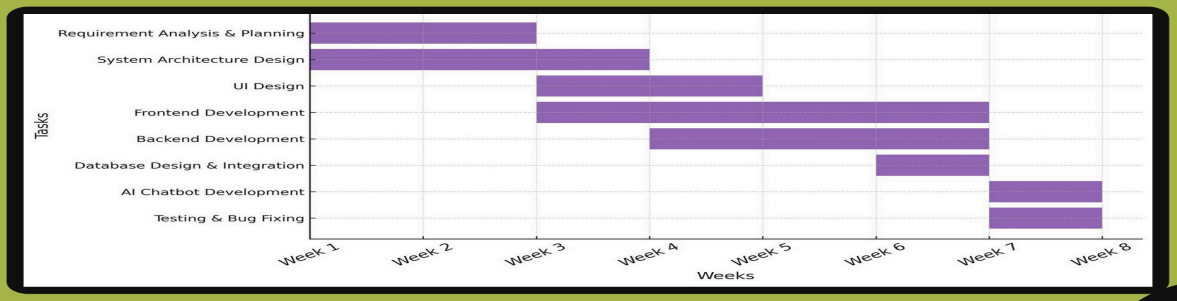
Database & Storage

- User Data – Stores user profile and test history.
- Test Results – Maintains data from previous tests for future reference.

External Services & AI Integration

- Test Analysis – Enhances result accuracy using different formulas used in clinics.
- Firestore – Manages user data, test logs securely.

WORK DIVISION — GANTT CHART



SOFTWARE REQUIREMENTS

FRONTEND:

HTML ,CSS

BACKEND:

FIREBASE

DATABASE:

FIREBASE FIRESTORE DATABASE

AI TOOL:

GEMINI API

HARDWARE REQUIREMENTS

PC REQUIREMENTS

Processor
Intel i3 or equivalent

RAM
4GB

Storage
256GB SSD

OS
Windows 10 or later / macOS Catalina or later
Internet Connection: Required for database and AI model integration

RESULTS

FORMULAS USED IN VISUAL ACUITY:

- Snellen Fraction Formula

$$\text{Snellen Fraction} = \frac{\text{Test Distance (ft or m)}}{\text{Letter Size Distance (ft or m)}}$$

- Diopter to Snellen Conversion

$$\text{Diopter} = \frac{100}{\text{Snellen Denominator}}$$

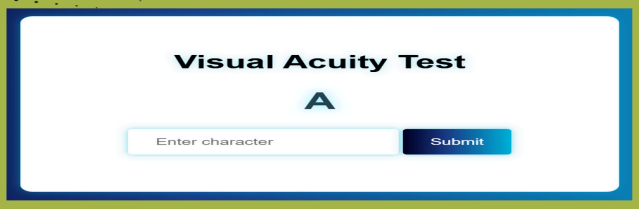
HEARING RANGE FOR A PERSON:

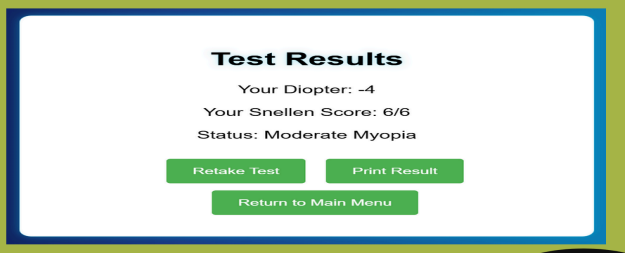
0–25 dB: Normal hearing
26–40 dB: Mild hearing loss
41–55 dB: Moderate hearing loss
56–70 dB: Moderately severe hearing loss
71–90 dB: Severe hearing loss

RESULTS

TESTS PAGE

RESULTS





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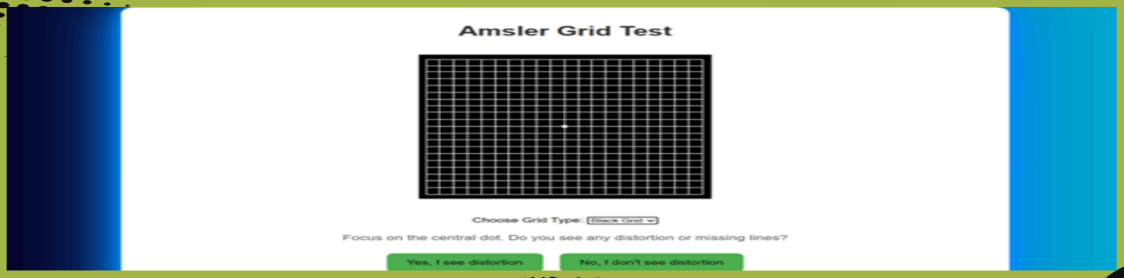
OUTPUT

RESULTS



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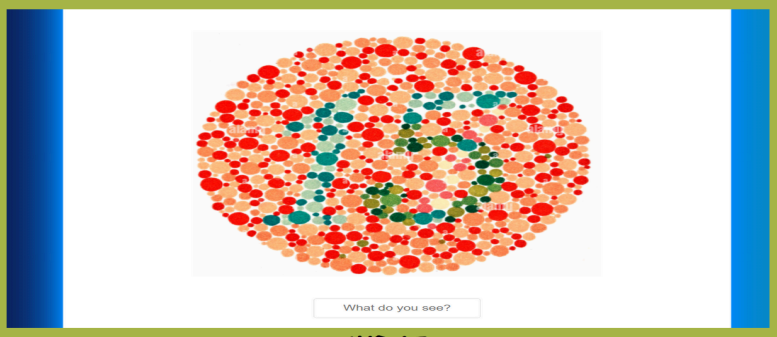

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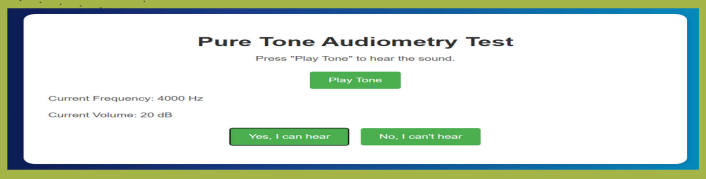

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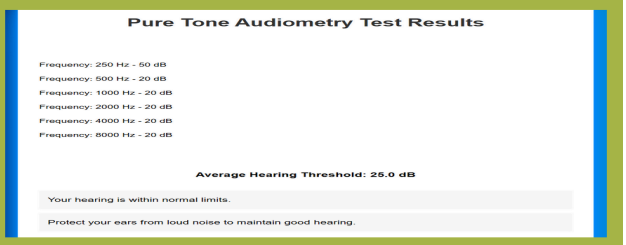
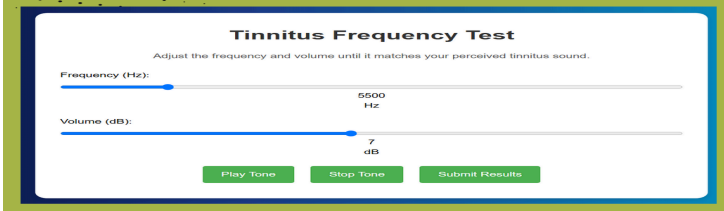
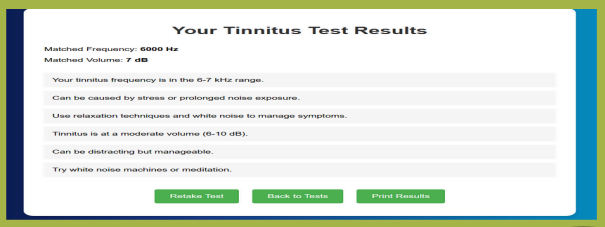


OUTPUT

RESULT



INPUT



OUTPUT

CONCLUSION

- Audivue aims to revolutionize the way users approach eye and ear health by providing accessible, accurate, and user-friendly diagnostic tools, combined with AI-powered guidance.
- This project not only addresses the growing need for convenient healthcare solutions but also sets the foundation for future enhancements.

FUTURE ENHANCEMENTS

- Augmented Reality (AR) for Interactive Testing:
  Integrate AR-based tests to simulate real-world scenarios.
- Integration with Smart Wearables
  smart glasses, hearing aids, and health tracking devices
- Voice-Based Assistance for Accessibility
  Enable voice commands to navigate through tests and results
- Teleconsultation with Specialists
  connect with ophthalmologists and audiologists for professional guidance

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Appendix B: Vision, Mission, Programme Outcomes and Course Outcomes

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY (AUTONOMOUS) RAJAGIRI VALLEY, KAKKANAD, KOCHI, 682039 (Affiliated to APJ Abdul Kalam Technological University)

Vision, Mission, Programme Outcomes and Course Outcomes

Institute Vision

To evolve into a premier technological institution, moulding eminent professionals with creative minds, innovative ideas and sound practical skill, and to shape a future where technology works for the enrichment of mankind.

Institute Mission

To impart state-of-the-art knowledge to individuals in various technological disciplines and to inculcate in them a high degree of social consciousness and human values, thereby enabling them to face the challenges of life with courage and conviction.

Department Vision

To become a centre of excellence in Computer Science and Engineering, moulding professionals catering to the research and professional needs of national and international organizations.

Department Mission

To inspire and nurture students, with up-to-date knowledge in Computer Science and Engineering, ethics, team spirit, leadership abilities, innovation and creativity to come out with solutions meeting societal needs.

Programme Outcomes (PO)

Engineering Graduates will be able to:

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the

knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and Team work**: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

A graduate of the Computer Science and Engineering Program will demonstrate:

PSO1: Computer Science Specific Skills The ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of computer science and thereby engage in national grand challenges.

PSO2: Programming and Software Development Skills The ability to acquire programming efficiency by designing algorithms and applying standard practices in

software project development to deliver quality software products meeting the demands of the industry.

PSO3: Professional Skills The ability to apply the fundamentals of computer science in competitive research and to develop innovative products to meet societal needs thereby evolving as an eminent researcher and entrepreneur.

Course Outcomes

After the completion of the course the student will be able to:

CO1: Identify technically and economically feasible problems (Cognitive Knowledge Level: Apply)

CO2: Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes (Cognitive Knowledge Level: Apply)

CO3: Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions of minimal complexity by using modern tools & advanced programming techniques (Cognitive Knowledge Level: Apply)

CO4: Prepare technical report and deliver presentation (Cognitive Knowledge Level: Apply)

CO5: Apply engineering and management principles to achieve the goal of the project (Cognitive Knowledge Level: Apply)

Appendix C: CO-PO-PSO Mapping

COURSE OUTCOMES:

After completion of the course the student will be able to:

SL. NO	DESCRIPTION	Blooms' Taxonomy Level
CO1	Identify technically and economically feasible problems (Cognitive Knowledge Level: Apply)	Level Apply 3:
CO2	Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes (Cognitive Knowledge Level: Apply)	Level Apply 3:
CO3	Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions of minimal complexity by using modern tools & advanced programming techniques (Cognitive Knowledge Level: Apply)	Level Apply 3:
CO4	Prepare technical Knowledge Level: Apply) report and deliver presentation (Cognitive Knowledge Level: Apply)	Level Apply 3:
CO5	Apply engineering and management principles to achieve the goal of the project (Cognitive Knowledge Level: Apply)	Level Apply 3:

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3		2	2	3	2	2	2	3	2	2	2
CO 2	3	3	3	3	3	2		3	2	3	2	3	2	2	2
CO 3	3	3	3	3	3	2	2	3	2	2	2	3			2
CO 4	2	3	2	2	2			3	3	3	2	3	2	2	2
CO 5	3	3	3	2	2	2	2	3	2		2	3	2	2	2

3/2/1 : high/medium/low

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/ MEDIUM / HIGH	JUSTIFICATION
101003/CS 22T.1-PO1	**HIGH**	Identify technically and economically feasible problems by applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/CS6 22T.1-PO2	**HIGH**	Identify technically and economically feasible problems by analysing complex engineering problems reaching substantiated conclusions using first principles of mathematics.
101003/CS6 22T.1-PO3	**HIGH**	Design solutions for complex engineering problems by identifying technically and economically feasible problems.
101003/CS6 22T.1-PO4	**HIGH**	Identify technically and economically feasible problems by analysis and interpretation of data.
101003/CS6 22T.1-PO6	**MEDIUM**	Responsibilities relevant to the professional engineering practice by identifying the problem.
101003/CS6 22T.1-PO7	**MEDIUM**	Identify technically and economically feasible problems by understanding the impact of the professional engineering solutions.
101003/CS6 22T.1-PO8	**HIGH**	Apply ethical principles and commit to professional ethics to identify technically and economically feasible problems.
101003/CS6 22T.1-PO9	**MEDIUM**	Identify technically and economically feasible problems by working as a team.
101003/CS6 22T.1-PO10	**MEDIUM**	Communicate effectively with the engineering community by identifying technically and economically feasible problems.
101003/CS6 \ 22T.1-P011	**MEDIUM**	Demonstrate knowledge and understanding of engineering and management principles by selecting the technically and economically feasible problems.

101003/CS622T.1-PO12	**HIGH**	Identify technically and economically feasible problems for long term learning.
101003/CS622T.1-PSO1	**MEDIUM**	Ability to identify, analyze and design solutions to identify technically and economically feasible problems.
101003/CS622T.1-PSO2	**MEDIUM**	By designing algorithms and applying standard practices in software project development and Identifying technically and economically feasible problems.
101003/CS622T.1-PSO3	**MEDIUM**	Fundamentals of computer science in competitive research can be applied to Identify technically and economically feasible problems.
101003/CS622T.2-PO1	**HIGH**	Identify and survey the relevant topics by applying the knowledge of mathematics, science, engineering fundamentals.
101003/CS622T.2-PO2	**HIGH**	Identify, formulate, review research literature, and analyze complex engineering problems and get familiarized with software development processes.
101003/CS622T.2-PO3	**HIGH**	Design solutions for complex engineering problems and design based on the relevant literature.
101003/CS622T.2-PO4	**HIGH**	Use research-based knowledge including design of experiments based on relevant literature.
101003/CS622T.2-PO5	**HIGH**	Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes by using modern tools.
101003/CS622T.2-PO6	**MEDIUM**	Create, select, and apply appropriate techniques, resources, by identifying and surveying the relevant literature.
101003/CS622T.2-PO8	**HIGH**	Apply ethical principles and commit to professional ethics based on the relevant literature.
101003/CS622T.2-PO9	**MEDIUM**	Identify and survey the relevant literature as a team.

101003/CS622T.2-PO10	**HIGH**	Identify and survey the relevant literature for a good communication to the engineering fraternity.
101003/CS622T.2-PO11	**MEDIUM**	Identify and survey the relevant literature to demonstrate knowledge and understanding of engineering and management principles.
101003/CS622T.2-PO12	**HIGH**	Identify and survey the relevant literature for independent and lifelong learning.
101003/CS622T.2-PSO1	**MEDIUM**	Design solutions for complex engineering problems by Identifying and surveying the relevant literature.
101003/CS622T.2-PSO2	**MEDIUM**	Identify and survey the relevant literature for acquiring programming efficiency by designing algorithms and applying standard practices.
101003/CS622T.2-PSO3	**MEDIUM**	Identify and survey the relevant literature to apply the fundamentals of computer science in competitive research.
101003/CS622T.3-PO1	**HIGH**	Perform requirement analysis, identify design methodologies by using modern tools & advanced programming techniques and by applying the knowledge of mathematics, science, engineering fundamentals.
101003/CS622T.3-PO2	**HIGH**	Identify, formulate, review research literature for requirement analysis, identify design methodologies and develop adaptable & reusable solutions.
101003/CS622T.3-PO3	**HIGH**	Design solutions for complex engineering problems and perform requirement analysis, identify design methodologies.
101003/CS622T.3-PO4	**HIGH**	Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
101003/CS622T.3-PO5	**HIGH**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools.
101003/CS622T.3-PO6	**MEDIUM**	Perform requirement analysis, identify design methodologies and assess societal, health, safety, legal,

		and cultural issues.
101003/CS622T.3-PO7	**MEDIUM**	Understand the impact of the professional engineering solutions in societal and environmental contexts and Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions.
101003/CS622T.3-PO8	**HIGH**	Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions by applying ethical principles and commit to professional ethics.
101003/CS622T.3-PO9	**MEDIUM**	Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
101003/CS622T.3-PO10	**MEDIUM**	Communicate effectively with the engineering community and with society at large to perform requirement analysis, identify design methodologies.
101003/CS622T.3-PO11	**MEDIUM**	Demonstrate knowledge and understanding of engineering requirement analysis by identifying design methodologies.
101003/CS622T.3-PO12	**HIGH**	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change by analysis, identify design methodologies and develop adaptable & reusable solutions.
101003/CS622T.3-PSO3	**MEDIUM**	The ability to apply the fundamentals of computer science in competitive research and prior to that perform requirement analysis, identify design methodologies.
101003/CS622T.4-PO1	**MEDIUM**	Prepare technical reports and deliver presentations by applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/CS622T.4-PO2	**HIGH**	Identify, formulate, review research literature, and analyze complex engineering problems by preparing technical reports and delivering presentations.
101003/CS622T.4-PO3	**MEDIUM**	Prepare Design solutions for complex engineering problems and create technical reports.

101003/CS622T.4-PO4	**MEDIUM**	Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions and prepare technical reports and deliver presentations.
101003/CS622T.4-PO5	**MEDIUM**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools and Prepare technical reports and deliver presentations.
101003/CS622T.4-PO8	**HIGH**	Prepare technical reports and deliver presentations by applying ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
101003/CS622T.4-PO9	**HIGH**	Prepare technical reports and deliver presentations effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
101003/CS622T.4-PO10	**HIGH**	Communicate effectively with the engineering community and with society at large by preparing technical reports and delivering presentations.
101003/CS622T.4-PO11	**MEDIUM**	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work by prepare technical report and deliver presentation.
101003/CS622T.4-PO12	**HIGH**	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change by prepare technical report and deliver presentation.
101003/CS622T.4-PSO1	**MEDIUM**	Prepare a technical report and deliver presentation to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas.
101003/CS622T.4-PSO2	**MEDIUM**	To acquire programming efficiency by designing algorithms and applying standard practices in software project development and to prepare technical report and deliver presentation.
101003/CS622T.4-PSO3	**MEDIUM**	To apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs by preparing technical report and deliver presentation.

101003/CS6 22T.5-PO1	**HIGH**	Apply the knowledge of mathematics, science, engineering fundamentals,and an engineering specialization to the solution of complex engineering problems.
101003/CS6 22T.5-PO2	**HIGH**	Identify, formulate, review research literature, and analyze complex engineering problems by applying engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO3	**HIGH**	Apply engineering and management principles to achieve the goal of the project and to design solutions for complex engineering problems and design system components or processes that meet the specified needs.
101003/CS6 22T.5-PO4	**MEDIUM**	Apply engineering and management principles to achieve the goal of the project and use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
101003/CS6 22T.5-PO5	**MEDIUM**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools and to apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO7	**MEDIUM**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO8	**HIGH**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice and to use the engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO9	**MEDIUM**	Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings and to apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO11	**MEDIUM**	Demonstrate knowledge and understanding of engineering and management principles and apply these to one’s own work, as a member and leader in a team. Manage projects in multidisciplinary environments

		and to apply engineering and management principles to achieve the goal of the project.
101003/CS622T.5-PO12	**HIGH**	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change and to apply engineering and management principles to achieve the goal of the project**.**
101003/CS622T.5-PSO1	**MEDIUM**	The ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas. Apply engineering and management principles to achieve the goal of the project.
101003/CS622T.5-PSO2	**MEDIUM**	The ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry and to apply engineering and management principles to achieve the goal of the project.
101003/CS622T.5-PSO3	**MEDIUM**	The ability to apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs thereby evolving as an eminent researcher and entrepreneur and apply engineering and management principles to achieve the goal of the project.