



Faculty of Computer Science and Information Technology

**IMPROVING THE KALAKA WEBSITE
WITH SVELTE FRAMEWORK AND SPEAKER DIARIZATION**

Nicholas Owen

Bachelor of Software Engineering with Honours

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NICHOLAS OWEN ANAK AMIN

This project is submitted in partial fulfilment of the
requirements for the degree of
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Projek ini merupakan salah satu keperluan untuk
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List of Abbreviations

AI	Artificial Intelligence
ASR	Automatic Speech Recognition
ERD	Entity Relationship Diagram
FCSIT	Faculty of Computer Science & Information Technology
FYP	Final Year Project
GUI	Graphical User Interface
PHP	Hypertext Preprocessor
SRS	Software Requirement Specification
UNIMAS	Universiti Malaysia Sarawak
UML	Unified Modeling Language
VSCoDe	Visual Studio Code
WAL	World Atlas of Languages

ABSTRACT

The Kalaka system, developed by UNIMAS in 2017, is an innovative platform aimed at preserving Malaysia's rich linguistic and cultural heritage (Juan & Busu, 2017). It serves as a valuable tool for studying and documenting the voices of Malaysia's ethnic communities. To expand its capabilities, Kalaka needs AI-driven tools like speaker diarization, which can unlock new opportunities for linguistic research. This project builds upon the work of Mohd Zulhafiz Rahim, Dr. Sarah Flora Samson Juan, and Professor Dr. Fitri Suraya Mohamad (2023), who focused on improving speaker diarization for low-resourced Sarawak Malay speech using advanced clustering techniques and x-vectors. Speaker diarization is a powerful technology that answers the question "Who spoke when?" by detecting and segmenting different voices within an audio recording (Sayyada et al.). It improves transcription accuracy and allows for in-depth speaker analysis, making it a valuable tool for researchers studying multilingual conversations. However, the current Kalaka system has several limitations. Its frontend is outdated and lacks interactivity, resulting in low user engagement. The system only offers basic features and does not support real-time updates or data visualizations. There is no dedicated language page to promote cultural learning, and advanced tools like speaker diarization are not yet integrated, limiting its effectiveness for audio analysis and language documentation. Furthermore, there is a need to enrich the platform with educational and engaging features such as a Word of the Day (WOTD), an interactive Glossary for exploring vocabulary, and Quiz modules to test user knowledge and promote active learning. To address these issues, this project has three main objectives: to review existing systems for feature ideas, to design and develop an improved version of Kalaka using the Svelte framework with speaker diarization integration, and to evaluate the new system through developer and user acceptance testing. The Prototyping Model will be used as the development methodology, emphasizing iterative development and continuous feedback. This approach ensures the project remains user-focused, allowing early prototypes to inform refinements and lead to a more effective final product. In conclusion, with its new revamp, the Kalaka system is expected to enhance user engagement through improved features and functionality. This chapter has demonstrated that the objectives of the proposed system have been successfully achieved, while its limitations have also been identified. The proposed future enhancements aim to address these limitations and further refine the system. Implementing these improvements will be essential to ensure a more effective and seamless user experience in real-world applications.

CHAPTER 1: INTRODUCTION

1.1 Introduction

The *Kalaka* system is an innovative platform created by UNIMAS in 2017 to preserve Malaysia's rich tapestry of languages and cultures (Juan & Busu, 2017). Designed as a powerful tool for studying and documenting linguistic diversity, *Kalaka* plays a crucial role in capturing the voices of Malaysia's ethnic communities. *Kalaka* need AI-driven tools like speech diarization, unlocking new possibilities for linguistic research. The integration of speech diarization will build upon the research conducted by Mohd Zulhafiz Rahim, Dr. Sarah Flora Samson Juan, and Professor Dr. Fitri Suraya Mohamad (2023), which focuses on improving speaker diarization for low-resourced Sarawak Malay conversational speech using advanced clustering techniques and x-vectors.

Speech diarization, for example, is a cutting-edge technology that detects and categorizes different voices within an unlabelled audio stream, accurately segmenting speakers in recordings for in-depth analysis (Sayyada et al.). This capability enhances transcription accuracy and speaker categorization, providing researchers with details insights into dialogues involving multiple speakers. With tools like these, *Kalaka's* future potential is boundless, offering a transformative approach to preserving and deepening our understanding of Malaysia's unique linguistic heritage.

1.2 Problem Statement

User engagement with the current *Kalaka* frontend is limited due to its overly simplistic and plain design, which relies solely on basic PHP. To address this, Svelte has been chosen as the framework to revamp the frontend, allowing for a more modern, responsive interface. With Svelte, *Kalaka* can incorporate dynamic elements and data visualization features, such as charts for statistical data, that enhance the platform's appeal and usability. Additionally, the system currently offers only basic features, making it necessary to introduce new, meaningful elements to increase its cultural relevance. For example, a dedicated page for the Sarawak Malay language could serve as a valuable resource for Sarawakians looking to learn new vocabulary or for others interested in exploring the language. Furthermore, integrating functionalities like

speaker diarization, which allows users to segment and identify speakers within audio recordings will enhance Kalaka's usability for language documentation. Svelte's reactivity model supports real-time interface updates, which is ideal for displaying active speakers or segmented data as the audio is processed, creating a seamless and responsive user experience. Because Svelte compiles components directly to optimized JavaScript, it minimizes browser load and improves performance, which is particularly advantageous for handling audio data efficiently.

1.3 Objectives

These are the objective of this project:

- To review existing systems similar to Kalaka to gather ideas for new features.
- To design and develop an improved version of Kalaka using the Svelte framework and integrate a speaker diarization model.
- To evaluate the improved Kalaka website through developer and user acceptance testing.

1.4 Methodology

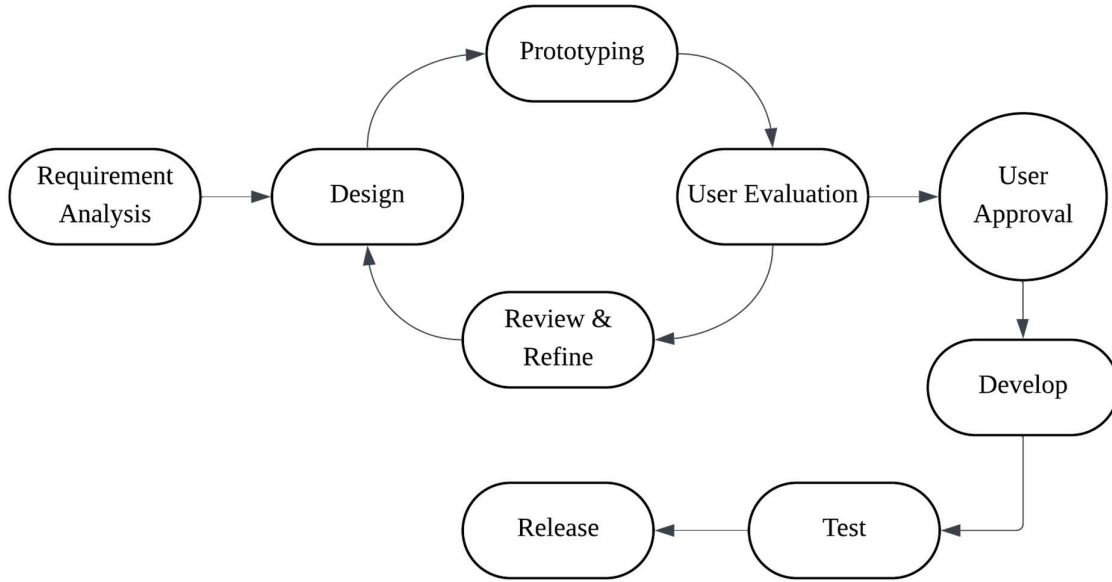


Figure 1. 1: Prototyping Model

For this project, the Prototyping Model will be employed to facilitate the revamp of the *Kalaka* website, transitioning it from PHP to Svelte. This methodology emphasizes an iterative approach, allowing for continuous refinement based on user feedback. By focusing on developing a functional prototype early in the process, the aim is to gather valuable insights that inform subsequent revisions, ultimately enhancing the user experience and ensuring the final product aligns closely with user needs.

1.4.1 Requirements

The initial phase involves gathering essential requirements for the revamped *Kalaka* system. This includes identifying key features that leverage Svelte's capabilities, such as improved interactivity and data visualization. Understanding user expectations and the functionalities needed for effective language documentation will guide the development process.

1.4.2 Design

In this phase, a basic structure of the *Kalaka* website is created using Svelte. This involves coding core components that outline the user interface and essential functionalities.

The focus is on creating a responsive and interactive design that enhances user engagement while maintaining the platform's cultural significance.

1.4.3 Prototyping

A functional prototype is developed using Svelte, integrating the core elements defined in the design phase. This prototype allows users to interact with primary features, such as language data visualization and vocabulary learning tools. The goal is to simulate the user experience of the final product while showcasing Svelte's performance benefits.

1.4.5 User Evaluation

The code prototype is presented to a group of test users for evaluation. Feedback is collected regarding usability, navigation, and the effectiveness of interactive features. This phase is critical for identifying areas of improvement based on real user interactions with the Svelte-based prototype.

1.4.6 Review and Refine

A Google Form survey will be provided to users to gather feedback on both the new and old version models. The survey will focus on key aspects such as functionality, performance, user experience, and feature enhancements. The feedback collected will be analyzed to identify areas for improvement, helping to refine the new model.

1.4.7 Develop

With an approved and refined prototype, the full development of the *Kalaka* system is undertaken. This phase involves expanding the Svelte codebase, integrating all required features, and ensuring robust backend functionality to handle user interactions and data management.

1.4.8 Testing

The prototype will be tested using both developer and user acceptance testing. Developer testing will focus on technical issues, ensuring that the system functions as intended. User acceptance testing will involve real users to assess the system's usability, functionality,

and overall user experience. Feedback from both testing phases will be used to refine and improve the prototype before its final deployment.

1.4.9 Release

Once testing is complete and necessary adjustments have been made, the revamped *Kalaka* website is launched for public use.

1.5 Scope

The scope of this proposed project is listed as follows:

- i. The Sarawak Malay Language page will be developed within *Kalaka*.
- ii. The speaker diarization integration will be implemented in *Kalaka*.
- iii. The *Kalaka* frontend will be revamped with new features and integrated with the *Kalaka* backend using Svelte framework.

1.6 Significance of Project

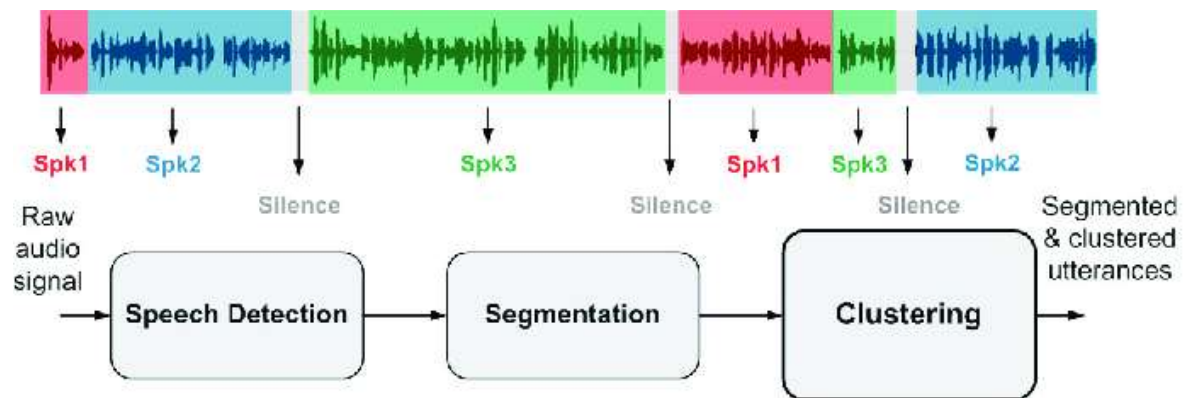


Figure 1. 2: The process of speaker diarization

The significance of this project to enhance *Kalaka* website that highlights Malaysia's linguistic diversity with a user-friendly design with advanced tools like speech diarization. Figure 1.2 illustrates the process of speaker diarization. Speaker diarization is an audio processing technique that segments conversation recordings into sections based on speaker

identity. This involves marking time boundaries and speaker labels to track when each individual speaks, essentially answering the question, "Who spoke when?" Initially developed to improve automatic speech recognition (ASR) by allowing systems to adjust to different speakers within a transcription (Mohd Zulhafiz, Juan, & Mohamad, 2023). Incorporating this technology into Kalaka will play a crucial role in analyzing multilingual conversations and preserving language differences and enable detailed speaker analysis in recorded conversations, helping users explore language use and interaction across diverse communities.

1.7 Project Schedule

FYP 1															
TASK WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Discussion with SV for FYP topic															
Brief Proposal Submission															
Completing the Full proposal															
Full proposal progress review															
Finalizing the Full proposal															
Full proposal submission															
Chapter 1 Submission															
Literature Review															
Literature Review progress review and correction															
Chapter 2 submission															
Requirement Analysis and Design															
Requirement Analysis and Design progress review and correction															
Chapter 3 submission															
Finalizing the FYP1 Report															
FYP1 Report Submission & Assesment															

Table 1. 1: Project Schedule for FYP 1 Report

FYP 2																	
TASK WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Implementation																	
Submission FYP revised																	
Implementation progress review and correction																	
Testing																	
Testing progress review and correction																	
Submission of Chapter 4																	
Conclusion and Future Work																	
Conclusion of Future Work progress review and correction																	
Submission 1 st draft Chapter 5 & Abstract																	
Full FYP 2 report																	
Full FYP 2 report progress review and correction																	
Submission 1 st draft FYP 2 Full Report																	
FYP 2 Presentation																	
FYP 2 Symposium and Exhibition																	
FYP 2 Amendment and Modifications																	

Table 1. 2: Project Schedule for FYP 2 Report

1.8 Expected Outcome

The outcomes of the *Kalaka* project will be a transformed and more engaging platform, which significantly enhances user experience, promotes cultural preservation, and supports data-driven language insights.

Another key outcome will be improved data visualization capabilities. By integrating interactive graphs and charts, *Kalaka* will provide users with visually represented language statistics and demographic insights, making it easier to understand language usage across different regions. This will add an educational dimension to the platform, allowing users to engage with data in a more interactive way and deepening their understanding of Malaysia's linguistic diversity.

The project will also deliver a dedicated resource for the Sarawak Malay language, with a vocabulary learning section, pronunciation guides, and daily language content, such as a “Word of the Day” feature. This dedicated page will strengthen *Kalaka*’s role in cultural preservation and provide a space for language learners and native speakers to expand their vocabulary and connect with their heritage. Additionally, the introduction of language learning tools like quizzes and flashcards will make the learning experience interactive, encouraging users to return and continue exploring Sarawak Malay.

Furthermore, with the integration of AI-based speech diarization, *Kalaka* will be equipped with advanced functionality to identify and segment different speakers in audio recordings. This feature will support linguistic research and allow users to gain more detailed insights into spoken language content, which is particularly valuable for language documentation efforts. This AI component will enhance *Kalaka*’s utility for researchers and language enthusiasts, making it a powerful tool for studying the dynamics of Sarawak’s spoken languages.

1.9 Project Report Outline

1.9.1 Chapter 1: Introduction

Chapter 1 provides an overview of the Kalaka project, covering its background, current limitations, and the purpose of proposed enhancements. This chapter outlines the problem statement, describing issues with the existing Kalaka website, such as limited user engagement, lack of interactive features, and minimal data visualization tools, all of which affect its role in language documentation and preservation. The project objectives highlight goals like improving the user interface with Svelte, integrating speech diarization for speaker segmentation, and supporting data visualization, addressing the current limitations effectively. Agile methodology will guide development, allowing iterative refinements to enhance the Kalaka user experience. The project scope details the specific improvements planned, while the significance section emphasizes the impact on cultural preservation and language learning. A Gantt chart illustrates the project schedule, ensuring timely task completion. Finally, the expected outcomes include a user-friendly Kalaka platform with advanced tools for language data collection and analysis, supporting Malaysia's linguistic heritage.

1.9.2 Chapter 2: Literature Review

Chapter 2 analyzes and compares three similar websites and three existing system-based websites to gather insights for enhancing the Kalaka frontend and functionality. This chapter examines the techniques used in these systems, evaluating their relevance to the proposed project and identifying key features that can be adapted to improve Kalaka's user experience and performance.

1.9.3 Chapter 3: Requirements, Analysis and Design

Chapter 3 explains the methodology used in developing the Kalaka system, with a focus on the Prototyping Model. This approach was chosen to enable iterative development and continuous user feedback, allowing for refinements that better align with user need. In this chapter, requirements are gathered through developer and user acceptance testing.

1.9.4 Chapter 4: Implementation and Testing

Chapter 4 details the development phase of the Kalaka system, focusing on the implementation of key features based on the Prototyping Model. This chapter outlines the setup and configuration of essential system components, including database integration, and frontend development with Svelte and Flowbite. The structure and functionality of both user and admin interfaces are presented, supported by screenshots and descriptions that illustrate the system's core operations. By following the previously analyzed requirements, this phase ensures the system aligns with its intended objectives, providing an efficient and user-friendly experience. This chapter also covers functional testing, which verifies the system's core features, and non-functional testing, which evaluates usability, performance, and responsiveness. User Acceptance Testing (UAT) is conducted through structured test cases to identify potential issues, followed by iterative refinements based on test results. By incorporating user feedback, supervisor input, and systematic evaluations, this phase ensures the system operates as intended while enhancing overall user satisfaction.

1.9.5 Chapter 5: Conclusion and Future Work

Chapter 5 evaluates the overall success of the Kalaka system, reviewing how well it achieves its objectives and identifying any limitations encountered during development. The chapter discusses future enhancements, including potential AI integration for improved speaker diarization and expanded data visualization capabilities. Additionally, recommendations for system scalability and performance optimization are considered. The chapter concludes with a summary of the project's impact, emphasizing its role in enhancing language documentation, improving accessibility, and supporting future advancements in the Kalaka platform.

1.10 Summary

In conclusion, Chapter 1 introduces the background and scope of the Kalaka project, detailing the challenges in the current system and the objectives for enhancing user engagement, usability, and functionality. This includes a discussion on the limitations of the existing Kalaka platform, such as limited interactivity and lack of advanced language tools, as well as the aim to modernize it by adding AI-driven tools like speech diarization and transitioning to the Svelte

framework. The significance, methodology, and anticipated outcomes of the project are also covered, including a Gantt chart to outline the project schedule.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Chapter 2 analyzes three existing systems alongside the *Kalaka* website. The primary focus of this literature review is to examine their features, functionalities, strengths, and weaknesses. A comparative analysis is then conducted to outline their advantages and limitations.

In addition to exploring system features, Chapter 2 delves into the tools required for web development. These tools are categorized into front-end development tools and the software utilized. This discussion helps identify the essential tools needed to design and implement the proposed system.

2.2 Review on *Kalaka* Website

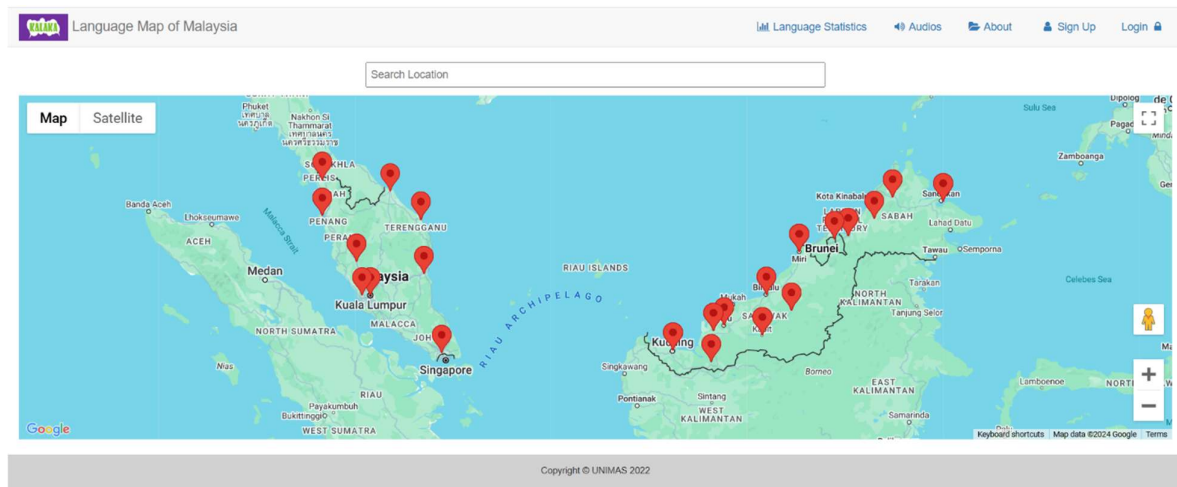


Figure 2. 1: Front Page in *Kalaka* webpage

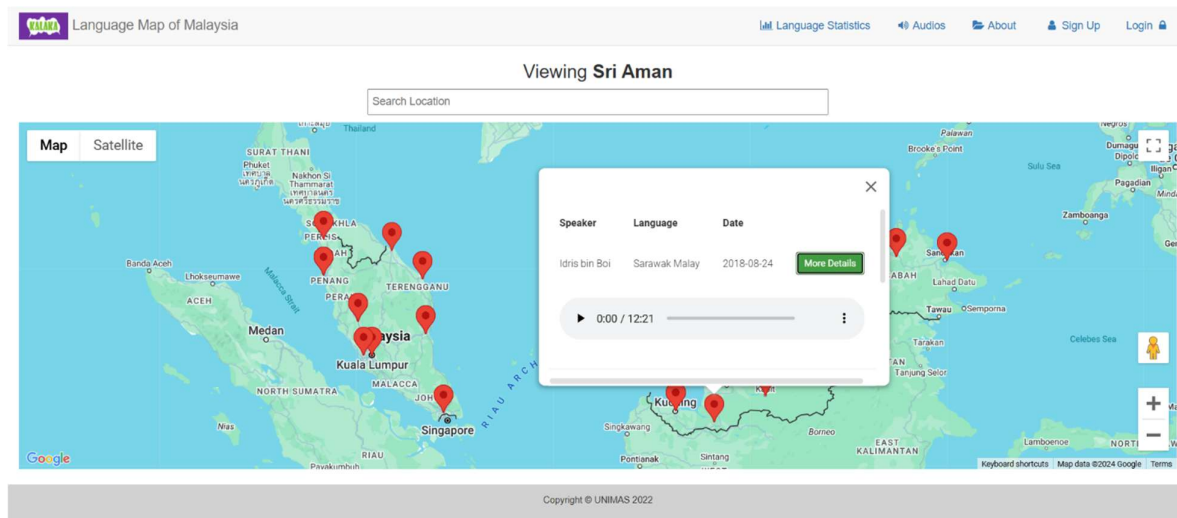


Figure 2. 2: Pop-up shows speaker's name, language, and date of contribution.

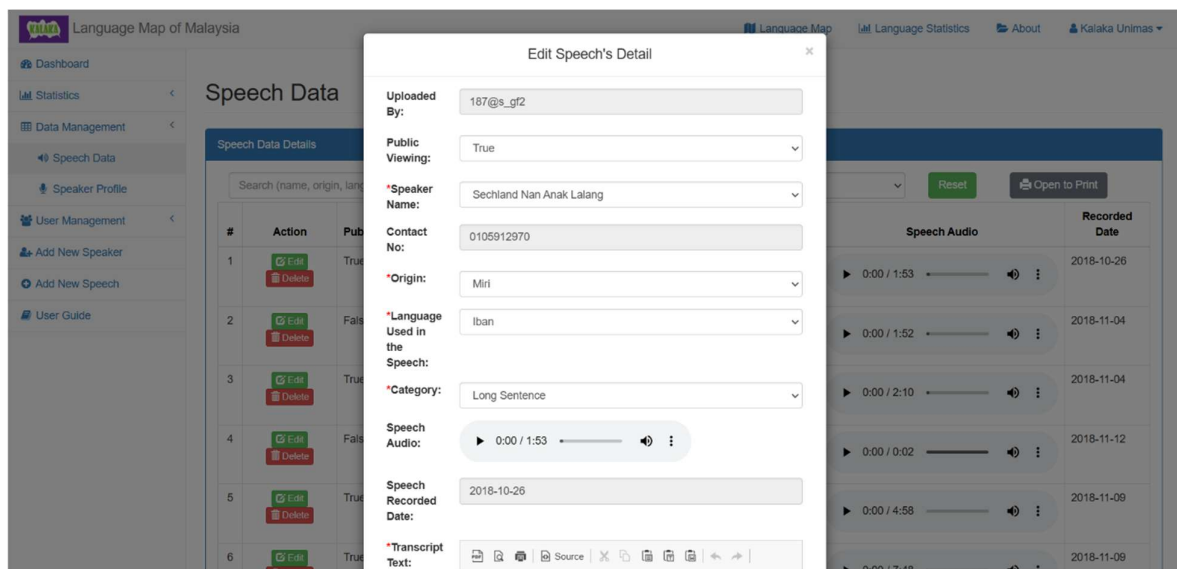


Figure 2. 3: Pop up for admin to edit speech's detail in admin page

Figure 2.1 illustrates a map of Malaysia, with red pin locations marking areas where speakers have contributed data. Clicking on a red pin opens a pop-up window (as shown in Figure 2.2) that displays detailed information, including the speaker's name, the language spoken, and the submission date of the audio data. The admin selects 'true' at the public viewing

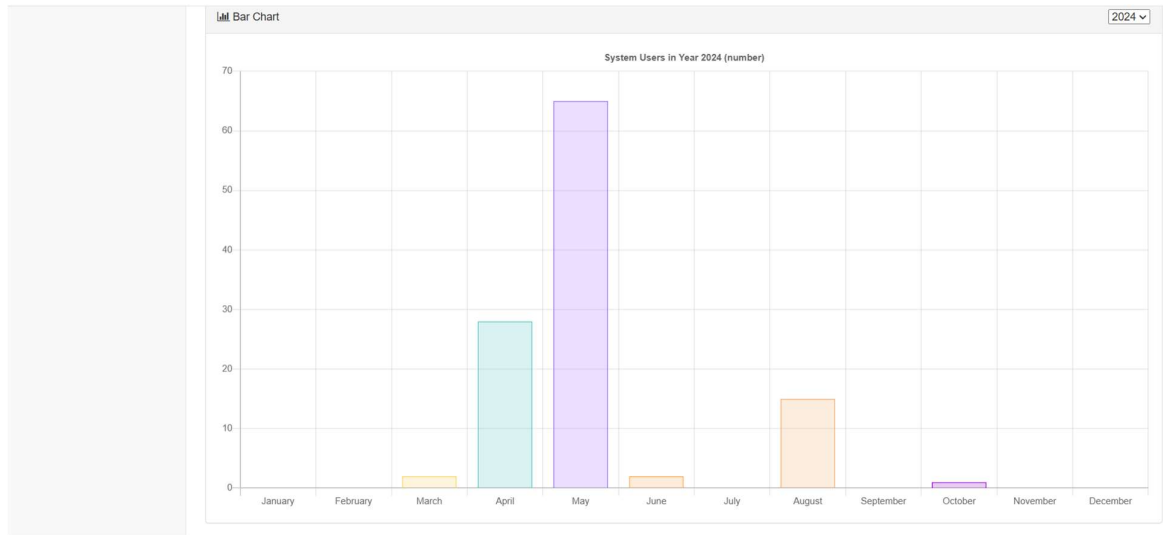


Figure 2. 5: System User in 2024 that use Kalaka in admin dashboard page

The line chart in Figure 2.4, which displays system user data for *Kalaka*, needs more visual elements to convey meaningful statistics effectively. The database contains detailed information about system users. Additionally, the line chart in Figure 2.4 must be better suited for representing the data due to its overly complex design. Using the same colour for multiple languages creates visual confusion, making it difficult for users to interpret the graph at a glance. Moreover, the placement of long language names along the y-axis adds to the clutter, resulting in a crowded and hard-to-read output that diminishes its utility for users. As shown in Figure 2.5, this data is primarily utilized within the admin dashboard.

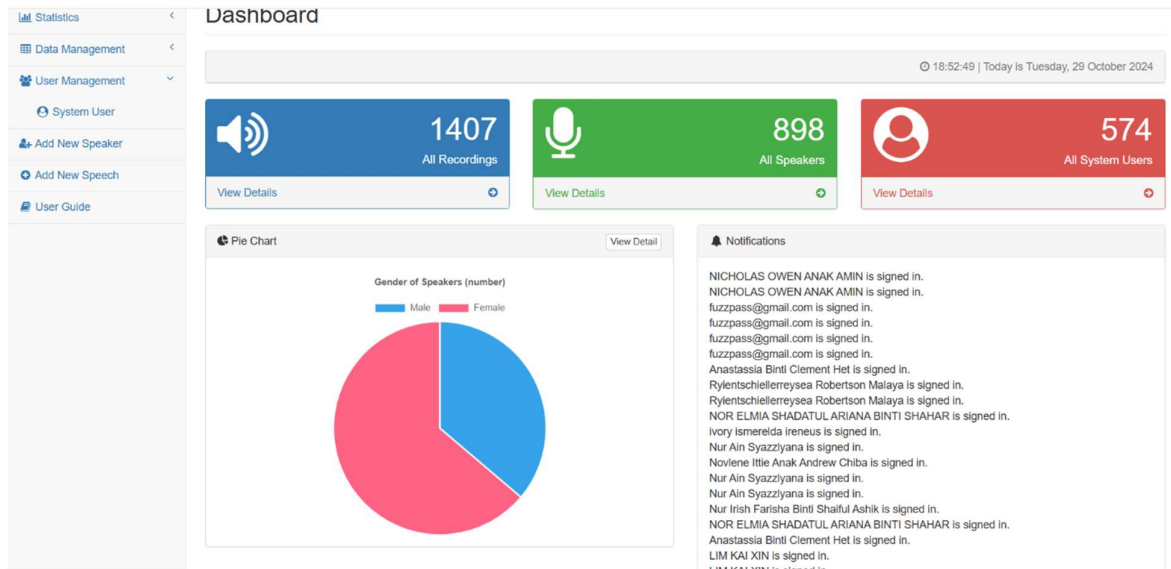


Figure 2. 6: Admin Dashboard in Kalaka

The notifications section displaying users who have signed in appears unengaging and has several issues. Firstly, it duplicates usernames, creating unnecessary redundancy. Additionally, it lacks a time-tracking feature to record when users sign in. This absence of timestamps hinders the administrator's ability to monitor system activities effectively.

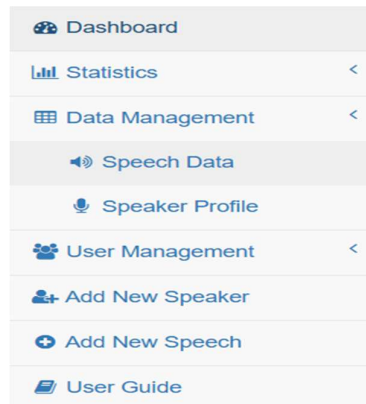


Figure 2. 7: Menu sidebar on admin page

In Figure 2.7, the menu sidebar on the admin page contains several sections, such as Dashboard, Statistics, Data Management, User Management, Add New User and Speech. The

"Add New Speaker" and "Add New Speech" options, which are related to data, are misplaced under separate sections instead of being grouped within the "Data Management" category. This misplacement makes the menu appear cluttered and fragmented, with too many sections, thereby reducing its organizational clarity and efficiency.

#	Action	Public	Speaker Name	Contact No	Origin	Language	Category	Speech Audio	Recorded Date
1	Edit Delete	True	Sechiland Nan Anak Lalang	0105912970	Miri	Iban	Long Sentence	0:00 / 1:53	2018-10-26
2	Edit Delete	False	Gregory Michael Anak Santok	0146859508	Kuching	Iban	Long Sentence	0:00 / 1:52	2018-11-04
3	Edit Delete	True	Gregory Michael Anak Santok	0146859508	Kuching	Iban	Long Sentence	0:00 / 2:10	2018-11-04
4	Edit Delete	False	John	0168345776	Lundu	Iban	Word	0:00 / 0:02	2018-11-12
5	Edit Delete	True	David Yasin	0138566158	Ranau	Dusun	Sound	0:00 / 4:58	2018-11-09
6	Edit Delete	True	David Yasin	0138566158	Ranau	Dusun	Sound	0:00 / 7:48	2018-11-09

Figure 2. 8: Speech Data Details table

Figure 2.8 illustrates a speech data details table, listing individual speaker audio recordings and contributor details. However, the system currently supports only single-speaker recordings. This limitation poses a challenge for users interested in analyzing group conversations to study linguistic interactions. Understanding conversational dynamics, such as how questions and responses are structured in a specific language, is valuable for users interested in linguistics. Although multiple speakers can be included as contributors, identifying who is speaking in a group recording becomes problematic due to the absence of an automated speaker diarization function.

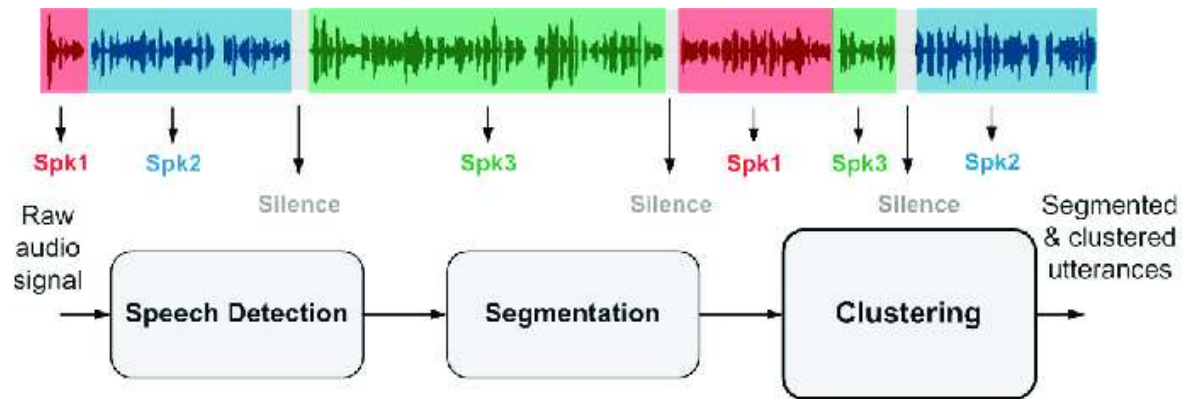


Figure 2. 9: Speaker Diarization Process

Speaker diarization is a transformative audio processing feature that identifies and distinguishes between speakers in a recording, enabling the separation of speech into segments attributed to individual speakers. This process involves audio segmentation, speaker identification, clustering similar voice patterns, and precise timestamping of speech intervals by automatically labelling "who spoke when," diarization enhances transcription accuracy and facilitates linguistic analysis, particularly for understanding conversational dynamics, accents, and speech patterns in underrepresented languages. Beyond transcription, this feature adds immense value across various domains, such as education, media, and customer service, by making audio data actionable, accessible, and easier to interpret. Integrating speaker diarization empowers users with structured insights into dialogues and real-time conversational data, elevating the functionality of any system. Without this feature in *Kalaka*, users may struggle to discern which speaker is talking at any given time.

2.3 Review on Similar Existing System

This review aims to analyze three language repository websites similar to *Kalaka*, focusing on identifying effective features and functions to integrate into *Kalaka*. The websites selected for discussion in this chapter are Endangered Languages Project, UNESCO World Atlas of Languages and Ethnologue.

2.3.1 Language Repository System

2.3.1.1 Endangered Languages Project



Figure 2. 10: Endangered Language Project website

The Endangered Languages Project (ELP) was launched in 2012 as a collaborative effort to document and preserve the world's endangered languages. It was initially developed by Google, in collaboration with the University of Hawai'i at Mānoa and Eastern Michigan University, through the Alliance for Linguistic Diversity. The project's creation was driven by concerns over the rapid disappearance of languages globally, with estimates that nearly half of the world's languages may vanish by the end of the century if not actively preserved.

ELP was designed as an online platform to bring together a global community of linguists, researchers, native speakers, and cultural activists to contribute data, resources, and multimedia content. The goal was to create a living, interactive archive that would not only document endangered languages but also raise awareness and provide tools for revitalization efforts. Through the platform, communities can share language data, connect with experts, and access resources for language maintenance and revitalization.

Today, ELP hosts information on thousands of endangered languages, including their classification, speaker population, and endangerment status. It also serves as a repository for video recordings, audio clips, and other cultural resources, making it a valuable tool for both researchers and language communities around the world.

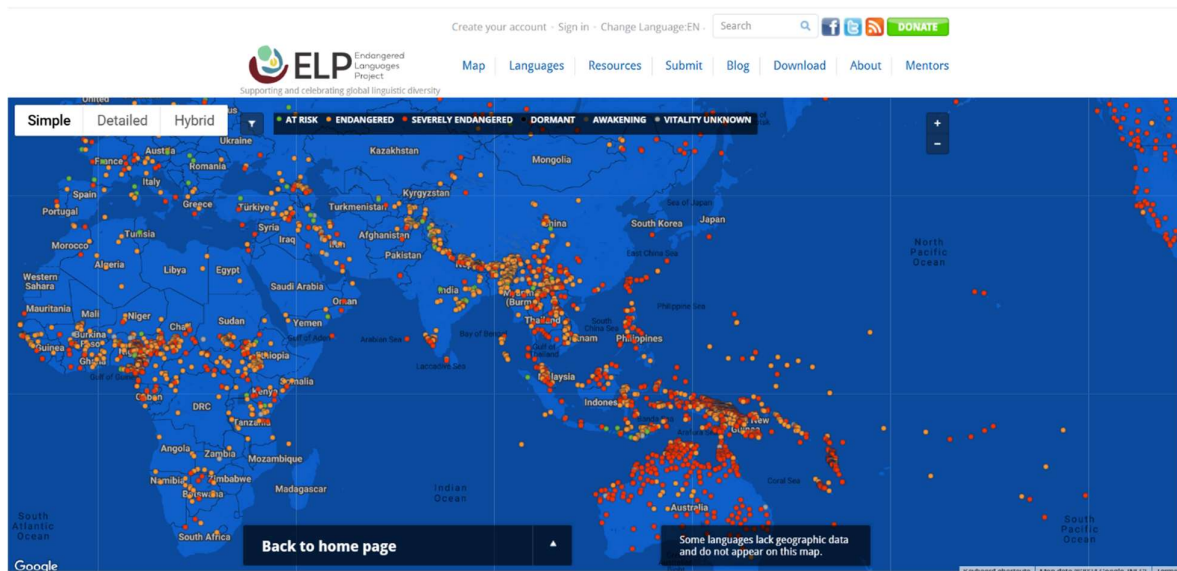


Figure 2. 11: Map in ELP website

ELP uses a color-coded interactive map that allows users to locate endangered languages by region. Each language is marked according to its level of endangerment, with distinct colors representing different stages: *At Risk* (green), *Endangered* (orange), *Severely Endangered* (black), *Dormant* (black), *Awakening* (grey), and *Vitality Unknown* (light grey). This visual, location-based feature improves accessibility and helps users quickly identify language information by geography, making it easier to understand the preservation urgency at a glance.

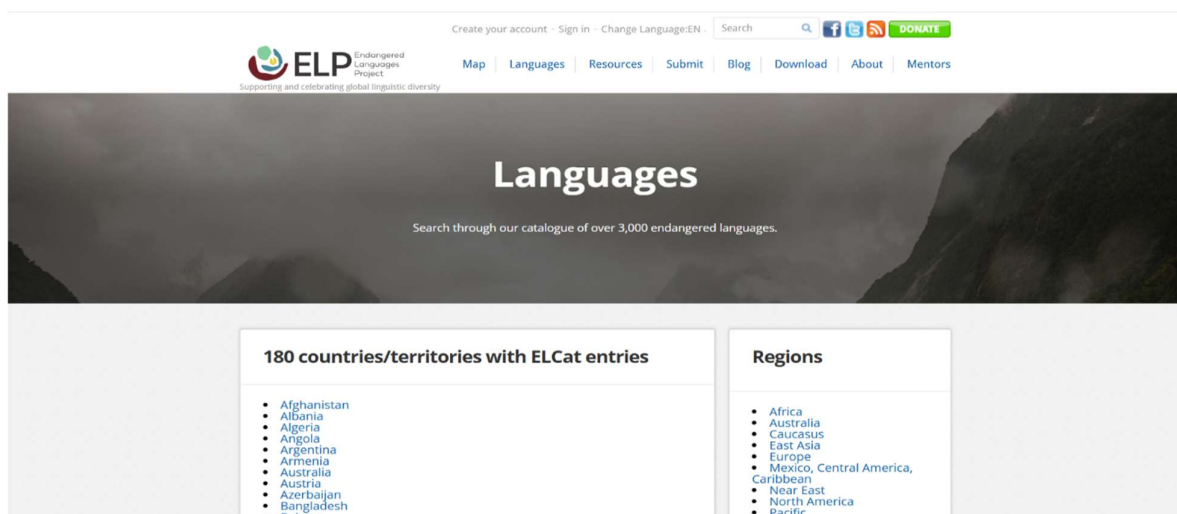


Figure 2. 12: Languages Page

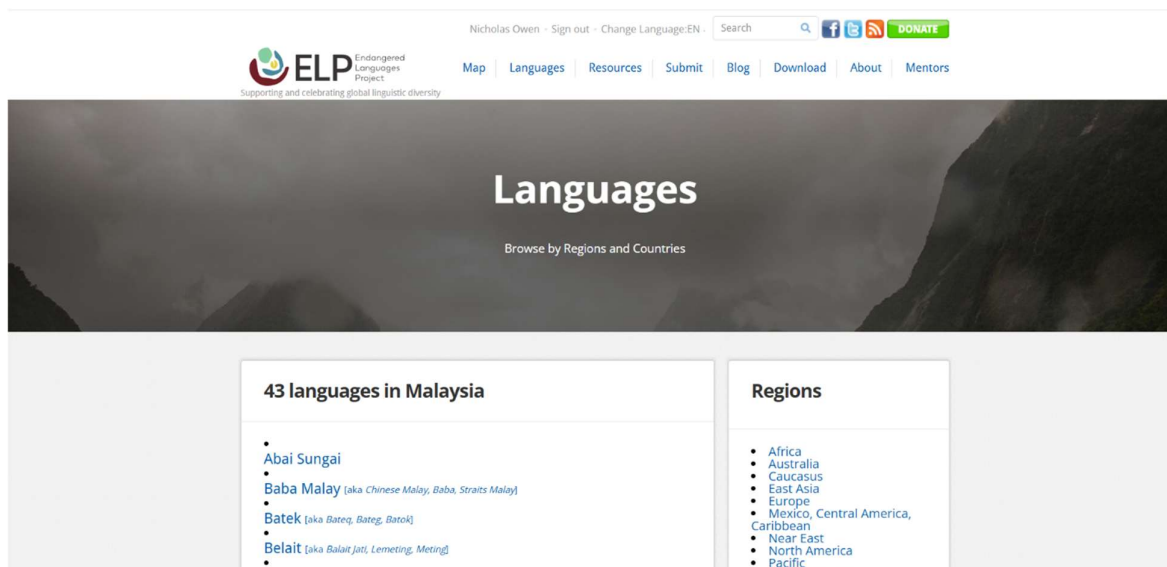


Figure 2. 13: All language in Malaysia

On this page, languages are categorized by country, allowing users to explore endangered languages based on their geographic locations. This layout provides an accessible way for visitors to identify and learn about at-risk languages within specific regions and countries. Each language profile includes details such as the language's current status, level of endangerment, and any relevant cultural or sociolinguistic information.

2.3.1.2 UNESCO World Atlas of Languages

The UNESCO World Atlas of Languages (WAL) is an online resource that documents the world's languages, aiming to promote linguistic diversity and support the preservation of endangered languages. Established in the context of UNESCO's commitment to cultural and linguistic diversity, WAL provides a database of over 8,000 languages, with around 7,000 still in use. It offers a detailed map interface where users can explore languages by geographical region, status, and other sociocultural and socio-political factors, making it an essential tool for both researchers and the public interested in language vitality and preservation.

The Atlas aligns with UNESCO's initiatives, such as the International Decade of Indigenous Languages (2022–2032), highlighting the urgency of preserving indigenous languages and the cultural heritage they represent. This platform also offers insights into languages' statuses, such as endangered or critically endangered, thus serving as a valuable

resource for policymakers, educators, and communities working toward safeguarding linguistic diversity.

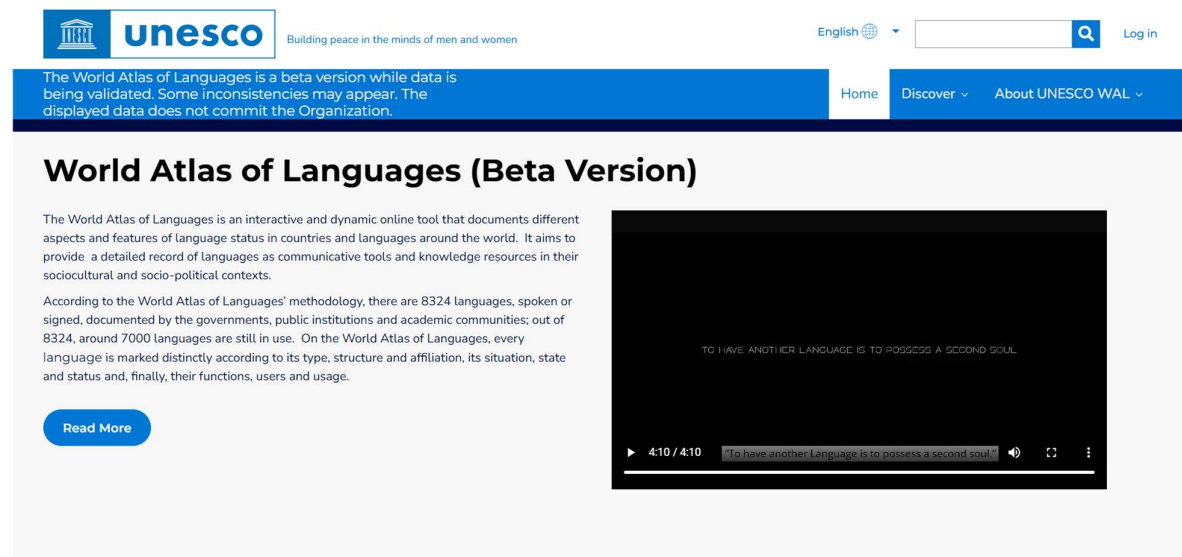


Figure 2. 14: UNESCO World of Atlas Home Page

In Figure 2.14, the UNESCO World Atlas of Languages (WAL) homepage is designed to be simple yet highly informative. The page features a central video that provides an engaging introduction, complemented by a concise "About Us" section to the left of the video, summarizing their mission and objectives. This design ensures that users immediately understand the website's purpose and goals without being overwhelmed by heavy data or complex visualizations. The clear layout and focus on introducing the platform make it an ideal example of how a homepage should prioritize accessibility and user orientation, effectively setting the stage for deeper exploration.

2.3.1.3 Ethnologue

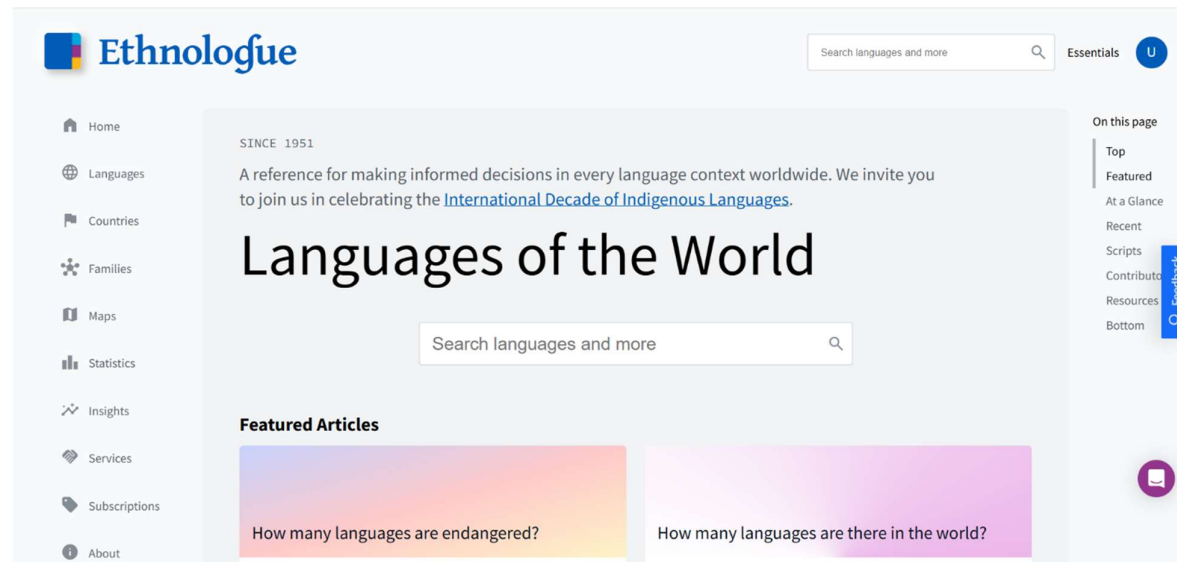


Figure 2. 15: Ethnologue Home Page

Ethnologue is a comprehensive reference work that documents the world's languages. It was established in 1951 by SIL International, an organization dedicated to linguistic research and promoting literacy, particularly among minority languages. Initially, Ethnologue was a printed catalog, but it has since transitioned into an extensive online resource. It documents over 7,000 living languages, providing data such as speaker populations, geographic distributions, and levels of endangerment. Ethnologue also assigns ISO 639-3 codes to languages for standardized identification.

The database is updated regularly, incorporating new research, reclassifications, and language discoveries. It uses tools like the Expanded Graded Intergenerational Disruption Scale (EGIDS) to assess language vitality and features innovative visualizations like the "language cloud" to represent the status of various languages.

Ethnologue plays a critical role in education, advocacy, and research by highlighting the diversity of human languages, many of which are endangered. It serves academics, NGOs, governments, and curious individuals as a trusted source of linguistic insights.

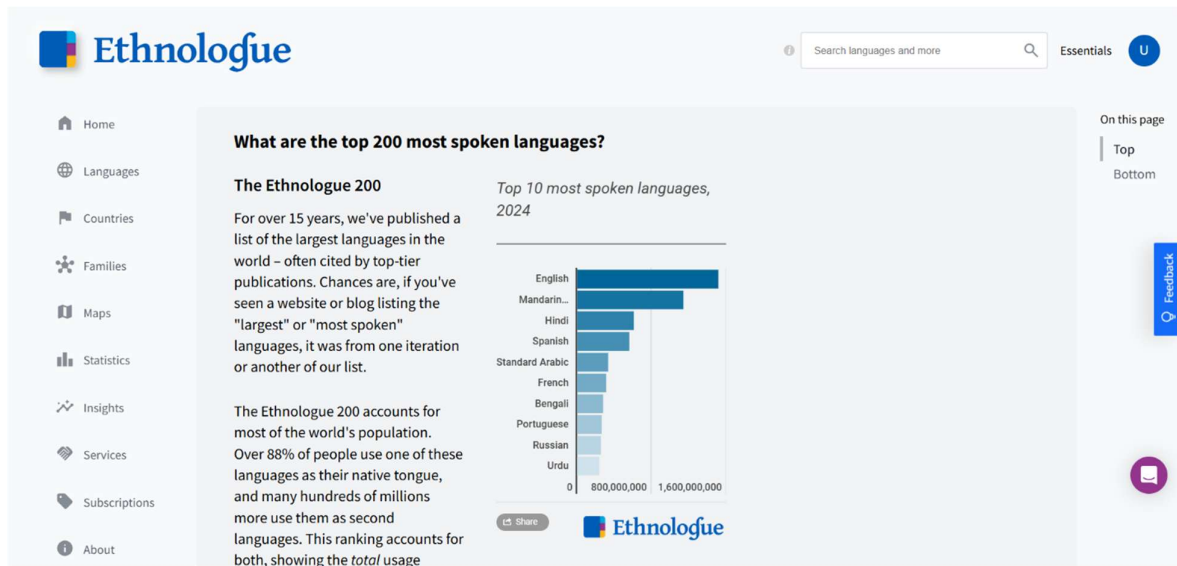


Figure 2. 16: Bar Graph in Ethnologue



Figure 2. 17: Pie Chart in Ethnologue

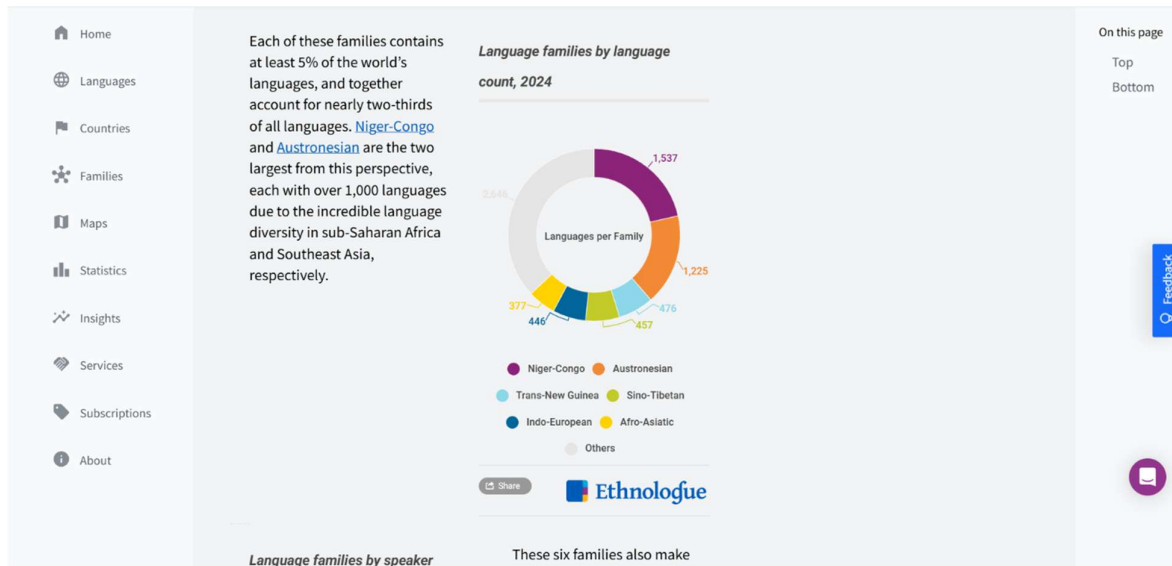


Figure 2. 18: Donut Chart in Ethnologue

The Insights page in Ethnologue leverages various graphs and charts to represent data, making it easily digestible for users. For example, as illustrated in Figure 2.16, Ethnologue employs a well-organized bar graph where the names of languages are displayed horizontally along the y-axis. This layout is clean and uncluttered and facilitates straightforward analysis from the top to the bottom of the graph.

Additionally, the x-axis features appropriately scaled numerical indicators to show the number of speakers for each language. Instead of overwhelming users with densely packed numbers and gridlines, Ethnologue uses large-scale markers and subtle guidelines, providing visual clarity. This approach ensures users can interpret the data effortlessly without excessive focus or strain.

Figures 2.17 and 2.18 showcase pie and donut charts that effectively utilize distinct colours to represent regions and language families, facilitating easy identification of data groups. These charts also include percentage values linked to their respective sections via clear lines, ensuring users can quickly interpret the proportional representation of each group. The design features uncluttered visuals and well-placed labels, making these charts highly user-friendly.

The combination of neat axis labelling, visually distinct scale markers, and different type of colour exemplify Ethnologue's commitment to user-centric data presentation. This

thoughtful design enhances accessibility and engagement for a diverse audience, aiding researchers, linguists, and the general public in analyzing linguistic statistics effectively.

2.3.2 Review On Existing Website

This review evaluates three existing websites, Word Coach, Gladia, and eLEAP, to derive insights and inspiration for improving the Kalaka system. The focus lies on analyzing their features, functionalities, and user interfaces to identify elements that could enhance Kalaka's design and usability. By examining these platforms, this study aims to pinpoint effective practices that can be adapted and integrated into Kalaka to create a more engaging and efficient user experience.

2.3.2.1 Word Coach

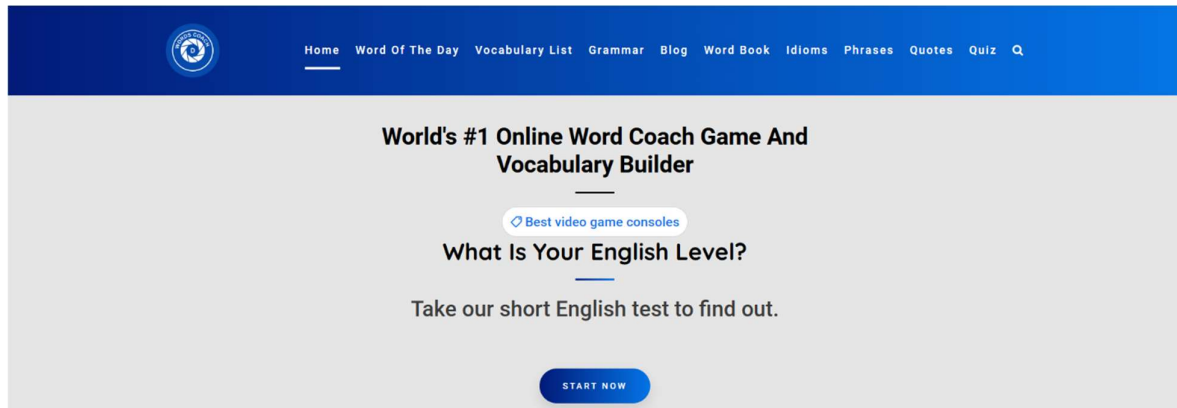


Figure 2. 19: Word Coach website

The Word Coach concept is rooted in Google's efforts to make language learning and vocabulary building accessible and engaging. Initially introduced as a feature within Google Search, Word Coach is an interactive tool designed to help users expand their English vocabulary. It appears prominently in search results when users query language-related terms or topics, and it operates as a gamified quiz, offering questions about word meanings, synonyms, and antonyms.

This tool mainly aims at non-native English speakers and learners interested in improving their language skills in an interactive and casual way. By incorporating features like scoring and feedback, Word Coach makes learning new words more engaging and fun. Over time, Google has refined its algorithms to ensure the tool provides contextually relevant questions, which are helpful for practical learning. The development of such tools aligns with Google's broader mission to make information universally accessible and helpful, especially for educational purposes.

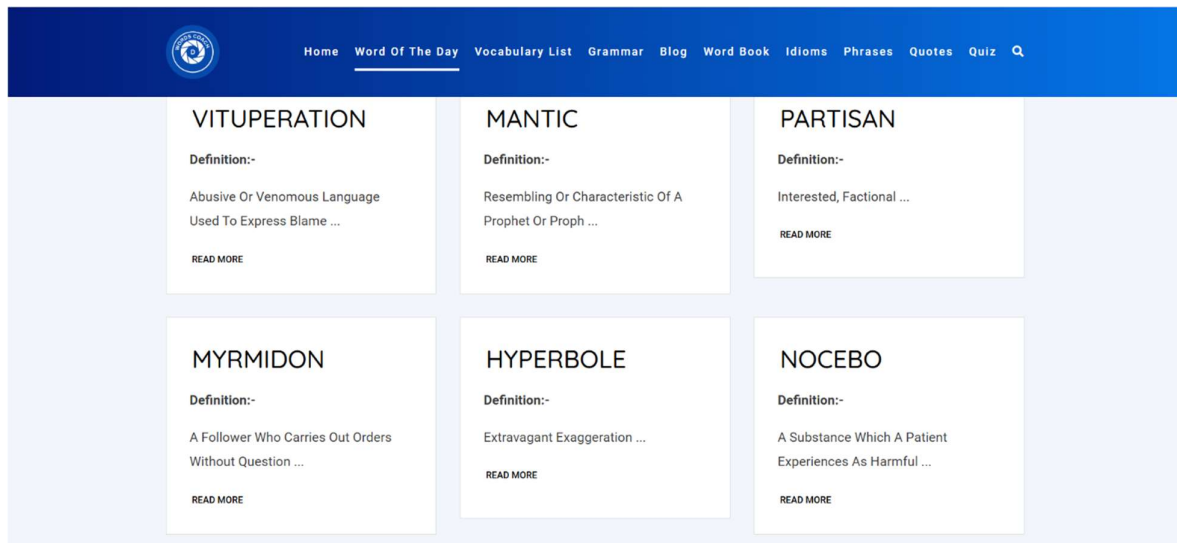


Figure 2. 20: Word of the Day in Word Coach

In Word Coach, there is a feature called *Word of the Day*, as illustrated in Figure 2.20. This page selects ten random words daily, accompanied by their meanings, to help users expand their vocabulary. The primary aim of this feature is to encourage consistent learning by presenting manageable daily word challenges.

It benefits users by providing an engaging way for them to learn new words regularly and enrich their vocabulary. Plus, it also fosters a language learning habit by introducing various words and meanings. Exposure to new words can significantly improve linguistic skills, comprehension, and communication. By promoting consistent interaction, the *Word of the Day* feature also helps maintain user engagement with the platform, ensuring continued educational value over time.

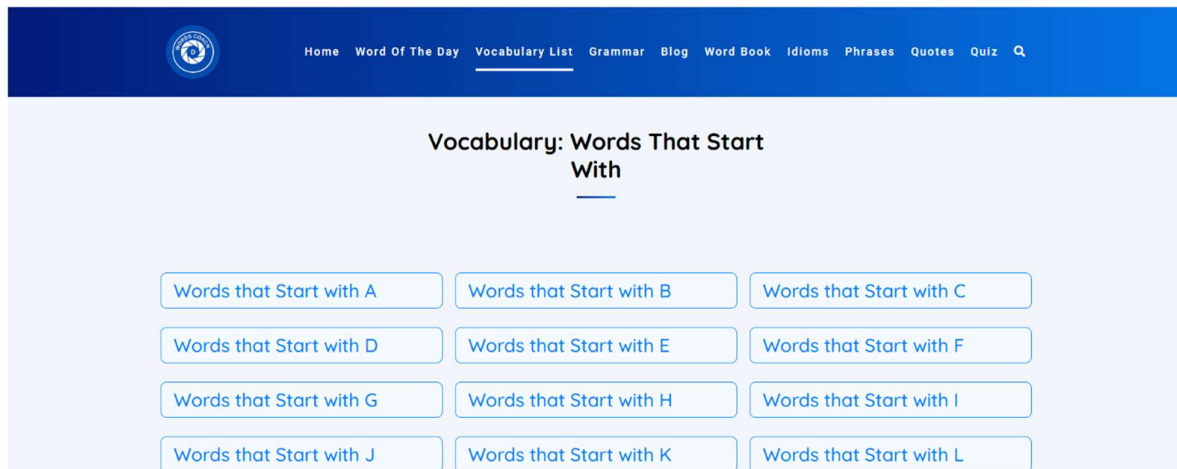


Figure 2. 21: Vocabulary List in Word Coach

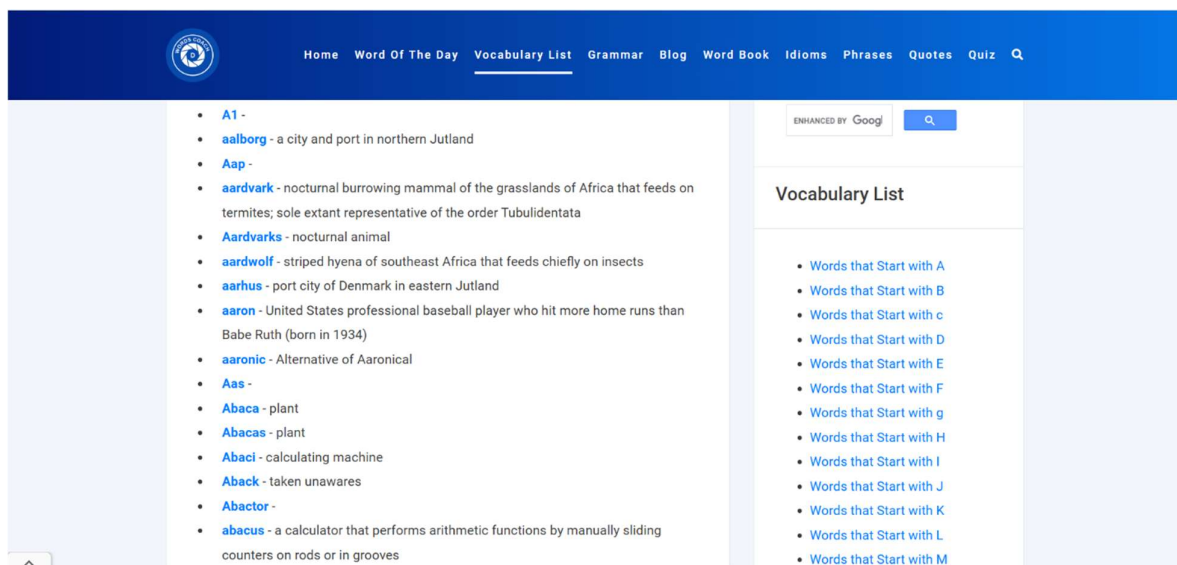


Figure 2. 22: Vocabulary List that start with A in Word Coach

Figure 2.11 & 2.12 showcases the *Vocabulary List* page in Word Coach, which presents an extensive collection of words and their meanings for users seeking to enhance their vocabulary. This page is organized alphabetically, with entries spanning from A to Z, ensuring a comprehensive resource for learners at various proficiency levels.

The *Vocabulary List* is a valuable supplement to the *Word of the Day* feature. This page provides a robust tool for independent learning for users who wish to explore beyond the daily selection or delve into specific words. By offering access to a broader range of vocabulary, it

supports users in discovering unfamiliar words at their own pace, catering to their curiosity and desire for more in-depth language exploration.

Furthermore, the alphabetical structure ensures easy navigation, enabling users to locate words of interest quickly. This feature is particularly beneficial for individuals preparing for language tests, writers looking to expand their lexicon, or anyone aiming to improve their communication skills. Incorporating examples of word usage, synonyms, or pronunciation guides within the list could enhance its utility, making it an even more effective learning resource.

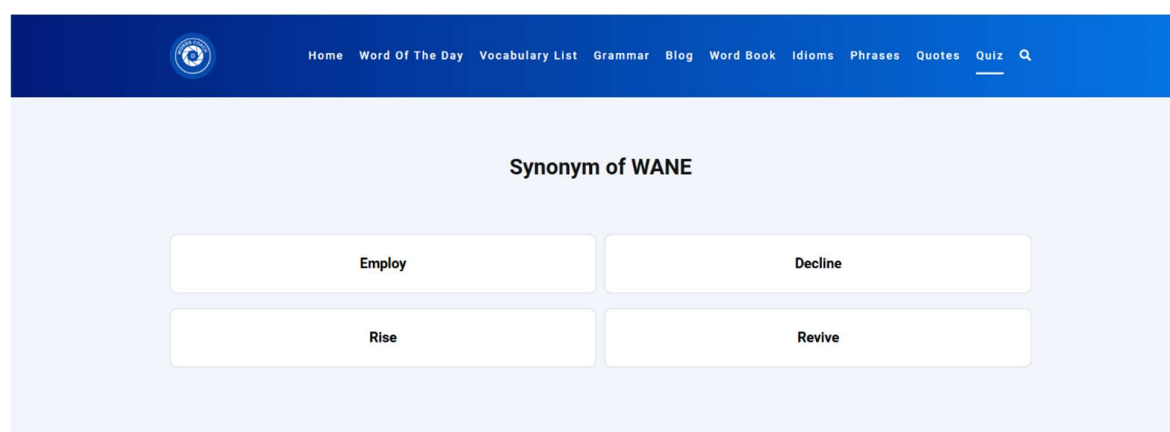


Figure 2. 23: Quiz page in Word Coach

The *Quiz* page in Word Coach, as illustrated in Figure 2.13, features an engaging and interactive word quiz designed to test users' knowledge of synonyms, antonyms, and other word relationships. This page provides a dynamic and enjoyable way for users to challenge themselves, making vocabulary learning an active and rewarding experience.

One of the key attractions of this feature is its competitive element. At the end of the quiz, users receive a score based on the number of correct answers, encouraging them to improve their performance with each attempt. This gamified approach motivates users to retry the quiz until they achieve a perfect score, transforming learning into a fun and persistent endeavour.

Moreover, the quiz not only promotes competition but also fosters knowledge acquisition. As users repeatedly engage with the quiz, they become exposed to new words and

concepts, enhancing their vocabulary and language skills. By providing immediate feedback on correct and incorrect answers, the page also aids in reinforcing memory and understanding.

2.3.2.2 Gladia

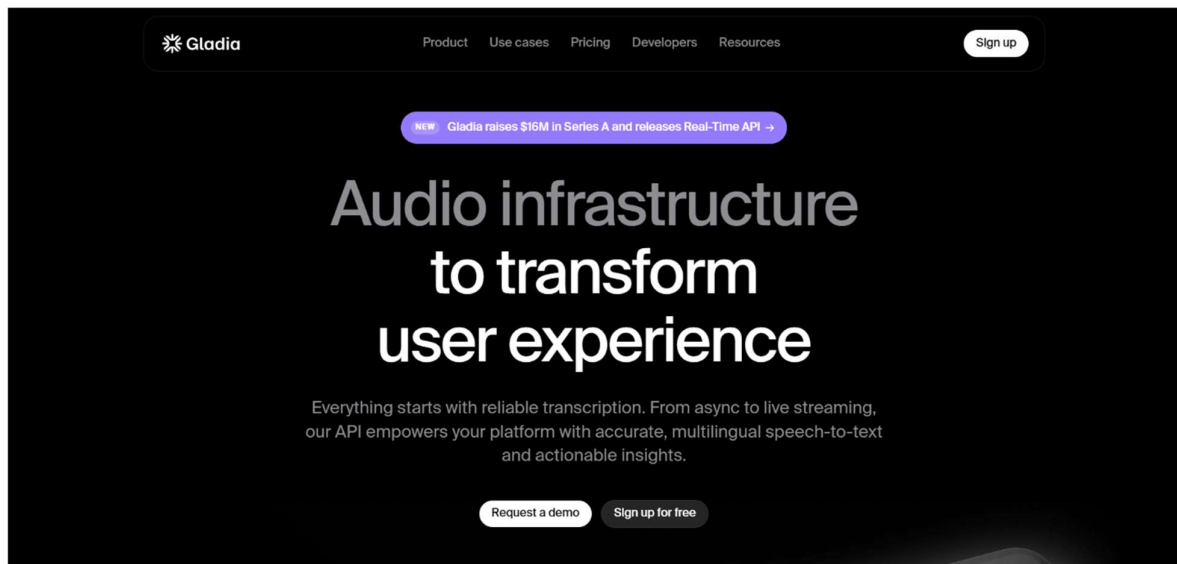


Figure 2. 24: Gladia website

Gladia is an AI-driven platform specializing in advanced audio transcription and analysis. Founded in 2022 by Jean-Louis Quéguiner, it addresses a critical transcription-service gap by offering robust multilingual support and exceptional accuracy. It features speaker diarization and real-time processing. Quéguiner's vision for Gladia stemmed from his frustration with existing tools that struggled to handle multilingual conversations and accents, particularly his French accent.

Gladia's services are platform-agnostic, enabling businesses to integrate audio intelligence seamlessly into their systems. It supports various use cases, from customer support automation to sales call analysis. The company's commitment to overcoming language and technology barriers makes it a standout solution in the voice AI space.

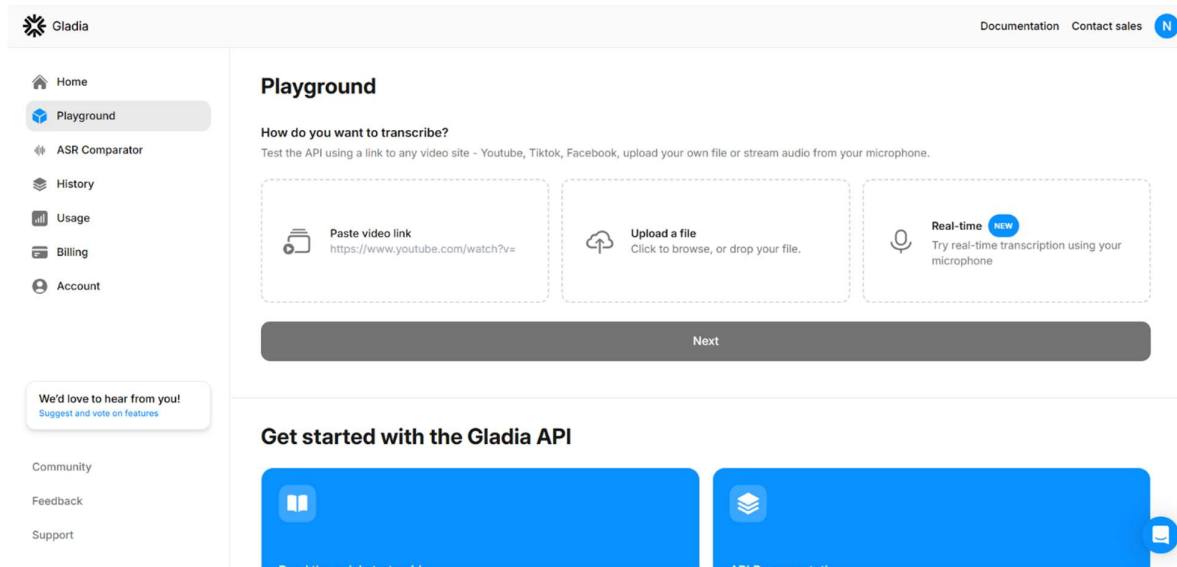


Figure 2. 25: Gladia playground page

The Gladia playground page offers a versatile transcription feature that caters to different user needs by allowing them to paste a video link, upload a file, or perform real-time transcription. These features are critical for accommodating various use cases. The "Paste Video Link" option is particularly helpful for handling large video files, as it avoids the lengthy upload process, ensuring efficiency. The "Upload File" feature is ideal for smaller audio or video files, offering flexibility for users working with localized or specific content. The "Real-Time Transcription" functionality, a newer addition, is a standout feature, especially beneficial for live scenarios such as meetings or discussions involving diverse accents. This innovative tool enhances accessibility and ensures smoother communication, making it a valuable asset for users in professional and personal contexts.

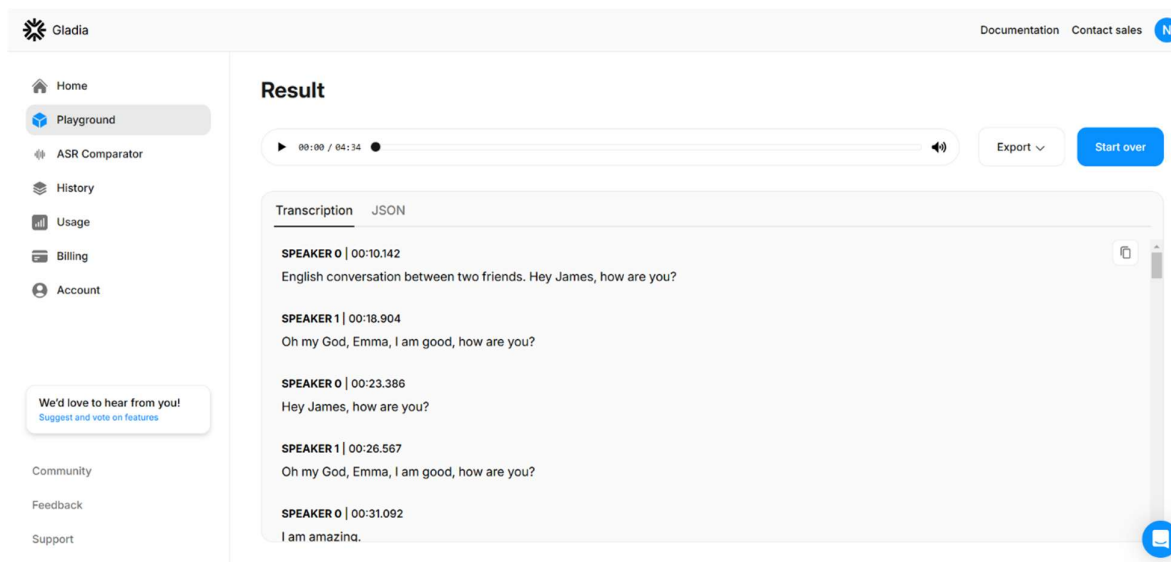


Figure 2. 26: Result of Transcription using Gladia

Figure 2.26 illustrates the transcription results, showcasing an impressively fast and efficient process. The transcription system delivers highly accurate results, successfully capturing speech with precision, including speaker identification and corresponding timestamps. The timestamp feature is particularly beneficial, as it organizes the transcription into manageable segments, making it easier for users to locate specific audio parts. Speaker identification further adds to the system's usability, especially for scenarios involving multiple speakers, such as interviews, meetings, or group discussions.

2.3.2.3 e-Learning Enrichment and Advancement Platform (eLEAP)

The e-Learning Enrichment and Advancement Platform (eLEAP) at Universiti Malaysia Sarawak (UNIMAS) is a robust system designed to support online teaching and learning activities. Launched as a response to the growing need for digital education tools, eLEAP is integral to UNIMAS's commitment to Outcome-Based Education (OBE). The platform facilitates virtual learning and assessment processes, particularly useful during the Movement Control Order (MCO) period in Malaysia when in-person education was restricted. It integrates tools for managing courses, delivering materials, and assessing program outcomes effectively.

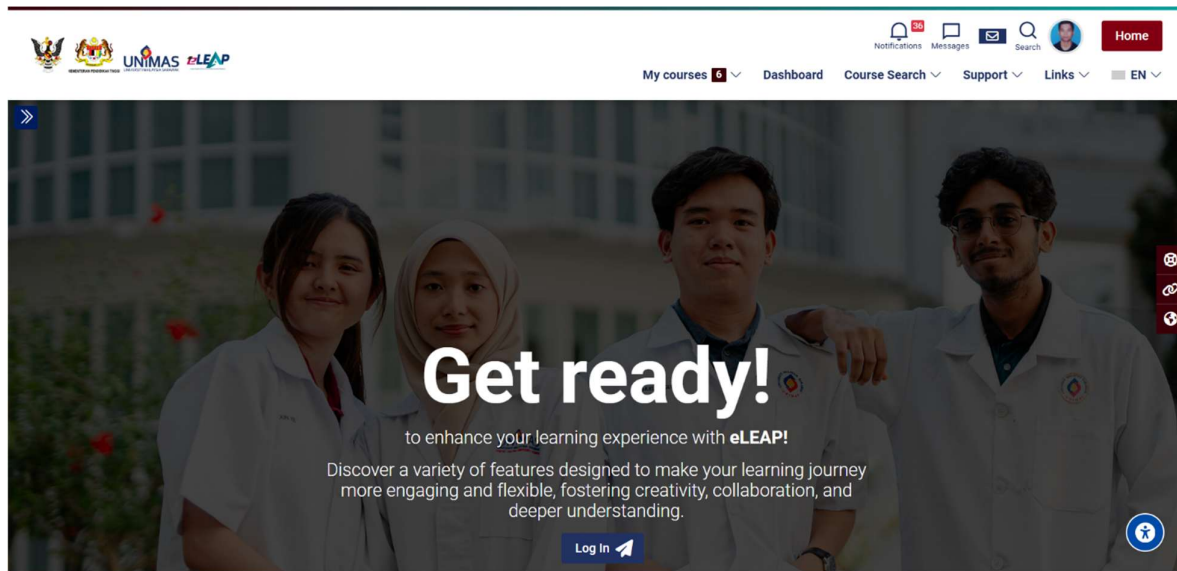


Figure 2. 27: eLEAP website

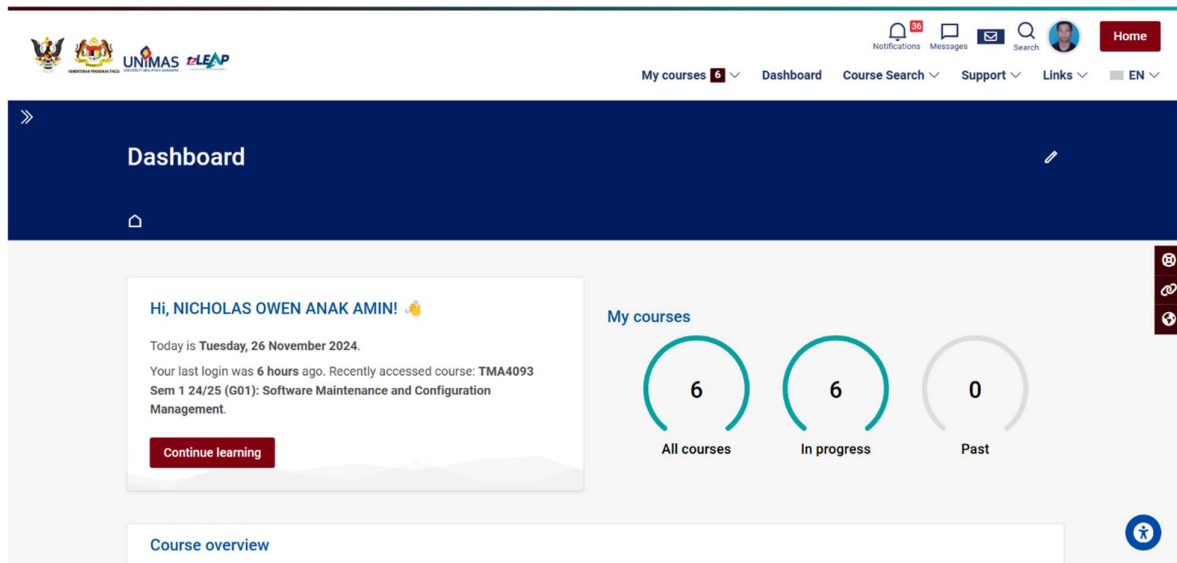


Figure 2. 28: eLEAP student dashboard

In Figure 2.27, the student dashboard is designed to create a welcoming and user-friendly experience by greeting users with a personalized "Hi" followed by their name. This friendly interaction fosters a sense of belonging and personalization, which enhances user engagement. The dashboard also includes a timestamp that records the user's login time, providing a clear activity record.

Furthermore, the activity log section of the dashboard is particularly noteworthy, as it details the various actions of the user, such as accessing specific courses. This feature benefits

students and administrators, offering transparency and an easy way to track student progress or activities. A well-organized user login activity section like this improves functionality and demonstrates a thoughtful approach to enhancing user experience and accountability.

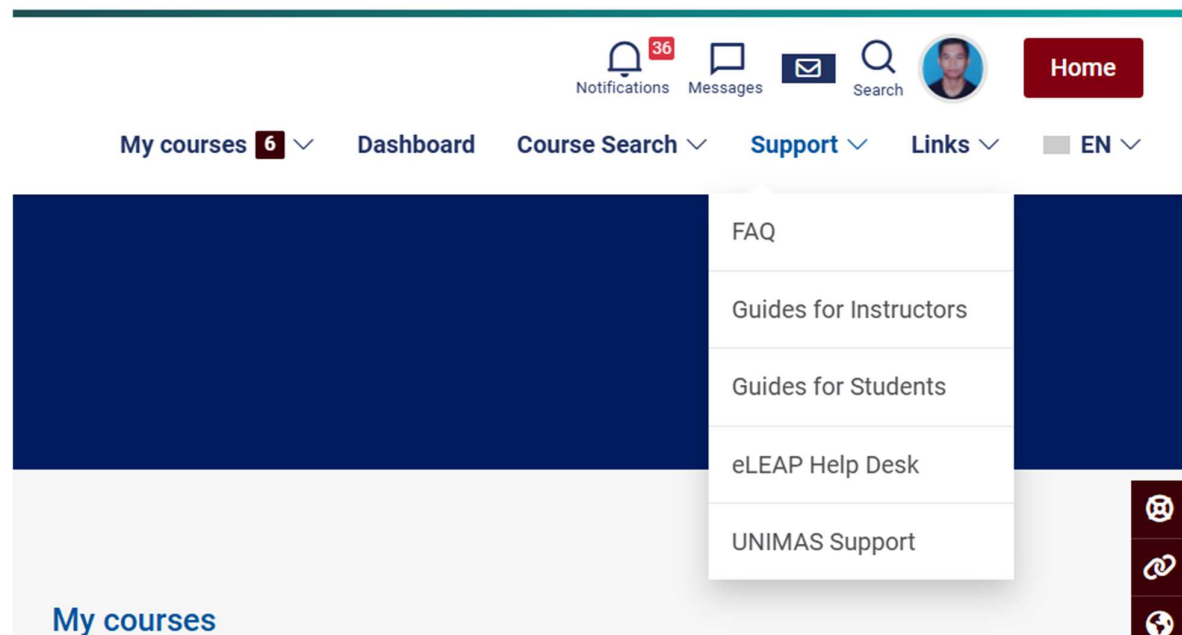


Figure 2. 29: Menu dropdown in eLEAP

Figure 2.29 showcases a clean and well-organized dropdown menu designed with user experience in mind. The menu sections are neatly categorized and arranged logically, ensuring users can easily navigate the options without feeling overwhelmed. Each category is clearly defined, which minimizes confusion and allows users to find relevant features or tools efficiently.

This thoughtful arrangement enhances visual appeal and functionality by aligning related options under intuitive headings. A well-structured dropdown like this is essential for maintaining an uncluttered interface, particularly in systems with numerous features, as it ensures that users can focus on their tasks without unnecessary distractions.

2.3.3 Comparison of All Reviewed Systems

Feature	Kalaka System	ELP	UNESCO WAL	Ethnologue	Word Coach	Gladia	eLeap
Introduction in Home Page	x	/	/	/	x	/	/
Google Map	/	/	x	/	x	x	x
Chart/Graph Statistic	/	x	x	/	x	x	x
Word of the Day	x	x	x	x	/	x	x
Vocabulary List	x	x	x	x	/	x	x
Quiz Page	x	x	x	x	/	x	x
Speaker Diarization	x	x	x	x	x	/	x
User Login Activities	/	x	x	x	x	x	/
Well Organized Menu	x	/	/	/	/	/	/

Table 2. 1: Comparison of Features Among All Language Systems

Several language systems approach user engagement differently in the home page introduction feature. The *Kalaka* System lacks a clear introductory section on the home page, which could confuse first-time users who are unfamiliar with its purpose. A more engaging and informative introduction could guide new users in interacting with the system. On the other hand, systems like ELP, UNESCO WAL, Ethnologue, and Gladia all include clear introductory elements, often with brief descriptions or videos that explain their purpose and functionality. These systems effectively set the stage for users to understand what the website offers before they dive into its features, enhancing the overall user experience. In comparison, the Word Coach system focuses more on functionality, such as quizzes and vocabulary learning, without providing a dedicated introduction, which may be more suited to returning users but could be less welcoming to newcomers.

For Google Map integration, both the ELP and Ethnologue systems stand out by incorporating maps that enable users to visualise language data geographically. These maps

provide a spatial representation of where languages are spoken, allowing users to efficiently understand the global distribution of languages. This geographical approach helps visualise the extent of a language's usage across different regions. In contrast, Word Coach and Gladia do not integrate Google Maps because their core functionalities do not require geographical data. Word Coach focuses primarily on vocabulary learning and does not need a map to enhance its features. Similarly, Gladia is centred around speech diarization and transcription services, focusing on processing and analysing audio rather than geographical representation of language data. Thus, including Google Maps is more relevant to systems like ELP and Ethnologue, which deal with language demographics and regional linguistic distribution.

Regarding statistics, Ethnologue excels over the *Kalaka* System by incorporating a variety of graphical representations such as bar graphs and pie charts to display language data. These visual elements effectively break down complex statistics, allowing users to compare languages or regions at a glance. Using graphs and charts, Ethnologue enhances user comprehension, offering a more user-friendly interface for data analysis. Systems like ELP, UNESCO WAL, Word Coach, and Gladia do not have this feature, as their core functions do not necessitate graphical representations. For example, ELP and UNESCO WAL focus more on language documentation and preservation, where interactive elements like maps and detailed language profiles are more important than statistical visualization. Similarly, Word Coach and Gladia are more focused on vocabulary learning and speech diarization, so charting language data is irrelevant to their primary objectives.

The Word of the Day, vocabulary list, and quiz page features in Word Coach are unique offerings that give users daily opportunities to expand their vocabulary. This combination of features helps to create a gamified experience that encourages users to return regularly, fostering a habit of language improvement. On the other hand, the *Kalaka* System does not currently feature a Word of the Day functionality, which could be a valuable addition to enhance its educational aspect. Introducing this feature could motivate users to visit the site daily, giving them a reason to engage more frequently. By integrating such a feature, *Kalaka* could boost its appeal for those interested in expanding their linguistic knowledge, much like Word Coach. However, platforms like ELP, UNESCO WAL, Ethnologue, and Gladia do not need such a feature, as their primary focus is not on vocabulary expansion. Thus, while Word Coach stands out in its use of gamification for vocabulary growth, other systems focus on different aspects of language learning or documentation, where daily word discovery is less critical.

Speaker diarization is an essential feature Gladia offers, providing automatic identification and timestamping of speakers within audio recordings. For linguistic research, this feature helps understand how individuals interact within a language or how various accents, tones, and speech nuances are used across diverse contexts. Capturing precise timestamps for each speaker enhances the accuracy and usability of transcription data, offering researchers and analysts a clearer view of verbal communication. However, other platforms such as ELP, UNESCO WAL, Ethnologue, and Word Coach do not require speaker diarization.

The reviewed systems, like eLEAP, Word Coach, Ethnologue, UNESCO WAL, and Gladia, demonstrate excellent implementation of user login activities and well-organised menus. *Kalaka* needs to improve in these aspects. Its lack of a detailed user login activity tracker limits the ability to monitor and audit user actions effectively. Additionally, *Kalaka's* menu structure appears cluttered and less intuitive, making navigation challenging compared to its counterparts.

In summary, each system has distinct strengths, catering to various user needs. The proposed system should incorporate the key features of the reviewed systems to create the most well-rounded user experience.

2.4 Review on Tools and Technology for Web Development

2.4.1 Front-end Development

Frontend development focuses on the client side of a website, dealing with the design, structure, and user interactions. It includes layout, colours, fonts, buttons, and navigation. Frameworks like Svelte are used in this project to build dynamic, responsive user interfaces that interact smoothly with backend services.

2.4.1.1 Svelte

The Kalaka system requires a frontend that can handle various tasks such as communicating with backend API services and processing data to the speaker diarization model. Therefore, a simple, efficient, and easy-to-manage frontend framework is needed to reduce development time and avoid unnecessary errors.

Svelte is chosen for this project because it offers a straightforward way of building user interfaces. Unlike frameworks such as React and Angular, which rely on more complex methods like using a virtual DOM, Svelte works differently (Cubet Techno Labs, 2023). It converts the code into optimized JavaScript when the project is built. As a result, the application runs faster because there is less work for the browser to do when displaying the content.

One of the main advantages of using Svelte is that it helps reduce the amount of code required to create a fully working interface. This makes the development process faster and reduces the chances of mistakes. Additionally, Svelte makes it easy to create interactive features because it uses a simple way to manage data and user interaction without the need for extra tools or libraries (Cubet Techno Labs, 2023).

Another important reason for using Svelte is its ability to produce small and efficient application files. This is helpful for users with devices that may not have strong performance, such as older computers or mobile phones. The smaller the application files, the faster they can load and run (Cubet Techno Labs, 2023).

Compared to other popular frameworks, Svelte is easier to learn and does not require advanced knowledge of complex programming concepts (Cubet Techno Labs, 2023). This allows new developers or small teams to use it effectively without spending too much time learning how it works. Although frameworks like React have a large community and Angular is known for its powerful features, both require more setup and a longer learning process.

Framework	Maintained By	Learning Difficulty	Performance	File Size	Data Handling	Suitable For
React	Facebook	Medium	Good (uses virtual DOM)	Medium	Needs extra tools	Web and mobile user interfaces
Angular	Google	Hard	Good (but heavier)	Large	Built-in features	Large and complex applications
Svelte	Open Source Community	Easy	Very good (no virtual DOM)	Small	Built-in features	Fast and simple web applications

Table 2. 2: Comparison of Popular Frontend Frameworks

Overall, Svelte provides a good balance of simplicity, performance, and ease of use, making it a suitable choice for the Kalaka project. Furthermore, any errors or issues that arise during development can be addressed more efficiently due to the advantages offered by Svelte, such as its simplified syntax and reactive features. Its lightweight structure and fast development process align well with the Prototyping Model methodology applied in this project, where rapid iterations and continuous improvements are required.

2.4.2 Software Development Tool

This section provides a detailed overview of the tools that will be used to develop the proposed system. Common examples of such tools include source code editors and compilers. For the proposed system, Visual Studio Code (VSCode) will be utilized as the primary source code editor, offering an efficient and versatile platform for the development process.

2.4.2.1 Visual Studio Code

Visual Studio Code (VSCode) is a free, streamlined code editor designed to provide essential tools for a fast code-build-debug cycle. It offers key features for debugging, task management, and version control, allowing developers to focus on coding efficiently. While VSCode covers fundamental development needs, more complex workflows can be handled by fully featured IDEs like Visual Studio. Key features include workspace management for organizing project directories, a wide array of extensions to enhance programming, and collaboration tools like Live Share and GitHub integration. Additionally, VSCode supports syntax highlighting and customizable color themes for an improved coding experience. It is freely available for download on its official website.

2.5 The Proposed System

To develop the proposed system, the key features discussed during the comparison of existing systems will serve as a fundamental reference for designing the functionalities in the new platform. These features, such as enhanced data visualization, interactive elements like vocabulary lists, quizzes, and speaker diarization, will be integrated into the system to ensure that it meets the diverse needs of users.

2.5.1 Home Page Layout

The *Kalaka* System would benefit from incorporating a clear introductory section on its home page to provide users with a better understanding of the platform's purpose and functionalities. This introductory content should highlight the critical features of *Kalaka*, making it easier for new users to navigate the system and access the tools they need.

2.5.2 Map

The system should improve its map functionality by providing more detailed geographical data and interactive features, enhancing the user's ability to visualize language data and make more informed decisions.

2.5.3 Data Visualization

Another area for improvement is *Kalaka*'s data visualization capabilities. Implementing better statistics graphs and charts will allow users to interpret and analyze data more effectively. By offering a range of visual representations such as bar charts, pie charts, or line graphs, *Kalaka* can provide a more transparent and more accessible overview of data.

2.5.4 Language Learning Page

Lastly, *Kalaka* should consider adding a Word of the Day, vocabulary list, and quiz page to promote daily engagement and support language learning. These features, seen in other systems like Word Coach, encourage continuous learning and can help users build their vocabulary over time. Integrating these interactive elements will make *Kalaka* a more dynamic and educational platform.

2.5.5 Speaker Diarization

For the *Kalaka* system, integrating speaker diarization would be a crucial feature. Since *Kalaka* involves language documentation and speech capture for educational and analytical purposes, automatically distinguishing and timestamping different speakers enhances its functionality. It would allow users to more effectively manage and analyze speech data, particularly in environments with multiple speakers, making it a valuable addition for research and educational purposes. The inclusion of speaker diarization would enable *Kalaka* to offer more comprehensive and user-friendly tools for those working with spoken language data.

To solve the problem of limited speaker diarization tools for less commonly used languages, the *Kalaka* system uses a method from Rahim et al. (2023) that combines automatic labeling with further model training. This method uses x-vector models in the PyAnnote.audio toolkit. These models are based on Time Delay Neural Networks (TDNN), which help to create short speaker features (x-vectors) from audio. These features are then grouped to figure out who is speaking and when. The process starts by testing a pre-trained x-vector model on a manually labeled Sarawak Malay dataset (1 hour and 26 minutes), giving a diarization error rate (DER) of 15.03%. Then, around 13 hours of unlabeled audio from the *Kalaka* website is processed

using the same model to create pseudo-labels (automatic speaker tags). These labeled files are used to train the model step by step, using 20%, 40%, 60%, 80%, and 100% of the data. As more data is used, the accuracy improves, and the best result is a DER of 13.59% using all the training data. This method is useful because it doesn't need a lot of manual labeling, which saves time and cost. PyAnnote also includes useful tools like voice activity detection, overlapping speech detection, and speaker change detection to improve results. The study also shows that the system works well for both male and female voices. Since x-vectors are strong in recognizing speakers even in noisy or real conversation settings, this method is a good fit for the Sarawak Malay language. Overall, this approach is practical and effective for low-resource languages and can be used in language preservation systems like Kalaka. It also opens the door for future improvements using semi-supervised learning and training models for different speaking environments.

2.5.6 Admin Dashboard

Tracking user actions, such as adding new speeches, registering new speakers, or editing existing speech data and profiles in admin page, is crucial. This feature would help identify the source of any data corruption or irregularities caused by user activity, ensuring better accountability and system integrity.

2.6 Summary

Chapter 2 provides an in-depth analysis of three similar and existing systems, evaluating their features and functions to inform the proposed system's development. A comparison table consolidates this evaluation's critical findings, highlighting each platform's strengths and weaknesses. Additionally, the chapter offers a brief overview of the web development tools reviewed, outlining the technologies and frameworks that will be used in the proposed system's development. The chapter also details the proposed system's new features, user interface design, and the integration of data drawn from the review process. In conclusion, the proposed system will be an enhanced version of the original, offering improved data management, additional features, and a more streamlined user experience, thus addressing the current system's limitations.

CHAPTER 3: REQUIREMENT ANALYSIS & DESIGN

3.1 Introduction

Chapter 3 outlines the methodology that will guide the development of the proposed system. The Prototyping Model methodology has been selected to identify system requirements and structure the design process for the proposed system.

3.2 Summary of Methodology

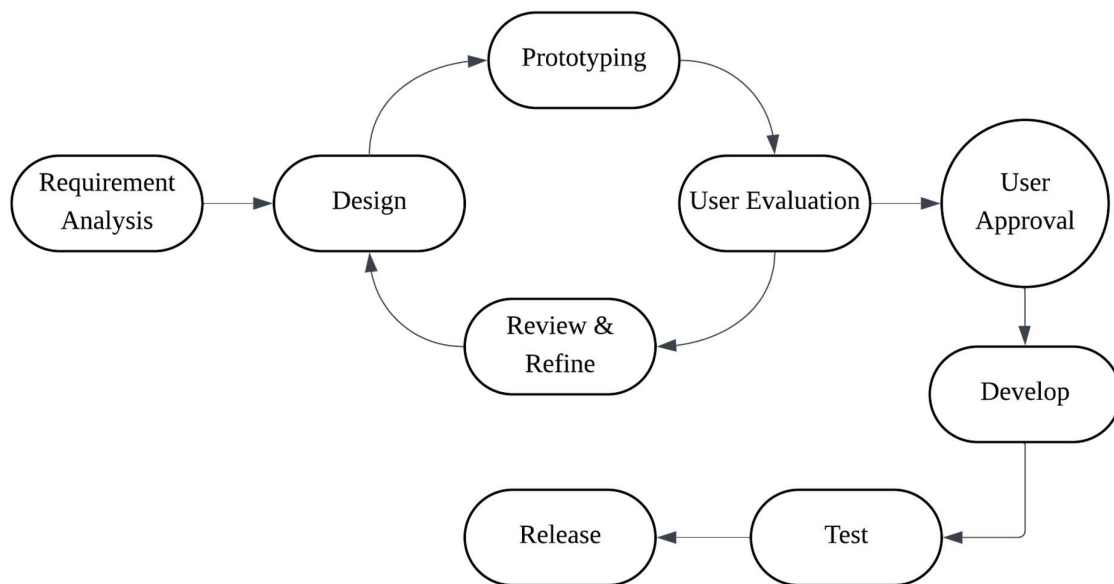


Figure 3. 1: Prototyping Model

Based on Figure 3.1, the Prototyping Model is a software engineering methodology that outlines the stages of the software development process. This model consists of six main phases: Requirements, Design, Prototyping, User Evaluation, Review and Refine, and Development. The Requirements and Design phases will be briefly covered in this section, with the Requirements phase detailing the proposed system's needs and the Design phase outlining the system's architecture, including its logical structure. The remaining phases will be discussed in Chapters 4 and 5. Table 3.1 below provides a summary of each phase in the Prototyping Model.

Phase	Technique	Tool
Requirements	System Requirement Planning • Documentation System Requirement Analysis • Functional Requirement • Non-Functional Requirement • Software Requirement	• Microsoft Word 2016 • <i>Kalaka</i> System
Design	System Design: • UML Activity Diagram • Data Flow Diagram Database Design: • Entity Relationship Diagram Graphical User Interface (GUI) • Wireframing	• Lucidchart • Figma
Prototyping	• Front-End Prototype	• Visual Studio Code • Svelte
User Evaluation	• Users' Review	• Google Form • <i>Kalaka</i> System
Review and Refine	• Supervisor's Review	• Google Form • <i>Kalaka</i> System
Develop	• Front-End Development • Software Development Tool	• Visual Studio Code • Svelte
Test	• Developer Testing • User Testing	• Developer and User Acceptance Test Case
Release	• Upload the revamp <i>Kalaka</i> system to the web hosting	• Web Hosting • <i>Kalaka</i> Database

Table 3. 1: Summary of Prototyping Model Methodology

3.3 System Requirements

The initial phase in developing the proposed system involves planning and analyzing its requirements, which is a foundation for the subsequent Design Phase.

3.3.1 System Requirement Planning

This section outlines the proposed system's problem statements, objectives, and scope. It also includes preparing a System Requirement Planning document, which will guide the subsequent System Requirement Analysis.

3.3.2 System Requirement Analysis

The second phase analyses the identified requirements and new features to be incorporated, as discussed in the previous chapter. This includes defining the functional requirements, non-functional requirements, and software requirements. The outcome of this analysis will directly influence the design of the proposed system.

3.3.2.1 Functional Requirement

1. Implementing Speaker Diarization for speech transcription.
2. Adding a page for Word of the Day, Quiz and Glossary for every language.
3. Redesigning and modernizing Kalaka's frontend using Svelte.

3.3.2.2 Non-Functional Requirement

1. The system should provide a responsive and smooth user experience, even during peak usage.
2. The application must accommodate growing data and user demands without affecting performance.
3. The system must safeguard user data against unauthorized access, breaches, and other vulnerabilities.

4. The interface should be intuitive and easy for users of all experience levels.
5. The system should function without unexpected interruptions and recover quickly from failures.
6. The application must work consistently across various browsers, operating systems, and devices.
7. The system should be designed for easy updates, bug fixes, and feature enhancements.
8. The system must ensure the accuracy and consistency of stored and processed data.
9. The architecture should allow components to be reused or modified independently.

3.3.2.3 Software Requirement

Software Requirement	Description
Visual Studio Code	Visual Studio Code is a free, lightweight code editor that offers tools for debugging, task management, and version control. It includes features like project directory organization, a wide range of extensions to simplify programming, and collaboration tools such as Live Share and GitHub integration.
MySQL	MySQL is a fully managed database service designed for deploying cloud-native applications. It enables the implementation of relational databases on a computer's storage system, manages user access, supports network connectivity, and provides tools for testing database integrity and creating backups.

Table 3. 2: Summary of software requirement

3.5 System Design

3.5.1 UML Activity Diagram & Use Case

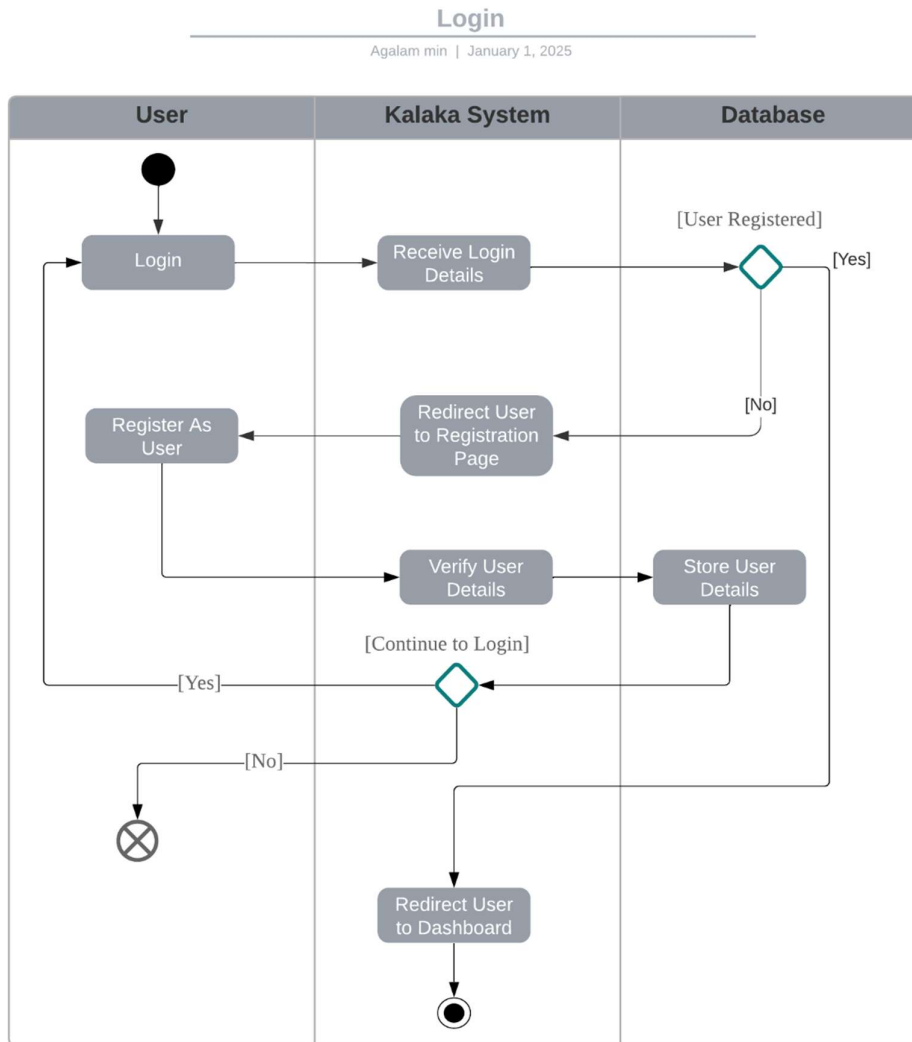


Figure 3. 2: Login Activity Diagram

Figure 3.2 illustrates the login flow of the Kalaka system, including interactions between the User, the Kalaka System, and the Database. The diagram outlines the process of user authentication and registration within the system. The process begins with the user initiating a login request, which is sent to the system to receive the login details. If the database confirms that the user is registered, the system redirects the user to the dashboard. However, if the user is not registered, the system redirects them to a registration page where they can submit their details. These details are verified by the system and stored in the database. Once the user is

registered, they can proceed with the login process, where their details are re-verified. If the details are valid, the user is redirected to the dashboard. In the case of invalid details, the system terminates the process and prompts the user to reattempt.

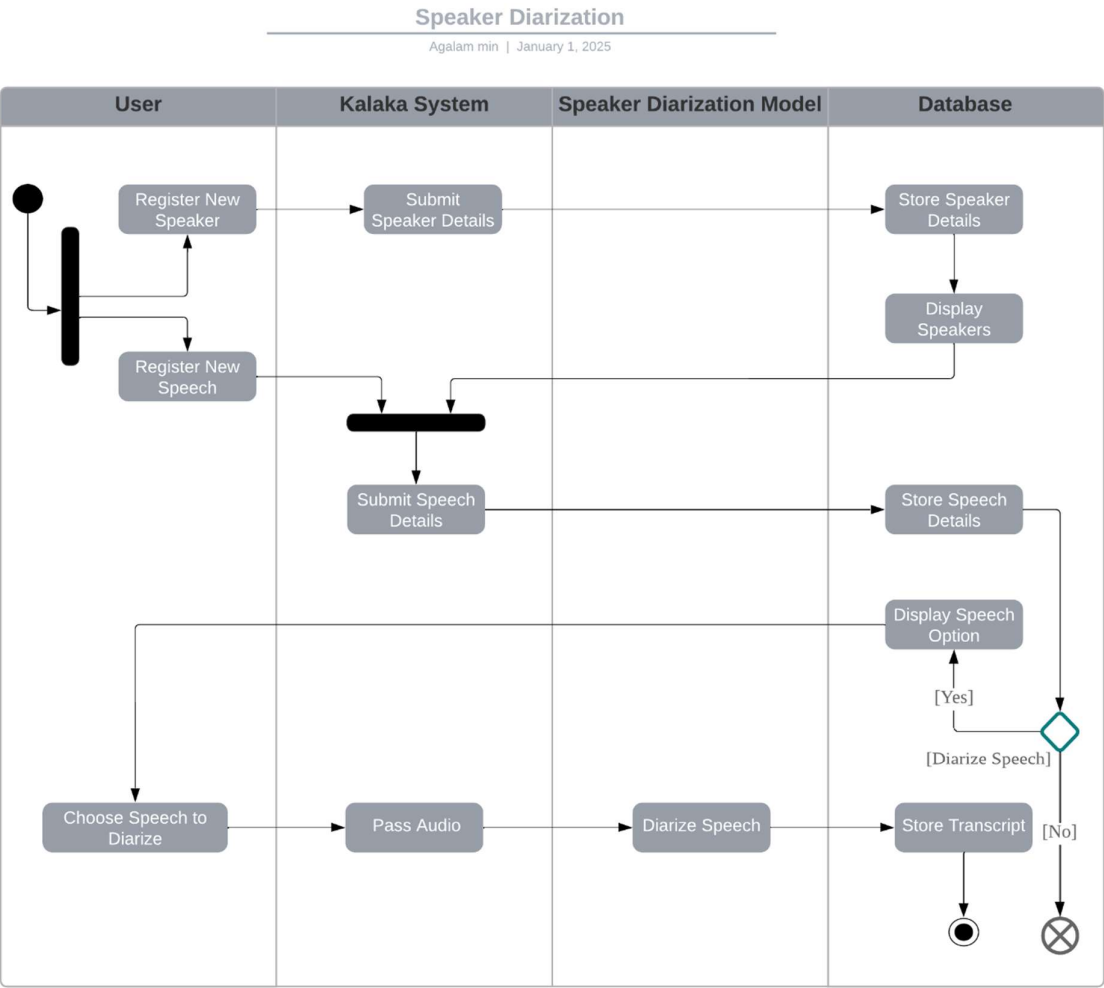


Figure 3. 3: Speaker Diarization Activity Diagram

Figure 3.3 illustrates the speaker diarization process in the Kalaka system, showcasing interactions among the User, the Kalaka System, the Speaker Diarization Model, and the Database. This flow focuses on registering speakers and their speeches and diarizing the audio for transcription purposes. The process begins with the User registering a new speaker. The speaker's details are submitted through the system and stored in the database. The database then displays the list of registered speakers. Similarly, when the User registers a new speech, the speech details are submitted, saved in the database, and displayed as available options for

further processing. Once a speech is registered, the User can choose a speech to diarize. The selected audio is passed to the Speaker Diarization Model, which processes the speech to identify and separate speaker segments. After successful diarization, the resulting transcript is stored in the database. The process terminates if the User decides not to diarize the speech, ensuring that only necessary operations are executed.

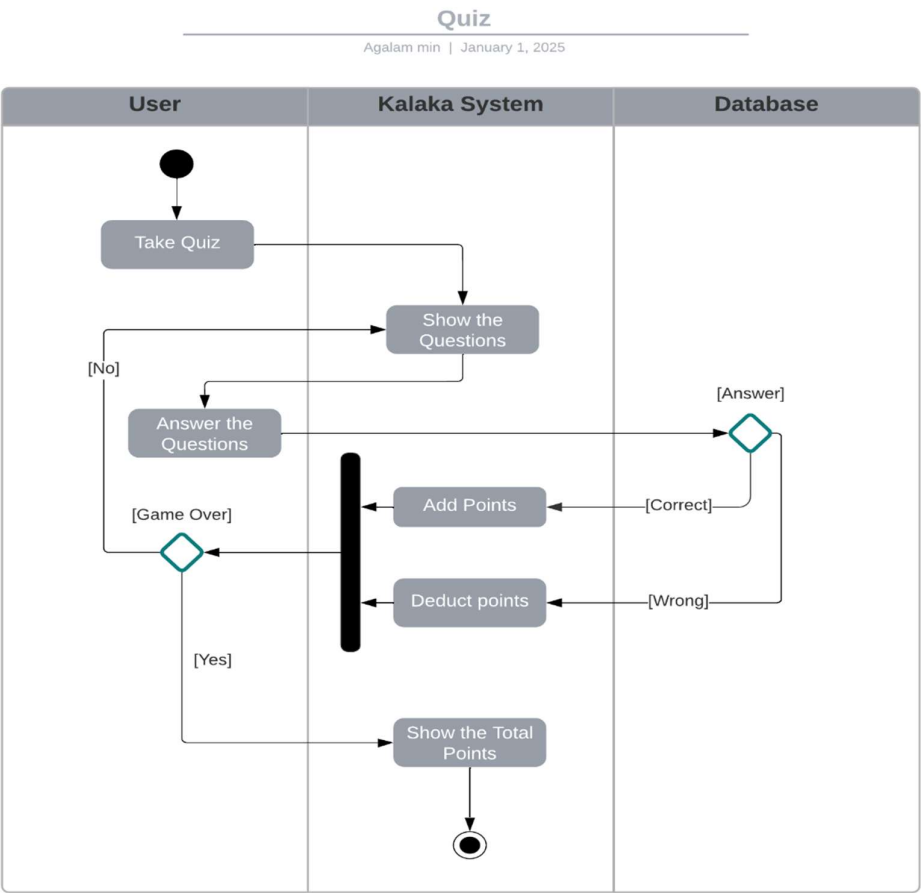


Figure 3. 4: Quiz Activity Diagram

Figure 3.4 illustrates the quiz process in the Kalaka system, highlighting interactions among the User, the Kalaka System, and the Database. This process focuses on taking quizzes, evaluating responses, and managing scores. The process begins with the User starting a quiz. The Kalaka system retrieves and displays questions from the database for the User to answer. After the User submits an answer, the system verifies it against the correct answers stored in the database. If the answer is correct, the system awards points to the User. If the answer is incorrect, points are

deducted from the User's score. The quiz continues until all questions are answered. Once the quiz is complete, the system calculates the total points and displays the User's final score.

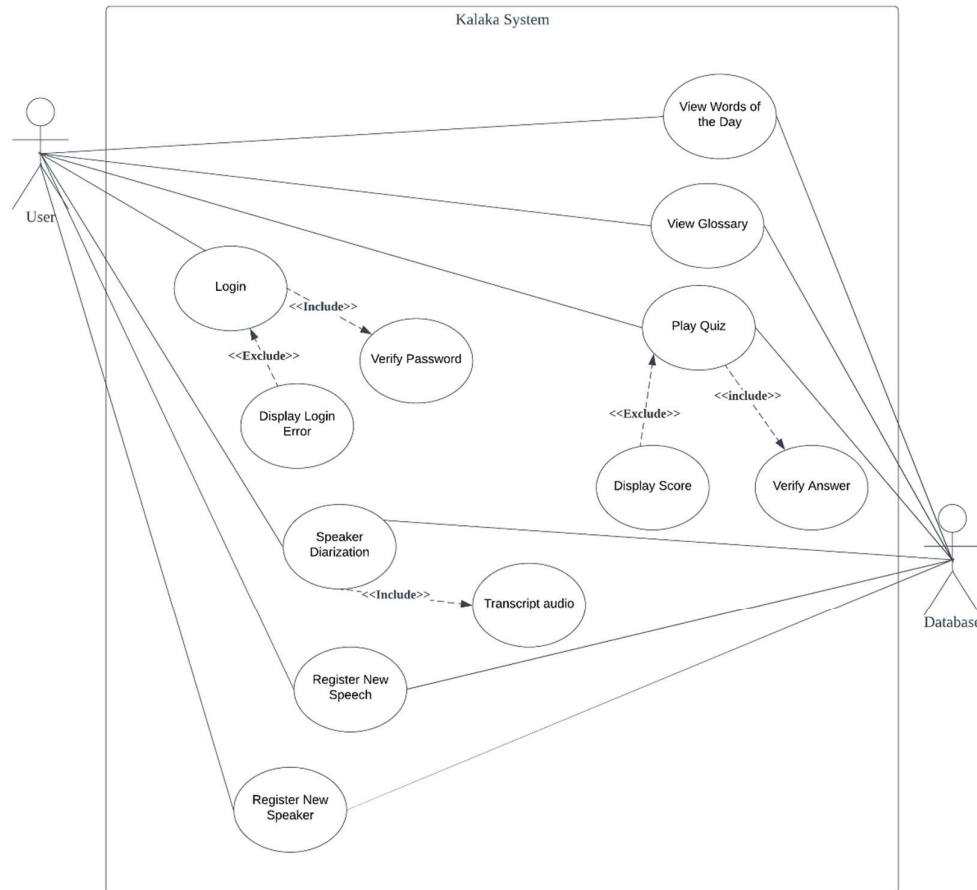


Figure 3. 5: Use Case for Words of the day and Glossary

The Use Case Diagram for the Kalaka System in Figure 3.5 highlights two key functionalities: "View Words of the Day" and "View Glossary," both powered by the system's interaction with Kalaka's database. The "View Words of the Day" feature generates and displays six random words daily, retrieved dynamically from the database, along with their meanings. Similarly, the "View Glossary" functionality allows users to access an extensive list of terms and definitions, all sourced directly from the database.

3.7 Graphical User Interface (GUI)

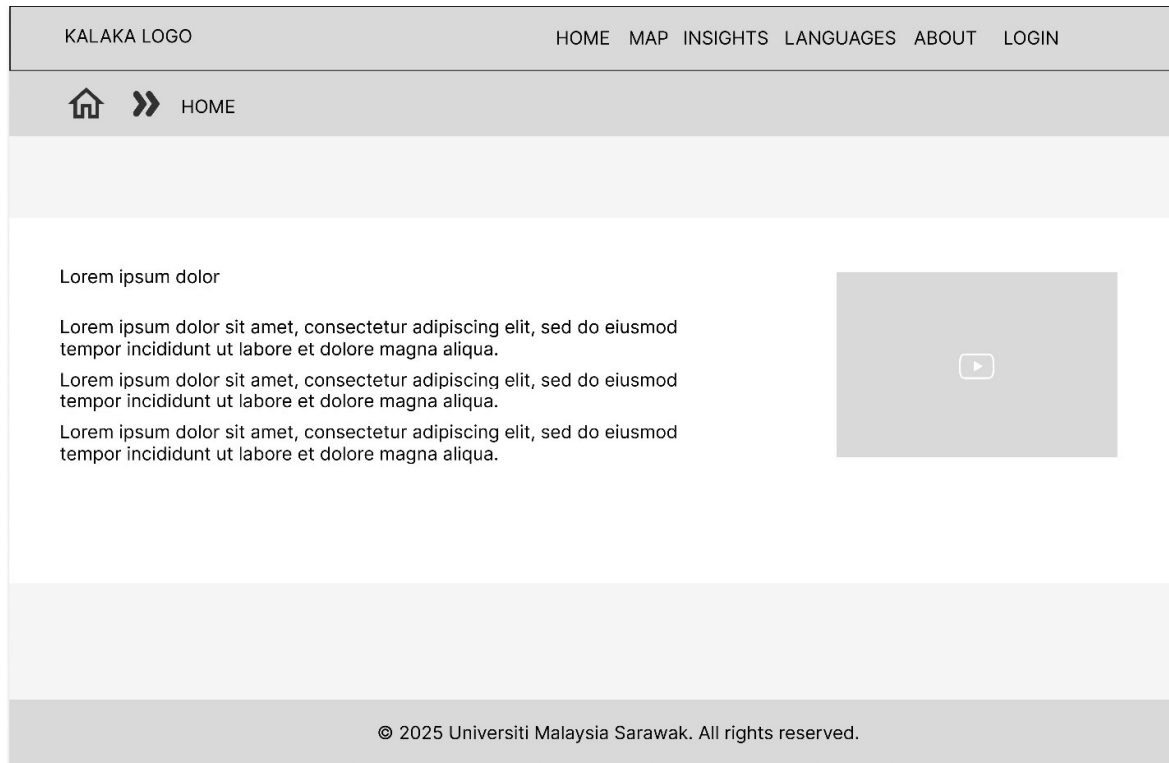


Figure 3. 7: The new GUI for the homepage

Figure 3.7 illustrates the new GUI for the homepage of the Kalaka system. This page serves as the central hub, offering users an introduction to the platform alongside a brief overview video. This page also provides a navigation bar with links to other pages, including the Map, Insights, Languages, About, and Login pages. The homepage is designed to be user-friendly and intuitive, ensuring a seamless user experience while providing an informative and welcoming entry point to the system.

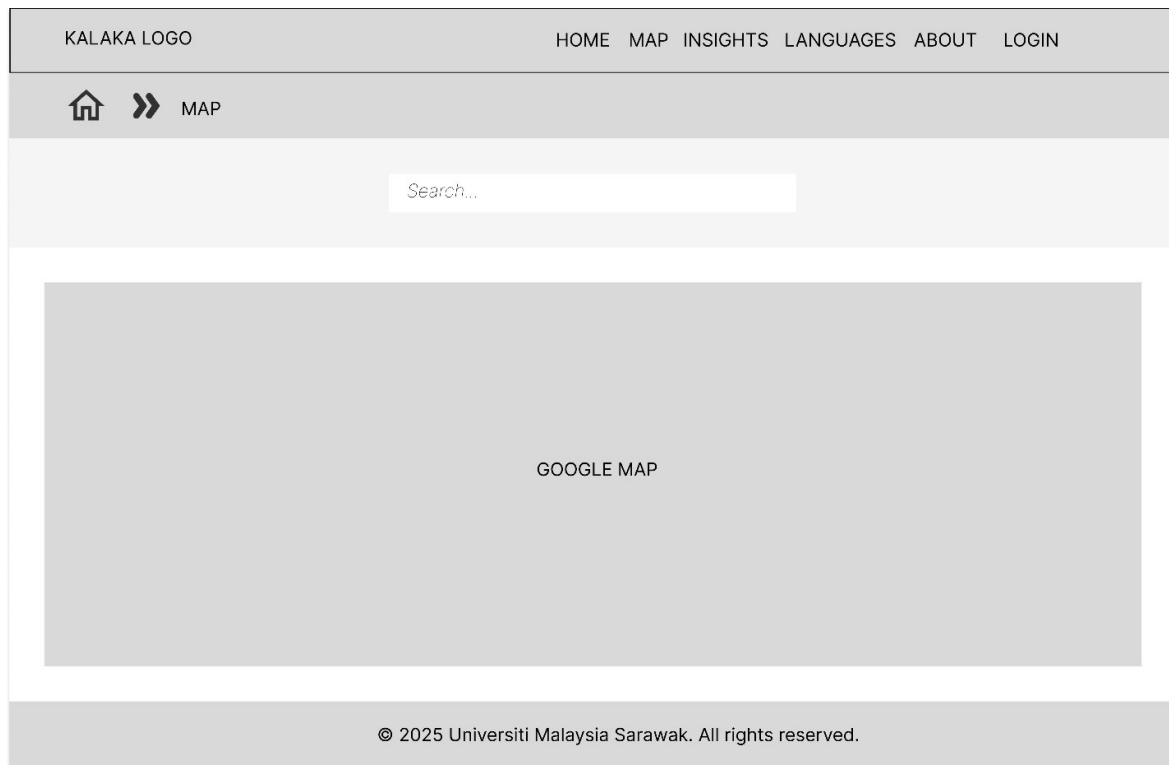


Figure 3. 8: The new GUI for the map page

Figure 3.8 illustrates the new GUI for the map page. The Kalaka system's Map page provides an interactive interface featuring a Google map and a search bar for locating specific places. Users can explore various locations in Malaysia directly on the map or utilize the search functionality to find a desired location quickly and efficiently. The map is designed to display detailed geographic information, enhancing usability and navigation.

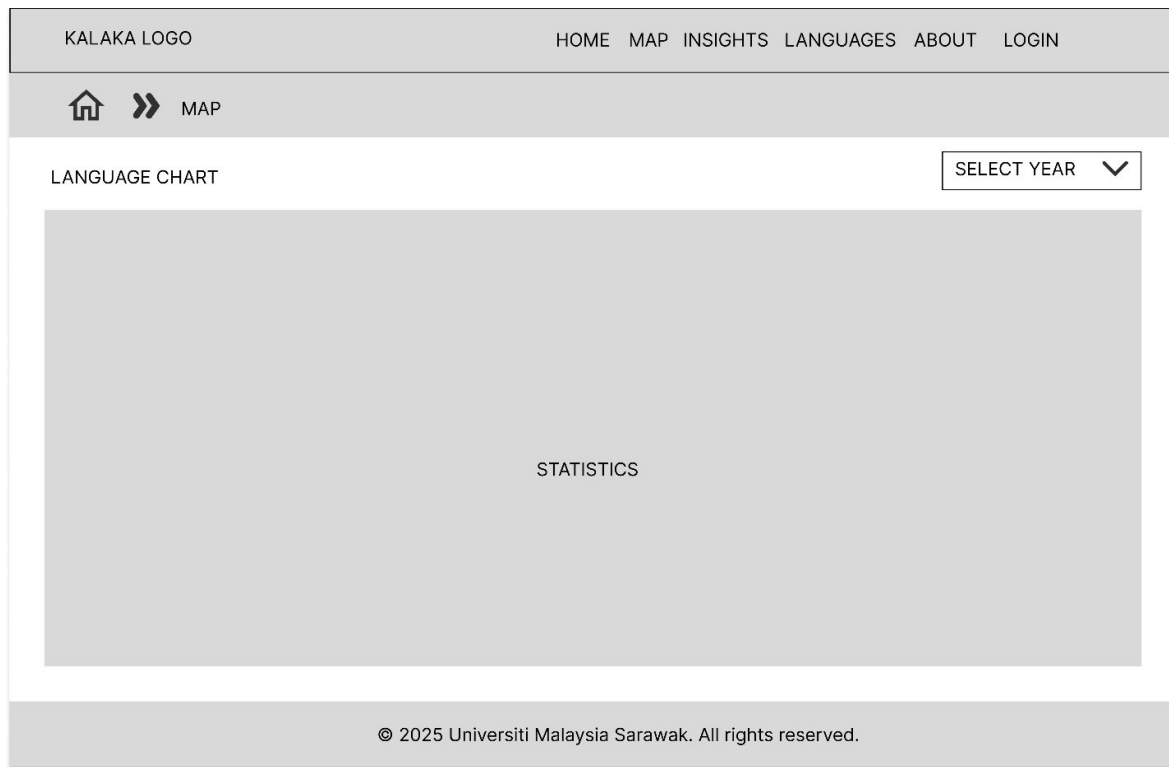


Figure 3. 9: The GUI for Insights page

Figure 3.9 illustrates the new GUI for the Languages Statistics page called Insights page. The Kalaka system's Insights page offers a comprehensive visualization of registration trends through an interactive graph. Users can select a specific year using the dropdown menu, allowing them to view detailed statistics on the number of registered speakers for each language during that period. The page is designed to provide clear and concise data representation, helping users analyze language trends and speaker distribution over time.

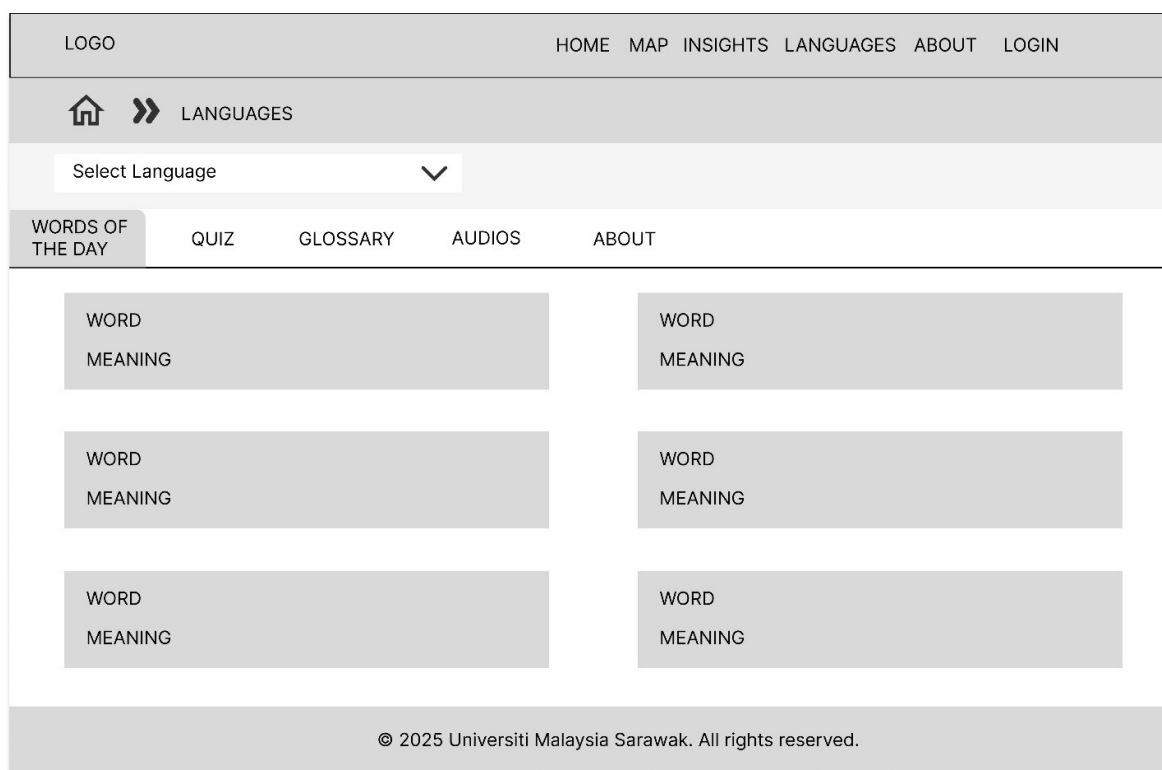


Figure 3. 10: The GUI for the languages page

Figure 3.10 illustrates the GUI for the languages page, which does not exist in the old Kalaka system. The Languages page of the Kalaka system is designed to provide a rich, interactive experience for users to explore and learn about various languages. Users can select their preferred language from a dropdown menu, which dynamically updates the page to display information and activities specific to the chosen language. The page is organized into five primary tabs: *Words of the Day*, *Quiz*, *Glossary*, *Audios*, and *About*. Each tab offers unique features to enhance the learning experience.

Under the Words of the Day tab, six random words are displayed daily, along with their meanings. This feature lets users discover new vocabulary engagingly and consistently, promoting language learning over time.

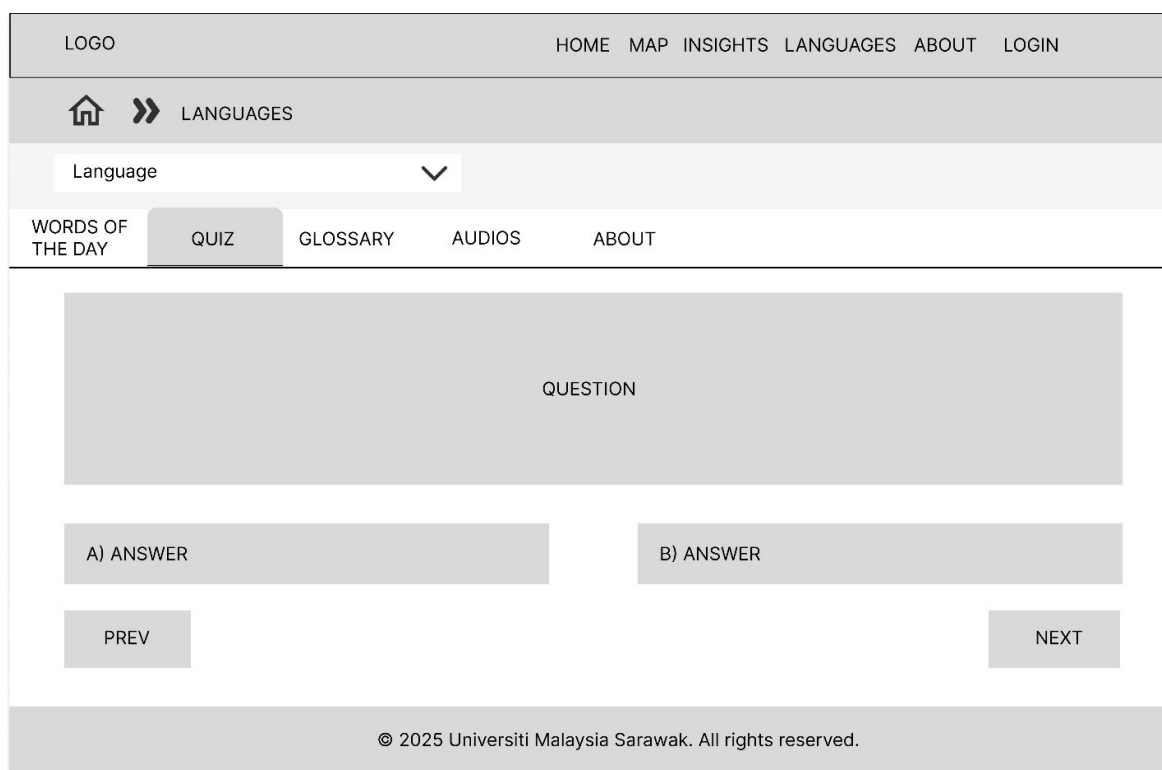


Figure 3. 11: The GUI for Quiz tab

In Figure 3.11, the Quiz tab provides an interactive learning activity in which users are presented with one question at a time and two answer options. Navigation buttons—*Previous* and *Next*—allow users to navigate the quiz, while the last question replaces the *Next* button with a *Submit* button. This tab encourages users to test their language knowledge in a structured and intuitive way.

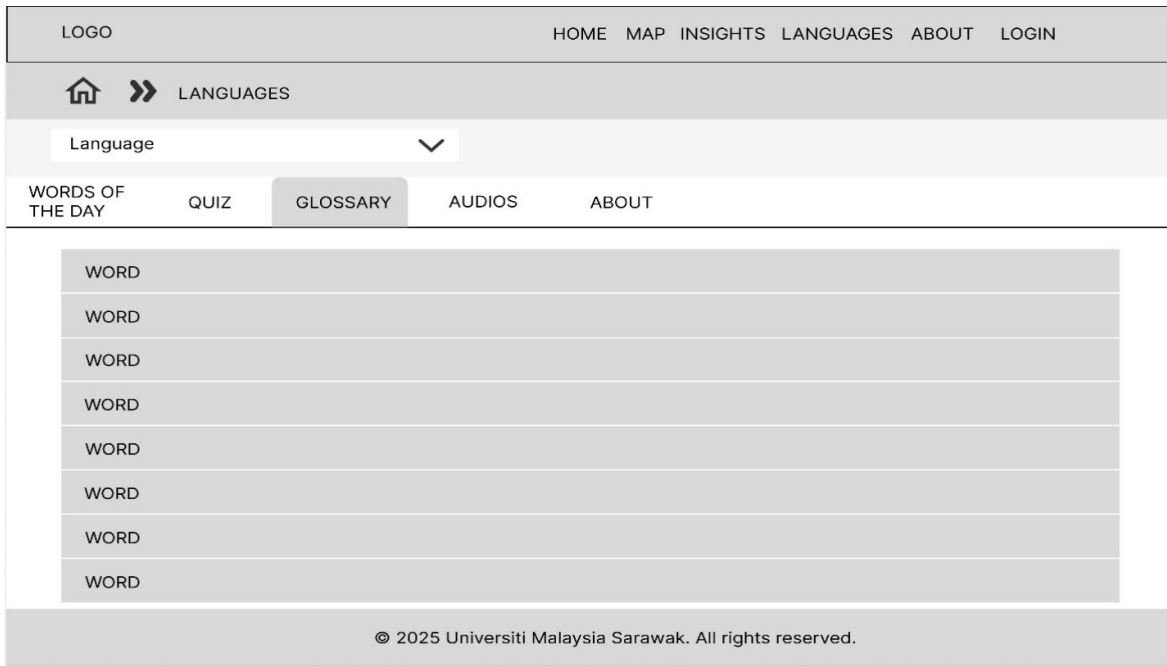


Figure 3. 12: The GUI for Glossary tab

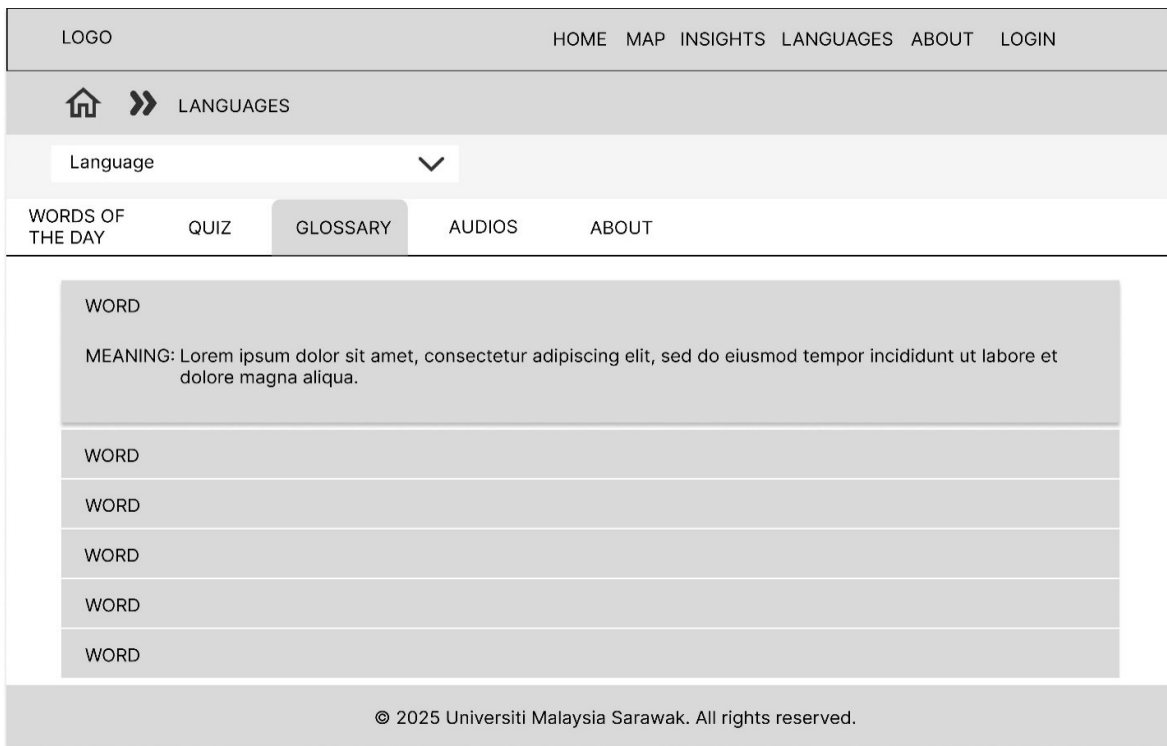


Figure 3. 13: The row can be clicked to revealing the meaning of the selected term

In Figure 3.12 and Figure 3.13, the Glossary tab offers a comprehensive list of terms in a table-like format. Each row can be clicked to expand, revealing the meaning of the selected term.

This tab is a detailed reference tool, helping users deepen their understanding of the language's vocabulary.

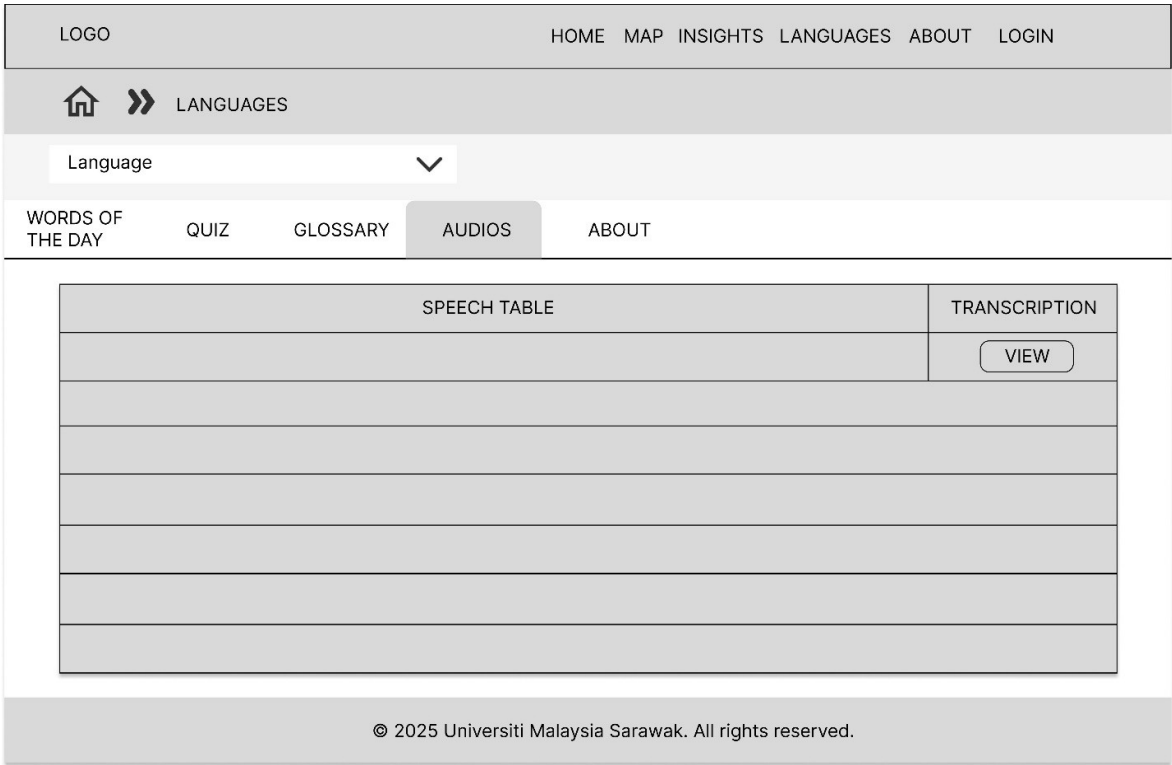


Figure 3. 14: the GUI for Audios tab

Figure 3.14 illustrates the Audios tab provides access to a speech table similar to the old Kalaka system. However, in this updated version, the "More Details" button will be replaced with a *Transcription* feature. The transcription results from speaker diarization, offering detailed text representations of the speech content. This improvement enhances accessibility and allows users to engage with audio materials more effectively.

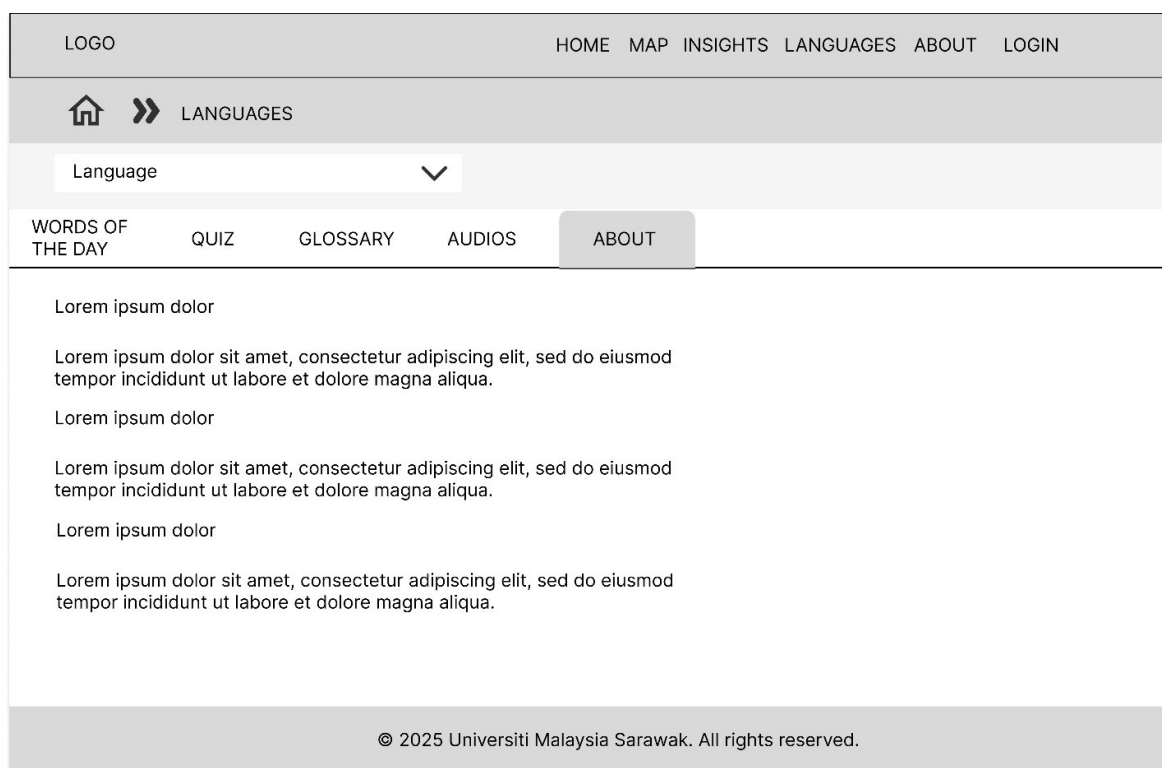


Figure 3. 15: the GUI for the About tab

Finally, the Figure 3.15 illustrates GUI for the About tab. The About tab provides cultural and historical context for the selected language. This section offers users valuable insights into the language's origins, traditions, and significance, fostering a deeper appreciation and understanding of its role in society.

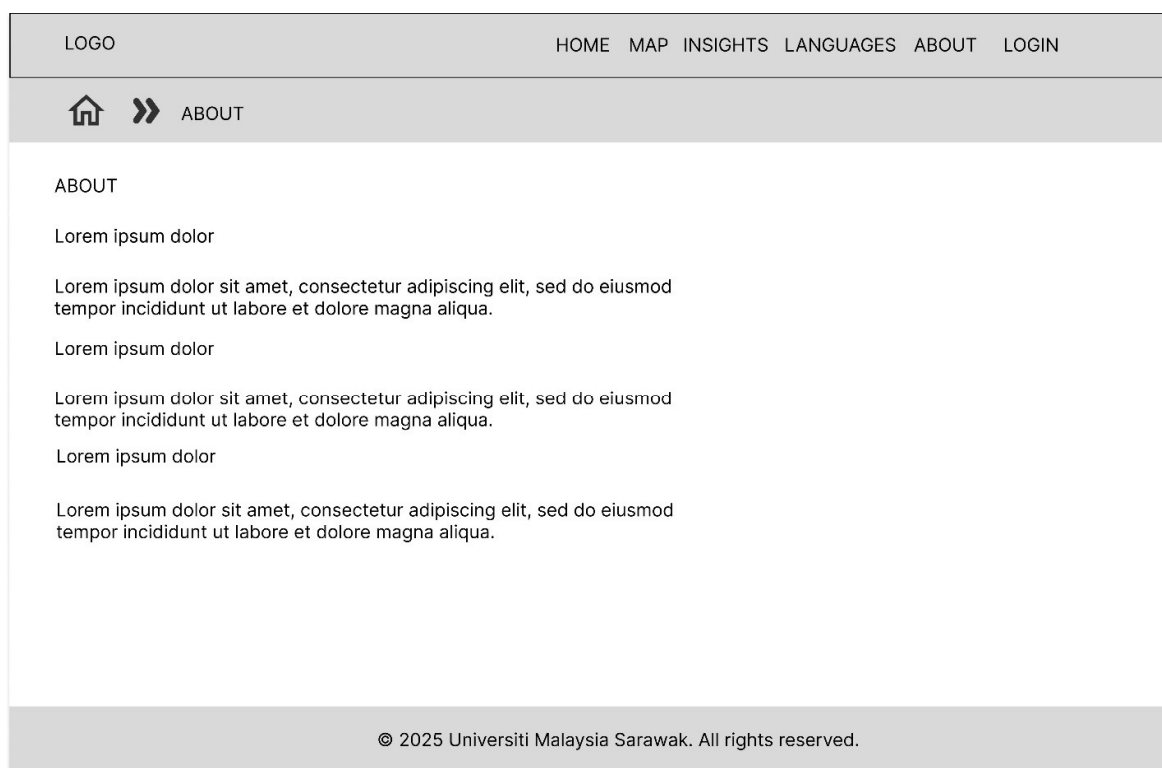


Figure 3. 16: The new GUI for the About page

Figure 3.16 illustrates new GUI for the About page. The About page in the revamped Kalaka system provides a comprehensive overview of the platform, highlighting its purpose, features, and enhancements from the previous version. This page is a central hub for users to understand the system's mission and its role in promoting linguistic and cultural preservation.

The redesigned About page replaces the old design with a modern, user-friendly layout that is more visually appealing and organized. The page begins with an introduction to Kalaka, explaining its primary focus on language preservation, speaker diarization, and fostering cultural appreciation. It also includes an acknowledgement section to recognize contributors and stakeholders who supported the development of Kalaka.

Figure 3. 17: The new GUI for the Login page

Figure 3.17 illustrates new GUI for the Login page. The Kalaka system's login page serves as the primary gateway for users to access the platform. The new Login page is designed with simplicity and functionality, ensuring a smooth and secure login process for all users.

When users navigate the Login page, they are prompted to enter their credentials, such as their username and password. Once the login details are submitted, the system validates the credentials by cross-referencing them with the stored user data in the database. If the credentials are correct, the user is granted access and redirected to the dashboard, which provides an overview of the system's features.

For new users who have not registered, the system automatically redirects them to a registration page where they can create an account. After completing the registration process, their information is securely stored in the database, allowing them to log in and use the platform in the future.

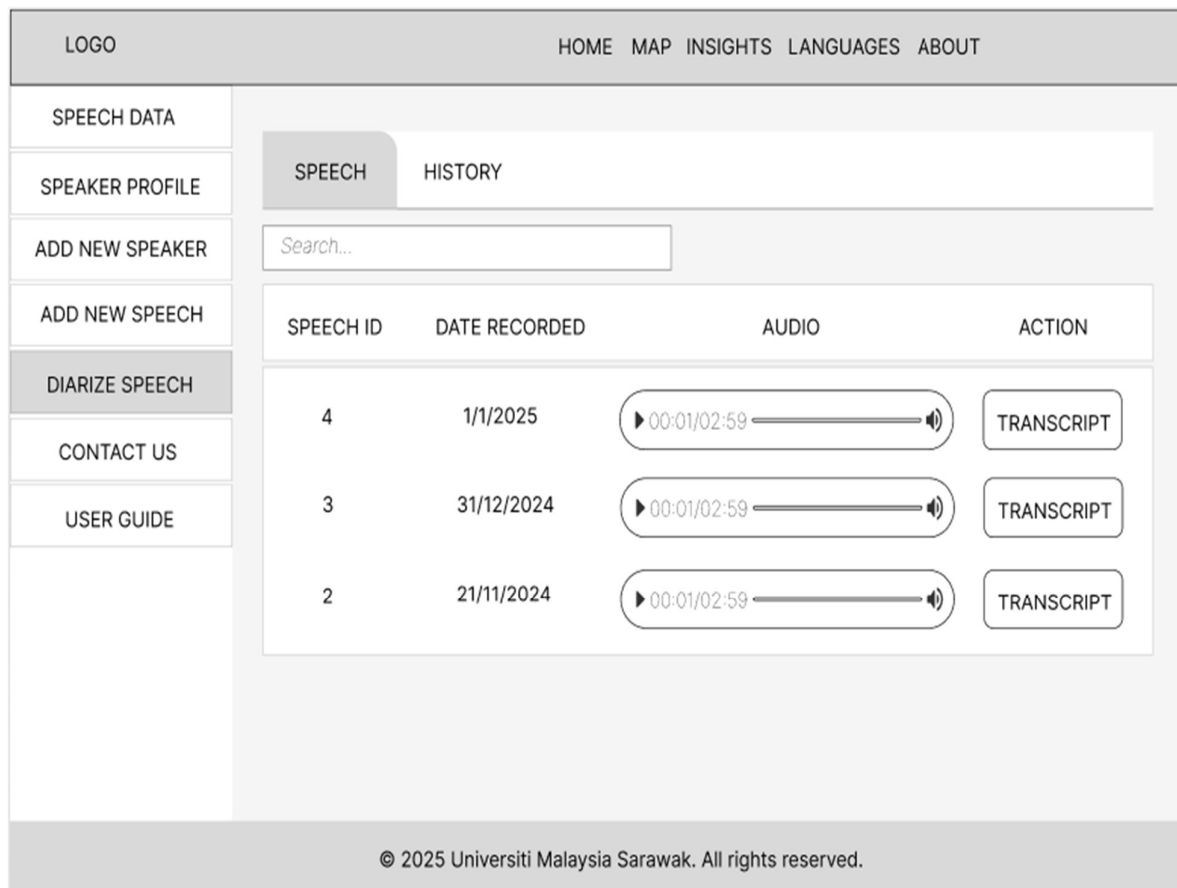


Figure 3. 18: The GUI for Diarize Speech page

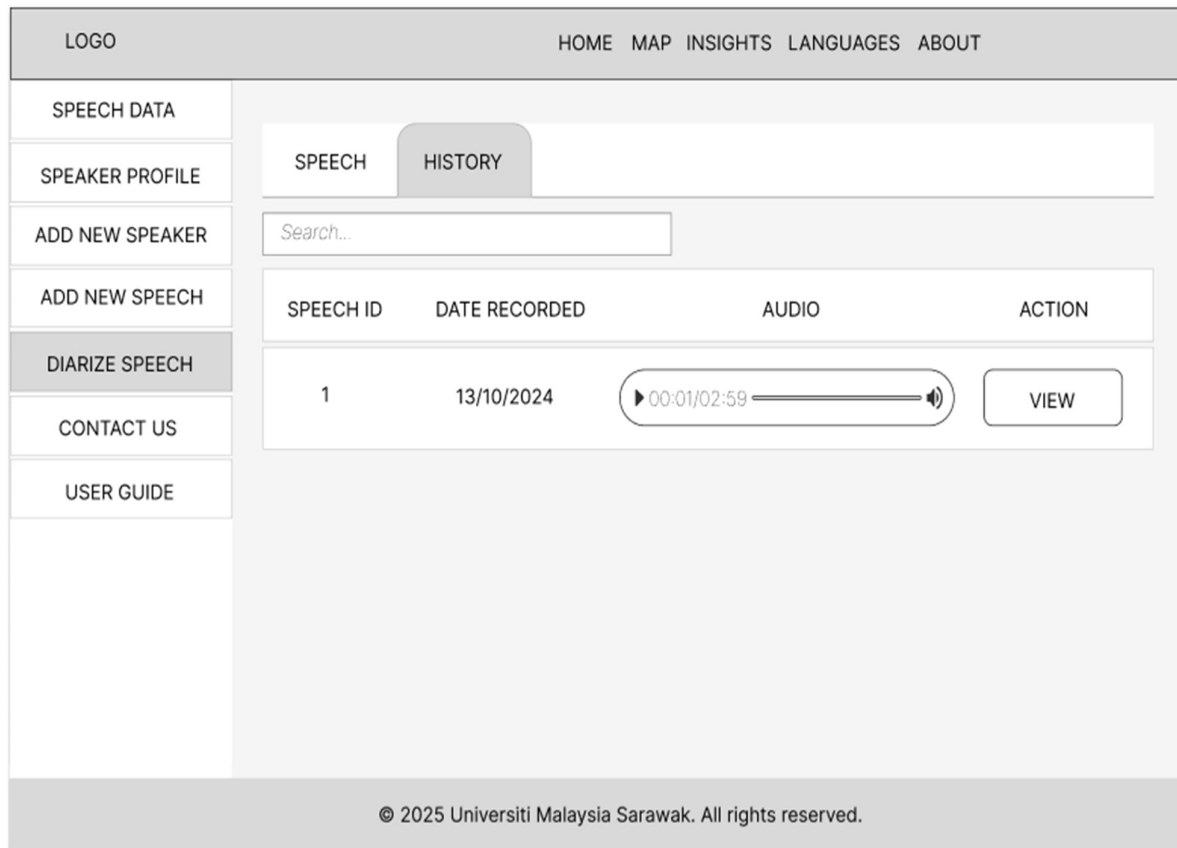


Figure 3. 19: The GUI for History tab

In Figure 3.18 and Figure 3.19, the Diarize Speech page enables users to efficiently manage and process speech data after logging in. It includes a table that displays speech records with columns for Speech ID, Date Recorded, and an integrated audio player for playback. Users can access transcriptions by clicking the "Transcript" button in the Action column after adding new speech. A search bar allows for quick filtering of speech entries. At the same time, the tabbed interface organizes content into two sections: the Speech tab for managing recordings awaiting transcription and the History tab for recordings with completed transcriptions.

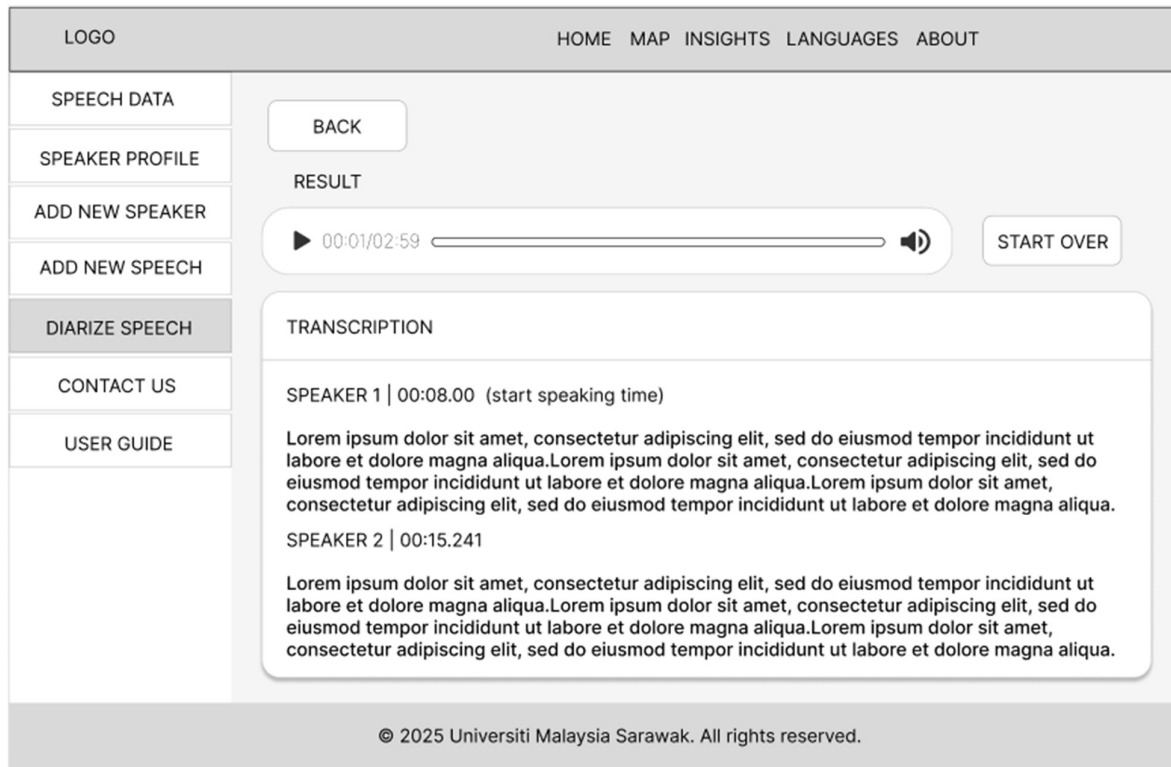


Figure 3. 20: The GUI for Diarize Speech Result page

In Figure 3.20, the Diarize Speech Result page displays the output of the diarization process for a selected speech recording. At the top, it provides a playback feature with an audio player, accompanied by "Back" and "Start Over" buttons for navigation and reprocessing. Below the player, the Transcription section presents the diarized text, segmented by speakers. Each speaker entry includes a timestamp indicating when the speaker started talking, followed by the corresponding transcribed text. This layout ensures a clear and organized presentation of the speaker's contributions within the recording.

3.1 Google Form Survey Analysis

The purpose of the Google Form survey was to gather insights from users regarding various aspects of Kalaka, including its features, usability, design, and potential improvements. By collecting responses directly from a sample group of users, the survey aimed to better understand their needs, preferences, and challenges with Kalaka. This analysis is integral for refining the system and ensuring it meets user expectations.

A total of 15 respondents participated in the survey. Although this sample size is relatively small, it provides valuable qualitative data to help identify patterns and trends within the user base. The survey was designed to cover various demographic aspects and collect specific feedback on Kalaka's existing functionalities and the potential addition of new features.

The survey outcome revealed key insights into how users perceive Kalaka, including their preferences for certain features, such as Words of the Day, Quizzes, and Speech-to-Text functionality, and their satisfaction with the current design and navigation. The responses also shed light on user challenges, highlighting areas for improvement regarding ease of use and design. Moreover, the survey revealed interest in adding functionalities like speaker diarization, suggesting potential areas for enhancing Kalaka's capabilities.

3.1.1 Demographic Information Analysis

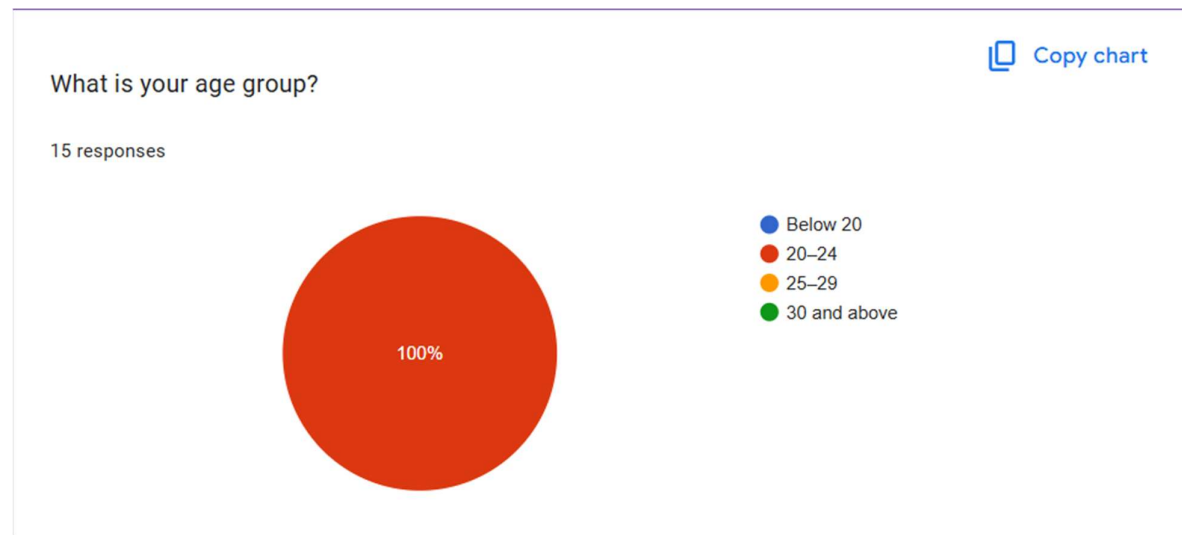


Figure 3. 21: Respondents' Age Group Distribution

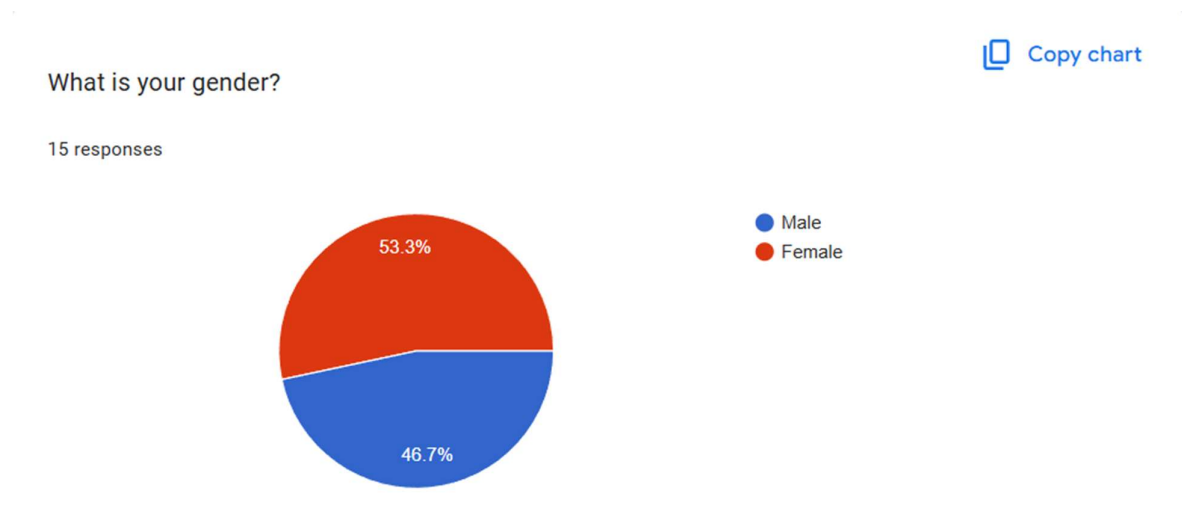


Figure 3. 22: Respondents' Gender Distribution

What is your state?

 [Copy chart](#)

15 responses

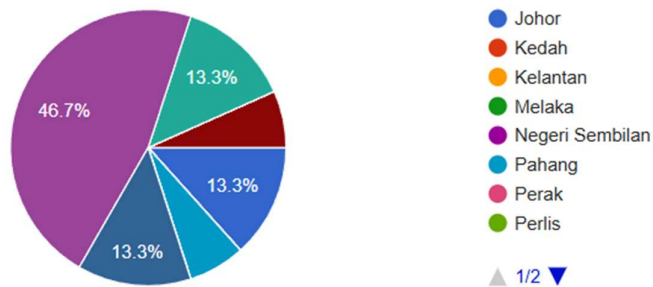


Figure 3. 23: Respondents' State Distribution

What is your current educational level?

 [Copy chart](#)

15 responses

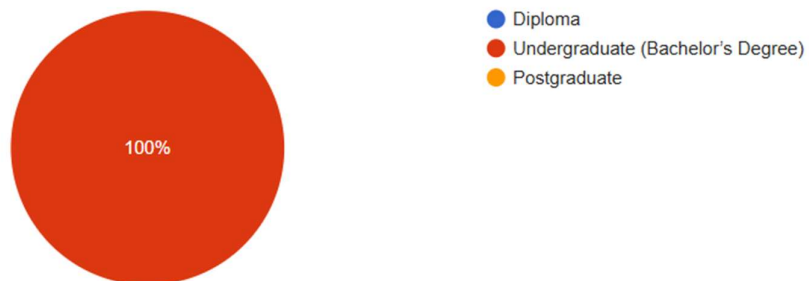


Figure 3. 24: Respondents' Current Education Distribution

Which faculty or department are you currently enrolled in?

 [Copy chart](#)

15 responses

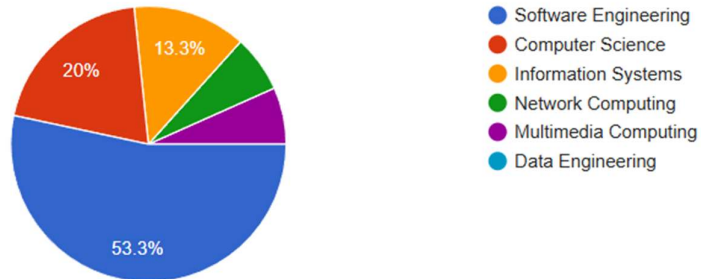


Figure 3. 25: Respondents' Faculty Course Distribution

What is your current year of study?

 [Copy chart](#)

15 responses

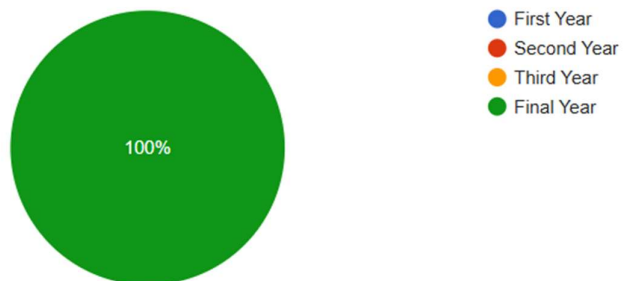


Figure 3. 26: Respondents' Current Year of Study Distribution

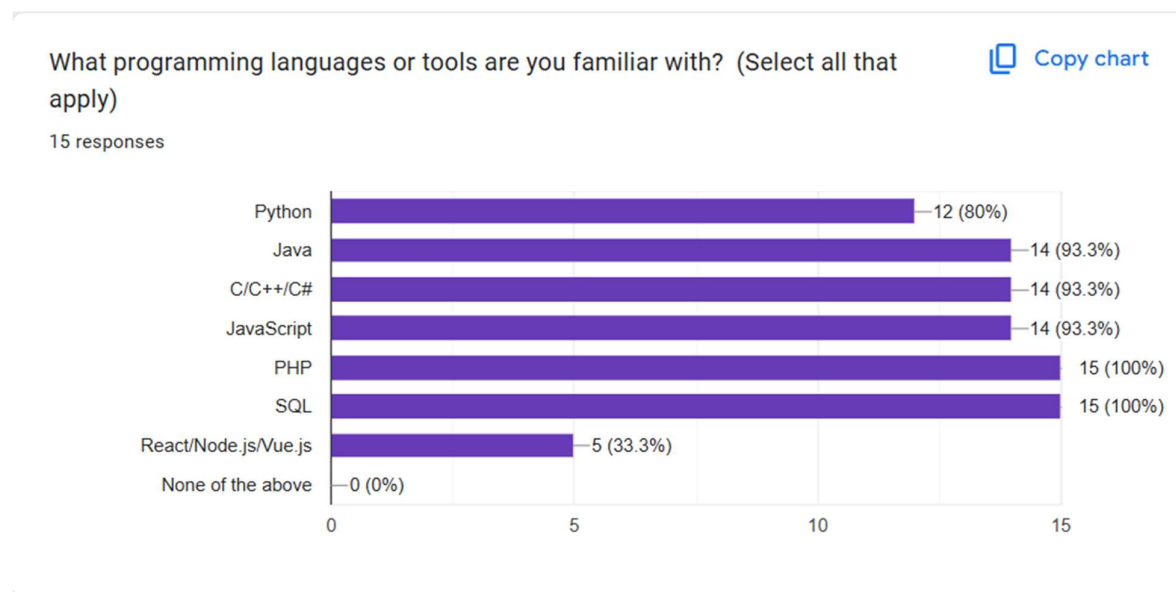


Figure 3. 27: Respondents' Programming Languages Distribution

This section provides an in-depth analysis of respondents' demographic information, offering valuable context for understanding the feedback provided in later sections. The data helps identify the target audience's characteristics, ensuring that Kalaka's development aligns with user profiles and needs.

Figure 3.21 illustrates the age group distribution of respondents, with the majority falling within the 20–24 age range. This aligns with the anticipated demographic of FCSIT students and young professionals. The insights from this group are particularly valuable, as final-year project (FYP) students can provide constructive feedback to improve the Kalaka website.

Figure 3.22 shows the gender distribution, with 46.7% male and 53.3% female participants. This near-balanced representation ensures that the survey insights are inclusive and relevant to all genders, helping to guide the design toward a gender-neutral, user-friendly interface.

The state-wise distribution, depicted in Figure 3.23, indicates a concentration of respondents from Sarawak. This is expected, given that most students at UNIMAS FCSIT are from Sarawak.

Figure 3.24 presents the current education levels of respondents, with 100% identifying as undergraduate students.

Figure 3.25 highlights that most respondents are enrolled in Software Engineering. Their technical background suggests they have a higher appreciation for advanced technologies and features, such as programming insights or system analytics.

Figure 3.26 illustrates the distribution of respondents by year of study, showing that final-year students form 100% of the majority.

Finally, Figure 3.27 outlines respondents' programming languages, with Python, Java, C/C++/C#, JavaScript, PHP, and SQL being the most commonly used. The survey also sought to determine whether respondents use frameworks like React, Vue.js, or Node.js, which could be relevant to Svelte-specific questions.

3.1.2: Svelte Specific Questions Analysis

How familiar are you with Svelte?

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15 responses

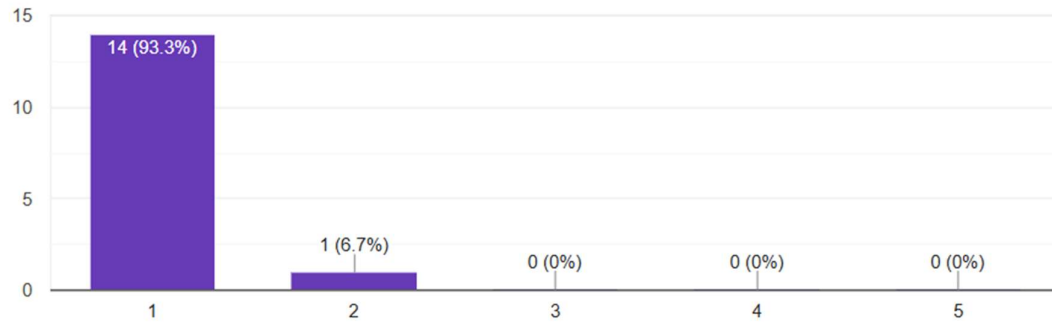


Figure 3. 28: Distribution of Respondents' Familiarity with Svelte

If you've used Svelte, what do you like most about it?

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15 responses

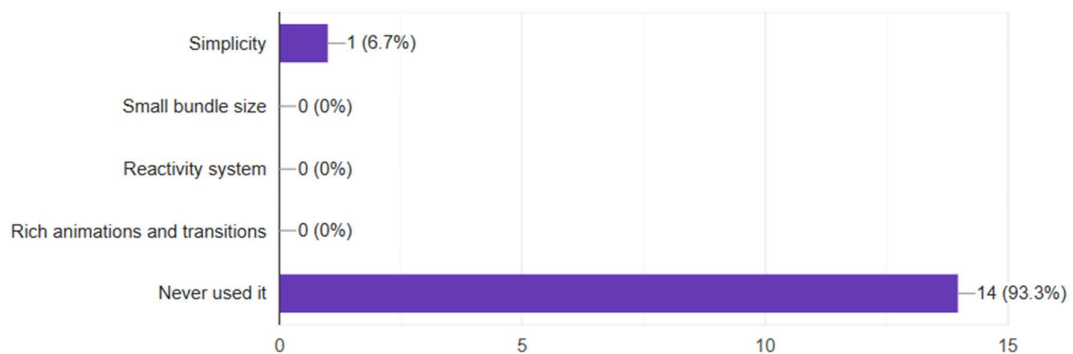


Figure 3. 29: Distribution of Respondents' Likes About Svelte

What do you think is the most important feature of a frontend framework?

 [Copy chart](#)

15 responses



Figure 3. 30: Distribution of the Importance Feature of Frontend Framework

In your opinion, how important is it for websites to use modern frameworks like Svelte to improve performance and interactivity?

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15 responses

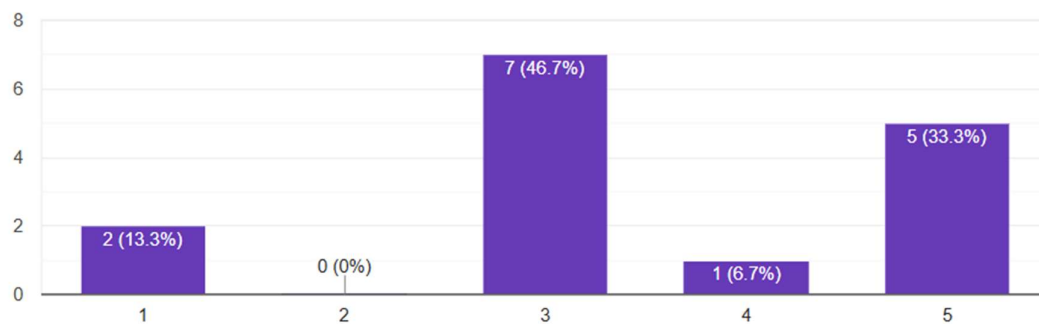


Figure 3. 31: Distribution of the Importance of Svelte

Do you think using a framework like Svelte could make website development and maintenance easier for developers?

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15 responses

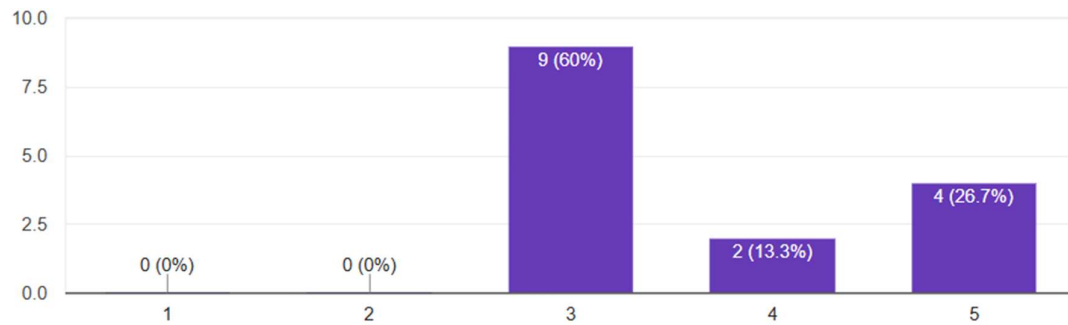


Figure 3. 32: Respondents' Opinions on Svelte

Do you value real-time interactivity (e.g., dynamic updates without reloading the page) in websites?

 [Copy chart](#)

15 responses

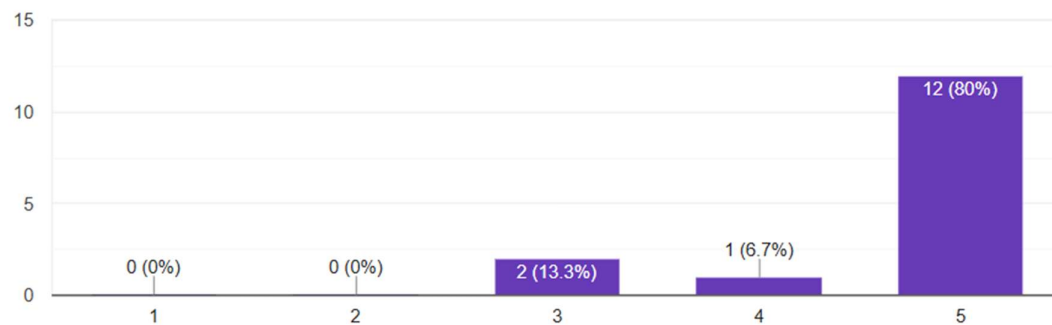


Figure 3. 33: Respondents' Opinions on Real-Time Interactivity

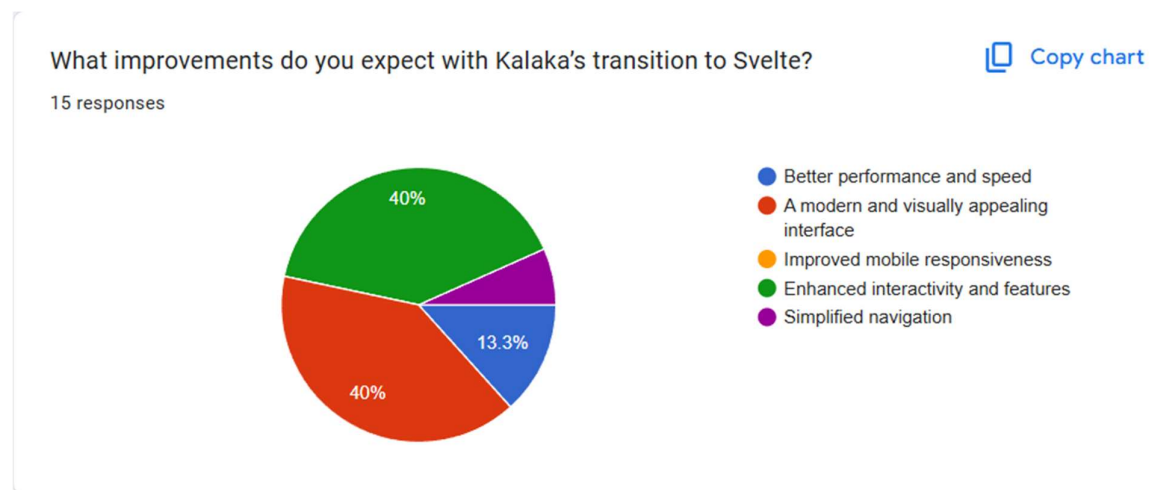


Figure 3. 34: Respondents' Expectations on Kalaka's Transition

This section provides an in-depth analysis of users' feedback on various aspects of Svelte, including familiarity, user preferences, and the perceived importance of its features. Each figure captures a specific dimension of user perceptions, offering actionable insights for integrating and leveraging Svelte effectively in Kalaka.

Figure 3.28 illustrates the distribution of respondents' familiarity with Svelte. This data helps gauge how well-known the framework is among the respondents and provides insights into their level of exposure, ranging from those unfamiliar with Svelte to those with significant experience with it.

Figure 3.29 highlights the distribution of respondents' likes about Svelte. It identifies the features of the framework that are most appreciated by the respondents, such as ease of use, performance, and simplicity. This information helps us understand the aspects of Svelte that resonate the most with users and can inform the design and development of Kalaka.

Figure 3.30 depicts the distribution of the importance of various frontend framework features. Respondents indicate which aspects of frontend development, such as performance, scalability, and responsiveness, they consider most important when choosing a framework. This data provides valuable guidance for prioritizing features in Kalaka's frontend design.

Figure 3.31 shows the distribution of the importance of Svelte as a framework. Respondents' views on how crucial Svelte is for modern web development are captured here. This helps assess

whether Svelte is a valuable tool for Kalaka's development and whether its adoption aligns with users' expectations.

Figure 3.32 presents respondents' opinions on Svelte, describing their overall perceptions of the framework. It provides feedback on its strengths, weaknesses, and suitability for web development, helping to identify areas where Svelte may excel or require further refinement in the Kalaka project.

Figure 3.33 illustrates respondents' opinions on real-time interactivity. This data focuses on how respondents perceive the need for real-time features in web applications, such as live updates and instant feedback. Understanding these opinions helps determine how critical such features are for Kalaka's users and whether Svelte's capabilities align with these needs.

Figure 3.34 depicts respondents' expectations for Kalaka's transition. It shows what users anticipate regarding the shift to Svelte, including their concerns and hopes for improvements in performance, usability, and overall user experience. This information is crucial for ensuring that the transition to Svelte meets user expectations and contributes to Kalaka's overall success.

3.1.3: Kalaka Specific Questions Analysis

What features do you consider essential for *Kalaka*?

 Copy

15 responses

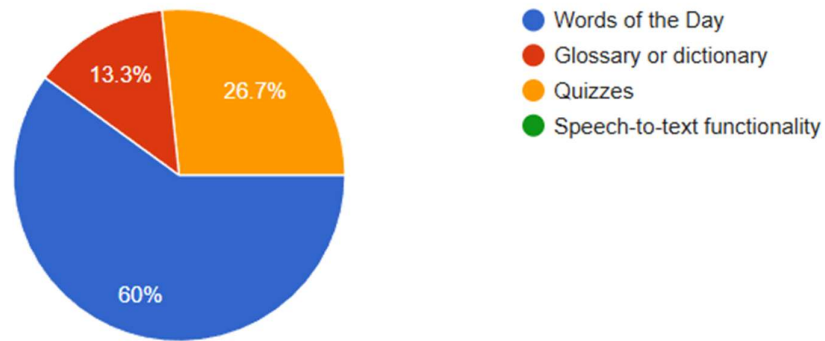


Figure 3. 35: Respondents' Considered Features for *Kalaka*

Should *Kalaka* include audio pronunciations for words and phrases?

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15 responses

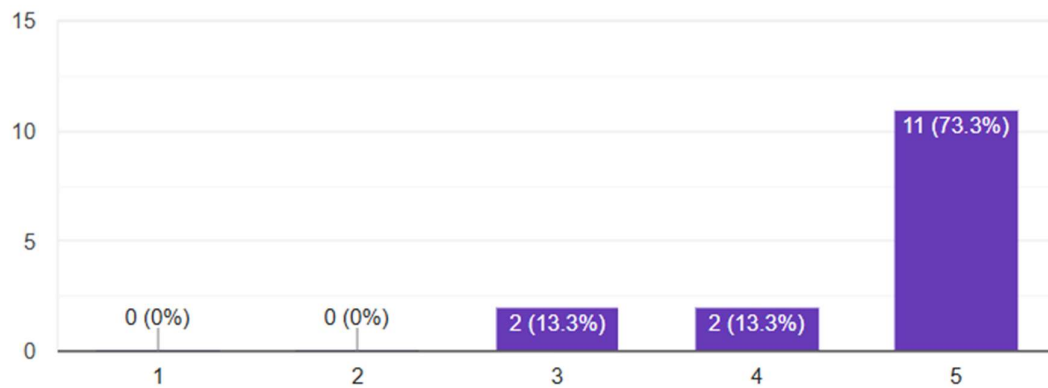


Figure 3. 36: Distribution of Responses on Whether *Kalaka* Should Have Audio Pronunciation

How easy is it to navigate the Kalaka website?

 Copy

15 responses

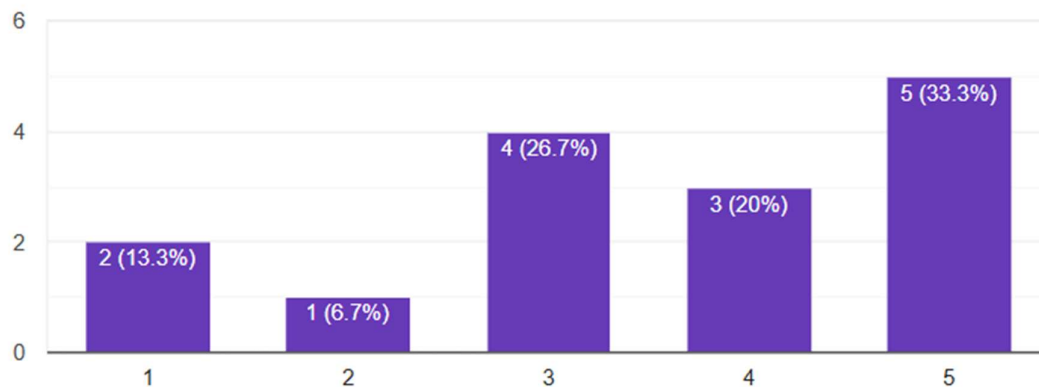


Figure 3. 37: Distribution of Responses on Whether Kalaka Is Easy to Navigate

How satisfied are you with the current design of the Kalaka website?

 Copy

15 responses

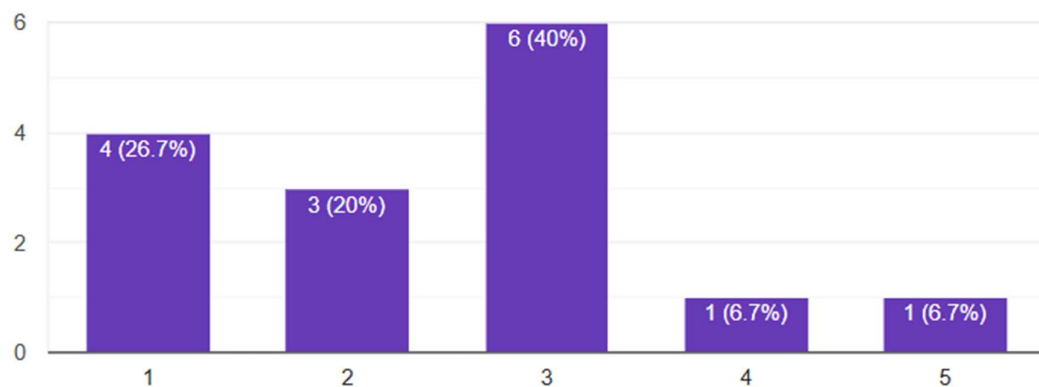


Figure 3. 38: Distribution of Responses on User Satisfaction with Kalaka's Current Design

What kind of design style do you prefer for the Kalaka website?

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15 responses

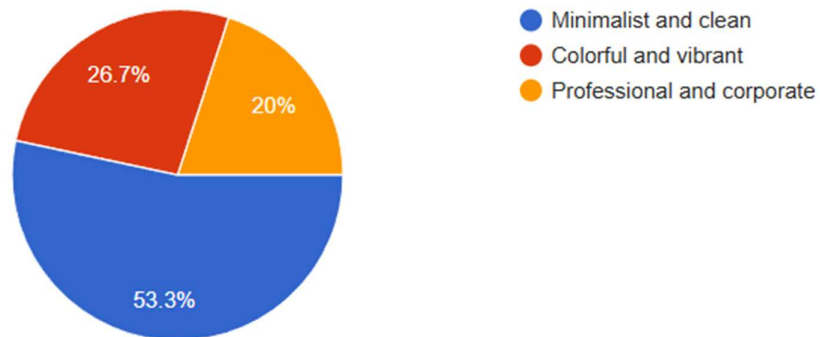


Figure 3. 39: Distribution of Responses on User Preferences for Kalaka's Design Style

What do you find most challenging when using Kalaka?

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15 responses

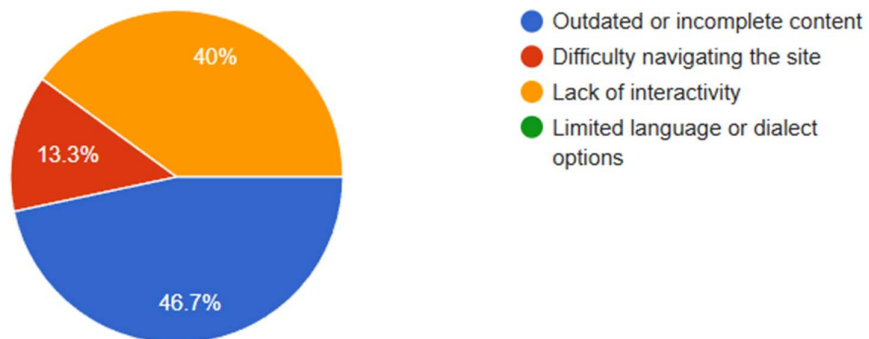


Figure 3. 40: Distribution of Responses on the Most Challenging Aspects of Using Kalaka

Which page of the Kalaka system do you think need improvement?

 Copy

15 responses

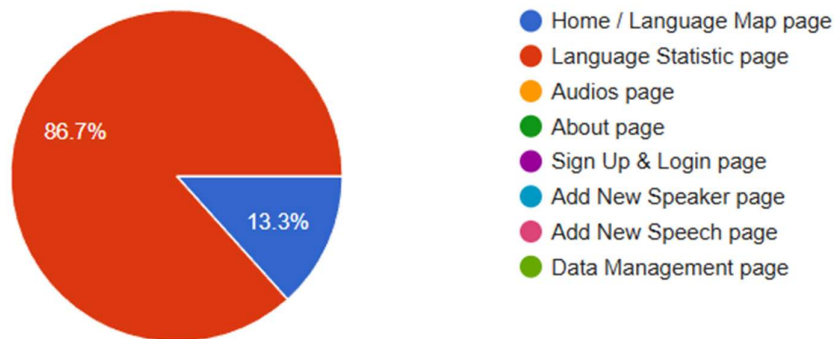


Figure 3. 41: Distribution of Responses on Which Page of Kalaka Needs Improvement

Do you think Kalaka would benefit from incorporating AI-based features like Speaker Diarization?

 Copy

15 responses

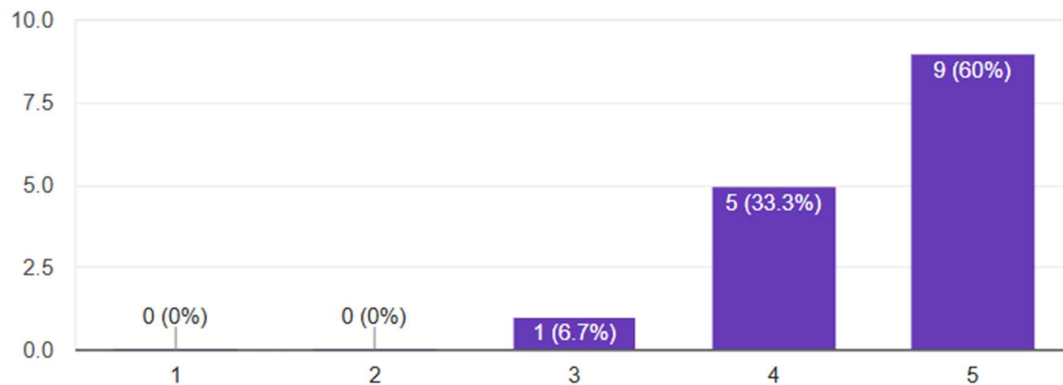


Figure 3. 42: Distribution of Responses on Whether Speaker Diarization can benefit Kalaka

This section provides an in-depth analysis of users' feedback on various aspects of Kalaka, including its features, usability, design, and potential areas for improvement. Each figure captures a specific dimension of user perceptions, offering actionable insights for enhancing Kalaka.

Figure 3.35 illustrates the features respondents consider essential for Kalaka. This survey question aimed to identify user preferences among features such as Words of the Day, Quizzes, Glossary, and Speech-to-Text functionality, helping determine which features would be most practical to include in Kalaka. Understanding these preferences helps identify areas where Kalaka can expand its functionality to better cater to user needs.

Figure 3.36 examines whether respondents believe Kalaka should include an audio pronunciation feature. A significant interest in this feature would underscore the importance of accessibility, particularly for language-related content. Implementing audio pronunciation could enrich the user experience and broaden Kalaka's appeal to a more diverse audience.

Figure 3.37 explores whether users find Kalaka easy to navigate. The data reflects overall perceptions of Kalaka's interface and layout. Any indications of difficulty in navigation suggest that improvements in user interface design and workflow optimization are necessary to enhance usability.

Figure 3.38 assesses user satisfaction with Kalaka's current design, offering a snapshot of how effectively the design meets user expectations. Most users rated their satisfaction level at 3, indicating a neutral stance or moderate satisfaction with the current design.

Figure 3.39 focuses on user preferences for Kalaka's design style. This analysis captures aesthetic and functional expectations trends, such as preferences for modern, minimalist designs or more interactive interfaces. Aligning the design style with user preferences ensures that Kalaka remains visually appealing and engaging.

Figure 3.40 identifies the most challenging aspects of using Kalaka. This analysis reveals common pain points, such as outdated or incomplete content, difficulty navigating the website, lack of interactivity or limited language or dialect options. Addressing these challenges is critical to optimizing the user experience and increasing satisfaction with the system.

Figure 3.41 pinpoints the specific pages within Kalaka that users feel need improvement. By identifying these areas, such as the homepage, language statistic page, or any page in Kalaka, targeted efforts can be made to refine the most impactful aspects of the system.

Finally, Figure 3.42 examines whether respondents believe speaker diarization could benefit Kalaka. This analysis highlights users' potential value in integrating this feature, particularly for scenarios involving multiple speakers or voice recognition. If users find it beneficial, this feature could enhance Kalaka's functionality and expand its use cases.

3.1.4: Speaker Diarization Specific Questions

How familiar are you with speaker diarization?

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15 responses

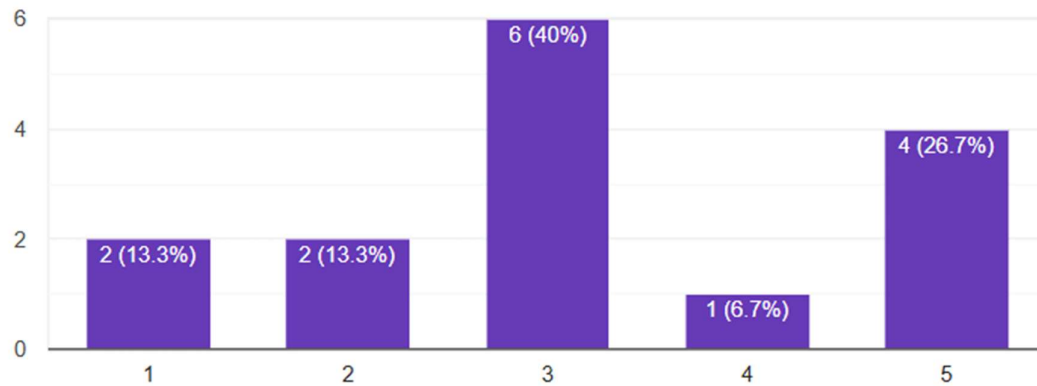


Figure 3. 43: Distribution of Responses on Whether User Familiar with Speaker Diarization

In your understanding, what does speaker diarization do?

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15 responses

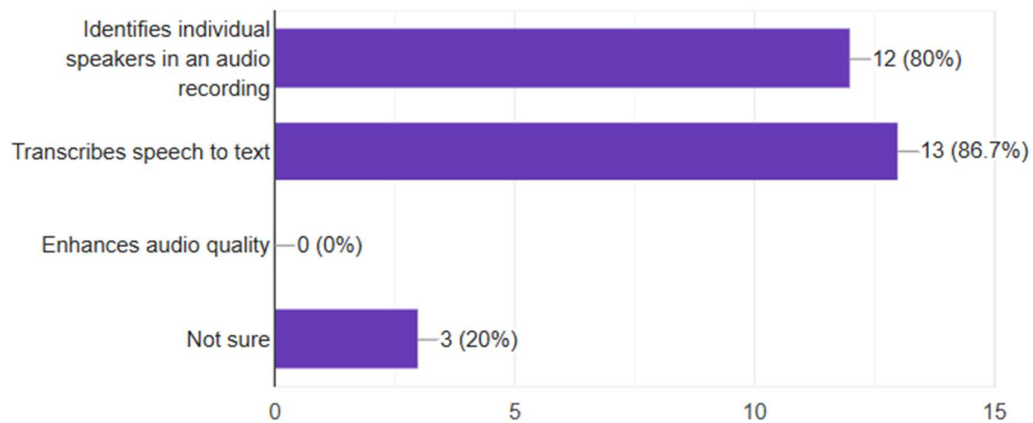


Figure 3. 44: Distribution of Responses on User Understanding of Speaker Diarization

Would you use a tool that can separate different speakers in a conversation?

 Copy

15 responses

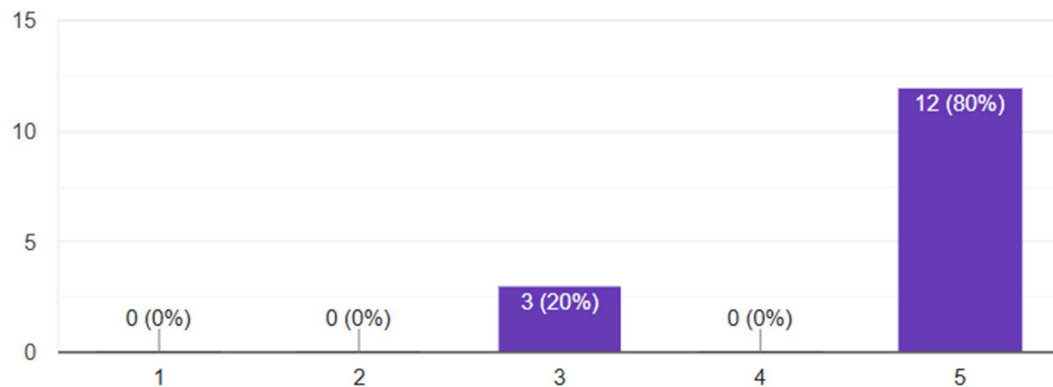


Figure 3. 45: Distribution of Responses on Whether Users Would Use Speaker Diarization

In what format would you prefer to see speaker diarization results?

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15 responses

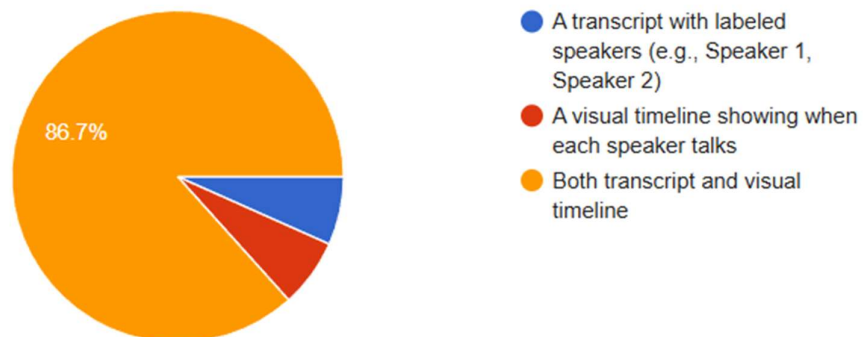


Figure 3. 46: Distribution of Responses on Which Speaker Diarization Result Users Want to See

Do you think speaker diarization can be useful for Kalaka?

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15 responses

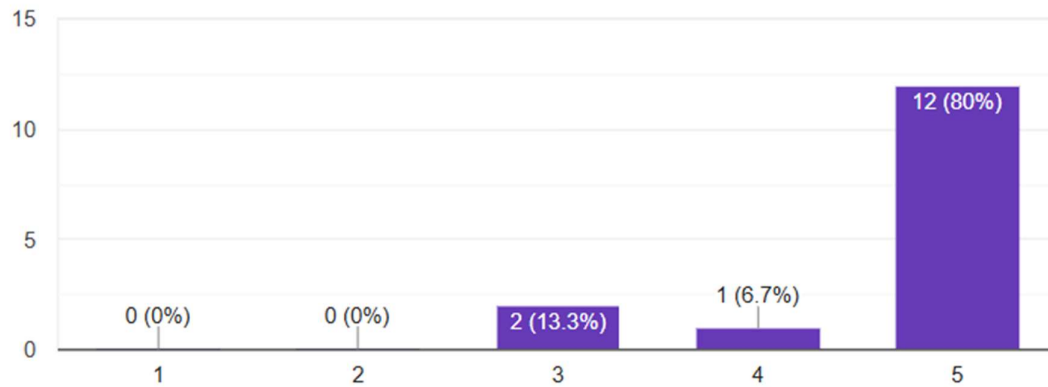


Figure 3. 47: Responses on Whether Users Find Speaker Diarization Useful

What features would you find most valuable in a speaker diarization tool?

 Copy

15 responses

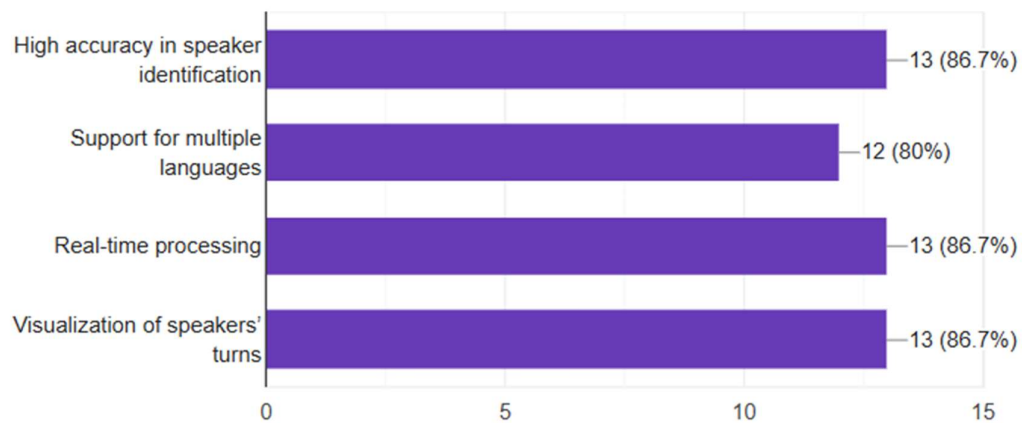


Figure 3. 48: Responses on What Users Find Most Valuable in Speaker Diarization

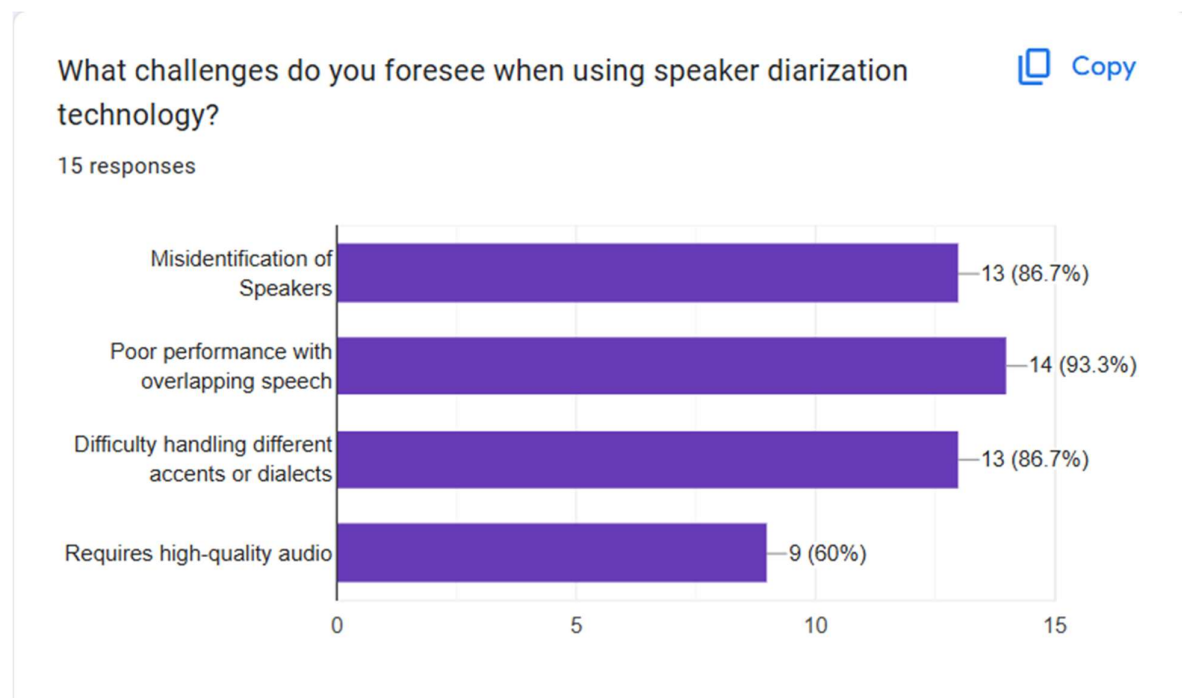


Figure 3. 49: Responses on Challenges Users Face with Speaker Diarization

This section in the survey were designed to assess users' familiarity with, understanding of, and perceptions regarding the potential use and value of speaker diarization in Kalaka. This feature, which involves identifying and separating different speakers in an audio recording, was explored to determine whether it would benefit Kalaka.

Figure 3.43 presents the distribution of responses on whether users are familiar with speaker diarization. The results revealed a mixed level of familiarity, with some respondents indicating they were already acquainted with the concept while others were not. This highlights the need to provide additional educational resources or explanations to introduce speaker diarization to users who may not be familiar with it, ensuring they can appreciate its potential benefits.

Figure 3.44 analyzes users' understanding of speaker diarization. Most respondents clearly understood the concept, recognizing its relevance in distinguishing between speakers in audio recordings. However, fewer users showed limited understanding, further underscoring the importance of clear explanations and tutorials to facilitate complete comprehension of this feature.

Figure 3.45 evaluates whether users would be interested in using speaker diarization. The responses indicated a generally positive reception, with many respondents expressing interest in utilizing this feature. This suggests that speaker diarization could be a valuable tool for enhancing Kalaka's functionality, particularly when differentiating between multiple speakers in audio recordings is necessary.

Figure 3.46 shows that most respondents would prefer speaker diarization to display both a transcript and a timeline. This suggests that users are most interested in seeing clear, labelled distinctions between speakers in audio content. They favoured speaker labels, such as Speaker 1, Speaker 2, and so on, and timestamps to track when each speaker contributes to the conversation. This feedback emphasizes the importance of providing well-organized and easily navigable results in Kalaka's speaker diarization feature.

Figure 3.47 investigates whether users find speaker diarization useful. The responses were overwhelmingly positive, with most participants indicating they would find the ability to distinguish speakers in audio recordings valuable. This feedback suggests that speaker diarization could be crucial in improving the quality and usability of Kalaka's content.

Figure 3.48 focuses on what users find most valuable about speaker diarization. The primary value identified was the ability to easily track and identify individual speakers, particularly in group discussions. This suggests that integrating speaker diarization would add significant utility to Kalaka, especially for users who rely on clear audio content for learning or reference.

Figure 3.49 examines the challenges users face with speaker diarization. A few respondents expressed concerns about overlapping voices, speaker misidentification, and difficulty handling different accents or dialects. These challenges highlight the need for further refinement of the feature to ensure its effectiveness in real-world scenarios, where audio quality and speech variability can impact accuracy.

3.8 Summary

Chapter 3 covered the Prototyping Model methodology and the design aspects of the proposed system. This chapter analyzes the requirements to define the functional, non-functional, and software needs. Additionally, the overall system workflow is modelled using UML Activity Diagrams and Data Flow Diagrams, while the database design is represented through an Entity Relationship Diagram (ERD).

CHAPTER 4: IMPLEMENTATION AND TESTING

4.1: Introduction

Chapter 4 explores the Prototyping stage of the Prototyping Model, which focuses on developing the proposed system. The previously analyzed and designed system requirements will be a reference throughout this phase to ensure the system meets its intended objectives.

This chapter will detail the installation and configuration of essential system components. Additionally, it will present the structure and functionality of both the user and admin pages, accompanied by screenshots and concise descriptions.

4.2: Installation of Configuration of System Components

Before beginning development, a specific software program must be installed and configured. The proposed system is developed using Microsoft Visual Studio Code (VSCode) as the primary development tool. The following section will provide a detailed explanation of its usage.

4.2.1: Visual Code Studio

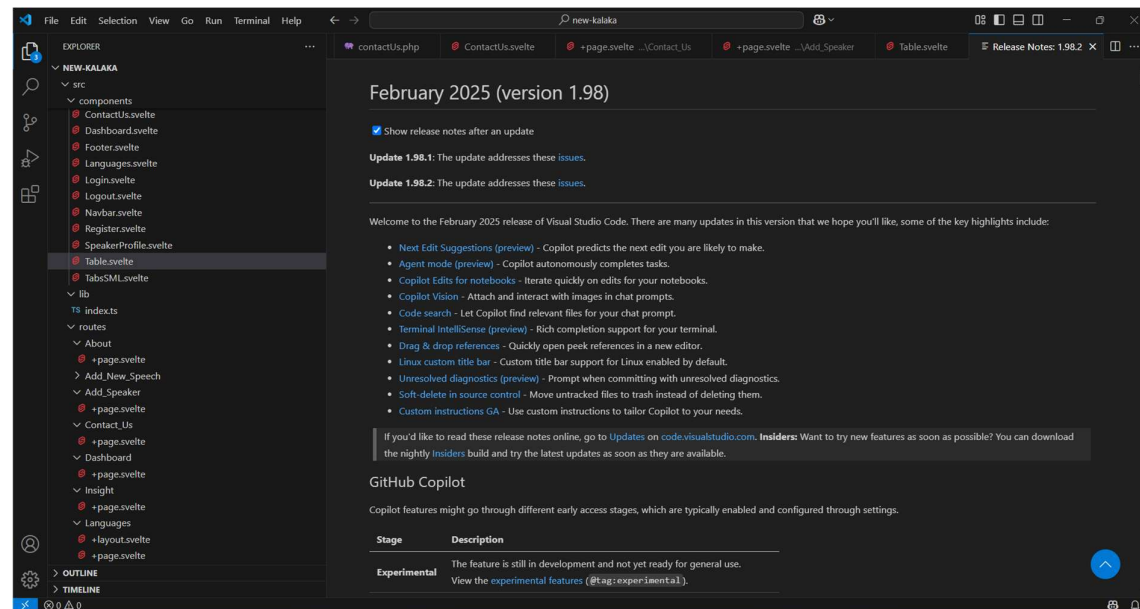


Figure 4. 1: Visual Studio Code

Visual Studio Code (VSCode) is a free, lightweight code editor equipped with features such as debugging, task automation, and version control. It will be used to develop and integrate

new features into the original Kalaka website. To install VSCode, the first step is to download its installer from the official website. Figure 4.1 above displays the VSCode interface.

4.3: Revamped Pages in the Kalaka System

This section highlights the updated and redesigned pages within the Kalaka system, including the Home, Map, Insights, Languages, and Login pages for both users and administrator. These pages have been rebuilt using Svelte, based on the structure of the previous Kalaka system, and introduced under new names to reflect their improved functionality and design.

4.3.1: Map Page

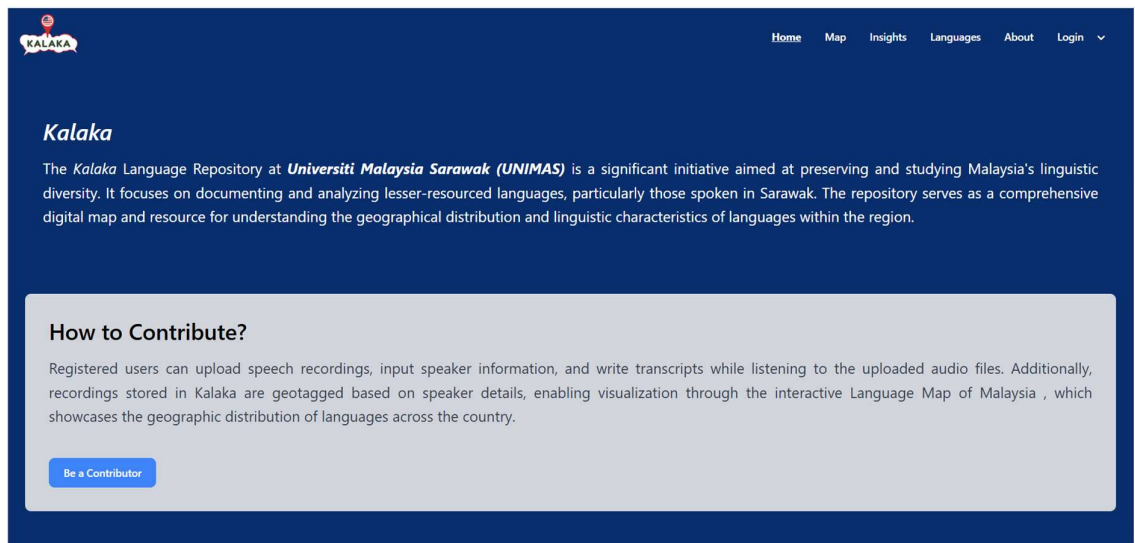


Figure 4. 2: Home Page

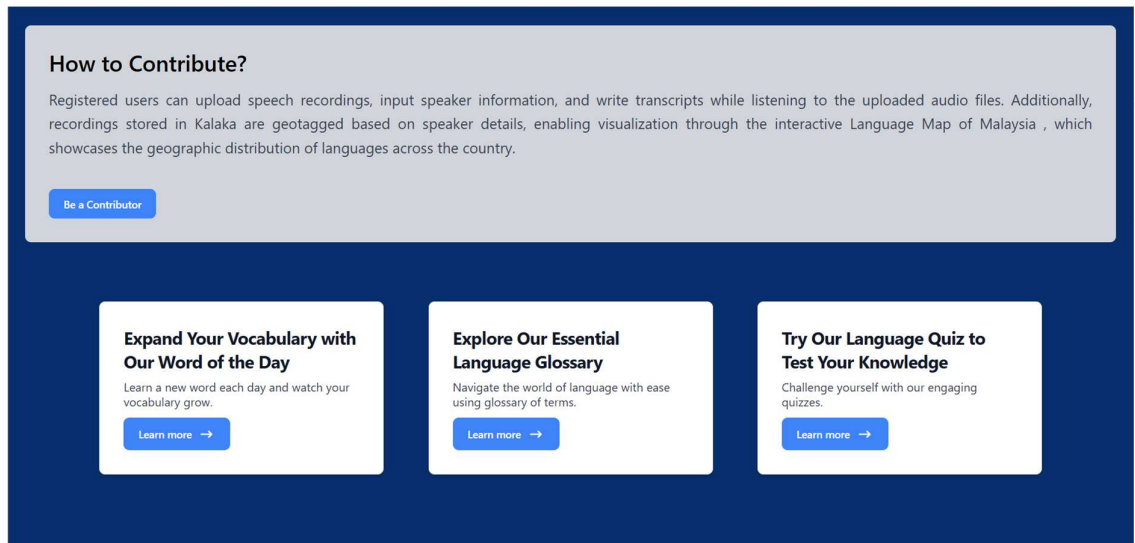


Figure 4. 3: Section to Other Pages

Figure 4.1 presents the redesigned home page of the Kalaka system, featuring a brief introductory video about Kalaka and preview sections for key pages such as Words of the Day, Glossary, and Quiz (refer to Figure 4.3). This refreshed layout is designed to capture users' attention with vibrant colors and engaging elements, offering a clear introduction to what Kalaka is and what it aims to achieve. By providing this overview, the home page not only helps users quickly understand the system's purpose but also encourages them to explore further and become part of the Kalaka community.

4.3.2: Map Page

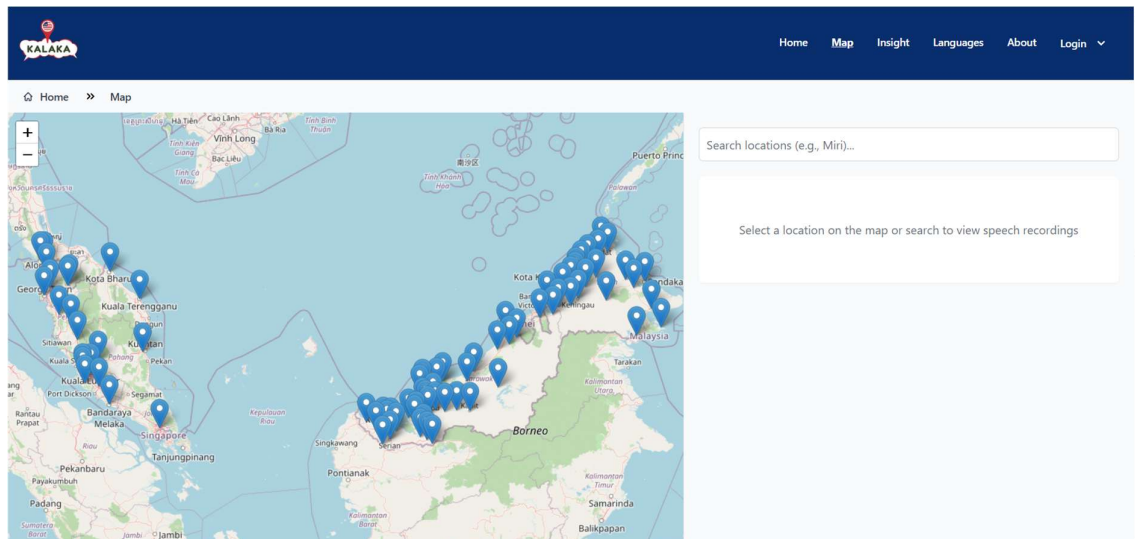


Figure 4. 4: Map Interface

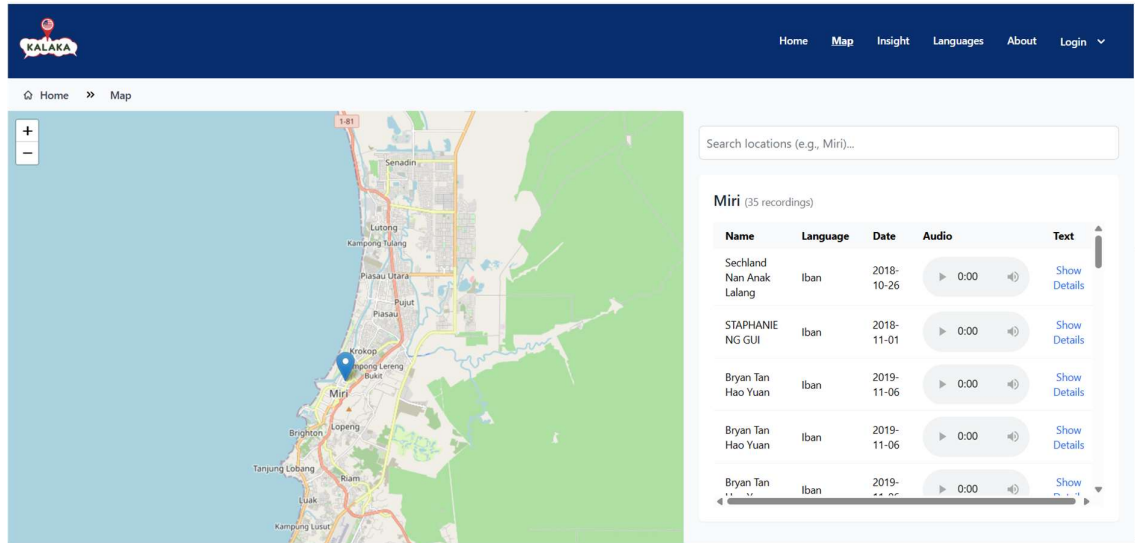


Figure 4. 5: Miri Recordings Data Table

Figures 4.4 and 4.5 demonstrate the redesigned *Map* page interface. The updated layout adopts a cleaner and more organized design, significantly reducing visual clutter and making the interface more user-friendly. This design approach not only improves the aesthetic appeal but also enhances readability and navigation, especially when handling large amounts of location-based data.

One of the key features introduced in this update is the dynamic search function, which allows users to quickly and efficiently locate specific data points or recordings on the map without having to manually browse through all available entries. This is particularly useful for users who are looking for specific speaker recordings, regional data, or linguistic entries tied to particular locations.

Overall, the new Map interface supports better user experience by providing a smoother interaction, reducing time spent on searching, and making the system more intuitive and responsive for researchers, educators, or students using Kalaka for language and cultural exploration.

4.3.3: Insights

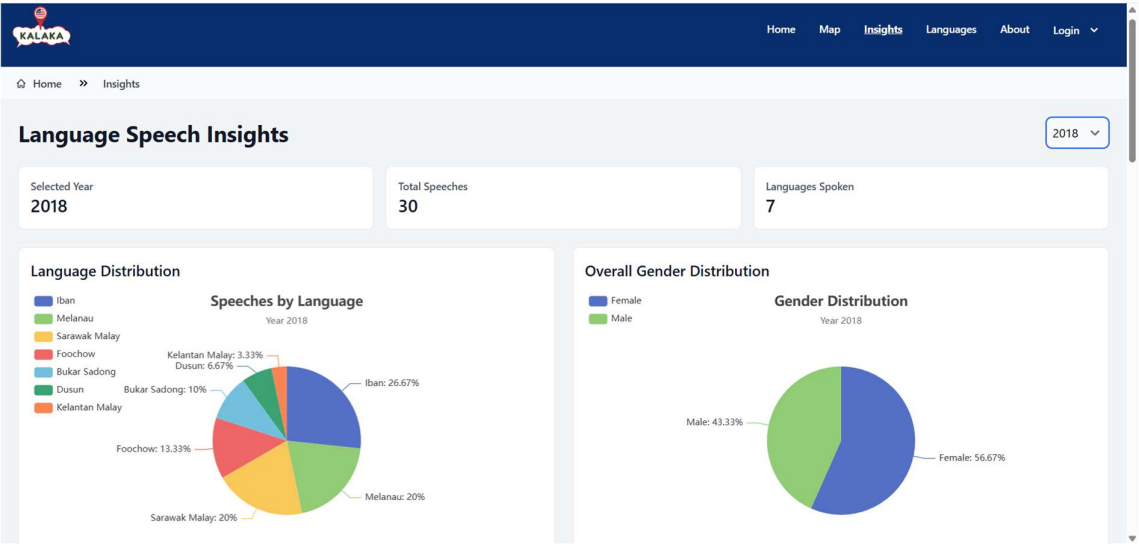


Figure 4. 6: Insights Page

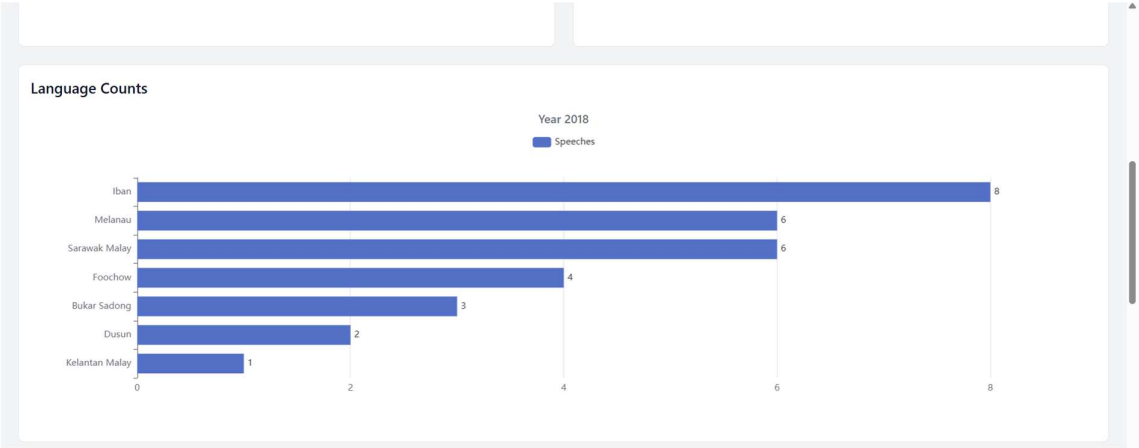


Figure 4. 7: Language Counts in Insight Page

LANGUAGE	TOTAL SPEECHES	FEMALE	MALE
Iban	8	5	3
Melanau	6	2	4
Sarawak Malay	6	5	1
Foochow	4	2	2
Bukar Sadong	3	3	0
Dusun	2	0	2
Kelantan Malay	1	0	1

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Figure 4. 8: Language Details Table

Figure 4.6 shows the newly introduced *Insights* page, which replaces the previous *Language Statistics* section in the Kalaka system. This page acts like a centralized dashboard for user, offering detailed and visually engaging data on the number of speeches recorded in Kalaka, categorized by language for a selected year. Its primary purpose is to help users such as researchers, educators, and linguists to analyze language distribution and usage trends over time.

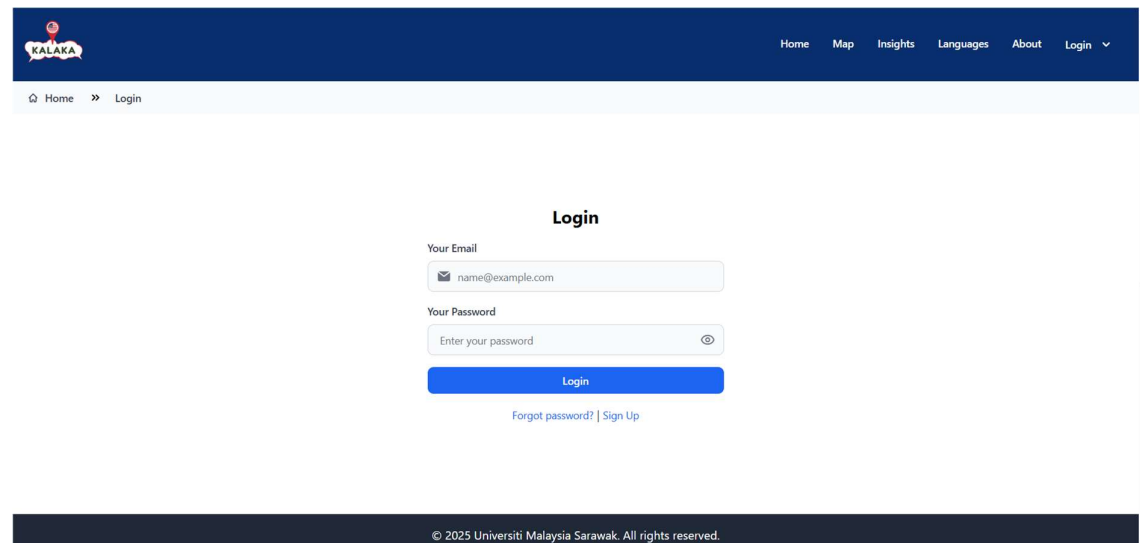
The interface features two pie charts, one bar chart, and a data table (refer to Figures 4.6 to 4.8). All visual elements dynamically reflect data based on the year selected by the user via a dropdown menu. The bar chart in Figure 4.7 illustrates the total number of speeches recorded per language, while the first pie chart presents the percentage distribution of each language. The second pie chart shows the overall gender distribution (male vs. female) of the speakers for the selected year. These visualizations offer both quantitative and proportional perspectives, making it easier to interpret and compare language usage and demographic patterns at a glance.

The language details table in Figure 4.8 complements the charts by displaying detailed information, including the language, total number of speeches, and the breakdown by male and female speakers. This tabular format enables more precise comparisons and supports further analysis.

Users can interact with the page by selecting a specific year from a dropdown menu. Upon selection, the charts automatically update to reflect the data for the chosen year or even

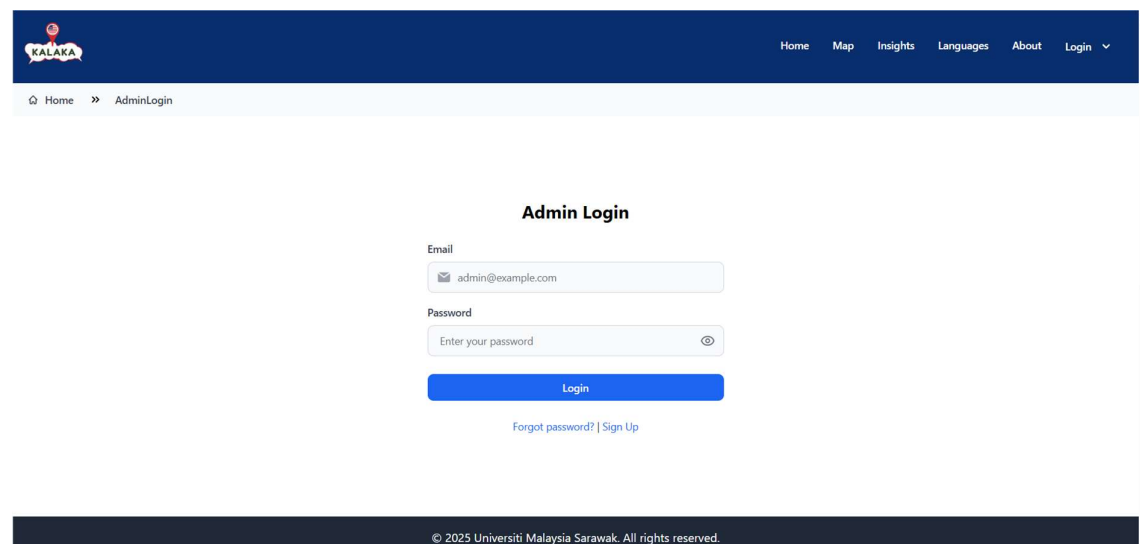
past years. This functionality makes it easy to explore historical trends and gain insights into how different languages are represented in Kalaka over time.

4.3.4: Login Page For Users and Administrator



The screenshot shows the 'User Login' page of the Kalaka application. It features a dark blue header with the 'KALAKA' logo on the left and navigation links (Home, Map, Insights, Languages, About, Login) on the right. Below the header, a breadcrumb trail shows 'Home' and 'Login'. The main content area is white and contains a 'Login' heading. Underneath, there are two input fields: 'Your Email' with the placeholder 'name@example.com' and 'Your Password' with the placeholder 'Enter your password'. A blue 'Login' button is positioned below the password field. At the bottom of the login section, there are links for 'Forgot password?' and 'Sign Up'. The footer is dark blue and contains the copyright notice '© 2025 Universiti Malaysia Sarawak. All rights reserved.'

Figure 4. 9: User Login Page



The screenshot shows the 'Admin Login' page of the Kalaka application. It features a dark blue header with the 'KALAKA' logo on the left and navigation links (Home, Map, Insights, Languages, About, Login) on the right. Below the header, a breadcrumb trail shows 'Home' and 'AdminLogin'. The main content area is white and contains an 'Admin Login' heading. Underneath, there are two input fields: 'Email' with the placeholder 'admin@example.com' and 'Password' with the placeholder 'Enter your password'. A blue 'Login' button is positioned below the password field. At the bottom of the login section, there are links for 'Forgot password?' and 'Sign Up'. The footer is dark blue and contains the copyright notice '© 2025 Universiti Malaysia Sarawak. All rights reserved.'

Figure 4. 10: Administrator Login Page

Figures 4.9 and 4.10 show the Login pages for Users and Administrators. These pages are revamped versions of the original login screens in Kalaka, now redesigned using the Svelte framework and Tailwind CSS library for a more modern and responsive user interface.

4.4: New Features Introduced in Kalaka System

The front end of the updated Kalaka system retains the core structure of the original website but has been fully redesigned using Svelte for improved performance and responsiveness. This enhanced version introduces four major new features: Words of the Day, Glossary, Quizzes, and Speaker Diarization, each aimed at enriching user engagement and supporting language learning and analysis.

4.4.1: Words of the Day

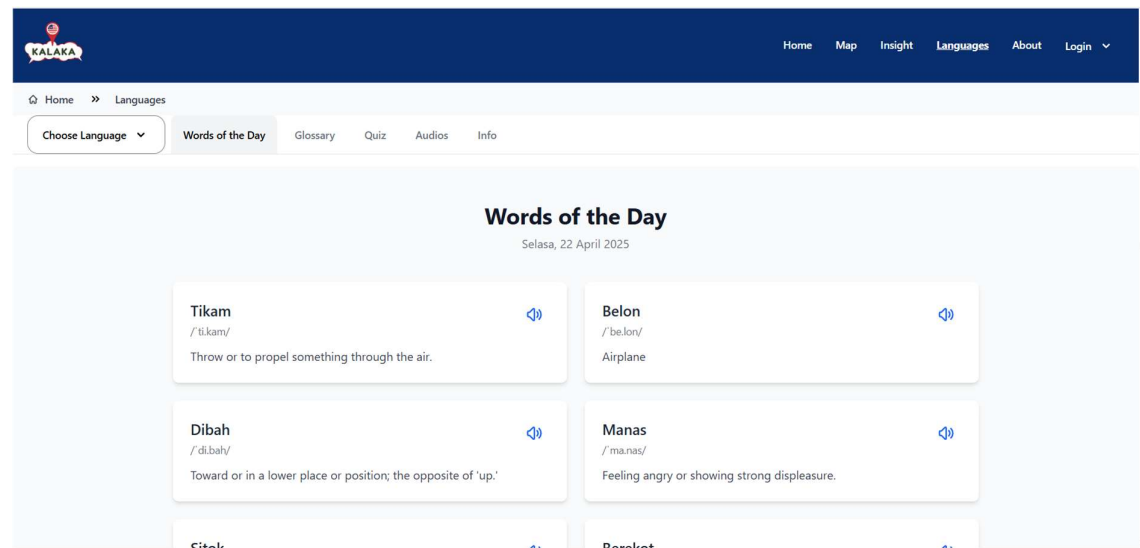


Figure 4. 11: Words of the Day

Figure 4.11 illustrates the *Words of the Day* interface, a key feature designed to promote daily language learning and encourage user engagement. This interactive page is particularly useful for users who are enthusiastic about expanding their vocabulary in Sarawak Malay and other available languages. A language selection dropdown allows users to switch between supported languages, making the feature versatile and inclusive for a broader audience.

The interface is updated automatically every day with a new set of words, ensuring that learning remains fresh, consistent, and engaging over time. This daily exposure to new vocabulary helps users build their language skills progressively, making it suitable for both beginners and those seeking to deepen their understanding of the language.

A standout element of this interface is the integrated text-to-speech (TTS) functionality. For each word displayed, users can click a button to hear its correct pronunciation. This feature

is especially valuable for learners who may not be familiar with how Sarawak Malay words sound, as it supports both auditory learning and pronunciation practice. By listening to native or near-native pronunciations, users can mimic the sounds more accurately, improving their speaking confidence and fluency.

4.4.2: Glossary

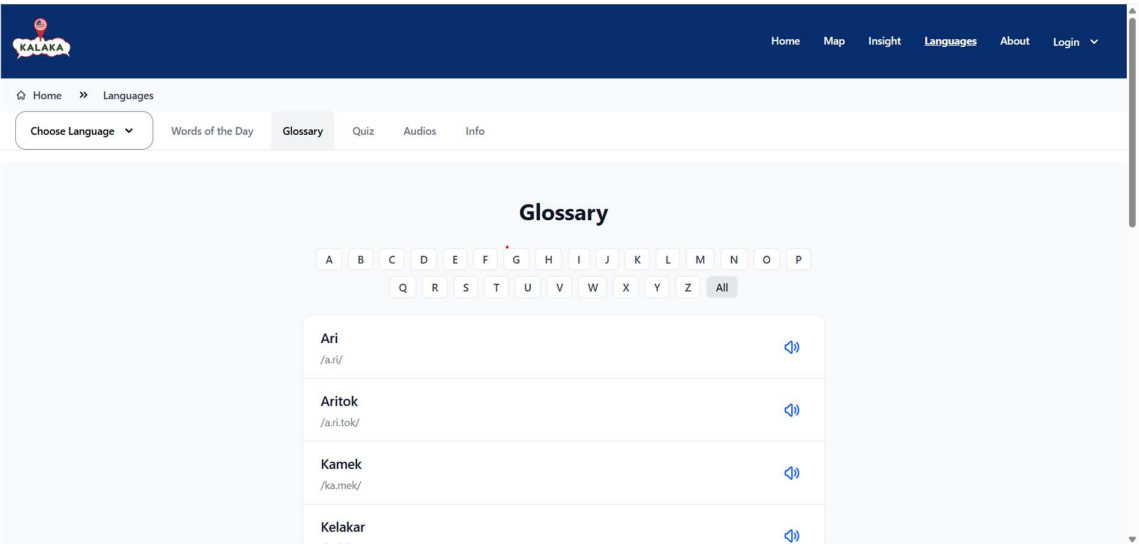


Figure 4. 12: Glossary Interface

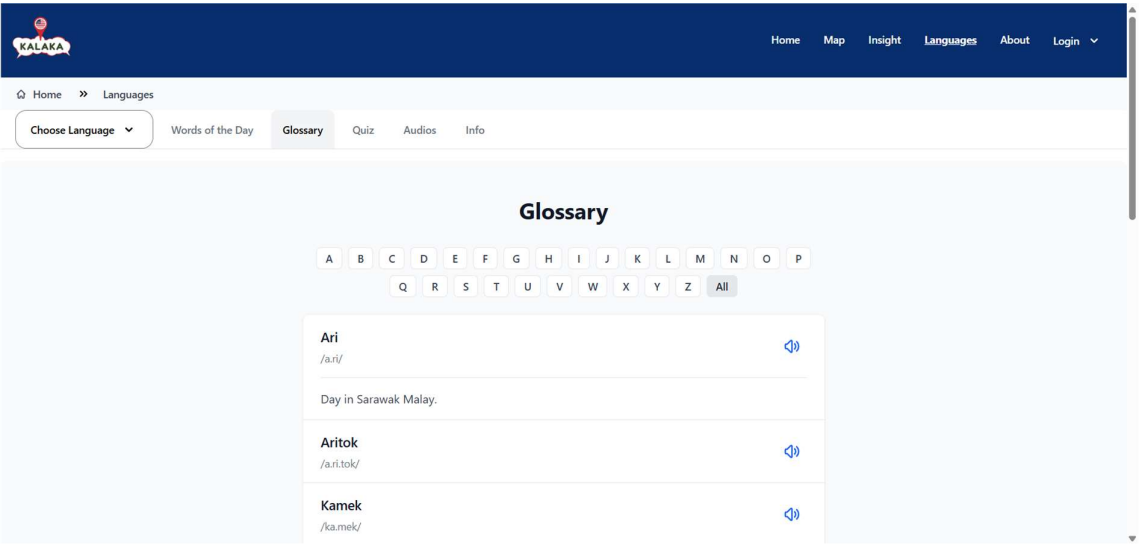


Figure 4. 13: Expanded row displaying the meaning.

Figures 4.12 and 4.13 demonstrate the *Glossary* interface, a feature designed to support users in exploring and learning Sarawak Malay vocabulary in a structured and self-paced manner. This page acts as a comprehensive dictionary within the Kalaka system, listing a wide range of words along with their meanings and pronunciations, making it an essential learning tool for both new and returning users.

An integrated text-to-speech (TTS) feature adds an auditory dimension to the learning process by playing the correct pronunciation of each word. In addition, the *Glossary* interface includes a filter function that lets users easily browse words based on the alphabet they select. This alphabet-based filtering makes navigation intuitive and helps users focus on specific sets of vocabulary, especially when learning systematically or revising words that begin with certain letters. For example, if a user selects the letter "B," the glossary will display all Sarawak Malay words that start with that letter, streamlining the learning experience.

The combination of visual word listings, audio pronunciation support, and alphabetic filtering makes the *Glossary* page an engaging and efficient tool for language acquisition. It encourages users to explore the richness of Sarawak Malay vocabulary and supports different learning styles whether visual, auditory, or a mix of both.

4.4.3: Quizz

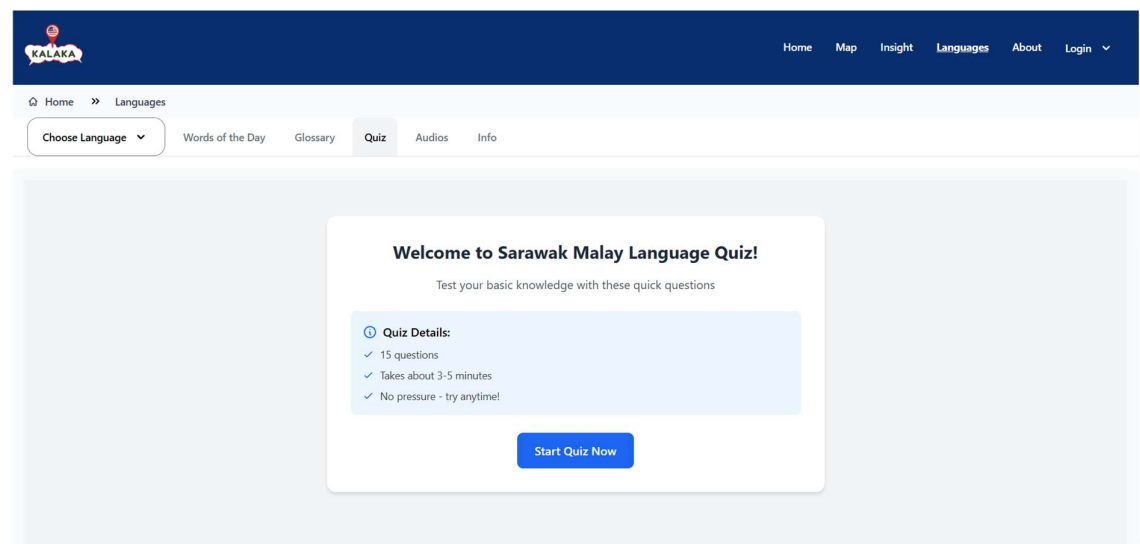


Figure 4. 14: Quiz Interface

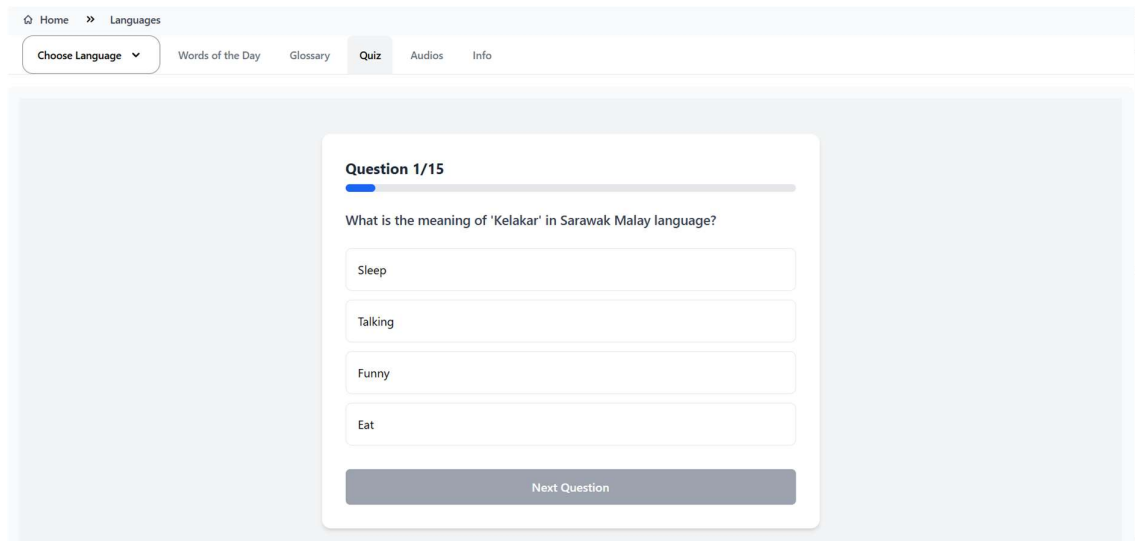


Figure 4. 15: Answering Quiz Interface

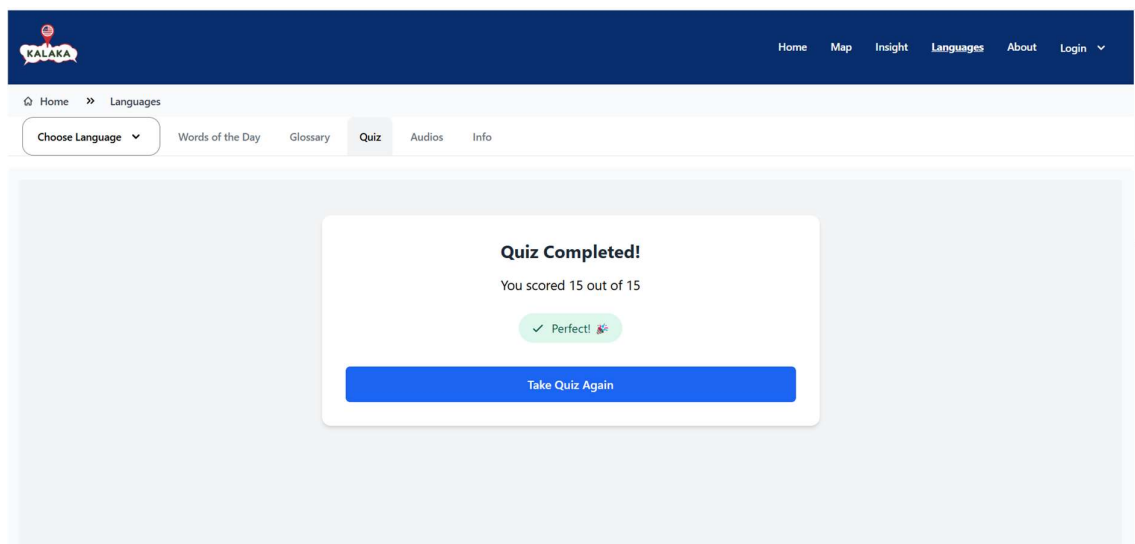


Figure 4. 16: The Quiz Result Interface

Figures 4.14 and 4.15 demonstrate the *Quiz* interface within the Kalaka system. This feature is designed to actively reinforce users' understanding of the language they are learning particularly Sarawak Malay by transforming vocabulary and comprehension into an engaging and interactive experience. After selecting their preferred language, users are presented with multiple-choice questions that test their familiarity with word meanings, usage, and pronunciation.

The quiz format is intentionally kept simple and stress-free, with no countdown timer or scoring pressure. This approach promotes a more relaxed and supportive environment for learning, where users can focus on comprehension and accuracy rather than speed. It is especially helpful for beginner and intermediate learners who may need more time to process each question.

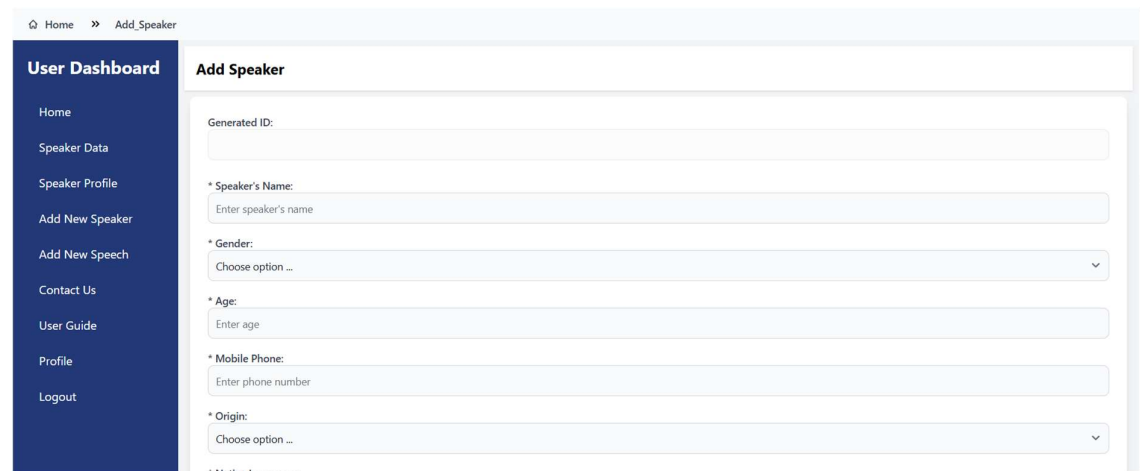
Each quiz question includes four options (A, B, C, and D), encouraging critical thinking and vocabulary recall. The structure of the quiz not only reinforces previously learned material from the *Words of the Day* and *Glossary* pages, but also helps identify areas that may need further review, making it a practical self-assessment tool.

Figure 4.16 displays the *Quiz Result* interface, which is shown upon completion of the quiz. This page provides immediate feedback, including the number of correct to give users a clear overview of their performance. This feedback helps learners track their progress and motivates them to revisit content or take the quiz again to improve their score.

4.5: User Interface

The user interface (UI) of the proposed Kalaka system has been improved to provide a cleaner, more user-friendly experience. Redesigned using modern tools like Svelte and Tailwind CSS, the interface now offers better navigation, visual consistency, and responsiveness across devices.

4.5.1: Add Speaker



The screenshot displays the 'Add Speaker' page within the Kalaka system's user interface. On the left, a dark blue sidebar titled 'User Dashboard' contains navigation links: Home, Speaker Data, Speaker Profile, Add New Speaker, Add New Speech, Contact Us, User Guide, Profile, and Logout. The main content area, titled 'Add Speaker', features a form with the following fields: 'Generated ID:' (a text input), '* Speaker's Name:' (a text input with placeholder 'Enter speaker's name'), '* Gender:' (a dropdown menu with 'Choose option ...'), '* Age:' (a text input with placeholder 'Enter age'), '* Mobile Phone:' (a text input with placeholder 'Enter phone number'), and '* Origin:' (a dropdown menu with 'Choose option ...'). Each field is preceded by an asterisk, indicating it is a required field. The form is styled with a clean, modern design using light blue and white colors.

Figure 4. 17: Add Speaker Page

Figure 4.17 illustrates the newly redesigned *Add Speaker* page in the user interface. Although the form layout remains consistent with the previous version, it has been rebuilt using Tailwind CSS, resulting in a cleaner, more modern, and responsive design. The use of Tailwind enhances visual consistency, improves spacing and alignment, and allows for a more user-friendly experience across different devices. On this page, users are required to complete all input fields such as the speaker's name, role, or any relevant details to successfully add a new speaker to the system.

4.6: Administrator Interface

The Administrator Interface is developed to streamline the management of content within the system. It provides essential tools for updating and maintaining language-related data, ensuring the platform remains dynamic and informative. Through its simplified input forms and clear layout, administrators can efficiently manage entries without technical complexity, supporting the system's growth and relevance over time.

4.6.1: Add New Word

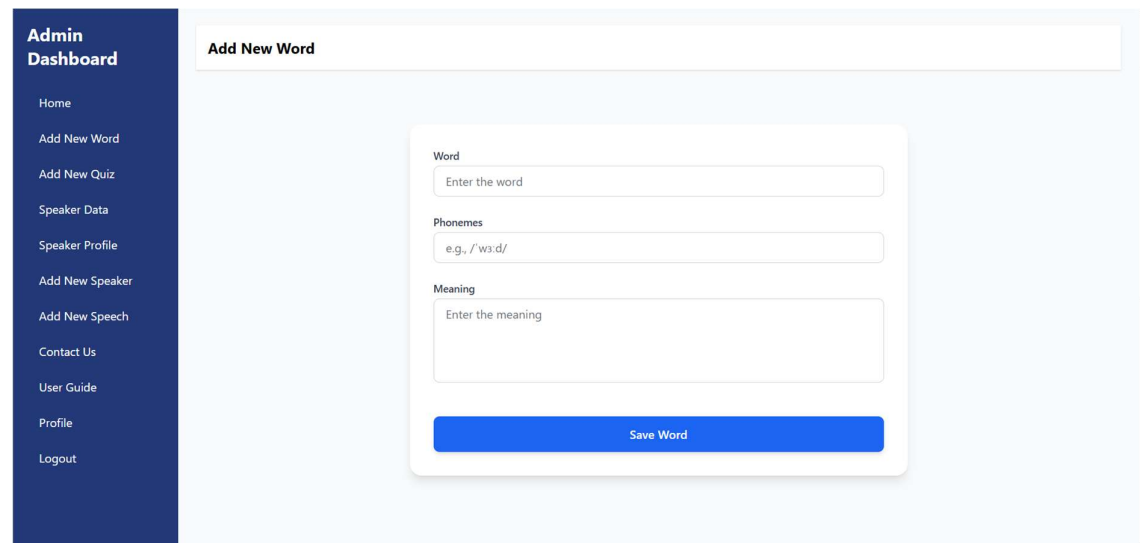


Figure 4. 18: Add New Word Page

Figure 4.18 illustrates the newly designed page that allows the Administrator to add new words into Kalaka's database. This interface plays a crucial role in supporting the functionality of both the *Words of the Day* and *Glossary* pages, as it serves as the primary input point for populating and updating the system's vocabulary content. Without this page, the Administrator would be unable to introduce new words, which would limit the platform's ability to grow and provide fresh learning materials.

The form is simple and user-friendly, requiring the Administrator to fill in all necessary fields including the word, its phonemes (sound representation), and its meaning. Once all fields are completed, the Administrator can click the *Save Word* button to store the new entry in the database.

Home » AdminAddQuiz

Admin Dashboard

- Home
- Add New Word
- Add New Quiz
- Speaker Data
- Speaker Profile
- Add New Speaker
- Add New Speech
- Contact Us
- User Guide
- Profile
- Logout

Add New Quiz

Question
Type your quiz question here

Option A
Enter option A

Option B
Enter option B

Option C
Enter option C

Option D
Enter option D

Correct Answer
Option A

Save Quiz

Figure 4. 19: Add New Quiz

Figure 4.19 demonstrates the page designed for the Administrator to add new quiz questions to the Kalaka system. This page is essential for maintaining and expanding the quiz content, ensuring that users have access to a diverse and engaging set of questions over time. The interface includes input fields for the question text, Option A, Option B, Option C, and Option D, along with a dropdown menu for selecting the correct answer.

Without this feature, the quiz content would remain static, which could lead to a repetitive and less engaging experience for users. By enabling the Administrator to easily add new questions, the system ensures that the Quiz page remains dynamic, challenging, and educational, providing users with continuous opportunities to test and improve their knowledge of the Sarawak Malay language.

4.7: Summary

Chapter 4 presents the implementation and testing of the proposed Kalaka system, developed based on the Prototyping Model to ensure alignment with the previously defined requirements. This chapter details the installation of necessary development tools such as Visual Studio Code and showcases the system's new and improved features through a series of redesigned interfaces. These include the Map and Insights pages, which enhance data visualization and usability, along with newly added components such as Words of the Day, Glossary, and Quiz that support interactive language learning. Each feature is accompanied by functional elements like text-to-speech and dynamic filtering to improve user experience. The chapter also covers both user and administrator modules, highlighting new interfaces like Add New Word, and Add Quiz, which facilitate system management and content updates. Throughout, screenshots and concise explanations are provided to offer a clearer view of the internal processes and overall functionality of the Kalaka system.

CHAPTER 5: TESTING

5.1: Testing

The testing phase evaluates the system to verify its accuracy, functionality, and completeness. This process ensures that the solution meets its intended objectives through functional and non-functional testing. These assessments determine whether the system performs as designed and fulfills user expectations, including interface usability and overall performance.

5.2: Functional Testing

Visitor Module

- i. Map
- ii. Insights
- iii. Languages - Words of the Day
- iv. Languages - Glossary
- v. Languages - Quiz
- vi. Languages - Audio (Speaker Diarization)

User Module

- i. Login
- ii. Sign Up
- iii. Speaker Profile Management
- iv. Speech Data Management
- v. Add New Speaker
- vi. Add New Speech
- vii. Logout

Administrator Module

- i. Login
- ii. Add Words
- iii. Add Quiz
- iv. Speaker Profile Management
- v. Speech Data Management
- vi. Users Management
- vii. Add New Speaker
- viii. Add New Speech Data
- ix. Logout

5.2.1: Unit Testing

This section describes the unit testing process used to detect and verify errors within individual components. The purpose of this testing is to identify and resolve bugs before integrating all individual components into a fully functioning system.

Module Category	No.	Module/Function	Pre-Condition	Expected Result	Results
Visitor	1	Words of the Day	Page is loaded; backend is connected and has word data.	Refresh words daily	Pass
				Text-to-Speech (TTS) works	Pass
	2	Glossary	Glossary data exists in the system.	Filter works	Pass
				TTS works	Pass
				Search bar functions correctly	Pass
	3	Quiz	Quiz questions and answers are present.	Quiz calculates mark	Pass
				Recognizes correct answers	Pass
	4	Speaker Diarization	Uploaded audio file is present; diarization service is active.	Able to diarize speech correctly	Pass
	5	Map	Location data is	Displays data at specific locations	Pass

			available in the database.	Shows correct result from search bar	
	6	Insights	Data exists for generating insights.	Fetches and displays data using graphs	Pass
User	7	Login	Click on the “Login” button without input the user email and password.	The system displays message “Please enter your email and password”	Pass
			Input user’s email incorrectly with correct password.	The system displays message “The password is invalid or the user does not have a password”.	Pass
			Input user’s password incorrectly with correct email.	The system displays message “There is no user record corresponding to this identifier. The user may have been	Pass

				deleted”.	
			Input user’s email without password.	The system displays message “Please enter your password”.	Pass
			Input password without email.	The system displays message “The email address is badly formatted”.	Pass
	8	Sign Up	Input email and password correctly.	Login to the system successfully.	Pass
			Click on the “Sign up” button without input the user’s name, email and password.	The system displays message “Please fill in this field”.	Pass
			Input user’s full name without user’s email and password.	The system displays message “Please fill in this field”	Pass
			Input user’s email	The system displays	Pass

			without user's full name and password.	message "Please fill in this field".	
			Input user's password without user's full name and email.	The system displays message "Please fill in this field".	Pass
			Input user's full name incorrectly.	The system displays message "Username must be in alphabet".	Pass
			Input user's email incorrectly.	The system displays message "Email is badly formatted".	Pass
			Input user's password Incorrectly.	The system displays message "Password should be at least 6 alphanumeric characters".	Pass
			Input user's full	Sign up successfully	Pass

			name, email and password correctly.	and redirect to login page correctly.	
	9	Speaker Profile Management	User is logged in; speaker profiles exist.	Able to manage and edit speaker profiles	Pass
	10	Speech Data Management	User is logged in; speech data exists.	Able to manage, view, and delete speech data	Pass
	11	Add New Speaker	Enter new speaker information on the Add Speaker page.	New speaker profile added successfully	Pass
	12	Add New Speech	Enter new speech information on the Add New Speech page.	New speech data added successfully	Pass
	13	Logout	Click on the logout button to check for correct redirection	User successfully logout from the system.	Pass

			to logout page.		
Administrator	14	Login	Click on the “Login” button without input the admin email and password.	The system displays message “Please enter your email and password”	Pass
			Input admin’s email incorrectly with correct password.	The system displays message “The password is invalid or the admin does not have a password”.	Pass
			Input admin’s password incorrectly with correct email.	The system displays message “There is no admin record corresponding to this identifier. The admin may have been deleted”.	Pass
			Input admin’s email	The system displays	Pass

			without password.	message “Please enter your password”.	
			Input password without email.	The system displays message “The email address is badly formatted”.	Pass
			Input email and password correctly.	Login to the system successfully.	Pass
	15	Add New Word	Admin choose to add new word.	Admin able to add new word	Pass
			Admin click on the “Edit” button to edit word.	Admin able to edit word	Pass
			Admin click on the “Delete” button to delete word.	Admin able to delete word	Pass
			Admin inputs a registered word to search word	Admin able to search word	Pass

			in the search bar to search for it.		
	16	Add New Quiz	Admin choose to add new quiz.	Admin able to add new quiz	Pass
			Admin click on the “Edit” button to edit quiz.	Admin able to edit quiz	Pass
			Admin click on the “Delete” button to delete quiz.	Admin able to delete word	Pass
			Admin inputs a registered quiz to search quiz in the search bar to search for it.	Admin able to search quiz	Pass
	17	Speaker Profile Management	Admin is logged in; speaker profiles table exist	Able to manage and edit speaker profiles	Pass

	18	Speech Data Management	Admin is logged in; speech data table exists.	Able to manage, view, and delete speech data	Pass
	19	Users Management	Admin is logged in; users management table exists.	Able to view, add, and delete users	Pass
	20	Add New Speaker	Enter new speaker information on the Add Speaker page.	New speaker profile added successfully	Pass
	21	Add New Speech Data	Enter new speech information on the Add New Speech page.	New speech data added successfully	Pass
	22	Logout	Click on the logout button to check for correct redirection to logout page.	Administrator successfully logout from the system.	Pass

Table 5. 1: shows the test case of Kalaka's unit testing.

5.3.: Brief Qualitative Analysis on Performance and System Features

This section presents a qualitative analysis comparing the performance of the original Kalaka system with the newly improved version developed using the Svelte framework and enhanced with additional features. The primary objective of this analysis is to identify direct improvements made over the old system and to detect any system errors or bugs encountered during the development of the new version. The analysis was conducted through live demonstrations of both systems, allowing for a side-by-side evaluation. The performance of each system was observed and assessed, with the findings summarized in Table 5.2.

Feature/Page	Old Kalaka System	New Kalaka System
Map Page	Slow loading when accessing Language Map	Still experiences slight delays on Language Map
Graph/Charts	No data displayed	Some minor display errors present
Table Data	No issues	Pagination not working properly

Table 5. 2: Brief Qualitative Analysis on Performance and System Features

5.4: User Acceptance Testing

This section discusses the User Acceptance Testing (UAT) conducted to evaluate user interaction with the proposed Kalaka system. The primary objective of UAT is to detect any system errors and assess user satisfaction with the system. The testing was carried out by presenting the system to a selected group of users. This group consisted of 15 students from Universiti Malaysia Sarawak (UNIMAS). A brief interview was conducted with 15 of the participants to gather their opinions and measure their level of satisfaction. At the end of the session, each respondent was given a Google Form questionnaire to provide structured feedback. The collected responses were analyzed, and the results are presented in the figures below to give a clear insight into user satisfaction. The complete UAT documentation is provided in Appendix C for further reference.

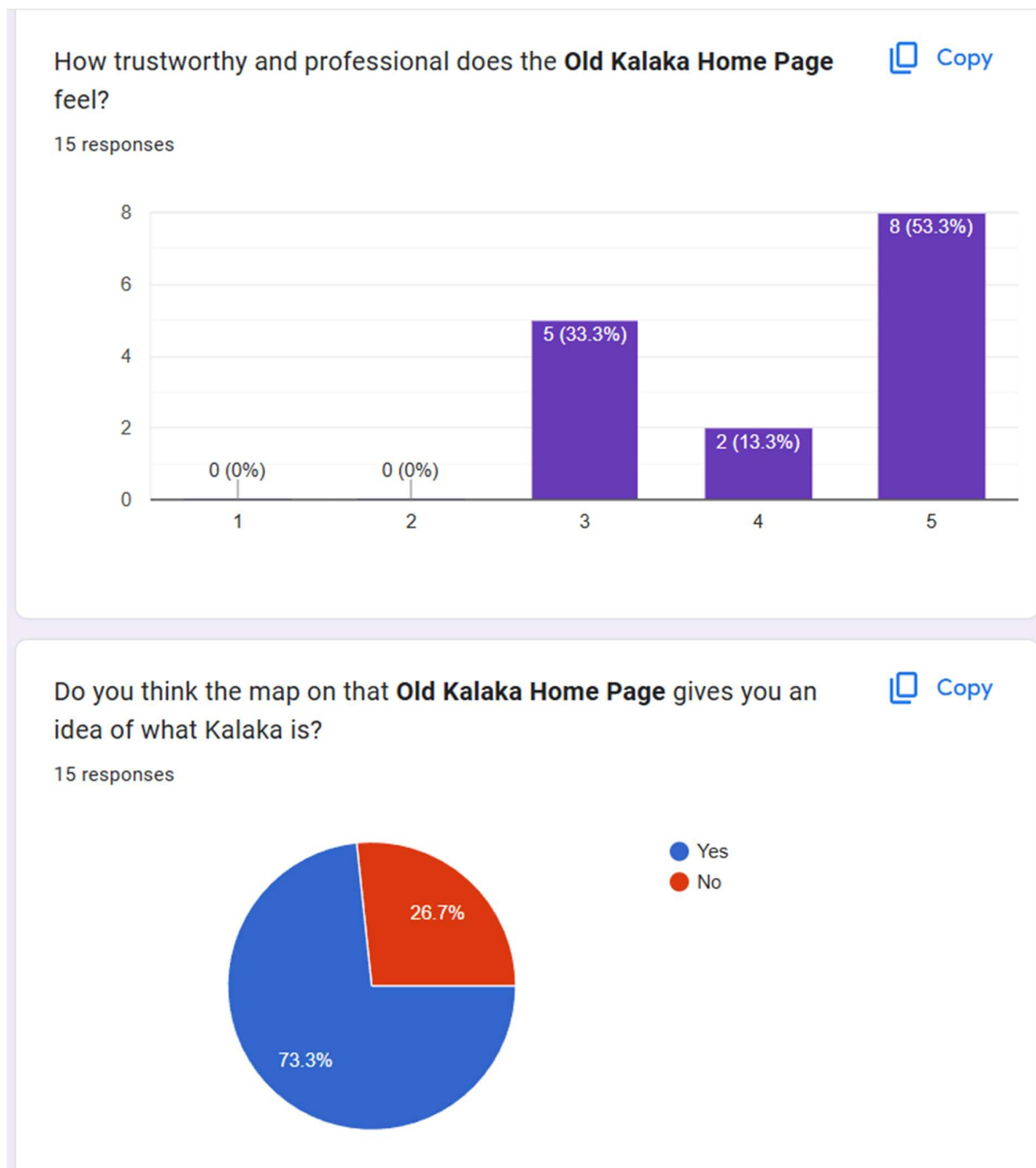


Figure 5. 1: Users' Perception of the Old Kalaka System

In Figure 5.1, users were asked about their initial understanding of the old Kalaka system. Most users clearly indicated that they understood the purpose of the system, recognizing it as a platform for language documentation and speech data collection. This shows that, despite its outdated interface, the system was able to communicate its core objective effectively to its users.

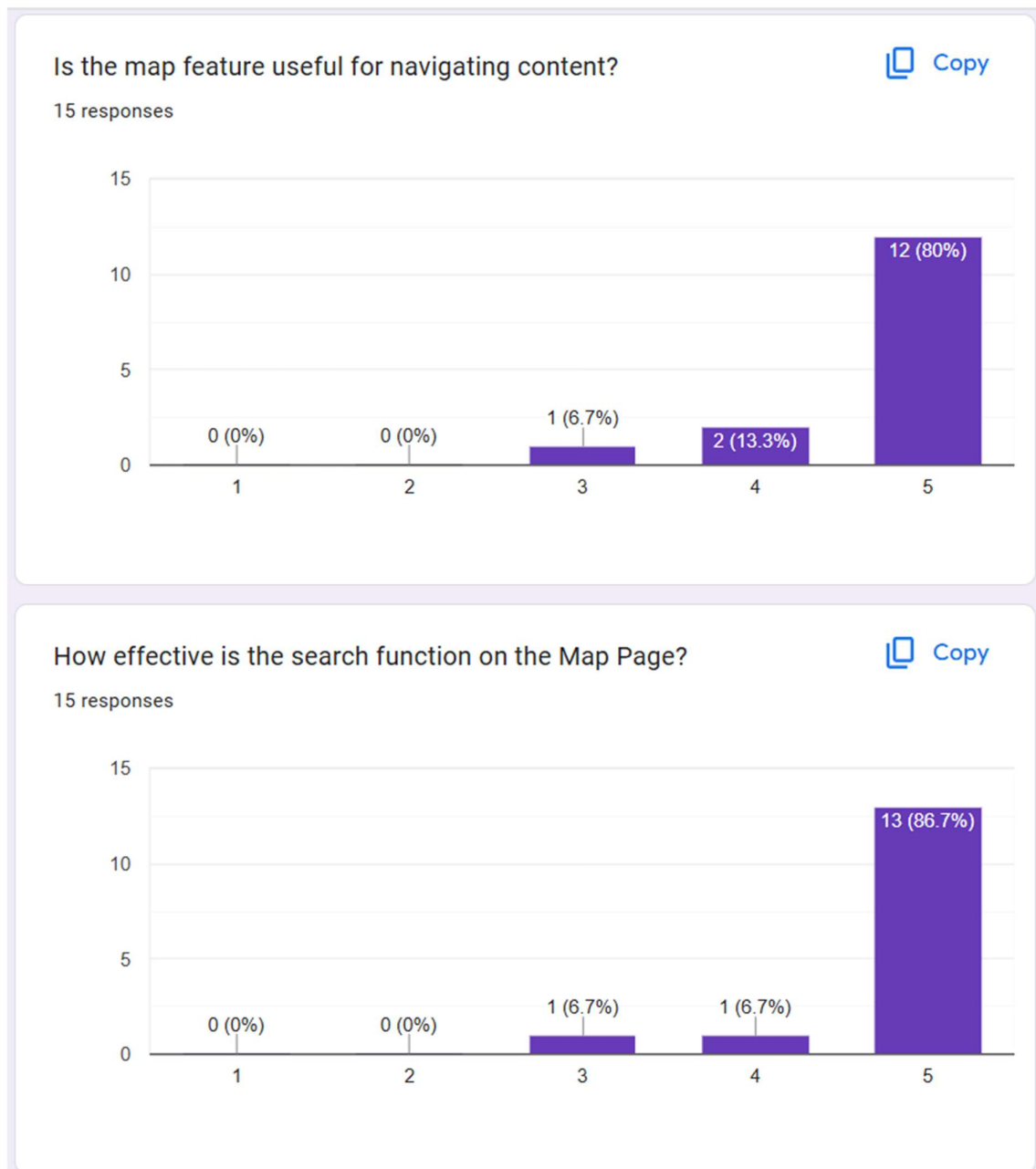


Figure 5. 2: Users' Perception of the Map page in the Old Kalaka System

Figure 5.2 focuses on the functionality of the Map page, particularly how well it allowed users to navigate and explore language content. The results show that users found this feature helpful and functional. They were able to interact with the map to access relevant data and appreciated its ability to visually connect language information with specific locations across Malaysia.

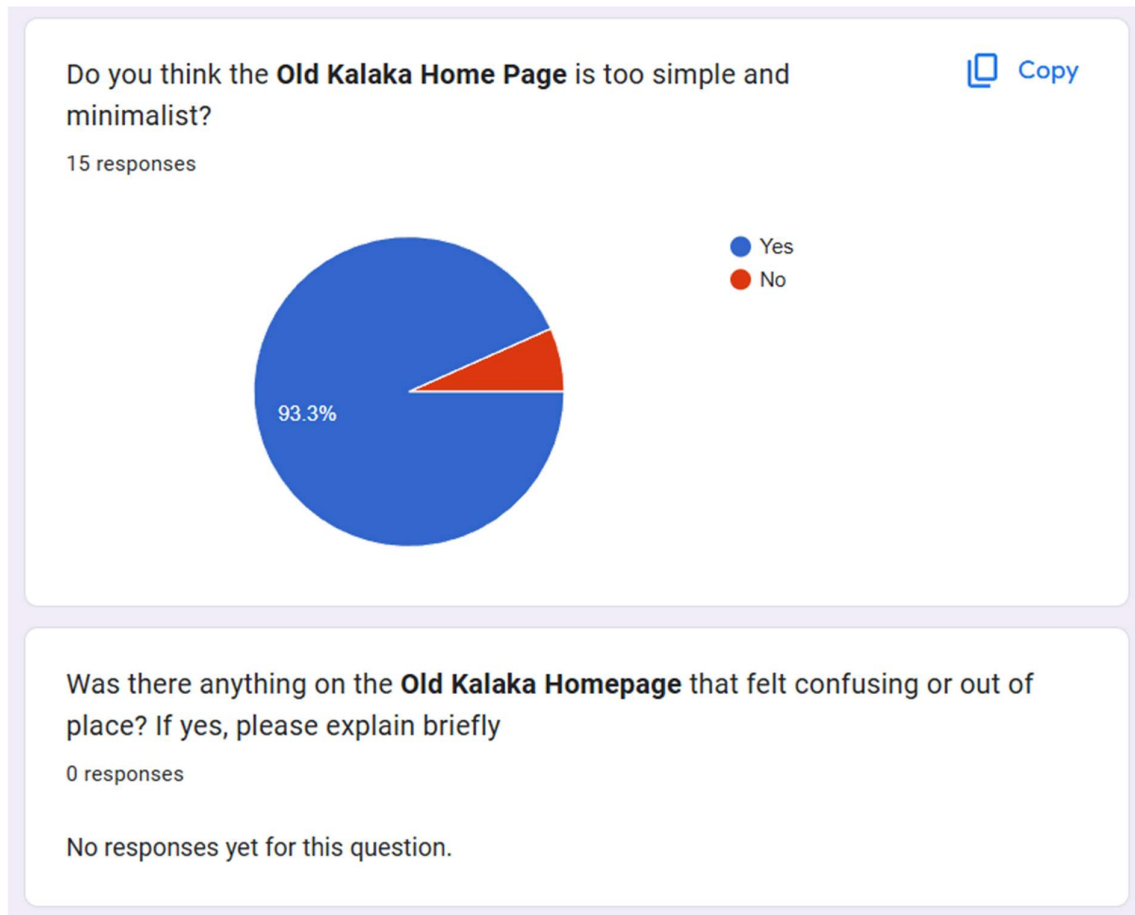


Figure 5. 3: Users' Perception of the Old Kalaka System design

Figure 5.3 presents feedback on the overall design of the home page in the old Kalaka system. Although the design was simpler compared to modern standards, users generally viewed it positively. They found the layout clear and the structure easy to follow, which helped them access and understand the available content effectively.

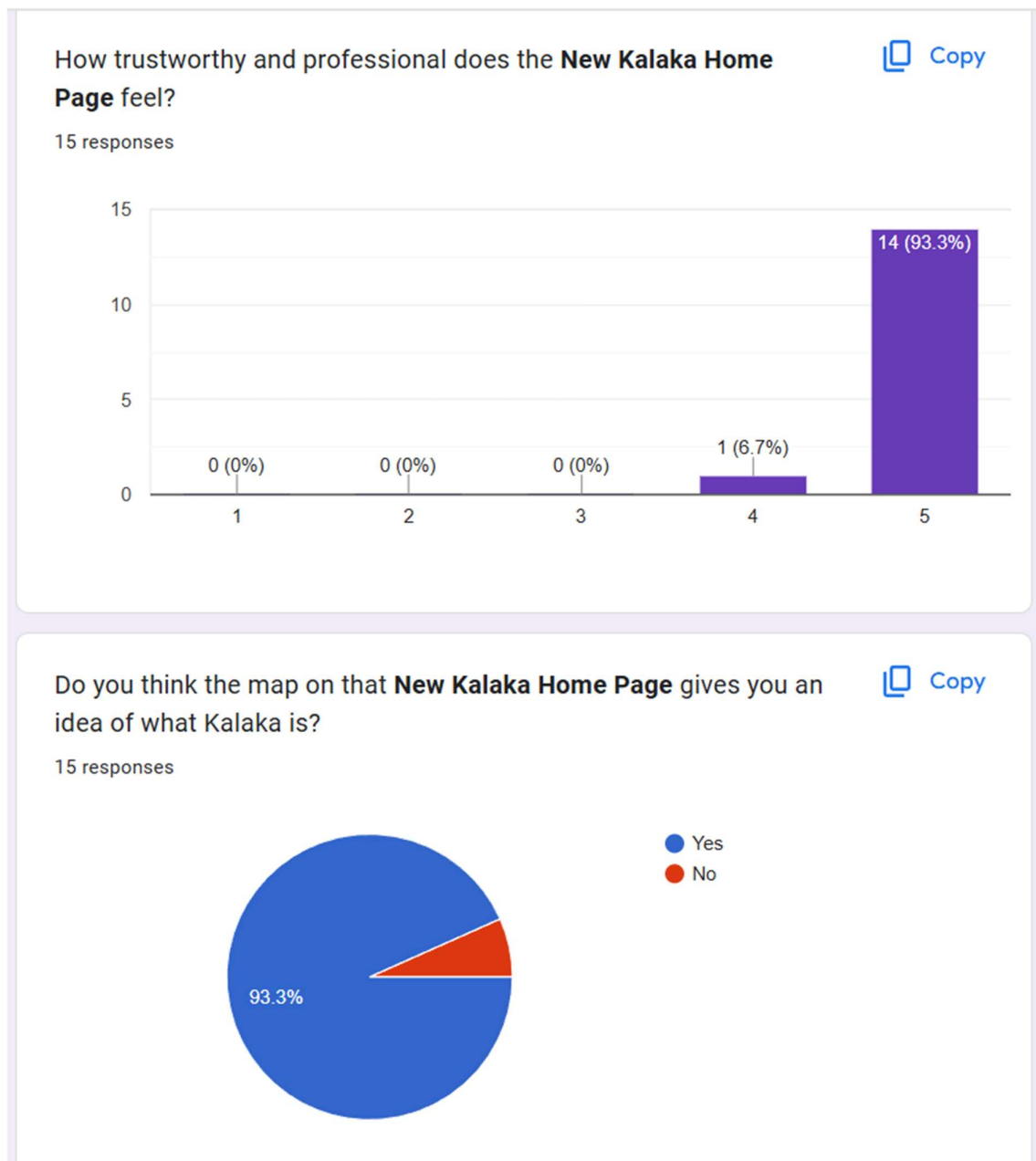


Figure 5. 4: Users' Perception of the New Kalaka System

In Figure 5.4, users shared their overall thoughts on the new Kalaka system. The majority continued to express a clear understanding of the system's purpose, just as they had with the old version. This indicates that the redesign maintained the system's ability to communicate its core objectives effectively to users.

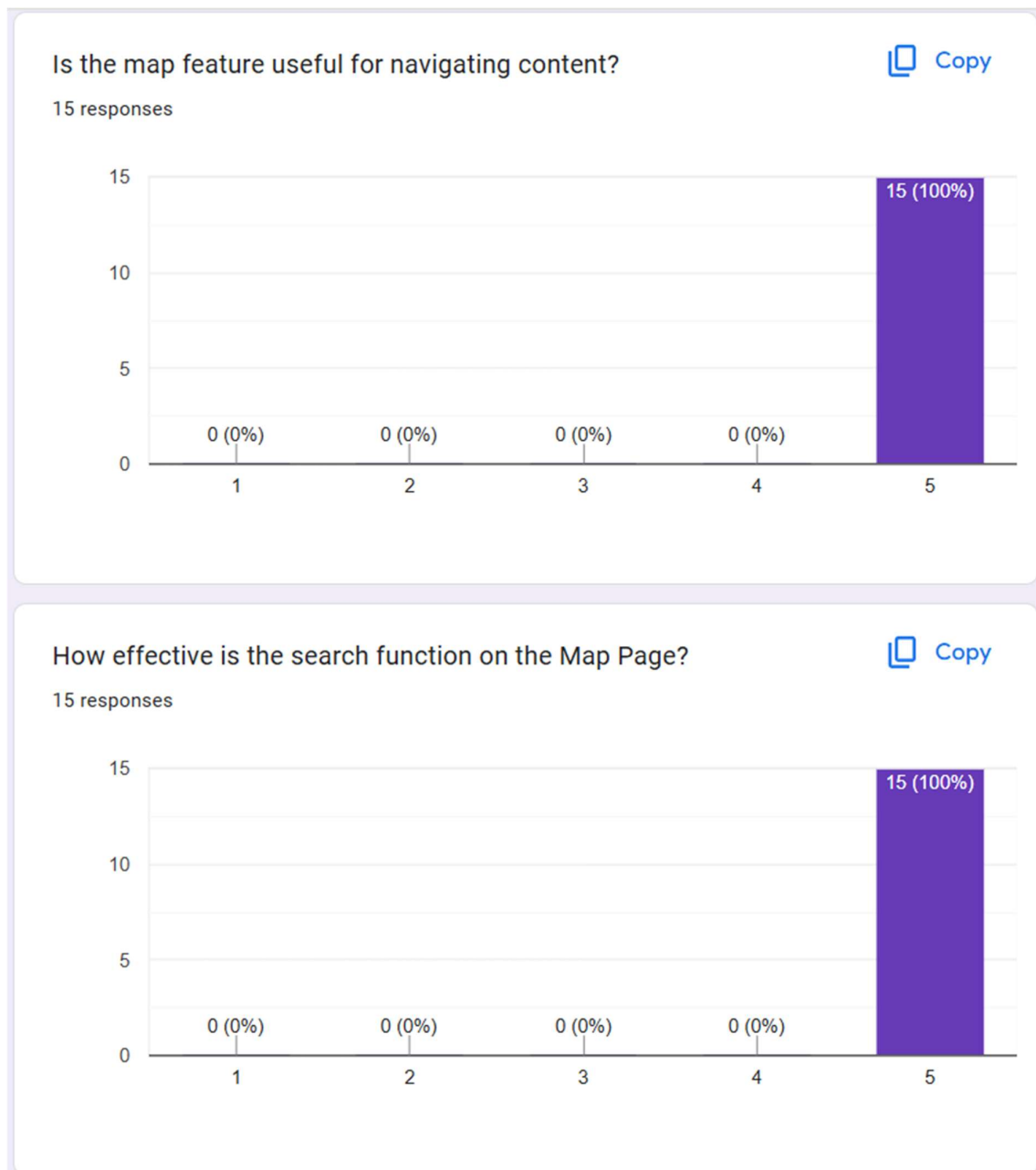


Figure 5. 5: Users' Perception of the Map page in the New Kalaka System

Figure 5.5 focuses on the Map page functionality in the new system. Users responded positively, confirming that they could still navigate and explore language content efficiently. The improvements in layout and responsiveness were noted, but overall, users found the feature to be just as functional as in the previous version.

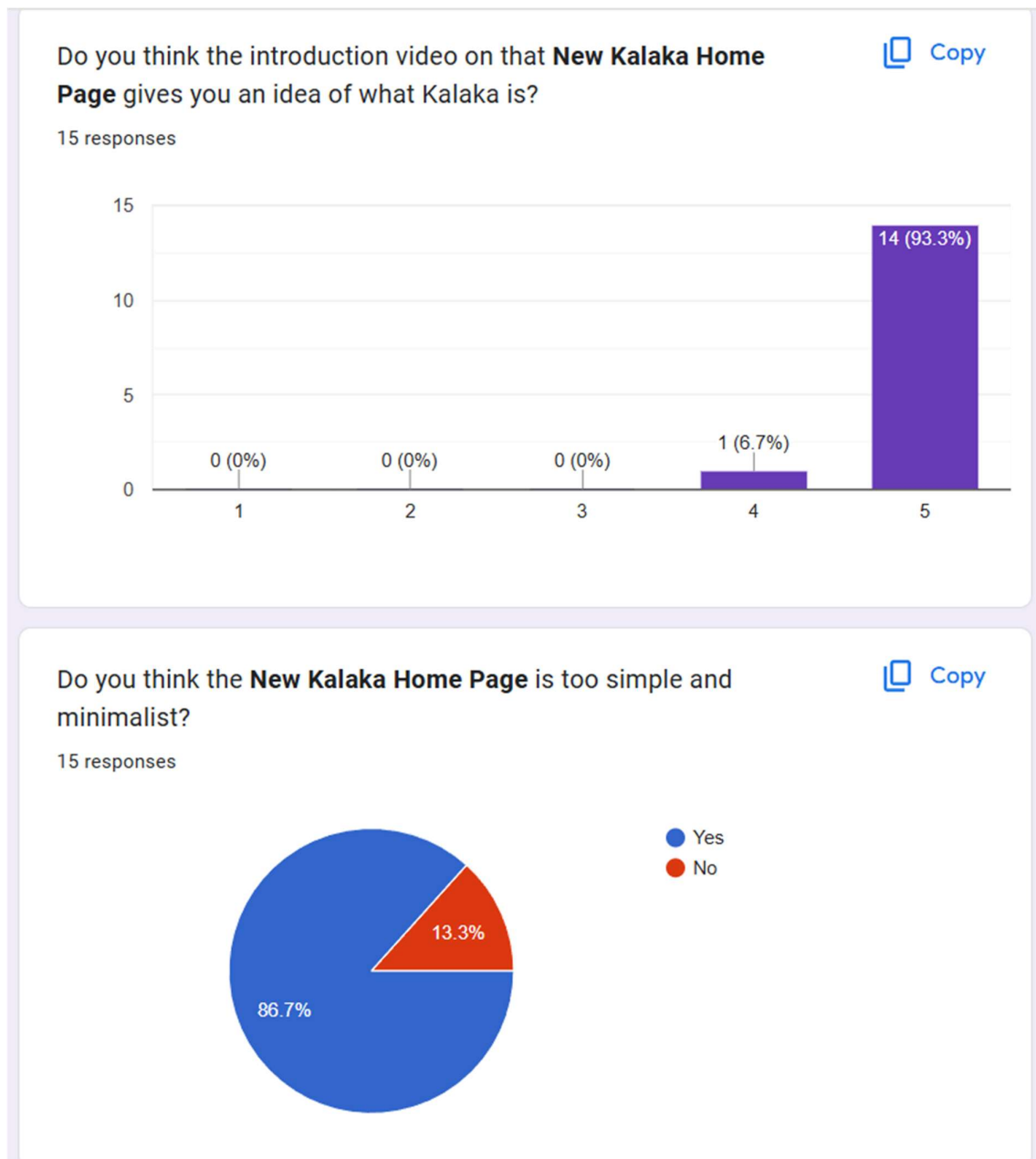


Figure 5. 6: Users' Perception of the New Kalaka System design

Figure 5.6 reflects user opinions on the design of the Map page in the new system. While some users appreciated the visual updates, the overall satisfaction level remained similar to the old system. The layout and clarity of information were still seen as strengths, contributing to a continued positive user experience.

Figure 5.7 compares the old and new home pages, clearly demonstrating that the new version is preferred by users due to its improved layout and accessibility.

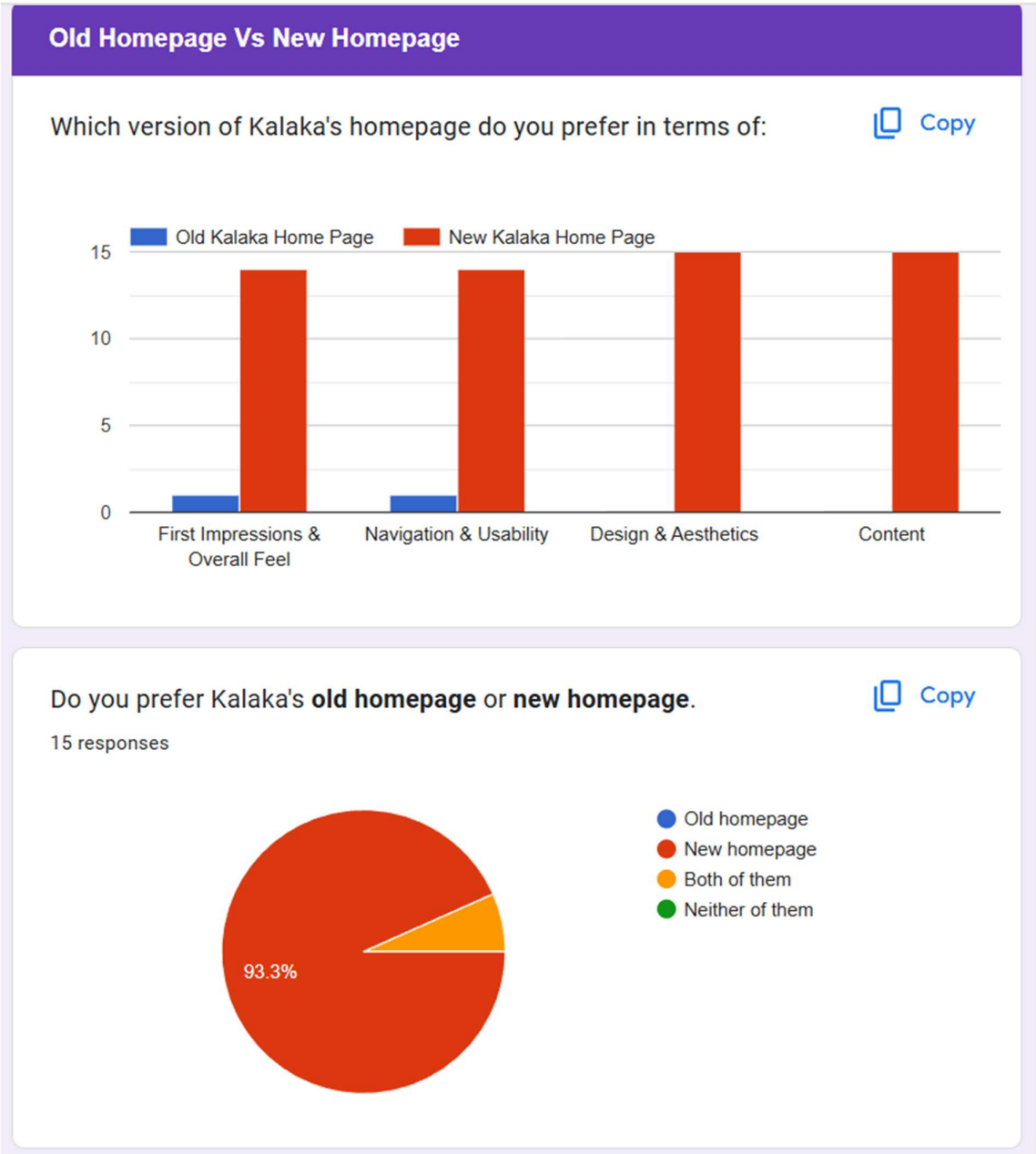


Figure 5. 7: Old vs. New Home Page of the Kalaka System

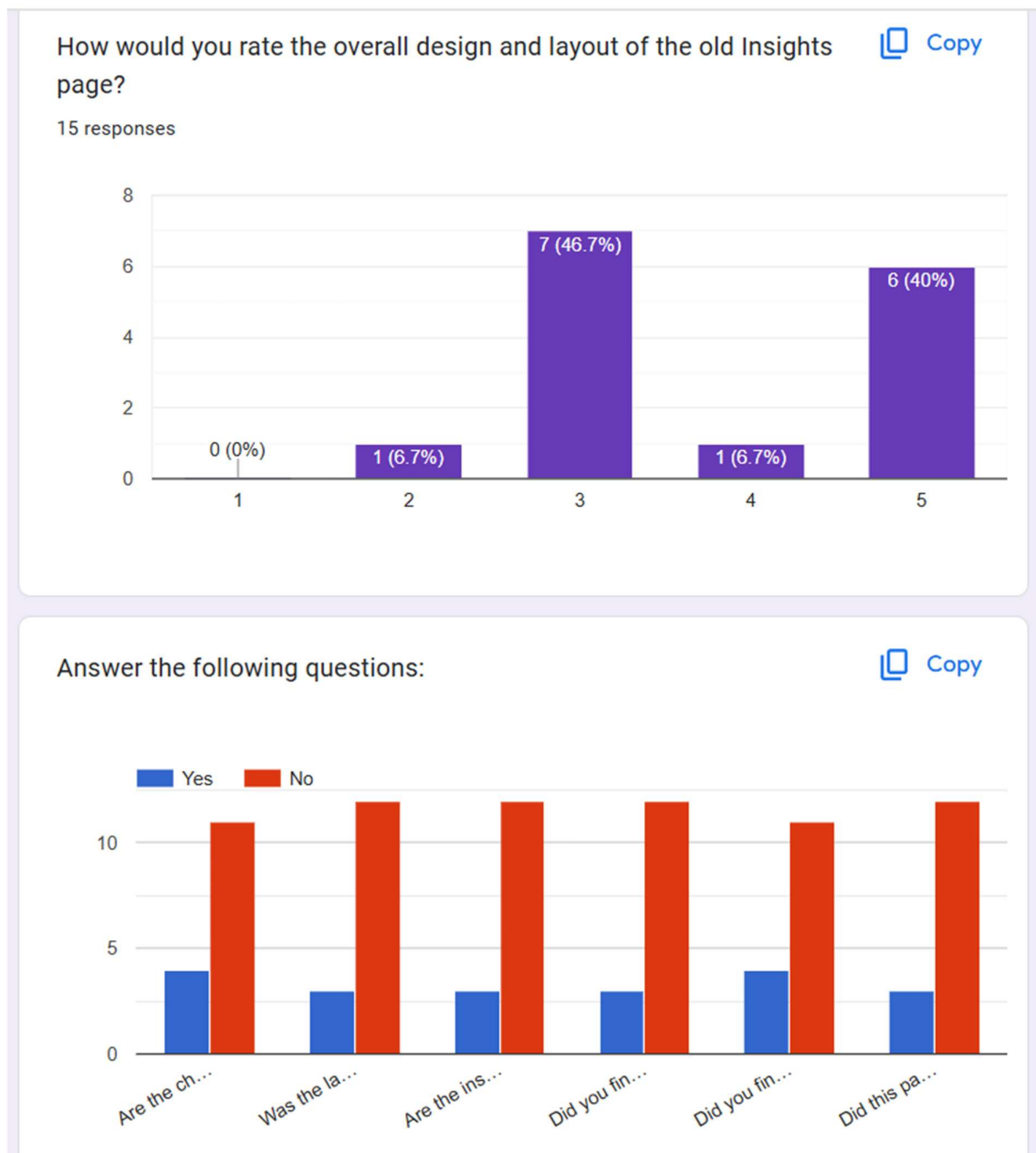


Figure 5. 8: User Rating of the Insights Page Design in the Old Kalaka System

In Figure 5.8, users rated the Insights page design in the old Kalaka system, with most respondents expressing dissatisfaction. Feedback indicated that the page was visually unappealing, lacked clarity, and did not effectively present data in an engaging or understandable way. Users found it difficult to interpret the information displayed and felt that the overall layout was outdated.

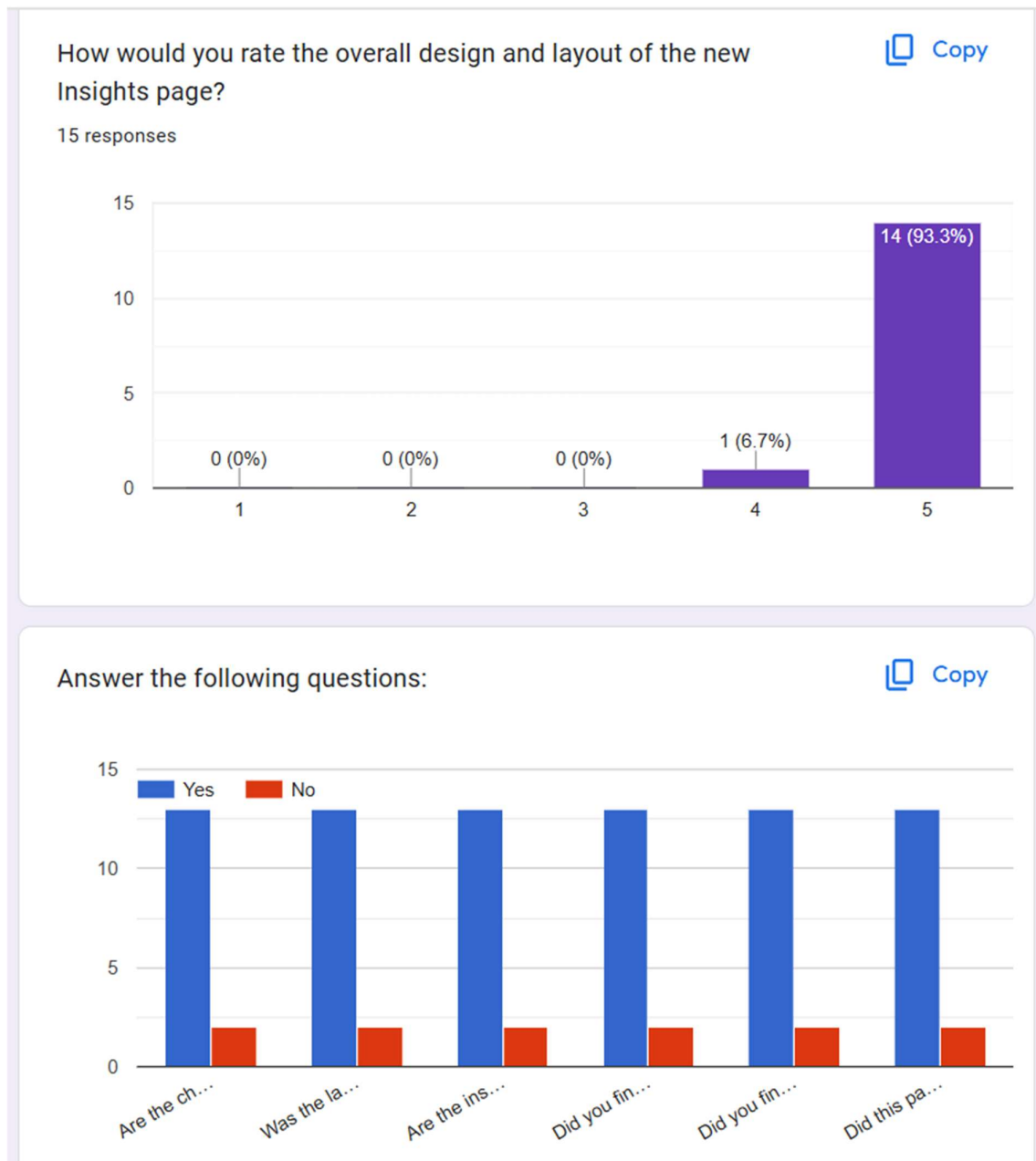


Figure 5. 9: User Rating of the Insights Page Design in the New Kalaka System

In contrast, Figure 5.9 shows that users were satisfied with the Insights page design in the new Kalaka system. The updated layout, improved visuals, and better organization of content contributed to a more positive user experience. Users appreciated the cleaner interface and found the page easier to navigate and understand. These enhancements helped make the Insights page more functional and visually appealing, successfully addressing the issues present in the old version.

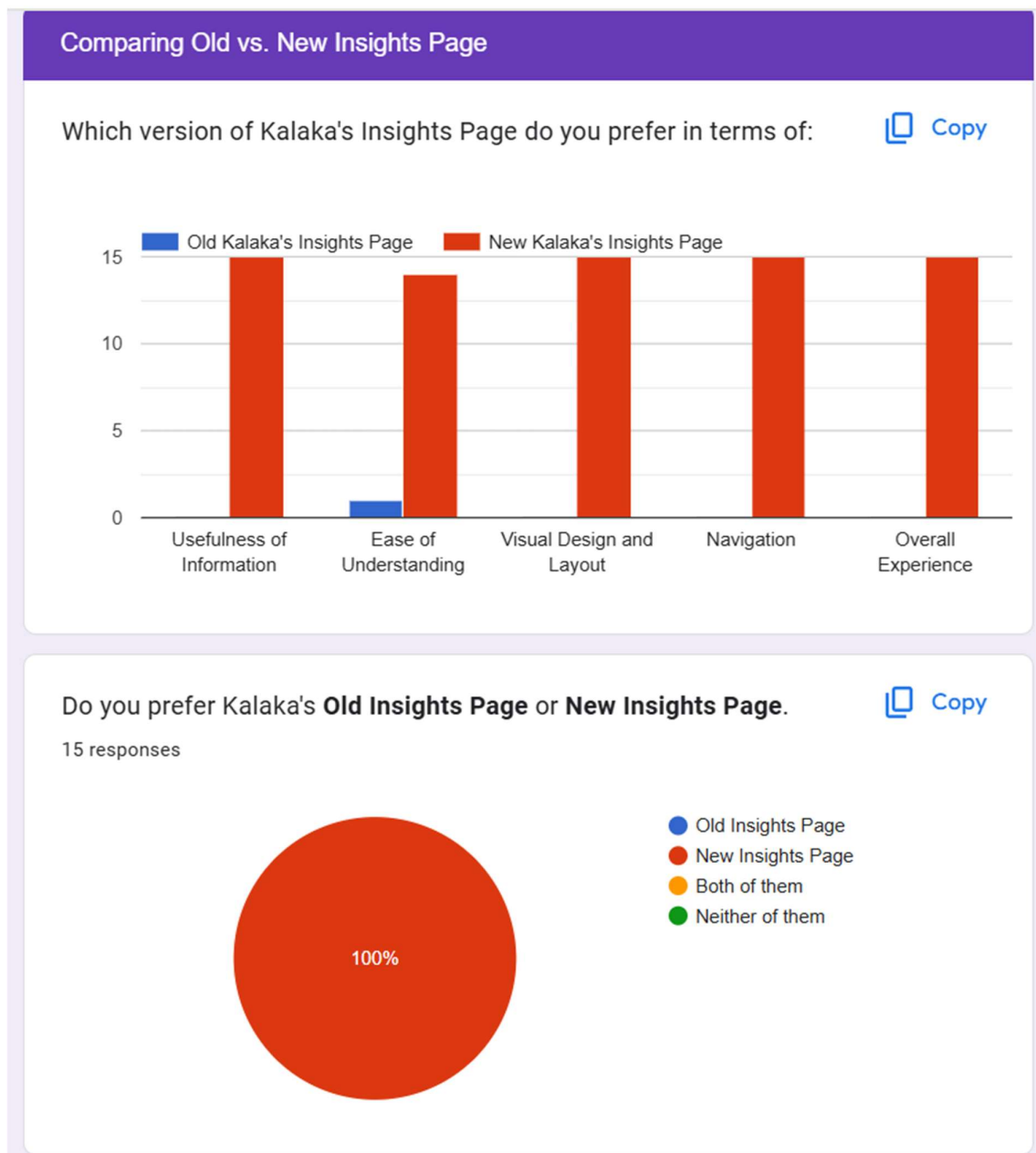


Figure 5. 10: User Preference, New Kalaka System vs. Old Kalaka System

In Figure 5.10, user preference data confirm that the majority of respondents favor the new Kalaka system over the old one. This reflects the success of the frontend revamp in addressing previous usability issues.



Figure 5. 11: Users' Thoughts on the Word of the Day (WOTD) and Glossary

Figure 5.11 focuses on users' perceptions of the Word of the Day (WOTD) and Glossary features in the new Kalaka system. Feedback shows that these educational elements were well received by the majority of users. They found the WOTD and Glossary feature very helpful, as it introduces a new term daily, encouraging consistent learning.

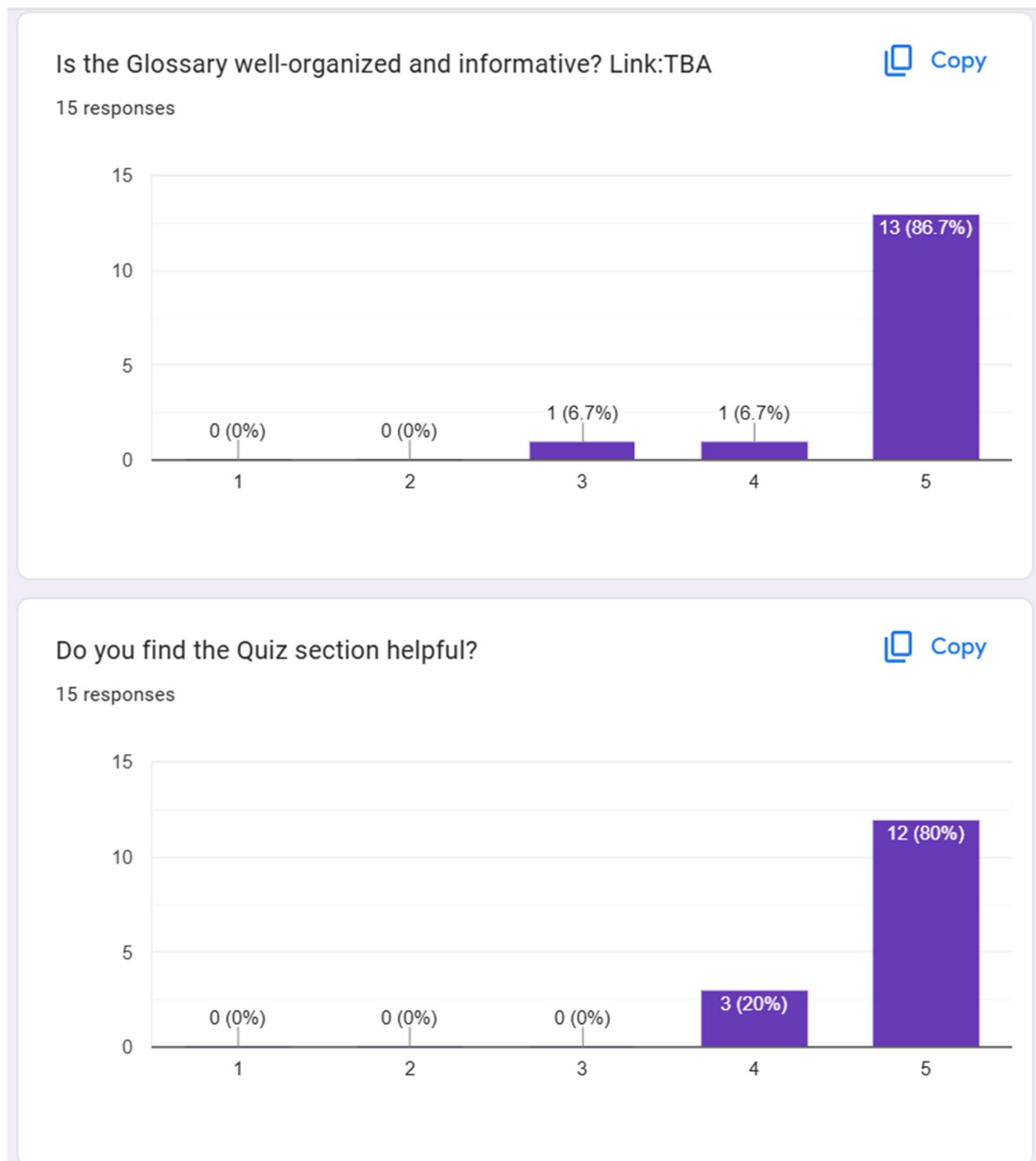


Figure 5. 12: Users' Thoughts on the Glossary and Quiz

Figure 5.12 examines user feedback on the Quiz features in the new Kalaka system. Users responded positively to the integration of definitions with interactive quizzes. Respondents appreciated the interactive nature of the quizzes, which added an enjoyable and educational aspect to the system.

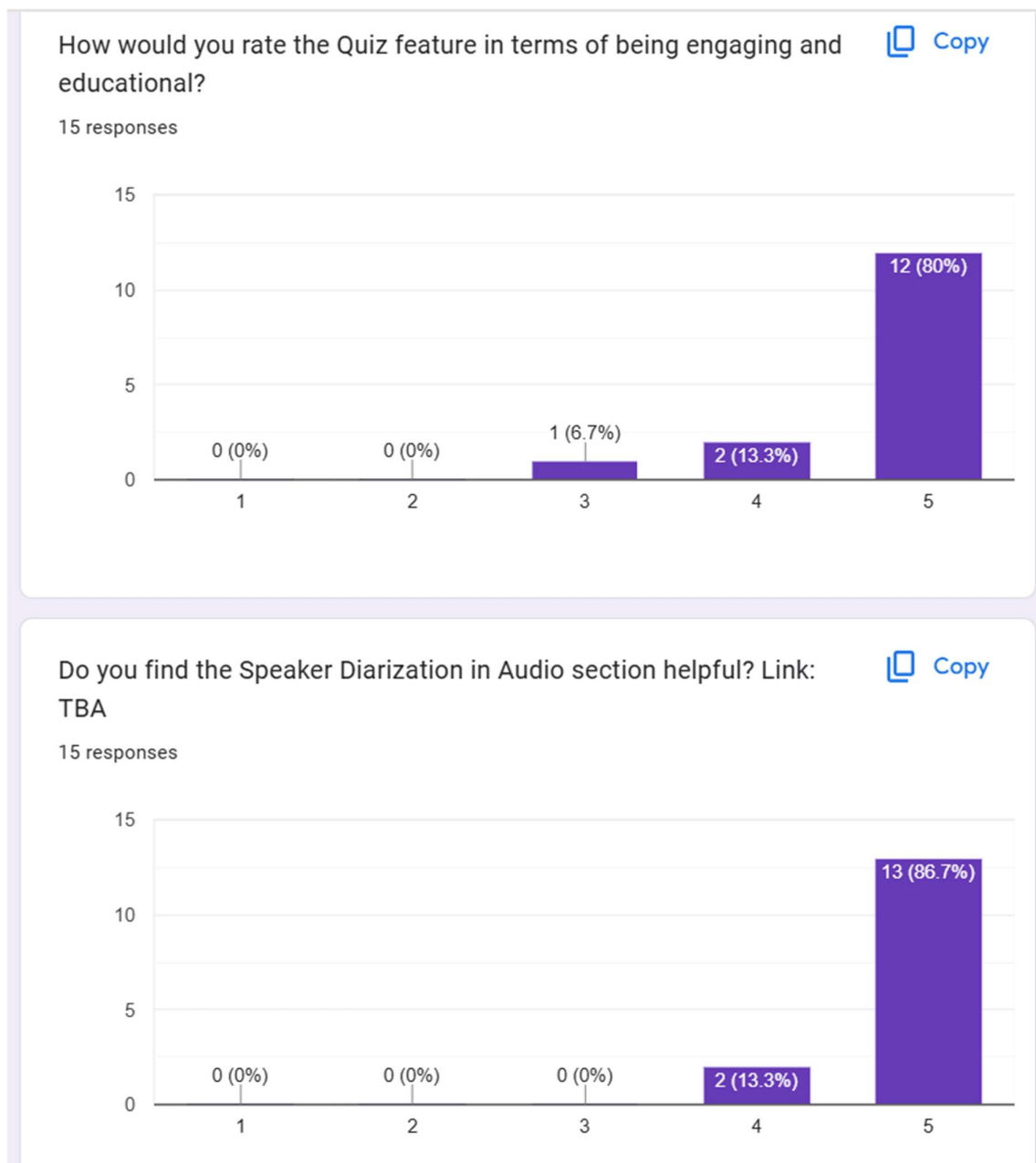


Figure 5. 13: Users' Thoughts on the Quiz and Speaker Diarization

Figure 5.13 highlights user opinions on the Speaker Diarization. Users found the speaker diarization functionality helpful and informative, particularly in identifying individual speakers within audio recordings. This feature was seen as valuable for linguistic analysis and improving the understanding of spoken content.

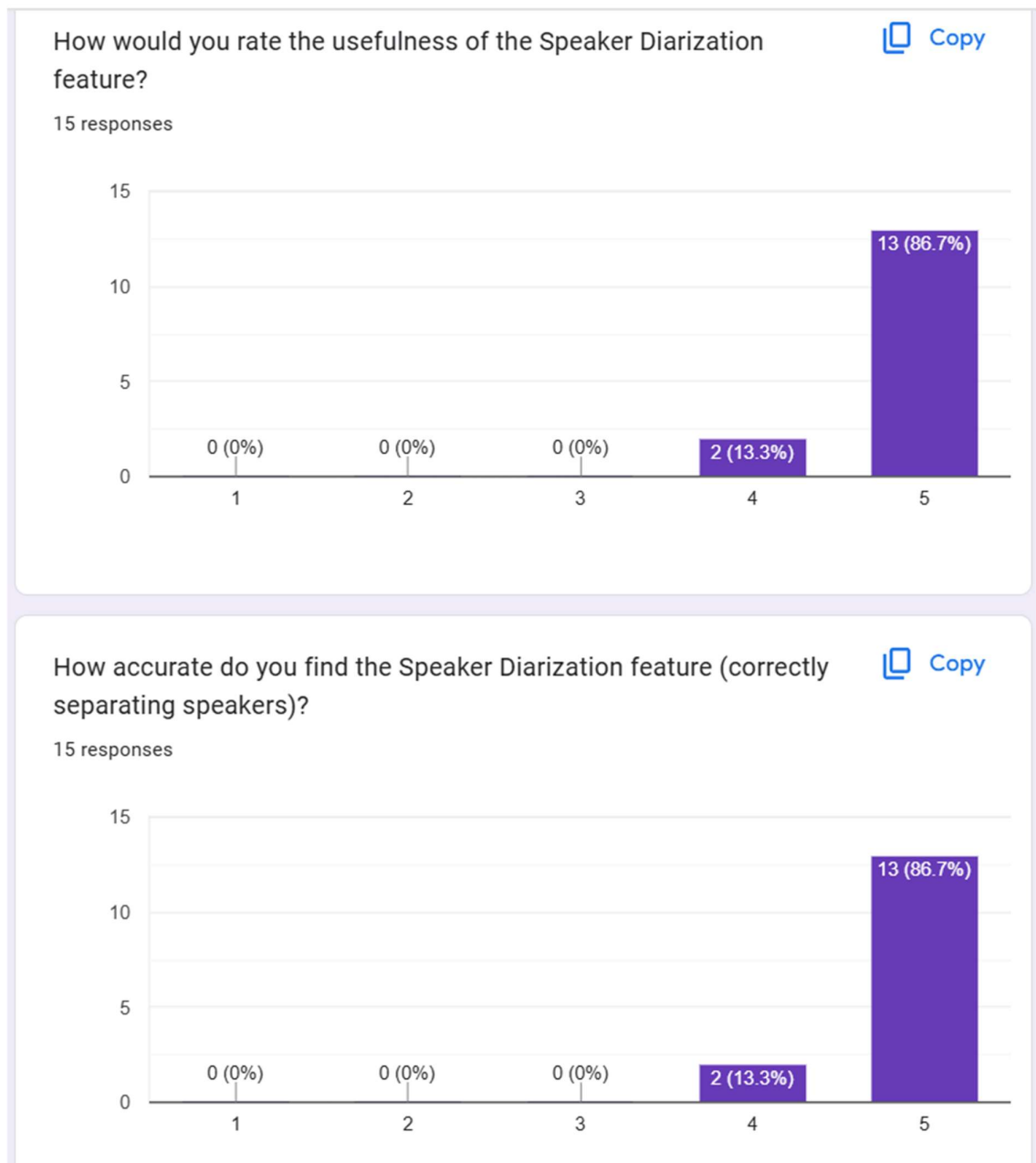


Figure 5. 14: User Acceptance of the Speaker Diarization Functionality

Figure 5.14 specifically measures user acceptance of the Speaker Diarization functionality integrated into the new Kalaka system. The majority of respondents found this feature highly useful for identifying individual speakers within recorded conversations. Users appreciated how the diarization tool could automatically segment audio based on speaker changes, which greatly supports transcription work, language analysis, and conversational research.

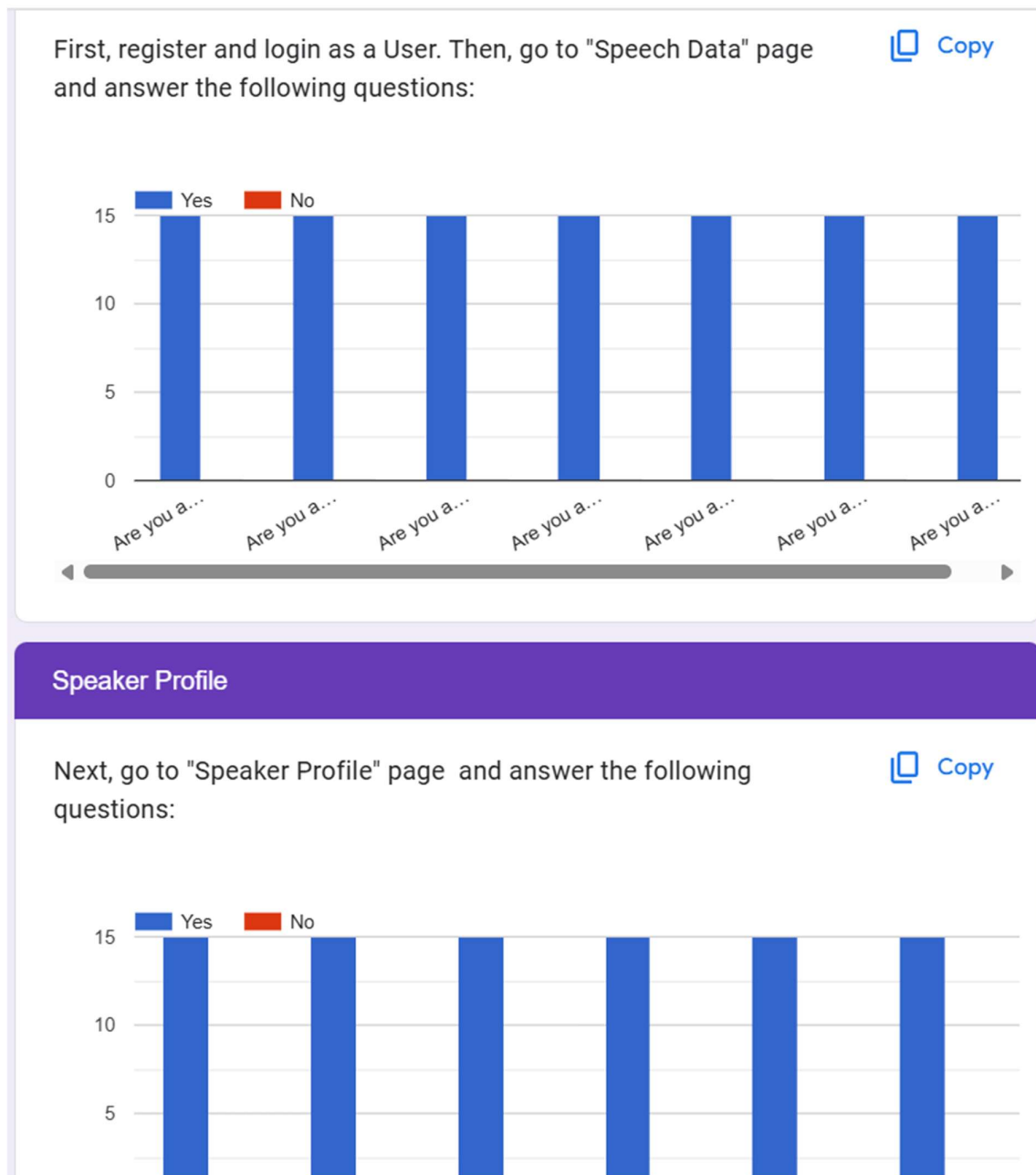


Figure 5. 15: User Testing of All Functions on the Speech Data and Speaker Profile Pages

Figure 5.15 evaluates user interaction across the Speech Data and Speaker Profile pages. The test results indicate that users were able to navigate these features effectively and understood the available functions without difficulty.

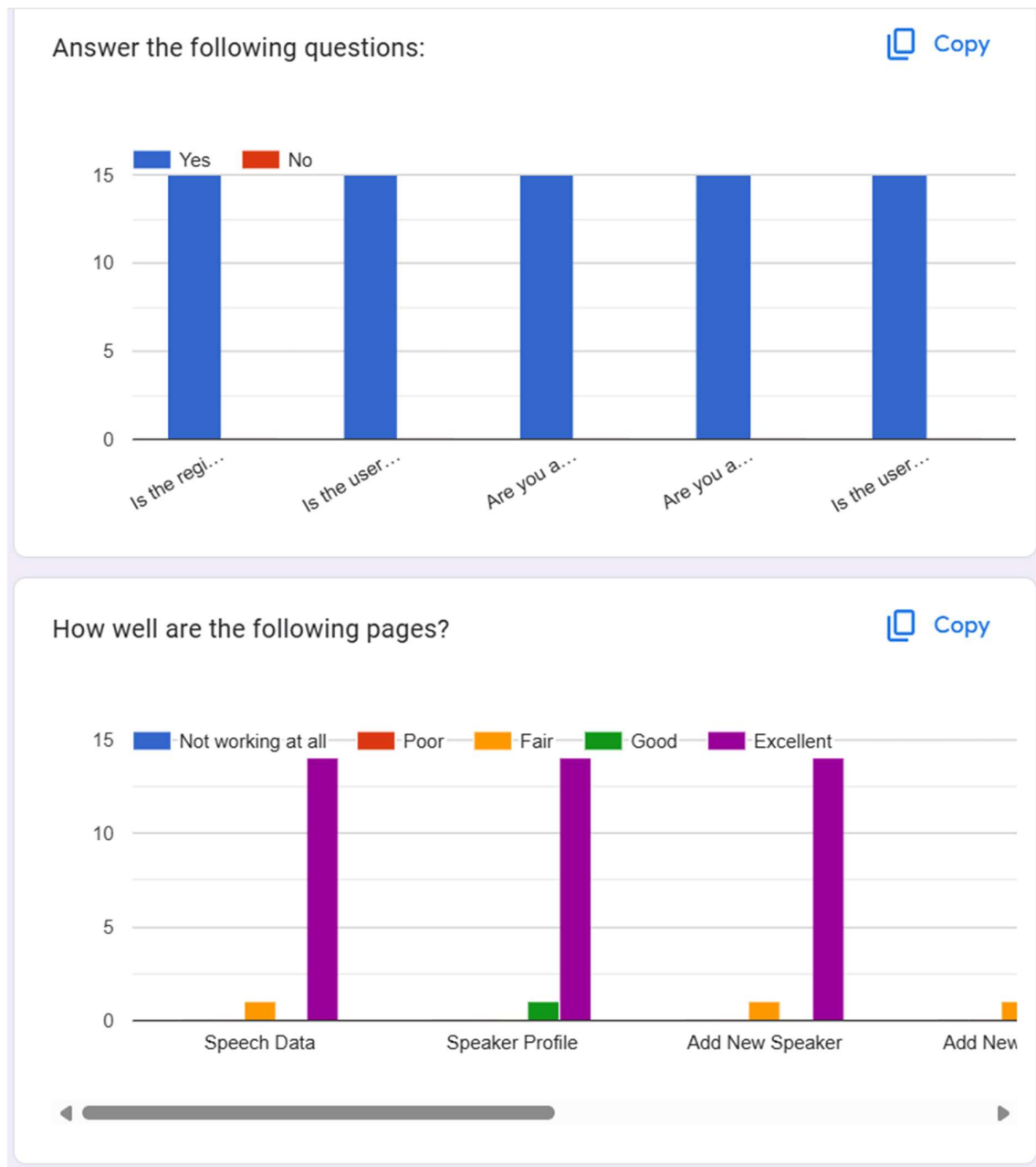


Figure 5. 16: User Satisfaction with the Functions and Pages in the New Kalaka System

Finally, Figure 5.16 summarizes overall user satisfaction with the new system. The responses suggest that the redesigned Kalaka system successfully meets user needs in terms of usability, functionality, and user experience.

CHAPTER 6: CONCLUSION AND FUTURE WORK

6.1: Introduction

This chapter presents the accomplishments related to the project objectives and outlines the limitations of the proposed system. Additionally, it discusses potential future enhancements and concludes with a summary of key findings.

6.2: Achievement of Objectives

Several objectives were established as initial guidelines for the development of the proposed system. By the end of the project, these objectives were successfully achieved, as summarized in Table 6.1 below.

Objective	Achievement
To review existing systems similar to Kalaka to gather ideas for new features.	A comprehensive review of similar linguistic and cultural preservation platforms was conducted. Insights gained from this analysis helped inform the design of new features such as the Word of the Day, Glossary, Quiz module, and integration of speaker diarization.
To design and develop an enhanced version of Kalaka using the Svelte framework and integrate a speaker diarization model.	The Kalaka frontend was successfully redesigned using the Svelte framework, resulting in a more interactive and responsive interface. A basic implementation of the speaker diarization model was also integrated, enabling speaker segmentation within audio recordings.

To evaluate the improved Kalaka website through developer and user acceptance testing.	Developer testing was conducted to ensure functional integrity, while user acceptance testing confirmed improved usability, user engagement, and relevance of new features in supporting language learning and documentation.
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Table 6. 1: Achievement of Objectives

6.3: Limitations

This section outlines the limitations identified in the proposed system. Several constraints and shortcomings have been observed during its development and implementation.

- a) Text-to-Speech does not sound like Sarawak Malay, more to English.
- b) Some pages, especially those with larger content or media, load slowly.
- c) Speaker diarization only can visualize the graph of someone speak but can not generate transcript from the speech.
- d) The quiz module lacks a leaderboard or score tracking, which could reduce user motivation and competitiveness

6.4: Future Work

This section explores potential future enhancements for the proposed system. The goal of these improvements is to enhance the system's performance by incorporating additional features. Several recommendations for future development are outlined below:

- a) Improve the Text-to-Speech feature to produce output that more accurately reflects the Sarawak Malay accent, as the current voice sounds more English-oriented.
- b) Optimize page performance to reduce loading times and improve user experience.
- c) Enhance the speaker diarization feature to not only visualize speaker activity but also generate accurate transcriptions from recorded speech.
- d) Introduce a leaderboard feature for the quiz module to display top scores or user rankings.

6.4: Conclusion

In conclusion, with its new revamp, the Kalaka system is expected to enhance user engagement through improved features and functionality. This chapter has demonstrated that the objectives of the proposed system have been successfully achieved, while its limitations have also been identified. The proposed future enhancements aim to address these limitations and further refine the system. Implementing these improvements will be essential to ensure a more effective and seamless user experience in real-world applications.

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APPENDICES

Appendix A: Gantt Chart FYP 1 & 2

FYP 1															
TASK WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Discussion with SV for FYP topic															
Brief Proposal Submission															
Completing the Full proposal															
Full proposal progress review															
Finalizing the Full proposal															
Full proposal submission															
Chapter 1 Submission															
Literature Review															
Literature Review progress review and correction															
Chapter 2 submission															
Requirement Analysis and Design															
Requirement Analysis and Design progress review and correction															
Chapter 3 submission															
Finalizing the FYP1 Report															
FYP1 Report Submission & Assessment															

FYP 2																	
TASK WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Implementation																	
Submission FYP revised																	
Implementation progress review and correction																	
Testing																	
Testing progress review and correction																	
Submission of Chapter 4																	
Conclusion and Future Work																	
Conclusion of Future Work progress review and correction																	
Submission 1 st draft Chapter 5 & Abstract																	
Full FYP 2 report																	
Full FYP 2 report progress review and correction																	
Submission 1 st draft FYP 2 Full Report																	
FYP 2 Presentation																	
FYP 2 Symposium and Exhibition																	
FYP 2 Amendment and Modifications																	

Appendix B: Kalaka Google Form Survey

Survey for Final Year Project: Improving *Kalaka* Website with Svelte Framework and Speech Diarization

Dear Respondent,

💎 Thank you for taking the time to complete this form.

👤 My name is **Nicholas Owen Anak Amin**, and I am a final-year Software Engineering undergraduate at the Faculty of Computer Science and Information Technology (FCSIT), Universiti Malaysia Sarawak (UNIMAS). I am currently conducting my Final Year Project titled:

🔗 *"Improving Kalaka Website with Svelte Framework and Speech Diarization."*

💡 The primary objective of this project is to enhance the user experience and functionality of the Kalaka website by revamping its frontend using the **Svelte framework**. Additionally, this project aims to integrate **speech diarization technology**, enabling advanced features such as speaker identification and segmentation. The improved Kalaka system seeks to provide a modern, efficient, and user-friendly platform to support linguistic education and research.

🔒 This survey complies with **Malaysia's Personal Data Protection Act 2010 (PDPA)**. All personal information collected will be used solely for academic purposes and will remain confidential in accordance with PDPA guidelines.

🕒 The survey is designed to take approximately **5 - 10 minutes** to complete. Your valuable feedback will play a significant role in the success of this project.

This survey consists of four sections:

- **Section 1:** Demographic Questions
- **Section 2:** Svelte-Specific Questions
- **Section 3:** Kalaka-Specific Questions
- **Section 4:** Speaker Diarization-Specific Questions

✉️ If you have any questions or concerns, please feel free to contact me at **78315@siswa.unimas.my**.

FYP Supervisor:

👤 Ts. Dr. Sarah Flora Anak Samson Juan
Senior Lecturer, FCSIT, Universiti Malaysia Sarawak (UNIMAS)
✉️ Email: **sjsflora@unimas.my**

🙏 Thank you for your kind cooperation and support!

☀️ Warm regards,
Nicholas Owen Anak Amin 😊

* Indicates required question

Section 1: Demographic Questions

This section consists of information regarding about yourself and your background.

1. What is your age group? *

Mark only one oval.

- ☐ Below 20
☐ 20–24
☐ 25–29
☐ 30 and above

2. What is your gender? *

Mark only one oval.

- ☐ Male
☐ Female

3. What is your state? *

Mark only one oval.

- ☐ Johor
- ☐ Kedah
- ☐ Kelantan
- ☐ Melaka
- ☐ Negeri Sembilan
- ☐ Pahang
- ☐ Perak
- ☐ Perlis
- ☐ Pulau Pinang
- ☐ Sabah
- ☐ Sarawak
- ☐ Selangor
- ☐ Terengganu
- ☐ Kuala Lumpur
- ☐ Labuan
- ☐ Putrajaya

4. What is your current educational level? *

Mark only one oval.

- ☐ Diploma
- ☐ Undergraduate (Bachelor's Degree)
- ☐ Postgraduate
- ☐ Other: _____

5. Which faculty or department are you currently enrolled in? *

Mark only one oval.

- ☐ Software Engineering
- ☐ Computer Science
- ☐ Information Systems
- ☐ Network Computing
- ☐ Multimedia Computing
- ☐ Data Engineering

6. What is your current year of study? *

Mark only one oval.

- ☐ First Year
- ☐ Second Year
- ☐ Third Year
- ☐ Final Year

7. What programming languages or tools are you familiar with? (Select all that apply) *

Tick all that apply.

- ☐ Python
- ☐ Java
- ☐ C/C++/C#
- ☐ JavaScript
- ☐ PHP
- ☐ SQL
- ☐ React/Node.js/Vue.js
- ☐ None of the above

Section 2: Svelte-Specific Questions

This section consists of questions regarding about Svelte.

8. How familiar are you with Svelte? *

Mark only one oval.

1 2 3 4 5

Not ☐ ☐ ☐ ☐ ☐ Very Familiar

9. If you've used Svelte, what do you like most about it? *

Tick all that apply.

- ☐ Simplicity
- ☐ Small bundle size
- ☐ Reactivity system
- ☐ Rich animations and transitions
- ☐ Never used it

10. What do you think is the most important feature of a frontend framework? *

Tick all that apply.

- ☐ Simplicity and ease of learning
- ☐ Performance and speed
- ☐ Compatibility with other tools
- ☐ Scalability for larger projects

11. In your opinion, how important is it for websites to use modern frameworks like Svelte to improve performance and interactivity? *

Mark only one oval.

1 2 3 4 5

Not ☐ ☐ ☐ ☐ ☐ Very Important

12. Do you think using a framework like Svelte could make website development and maintenance easier for developers? *

Mark only one oval.

	1	2	3	4	5	
No	☐	☐	☐	☐	☐	Yes

13. Do you value real-time interactivity (e.g., dynamic updates without reloading the page) in websites? *

Mark only one oval.

	1	2	3	4	5	
No	☐	☐	☐	☐	☐	Yes

14. What improvements do you expect with Kalaka's transition to Svelte? *

Mark only one oval.

- ☐ Better performance and speed
- ☐ A modern and visually appealing interface
- ☐ Improved mobile responsiveness
- ☐ Enhanced interactivity and features
- ☐ Simplified navigation

Section 3: Kalaka-Specific Questions

This section consists of questions about *Kalaka*.

Before answering the questions in this section, **please review the old *Kalaka* website** at the following link: <http://kalakamap.unimas.my/kalaka/pages/firstpage.php>

15. What features do you consider essential for *Kalaka*? *

Mark only one oval.

- ☐ Words of the Day
☐ Glossary or dictionary
☐ Quizzes
☐ Speech-to-text functionality

16. Should *Kalaka* include audio pronunciations for words and phrases? *

Mark only one oval.

	1	2	3	4	5	
Not	☐	☐	☐	☐	☐	Very Important

17. How easy is it to navigate the *Kalaka* website? *

Mark only one oval.

	1	2	3	4	5	
Very	☐	☐	☐	☐	☐	Very Easy

18. How satisfied are you with the current design of the *Kalaka* website? *

Mark only one oval.

	1	2	3	4	5	
Very	☐	☐	☐	☐	☐	Very Satisfied

19. What kind of design style do you prefer for the Kalaka website? *

Mark only one oval.

- ☐ Minimalist and clean
- ☐ Colorful and vibrant
- ☐ Professional and corporate

20. What do you find most challenging when using Kalaka? *

Mark only one oval.

- ☐ Outdated or incomplete content
- ☐ Difficulty navigating the site
- ☐ Lack of interactivity
- ☐ Limited language or dialect options

21. Which page of the Kalaka system do you think need improvement? *

Mark only one oval.

- ☐ Home / Language Map page
- ☐ Language Statistic page
- ☐ Audios page
- ☐ About page
- ☐ Sign Up & Login page
- ☐ Add New Speaker page
- ☐ Add New Speech page
- ☐ Data Management page

22. Do you think Kalaka would benefit from incorporating AI-based features like Speaker Diarization? *

Mark only one oval.

	1	2	3	4	5	
No	☐	☐	☐	☐	☐	Yes

Section 4: Speaker Diarization-Specific Questions

This section consists of questions about speaker diarization.

23. How familiar are you with speaker diarization? *

Mark only one oval.

	1	2	3	4	5	
Not	☐	☐	☐	☐	☐	Very Familiar

24. In your understanding, what does speaker diarization do? *

Tick all that apply.

- ☐ Identifies individual speakers in an audio recording
- ☐ Transcribes speech to text
- ☐ Enhances audio quality
- ☐ Not sure

25. Would you use a tool that can separate different speakers in a conversation? *

Mark only one oval.

	1	2	3	4	5	
No	☐	☐	☐	☐	☐	Yes

26. In what format would you prefer to see speaker diarization results? *

Mark only one oval.

- ☐ A transcript with labeled speakers (e.g., Speaker 1, Speaker 2)
- ☐ A visual timeline showing when each speaker talks
- ☐ Both transcript and visual timeline

27. Do you think speaker diarization can be useful for Kalaka? *

Mark only one oval.

	1	2	3	4	5	
No	☐	☐	☐	☐	☐	Yes

28. What features would you find most valuable in a speaker diarization tool? *

Tick all that apply.

- ☐ High accuracy in speaker identification
- ☐ Support for multiple languages
- ☐ Real-time processing
- ☐ Visualization of speakers' turns

29. What challenges do you foresee when using speaker diarization technology? *

Tick all that apply.

- ☐ Misidentification of Speakers
- ☐ Poor performance with overlapping speech
- ☐ Difficulty handling different accents or dialects
- ☐ Requires high-quality audio

30. Consent Form *

Tick all that apply.

☐ I have clearly read and comprehended the information presented above. I voluntarily consent and offer to participate in this survey. By checking the box on this consent form, I certify that all of the information I have provided is true and correct to the best of my knowledge and will be used solely for academic purposes.

This content is neither created nor endorsed by Google.

Google Forms

Kalaka System User Acceptance Testing (UAT) Survey

15 responses

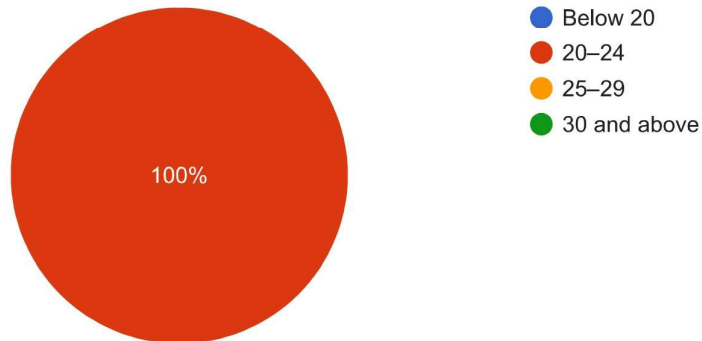
[Publish analytics](#)

Section 1: Demographic Questions

What is your age group?

 [Copy](#)

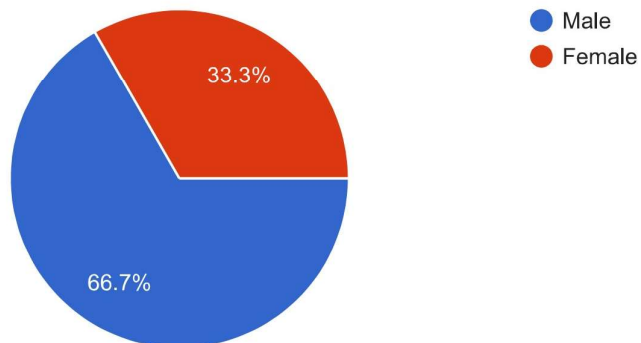
15 responses



What is your gender?

 [Copy](#)

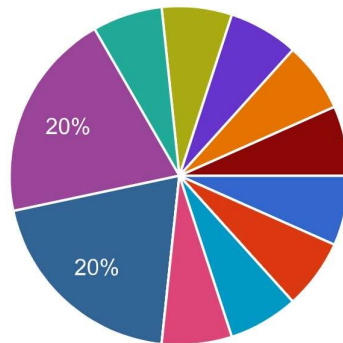
15 responses



What is your state?

 Copy

15 responses



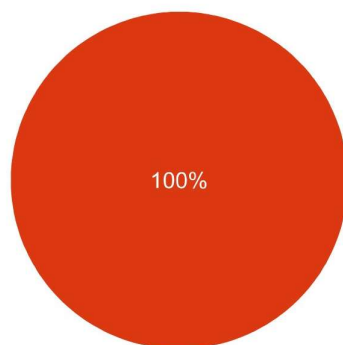
- Johor
- Kedah
- Kelantan
- Melaka
- Negeri Sembilan
- Pahang
- Perak
- Perlis

▲ 1/2 ▼

What is your current educational level?

 Copy

15 responses

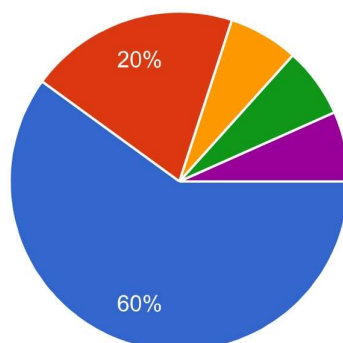


- Diploma
- Undergraduate (Bachelor's Degree)
- Postgraduate

Which faculty or department are you currently enrolled in?

 Copy

15 responses

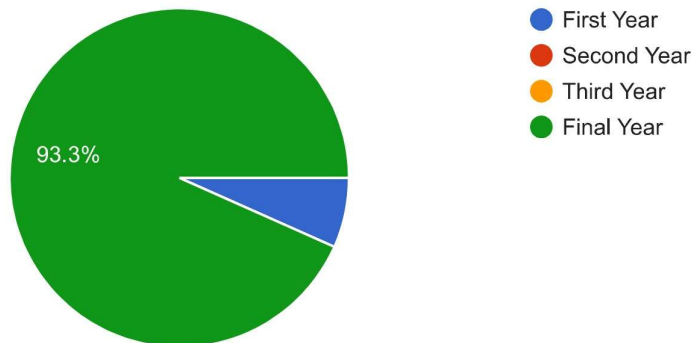


- Software Engineering
- Computer Science
- Information Systems
- Network Computing
- Multimedia Computing
- Data Engineering

What is your current year of study?

 Copy

15 responses



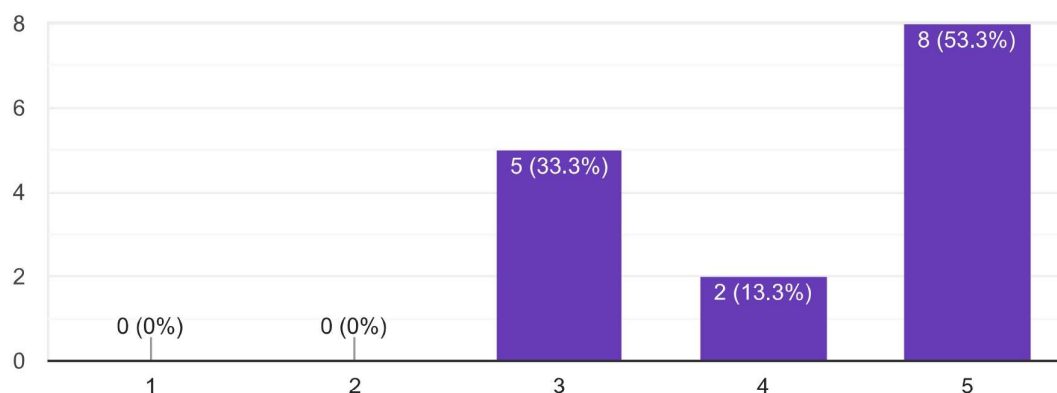
Section 2: Home Page

The Old Kalaka Home Page

How trustworthy and professional does the **Old Kalaka Home Page** feel?

 Copy

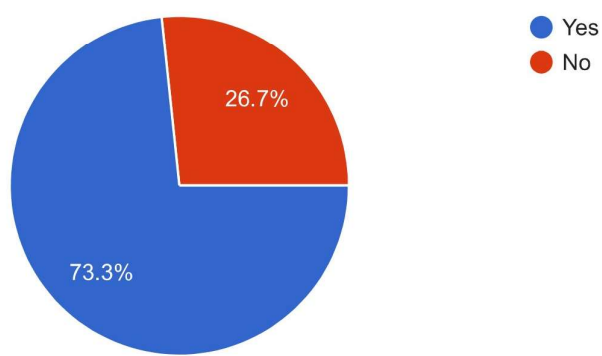
15 responses



Do you think the map on that **Old Kalaka Home Page** gives you an idea of what Kalaka is?

 Copy

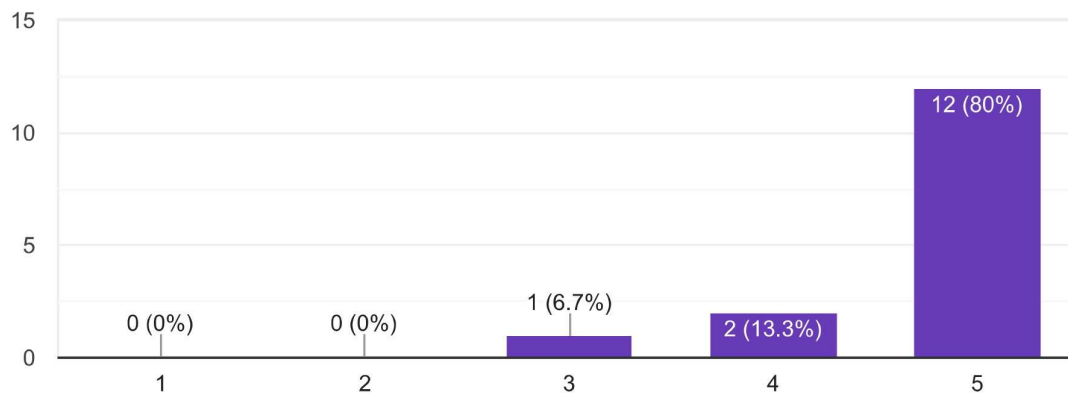
15 responses



Is the map feature useful for navigating content?

 Copy

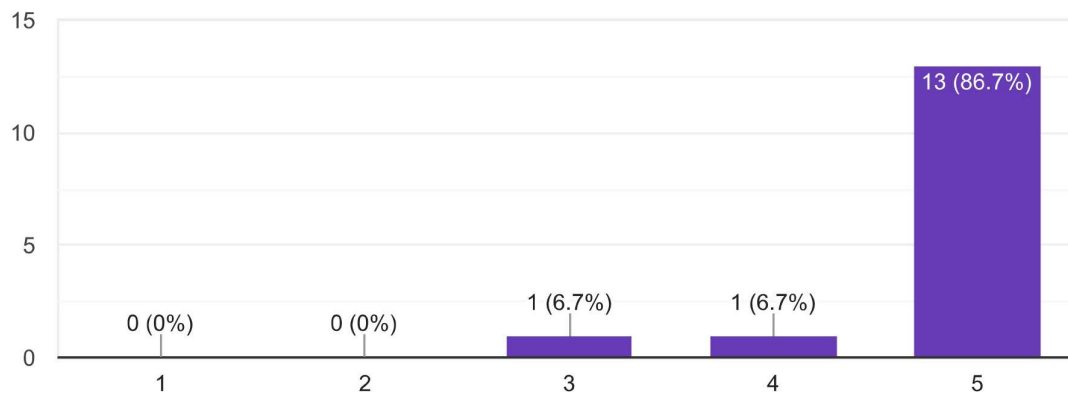
15 responses



How effective is the search function on the Map Page?

 Copy

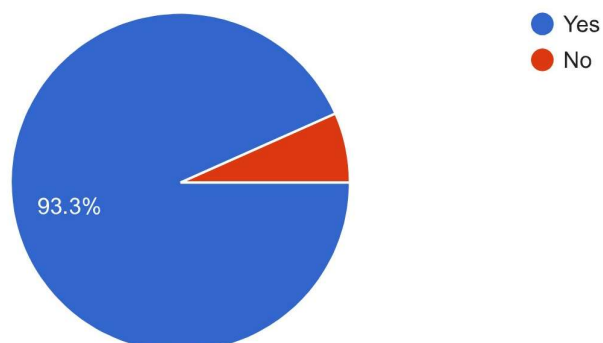
15 responses



Do you think the **Old Kalaka Home Page** is too simple and minimalist?

 Copy

15 responses



Was there anything on the **Old Kalaka Homepage** that felt confusing or out of place? If yes, please explain briefly

0 responses

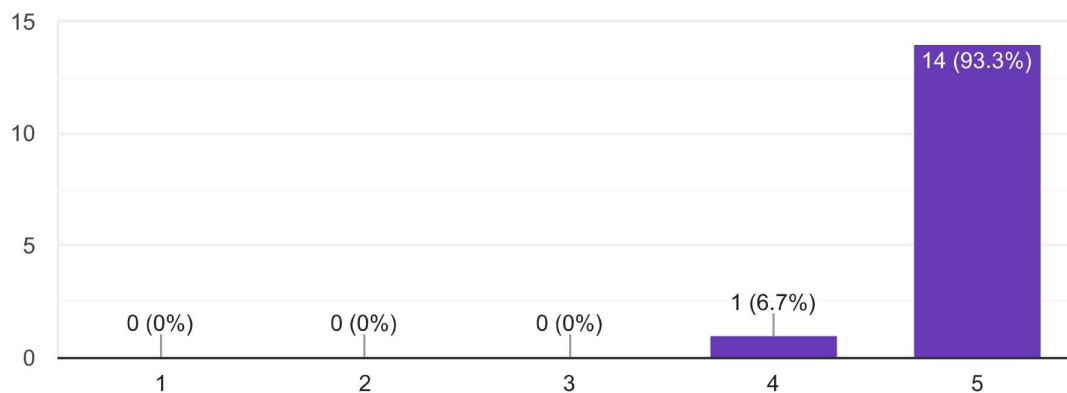
No responses yet for this question.

The New Kalaka Home Page

How trustworthy and professional does the **New Kalaka Home Page** feel?

 Copy

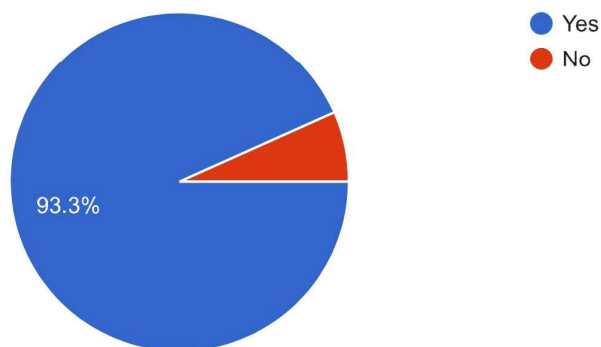
15 responses



Do you think the map on that **New Kalaka Home Page** gives you an idea of what Kalaka is?

 Copy

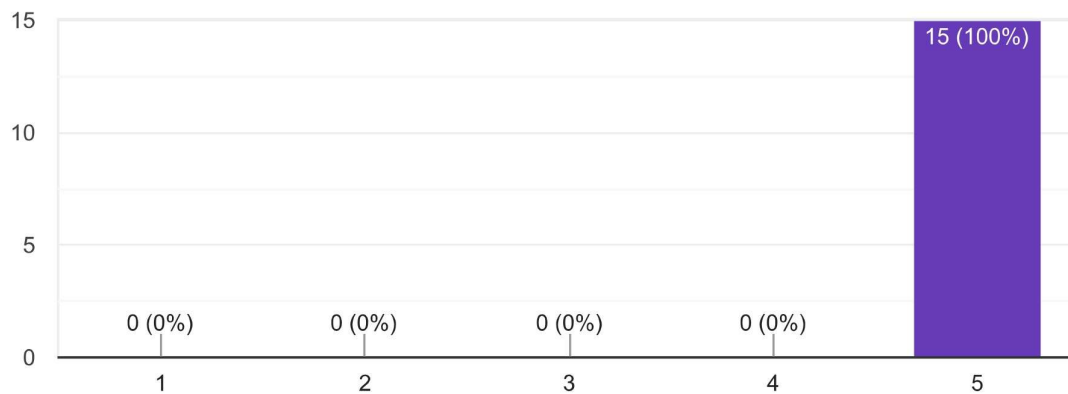
15 responses



Is the map feature useful for navigating content?

 Copy

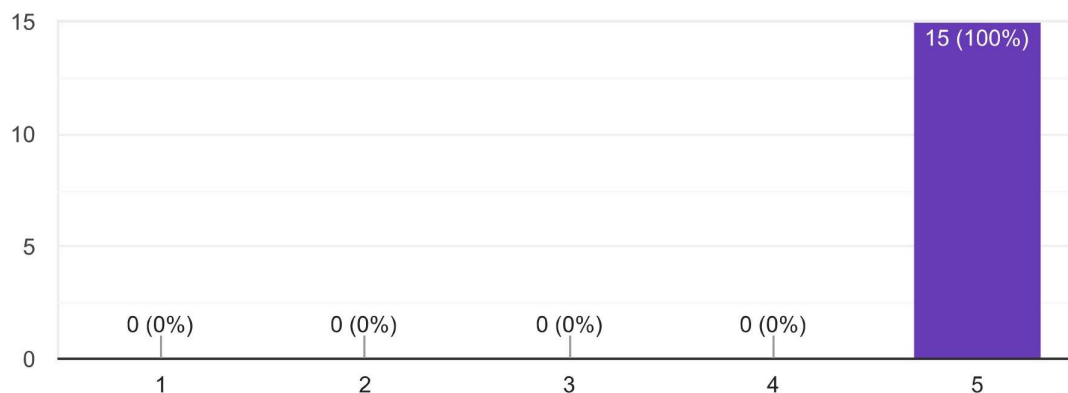
15 responses



How effective is the search function on the Map Page?

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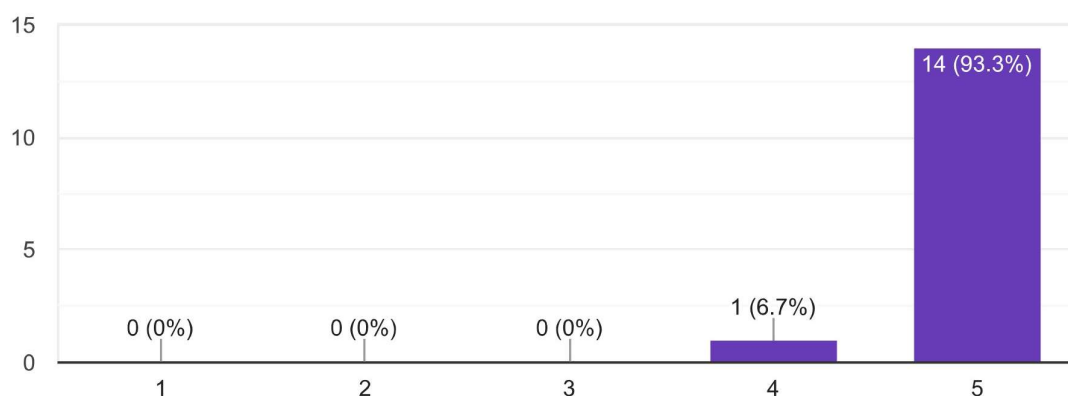
15 responses



Do you think the introduction video on that **New Kalaka Home Page** gives you an idea of what Kalaka is?

 Copy

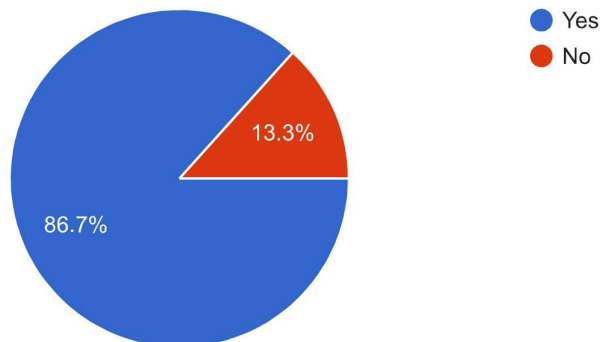
15 responses



Do you think the **New Kalaka Home Page** is too simple and minimalist?

 Copy

15 responses



Was there anything on the **New Kalaka Homepage** that felt confusing or out of place?
If yes, please explain briefly

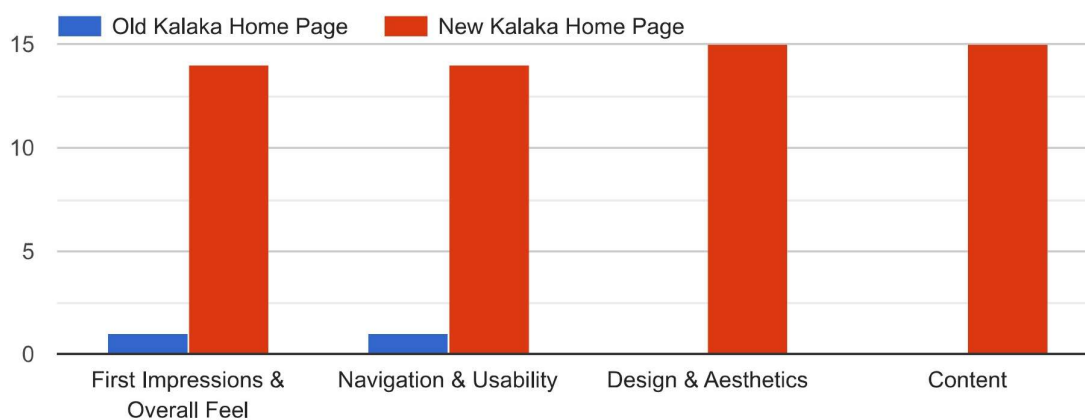
0 responses

No responses yet for this question.

Old Homepage Vs New Homepage

Which version of Kalaka's homepage do you prefer in terms of:

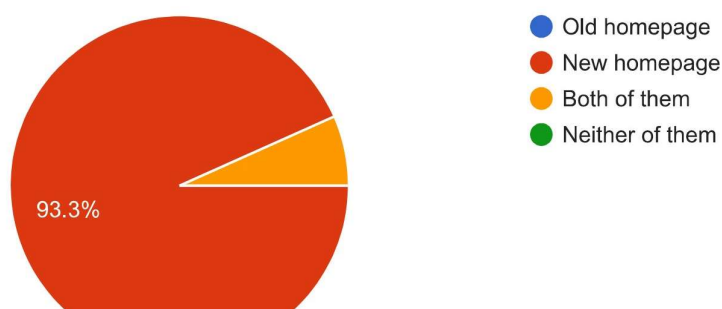
 Copy



Do you prefer Kalaka's **old homepage** or **new homepage**.

 Copy

15 responses



If you choose both or neither of them, give your reasons why. (OLD Vs NEW HOMEPAGE)

0 responses

No responses yet for this question.

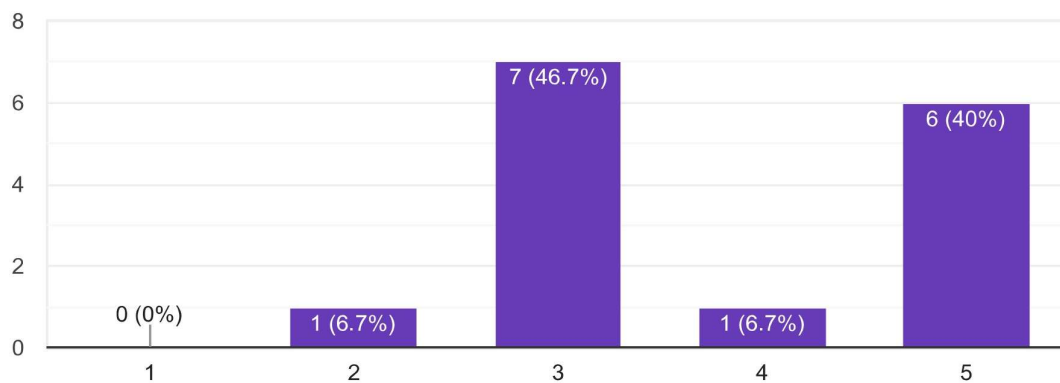
Section 3: Insights Page

Feedback on the Old Insights Page

How would you rate the overall design and layout of the old Insights page?

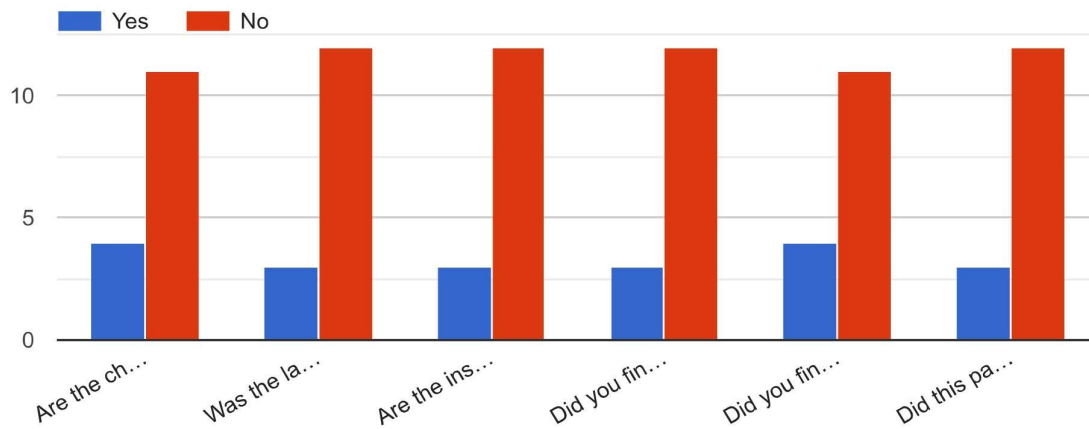
 Copy

15 responses



Answer the following questions:

 Copy



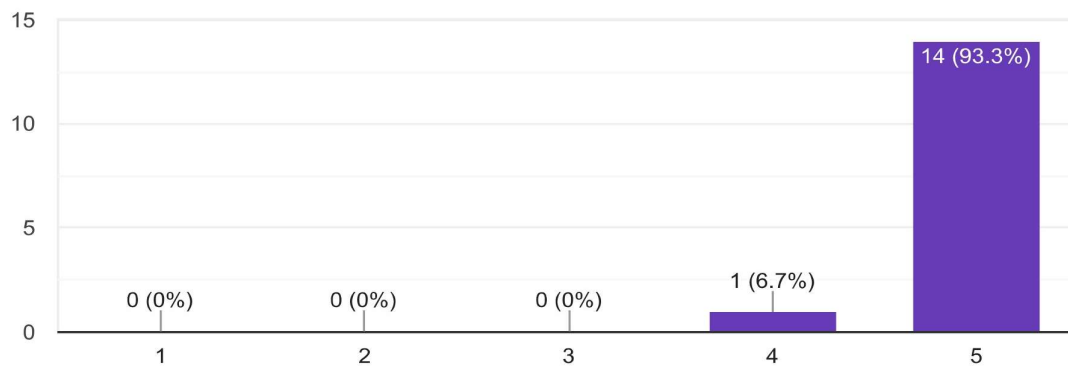
Feedback on the New Insights Page

Copy

How would you rate the overall design and layout of the new Insights page?

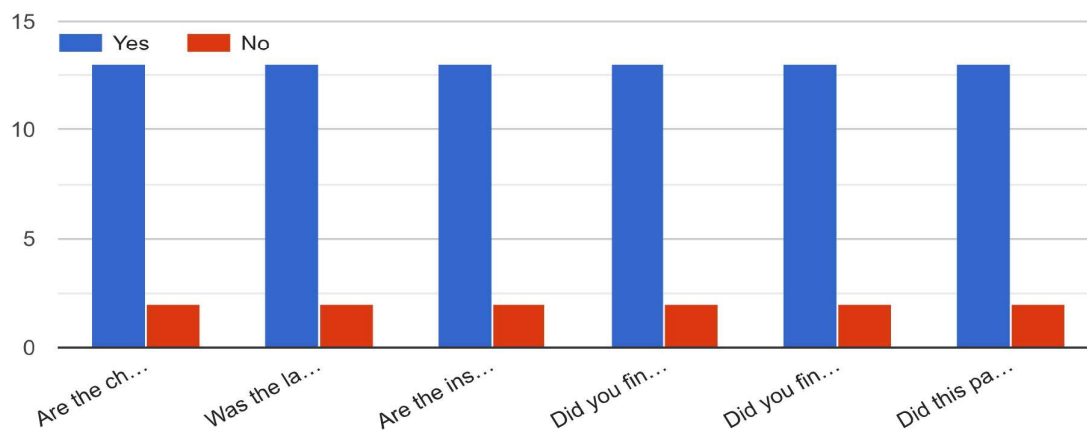
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15 responses



Answer the following questions:

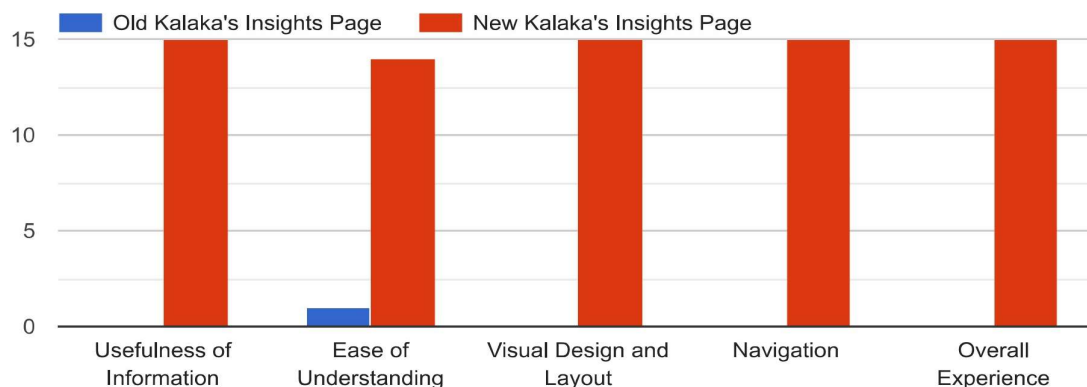
 Copy



Comparing Old vs. New Insights Page

Which version of Kalaka's Insights Page do you prefer in terms of:

 Copy

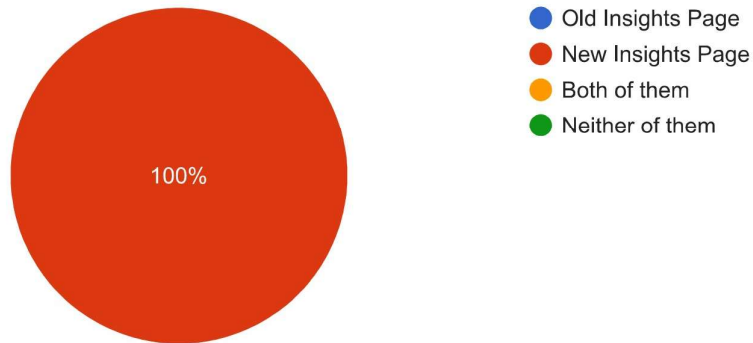


Copy

Do you prefer Kalaka's **Old Insights Page** or **New Insights Page**.

 Copy

15 responses



If you choose both or neither of them, give your reasons why. (OLD Vs NEW INSIGHTS PAGE)

0 responses

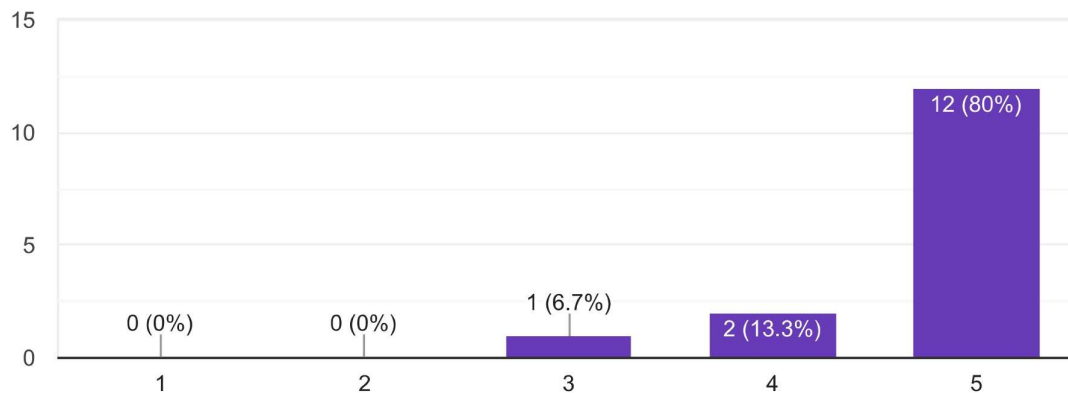
No responses yet for this question.

Section D: Languages Page

Do you find the Word of the Day section helpful? Link:TBA

 Copy

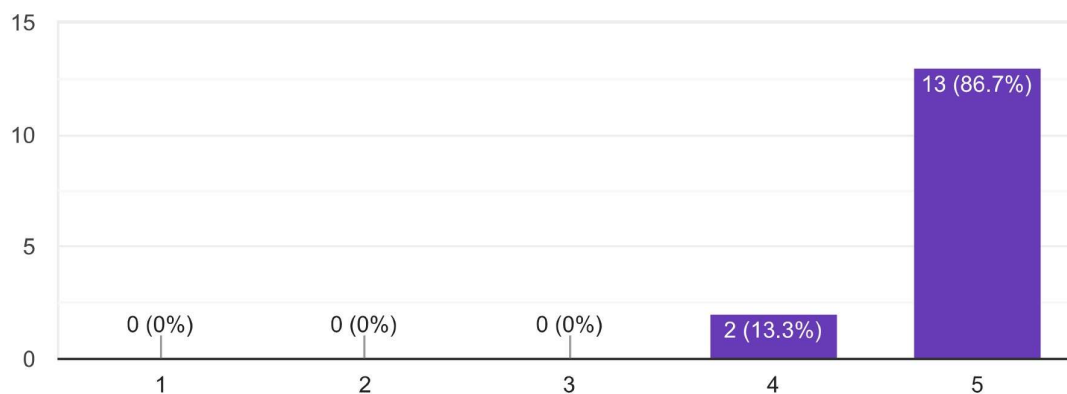
15 responses



Do you find the Glossary section helpful? Link: TBA



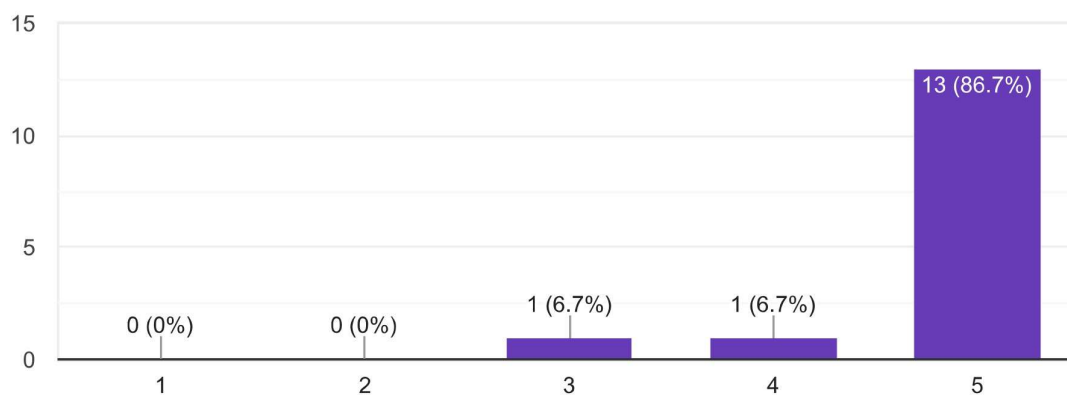
15 responses



Is the Glossary well-organized and informative? Link:TBA



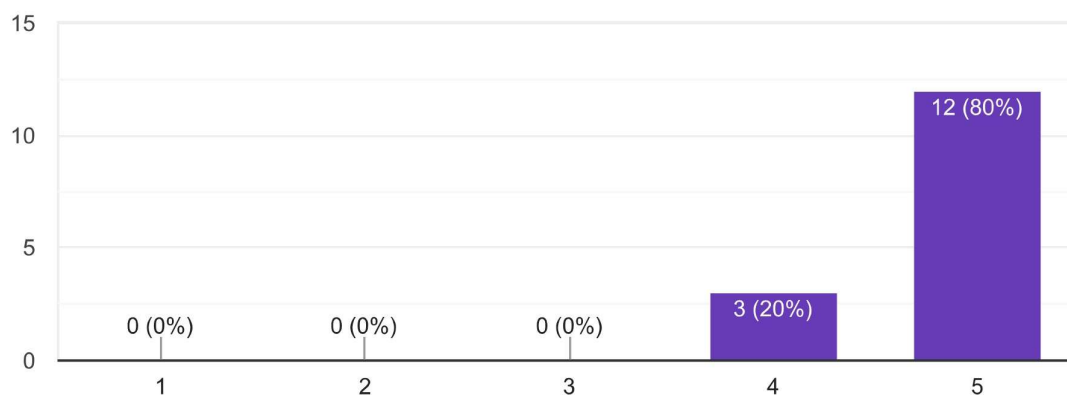
15 responses



Do you find the Quiz section helpful?



15 responses

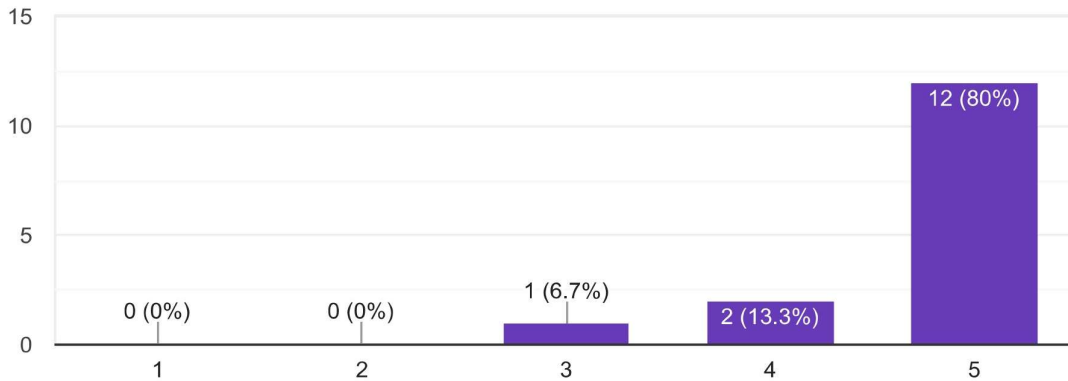


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How would you rate the Quiz feature in terms of being engaging and educational?

 Copy

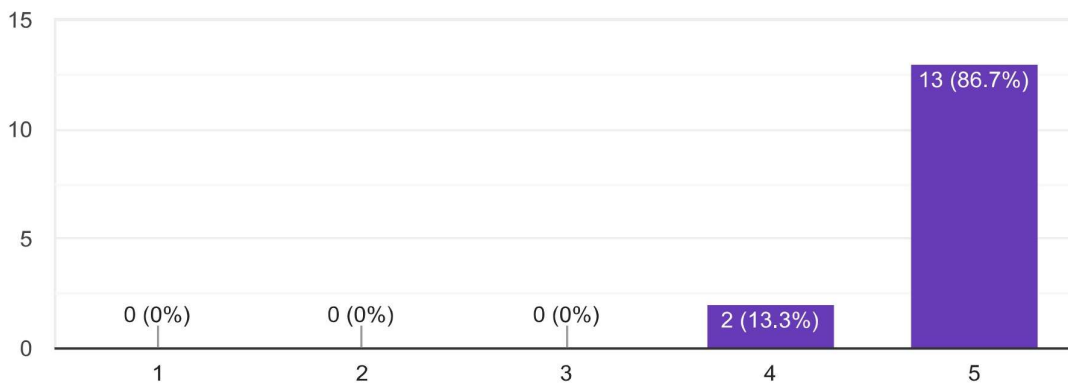
15 responses



Do you find the Speaker Diarization in Audio section helpful? Link: TBA

 Copy

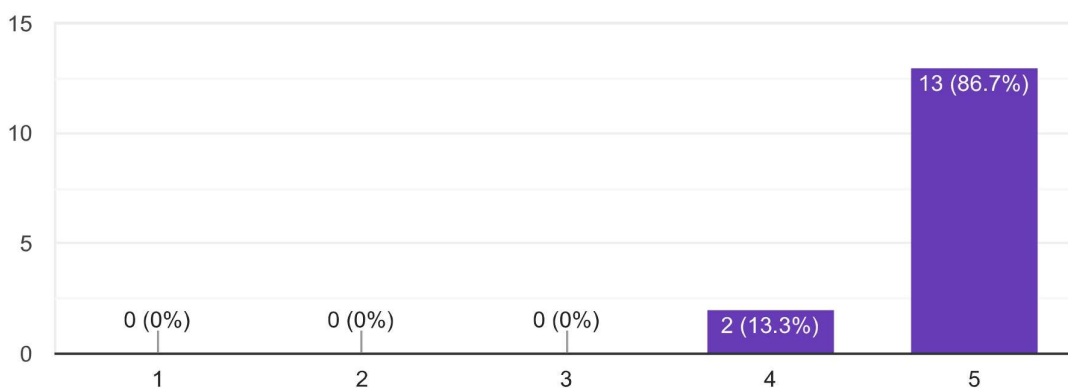
15 responses



How would you rate the usefulness of the Speaker Diarization feature?

 Copy

15 responses

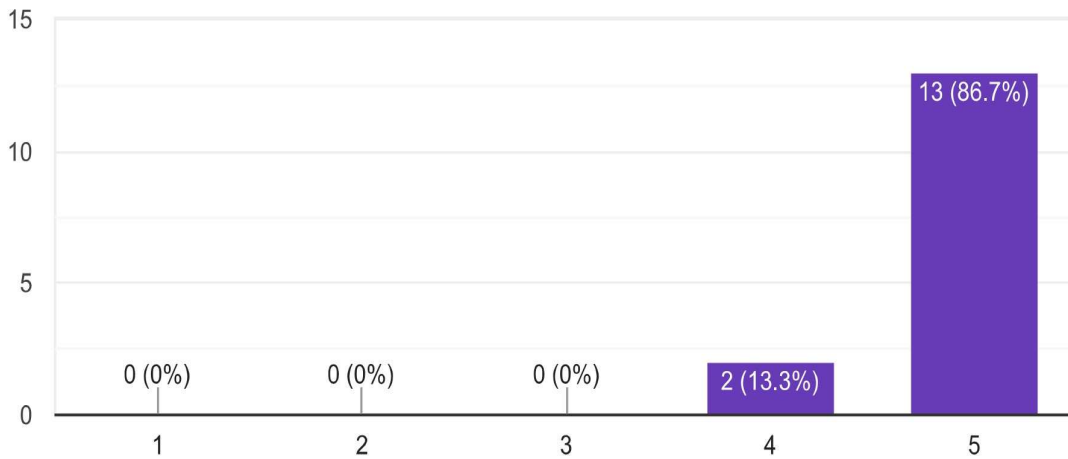


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How accurate do you find the Speaker Diarization feature (correctly separating speakers)?

 Copy

15 responses

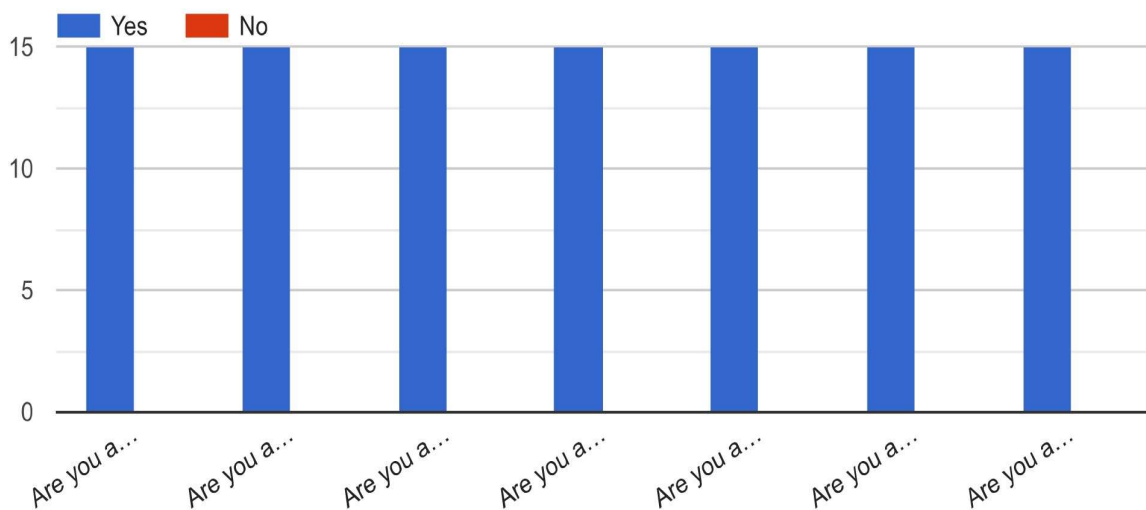


Section E: User Pages

Speech Data

First, register and login as a User. Then, go to "Speech Data" page and answer the following questions:

 Copy

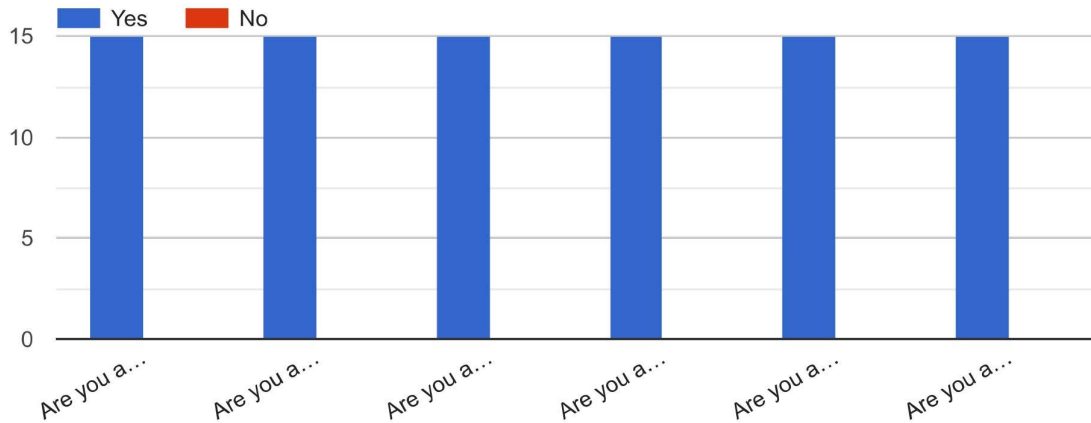


Speaker Profile

Copy

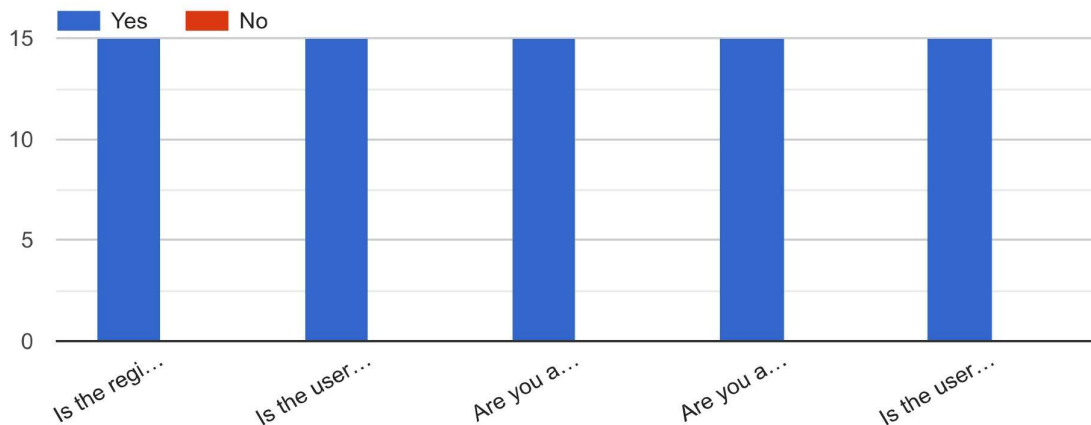
Next, go to "Speaker Profile" page and answer the following questions:

 Copy



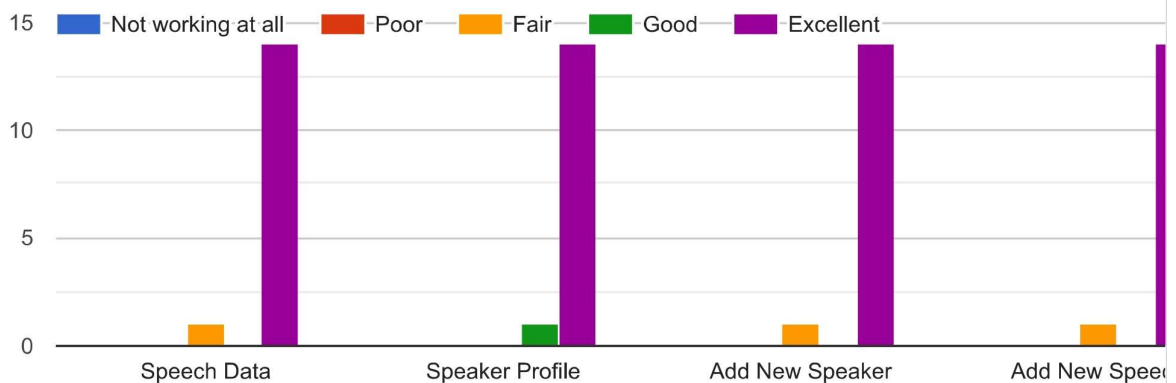
Answer the following questions:

 Copy



How well are the following pages?

 Copy



Suggestions for improving user pages and features

0 responses

No responses yet for this question.

✓ **Thank You for Completing the Survey!**

How well are the following pages?

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Does this form look suspicious? Report

Google Forms