A MOBILE APPLICATION TO IMPROVE ONLINE LEARNABILITY TO VISUALLY IMPAIRED ELEMENTARY SCHOOL CHILDREN

Project Id: TMP-23-310

Final Report

Sathsarani.B.A.D.A

BSc (Hons) in Information Technology Specializing in Information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology Sri Lanka

September 9th

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Declaration of the Candidate and the Supervisor

I declare that this is my own work, and this dissertation does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any other university or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgment is made in the text.

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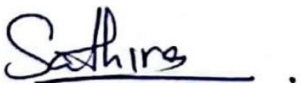
The supervisor/s should certify the proposal report with the following declaration.
The above candidates are carrying out research for the undergraduate Dissertation under my supervision.



02/05/2023

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Signature of the supervisor: Date:

Acknowledgement

I'd want to use this opportunity to extend my heartfelt gratitude to everyone who contributed to the successful completion of this study. This initiative would not have been feasible without their direction, support, and assistance. First and foremost, I want to thank my supervisor, Mrs. Chathurangika Kahandawaarachchi, and my co-supervisor, Mr. Sathira Hettiarachchi, for their help. Their professional experience, invaluable ideas, and constant support throughout the study process influenced the direction and quality of this work greatly. I am grateful for their tolerance, encouragement, and unwavering support.

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Finally, I'd like to convey my heartfelt appreciation to everyone who helped bring this study to fruition in any way, large or small. Your contributions have been tremendous, and I am grateful for the opportunity to work with everyone.

Abstract

Blindness is a condition in which a person loses the capacity to see fully or partially. It is also reported to be one of the most common disabilities worldwide. Most of the time, finding a complete cure for this ailment is unattainable. As a result, people who are blind adjust to living with their blindness as a part of them. This work intends to construct a chatbot that uses artificial intelligence to predict the most relevant answers to the users' requests in order to assist visually impaired persons. This bot is constructed in such a way that it allows the user to give voice notes rather than textual, as do traditional chatbots. The chatbot is built using a specific architecture. This architecture converts user-sent text to text first. The core architecture of the chatbot is comprised of deep neural networks and APIs used for speech-to-text and text-to-speech conversion. This text is subsequently utilized to identify the best response for the user, which is ultimately delivered to the user. The inner workings of the architecture include an AI technique known as deep neural networks, speech- to-text and text-to-speech APIs and etc.As part of my contribution, I will create a supportive voice bot to assist visually impaired students with their studies. I plan to create a voice bot in three languages: Sinhala, English, and Tamil, as well as subject-based questions and answers. Further, I will create an accessibility mode and incorporate it into the user interface design. A supportive voice bot can help reduce stress and anxiety for visually impaired students. Because they may be overwhelmed by the amount of information they must process, the bot can guide them through the process with a calm and supportive voice.

Keywords— Artificial Intelligence, Chatbot, Preprocessing, Deep Neural Network, Speech Recognition

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1. Introduction

1.1 Background Literature

IBM emerged as a pioneer in the field of digital voice recognition technologies for computers in the 1990s. This was the first stage of a pioneering technique that would eventually provide the groundwork for modern voice command recognition systems. When Apple debuted Siri in 2011, the evolution of virtual house aid took a huge step ahead. Following that, large businesses such as Google and Microsoft entered the voice technology field. Google launched Google Now in 2012, whereas Microsoft debuted the "Cortana" assistant at their "annual Build worldwide developer's conference" in 2013. Amazon entered the race in 2014 with the launching of their breakthrough product, Amazon Alexa, which set the ground for a smart speaker revolution.

Several significant technology advances occurred in 2015, including the release of the Amazon Echo and the Amazon Alexa Skills Kit in the United States. Microsoft made strides as well, integrating Windows into both desktop and mobile platforms. In May 2016, Google decided to enter the voice technology market by releasing the Google Home as part of the Allo messaging service. The battle to offer the most advanced voice support technologies to the general public heated up when Samsung purchased the virtual assistant startup "viv" the same year.

speech assistants, which are driven by technologies such as speech recognition, artificial intelligence (AI), and natural language processing (NLP), can understand human questions, answer to them, and carry out activities as required. According to a study [5,] the Zira Voice Assistant effectively interprets user requests and performs frequently requested activities, simplifying our lives. When the assistant receives voice input, it responds with a "OKAY," records the user's message, and conducts the required action. Zira can also communicate in a human-like fashion, thanks to the "Speak" function built into the PythonTTSX3 implementation. The Speech Recognition module captures voice input via the "speech_recognition.Microphone()" method, whereas the "pyttsx3" function translates text to speech. The Recognizer.recognize_google() function is used when Zira's primary language is English.

Another study [1] created a text-to-speech system capable of converting speech into a Japanese accent. This entailed constructing and training a model to read Japanese text aloud with a specified accent, which was accomplished using BERT characteristics. The model was also trained to change the tone of the audio based on the text's emotional content.

A separate study [2] seeks to develop an end-to-end text-to-voice translation system capable of translating speech into a natural tone. This work applies an approach called context-aware mask prediction to improve

its effectiveness, which eliminates the effects of cut-copy actions on the algorithm's performance. When compared to other text-to-speech conversion technologies, this model outperforms the competition.

The proposed solution expands on the strategies used by existing voice assistants while making a critical differentiation. Unlike prior studies, our research focuses on producing a useful speech bot capable of assisting visually challenged pupils in many languages, notably English, Sinhala, and Tamil. This project attempts to close the research gap while also providing critical help to a previously underserved community.

1.2 Research Gap

Numerous research attempts and systems have been introduced, as previously pointed out, but the implementation of a completely integrated system incorporating all of the desired attributes remains elusive. The proposed system in difficulty, on the opposite, displays a higher level of efficacy and comprehensiveness.

When it comes to delivering a beneficial voice bot targeted to the special needs of visually impaired students, there is a noticeable gap in the landscape of existing studies. In contrast, our proposed solution addresses this weakness by developing a dedicated voice bot that is embedded within a mobile application. Notably, there is already a desktop-based voice assistant in the current environment, but it is limited in dimensions because it only runs in English.

Our proposed approach, on the alternative, takes a step toward inclusivity by increasing its linguistic capabilities to include three languages: English, Sinhala, and Tamil. This forward-thinking strategy aims to break down language barriers and provide assistance to a broader group of consumers with varied linguistic origins.

We have created a summary comparison in the table below to highlight the distinguishing elements between the proposed system and the present approach.

Research	Supportive voice bot for multilingual languages	Accessibility mode in the UI design.	Voice input and response	Mobile application
Research 1 [2]	✗	✗	✓	✓
Research 2 [5]	✗	✗	✓	✗
Research 3 [4]	✗	✗	✓	✓
New Research	✓	✓	✓	✓

Table 1

2. Research Problem

Individuals with visual impairments encounter a wide range of daily obstacles, from reading a book to navigating city streets independently. While there are existing tools and technology to help people overcome these challenges, it is clear that they fall short of providing comprehensive answers. Vision, whether seeing or visually handicapped, plays an unquestionably important role in the human experience, influencing every aspect of existence. Even everyday chores frequently necessitate the assistance and support of those with visual impairments. The purpose of this study project was to delve thoroughly into the multifaceted issues faced by the visually impaired in their daily lives and to give holistic and satisfactory solutions to these challenges.

Students with visual impairments are frequently at a disadvantage when compared to their peers with other disabilities within the various divisions of the disabled community. The incorporation of assistive technologies has emerged as a critical technique for leveling the educational playing field by lowering learning complexity. Although these assistive technologies have made it possible for impaired people to access e-learning content, it is important to note that they have yet to be demonstrated to be uniformly beneficial for all users. The unique educational needs of visually impaired kids face special challenges. In typical classroom environments, such students frequently rely on the assistance of teachers and peers to gain access to course content. With the increased integration of technology into the educational scene, however, there is a chance to add novel types of support, with speech bots emerging as a promising alternative.

As a result, the concept of disability-aware e-learning systems is becoming increasingly important. Individuals with disabilities have particular criteria for obtaining information in formats that meet their needs. This needs the creation of assistive and adaptive technology capable of providing globally accessible knowledge. Voice bots, which are artificial intelligence-infused computer systems, constitute a watershed moment in this attempt. They interact with users using spoken language, adapting to their inputs, asking questions, and providing advice on a variety of topics. Voice bots have enormous potential in the context of education to provide a friendly and inclusive learning environment that is especially advantageous for visually impaired pupils.

Finally, our research path has been guided by a deep dedication to tackling the various issues that people with visual impairments confront in their daily lives, particularly in the educational sphere. It is critical that we work to close the accessibility gap and create customized solutions that empower and uplift the visually impaired community. With their ability to engage, assist, and support, voice bots are a big step forward in

fostering inclusivity and improving the educational experience for visually impaired students and, by extension, all individuals with disabilities.

3. Research Objectives

In this section, the objectives of the research are divided into main and sub. The objectives are separately listed below.

3.1 Main Objective

The primary goal and mission driving the development of a supporting speech bot customised for visually impaired students are rooted in a strong desire to improve and empower their educational journeys. This project revolves around the development of a very adaptable speech bot with a wide range of capabilities, all precisely planned to encourage and enrich these students' learning experiences. This voice bot's varied features include replying to enquiries, providing detailed explanations, leading students through tasks, and providing extensive academic support across a wide range of courses and topics.

The pursuit of innovation and inclusivity, on the other hand, is a constant driving factor behind this initiative. In response to the ever-changing educational context, there is a compelling imperative to broaden the horizons of this useful voice bot. One critical aspect of this enhancement is the speech bot's capacity to work in a bilingual situation. This revolutionary program aims to empower visually impaired children from various linguistic backgrounds by breaking down language barriers and providing them with the skills and resources they need to succeed in their scholastic endeavors.

In essence, the creation of this helpful voice bot represents a firm commitment to fostering the educational growth and achievement of visually impaired children. It reflects a continual journey toward innovation, inclusivity, and the removal of linguistic barriers, with the ultimate goal of ensuring that every student, regardless of background or visual impairment, has access to the tools and assistance necessary to thrive in the domain of education.

3.2 Sub Objective

We have selected numerous sub-objectives within the scope of this project that contribute to the overarching goal of building a comprehensive and inclusive learning environment. One of these sub-goals is the creation of a helpful voice bot, a key component aimed to enhance the learning experience, particularly in the context of multilingual language training. This sub-goal demands the development of

a sophisticated speech bot system capable of speaking and interacting with people in many languages. By doing so, we hope to establish an inclusive educational platform that welcomes learners from various language origins and improves their access to educational resources.

Another key sub-goal is the establishment of an accessibility mode within the system. This feature is intended to dramatically improve the visual experience for users, with a particular emphasis on those with visual impairments. We are devoted to providing a user-friendly design for those with unique visual demands by adding aspects such as High Contrast Mode and Text-to-Speech capability. This attempt demonstrates our commitment to building an accessible learning ecosystem in which every user may effectively engage with the information.

Furthermore, a key sub-goal of this project is to provide consumers with relevant information as well as constructive input on specific themes. To do this, we are building a strong information delivery system that provides consumers with accurate, contextually appropriate content in real time. Furthermore, our technology will be able to provide significant feedback to users, supporting them in their knowledge and mastery of the subject matter at hand. These elements are essential for facilitating successful learning and knowledge acquisition on the platform, allowing users to embark on a journey of continual growth and advancement.

In essence, these sub-objectives are critical building pieces in our quest to create a comprehensive educational platform that prioritizes diversity, accessibility, and successful learning. We hope to establish an ecosystem that not only conveys knowledge but also encourages a sense of inclusion and empowerment, allowing learners from all linguistic backgrounds and with diverse needs to succeed in their educational aspirations.

4. Methodology

4.1 Methodology including the system diagram

1. Setup Flask Web Application

    - Import the required modules: Flask, request, send_file, jsonify, make_response, after_this_request, os, and your ChatBot class should all be imported.
    - Begin by creating a Flask web application instance.
    - Set the audio file upload folder.

2. Define the Chatbot API Endpoint
    - Create a '/chatbot' route that accepts POST queries.
    - Handle incoming audio files and form data within the route function ('process_audio()').

3. Analyze the Audio File
    - Retrieve the request's uploaded audio file, language, and grade.
    - Move the audio file to the upload directory.
    - Install the audio file, language, and grade into the ChatBot.
    - To generate a response, run the chatbot.

4. Text-to-Speech Conversion
    - Convert the chatbot's response text into speech using the 'gTTS' library.
    - In the answer folder, save the generated speech as an audio file ('output.mp3').

5. Speech Recognition
    - Use the'speech_recognition' library to turn the user's voice input into text.
    - Recognize the user's speech based on the language selected.
    - Handle exceptions when voice recognition fails.

6. Natural Language Processing (NLP)
    - Normalize the user's input text by eliminating punctuation, converting to lowercase, and

lemmatizing the terms.

- Determine whether the user's input comprises greetings or exit commands.

7. Generate Response
    - Add the user's input to the collection of sentence tokens.
    - Create TF-IDF (Term Frequency-Inverse Document Frequency) vectors for the sentence tokens.
    - Use cosine similarity to find the most similar sentence.
    - If the TF-IDF similarity is low or the user requests information, consult Wikipedia.
    - Create the chatbot's answer based on the user's input.

8. Translate Text
    - Use the 'LangTranslator' class to translate between languages if the language is not English.
    - If necessary, translate the response into the user's language.

9. Prepare Response
    - If the chatbot generated an audio file (output.mp3), attach it as an attachment to the response.
    - Return a JSON response containing the text response from the chatbot and, if available, the audio file.

10. Launch the Flask Application
    - Launch the Flask application and allow it to listen for incoming POST requests.
    - For development reasons, run the application in debug mode.

11. Error Handling
    - Handle exceptions and return appropriate error messages if any element of the procedure fails

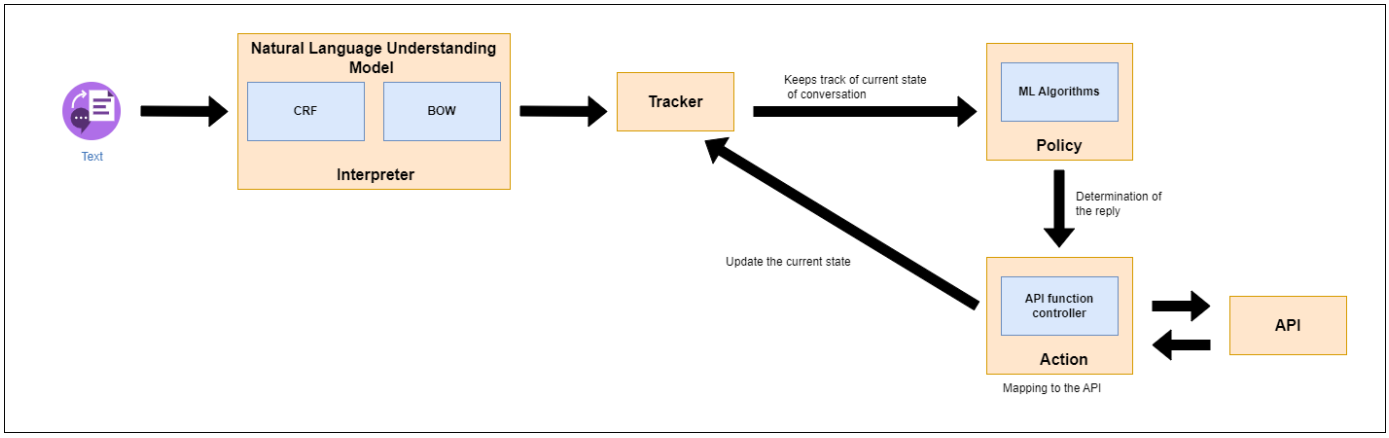

Figure 1

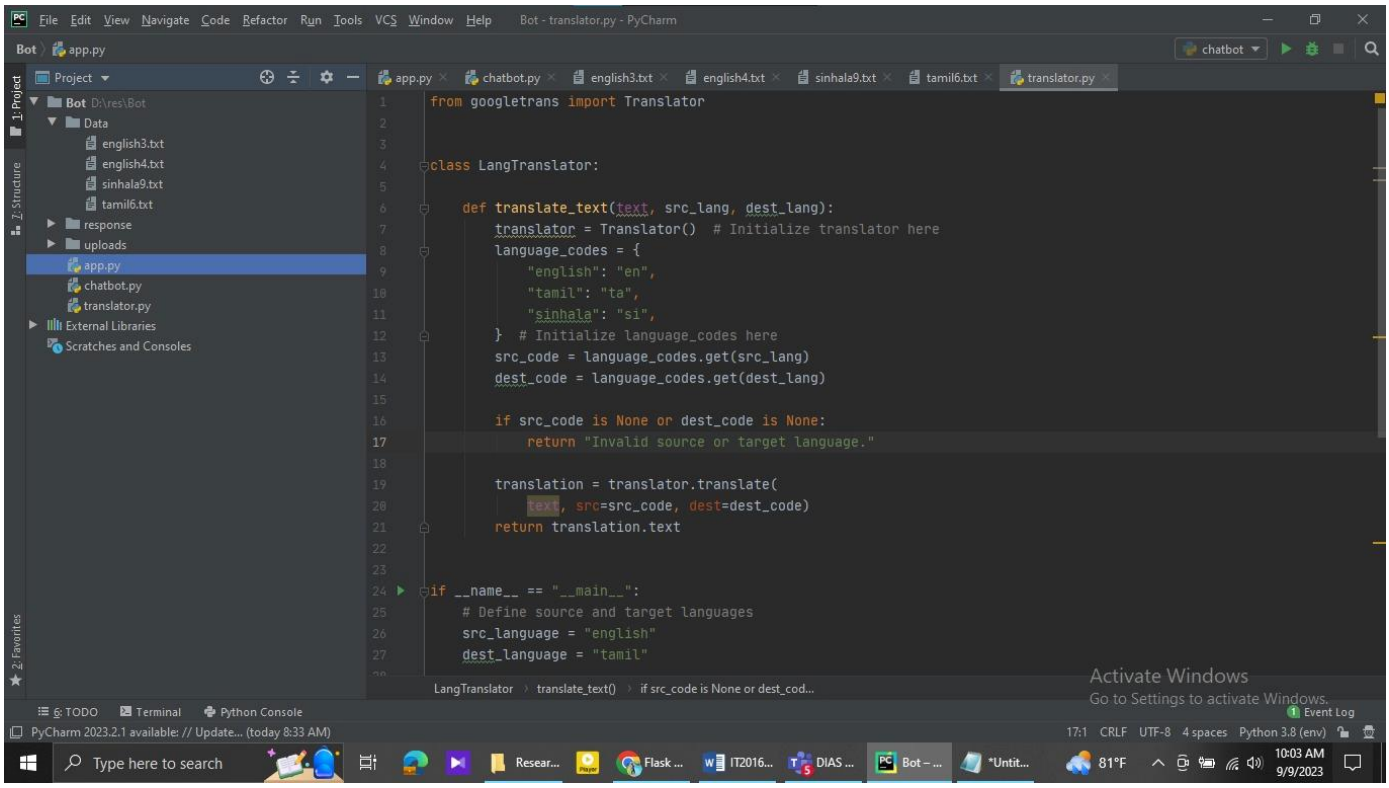

Figure 2: Implementation of app

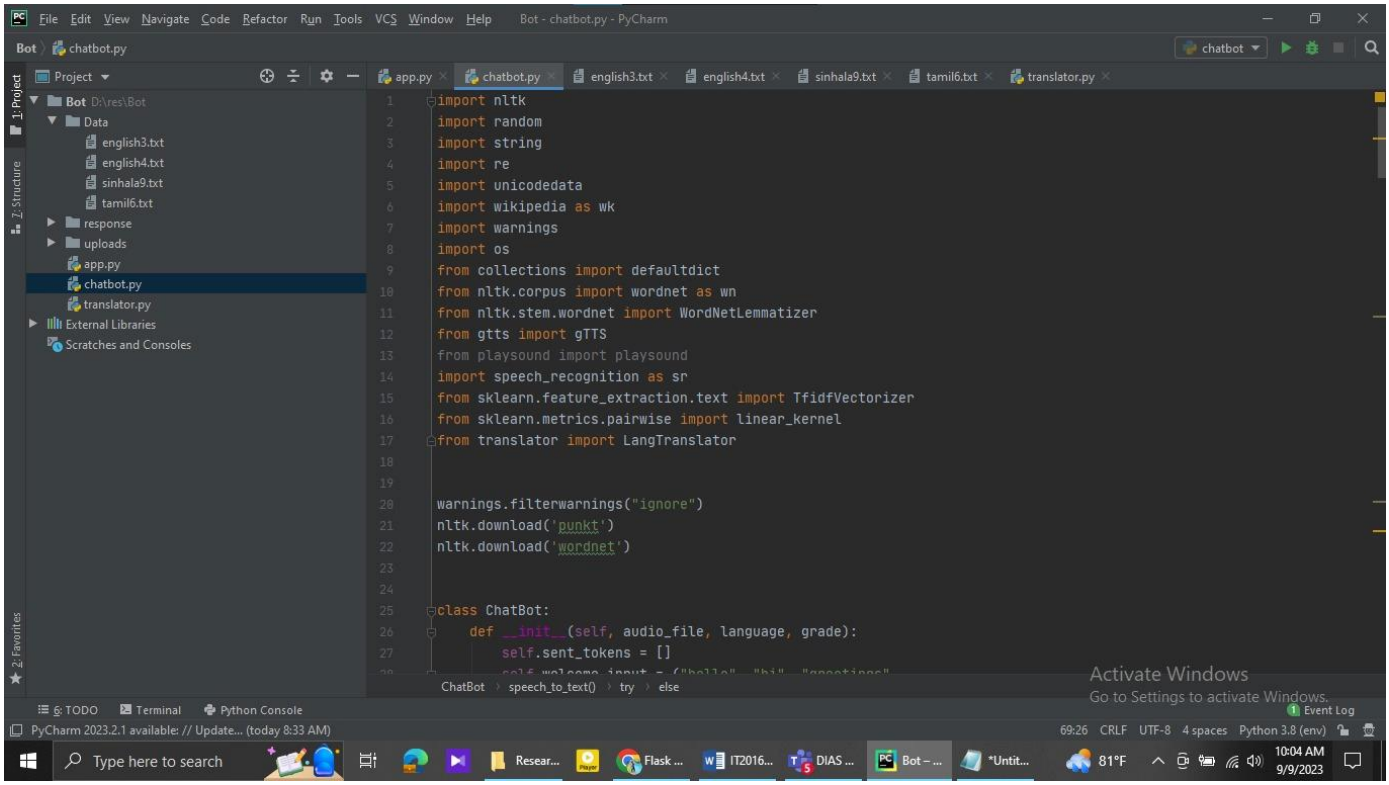

Figure 3:Implementation of chatbot

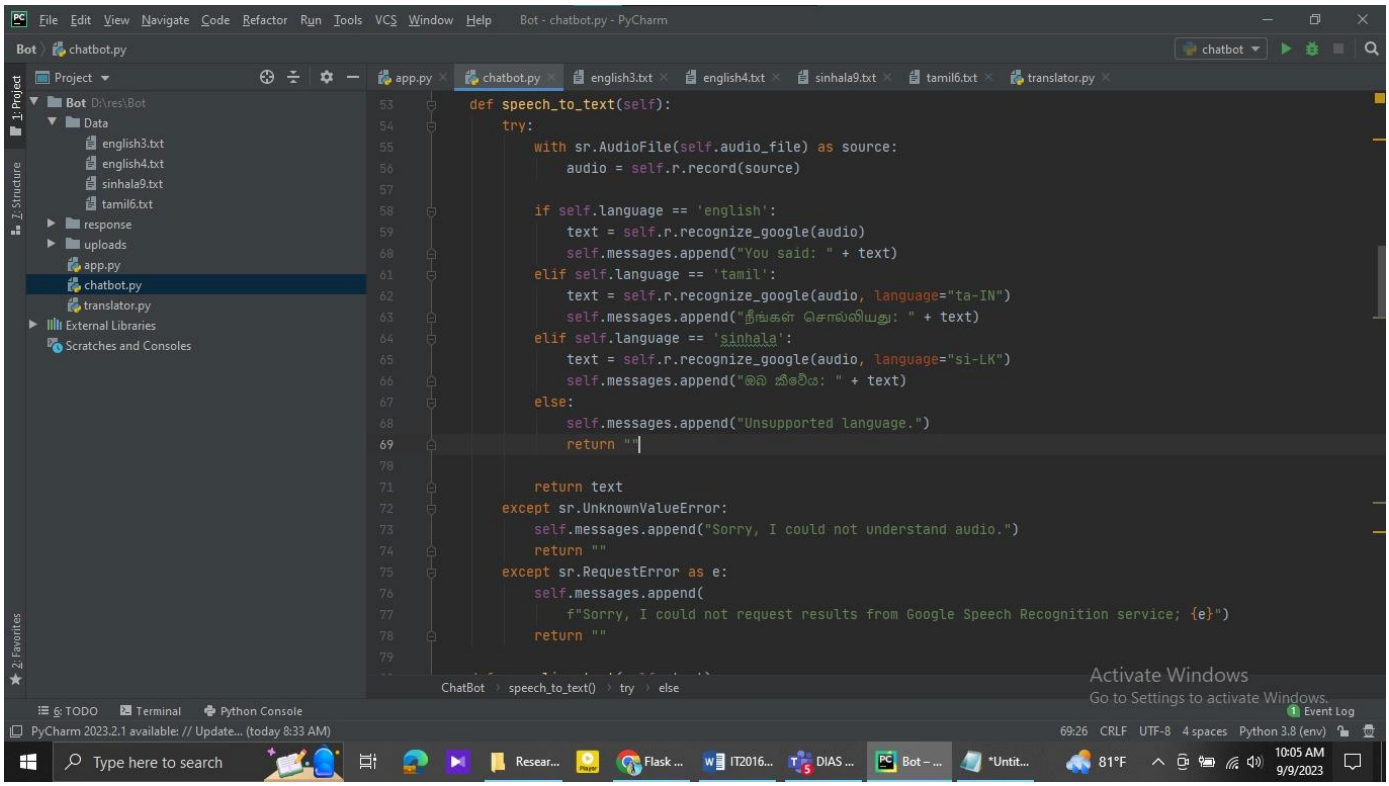

Figure 4:Implementation of chatbot

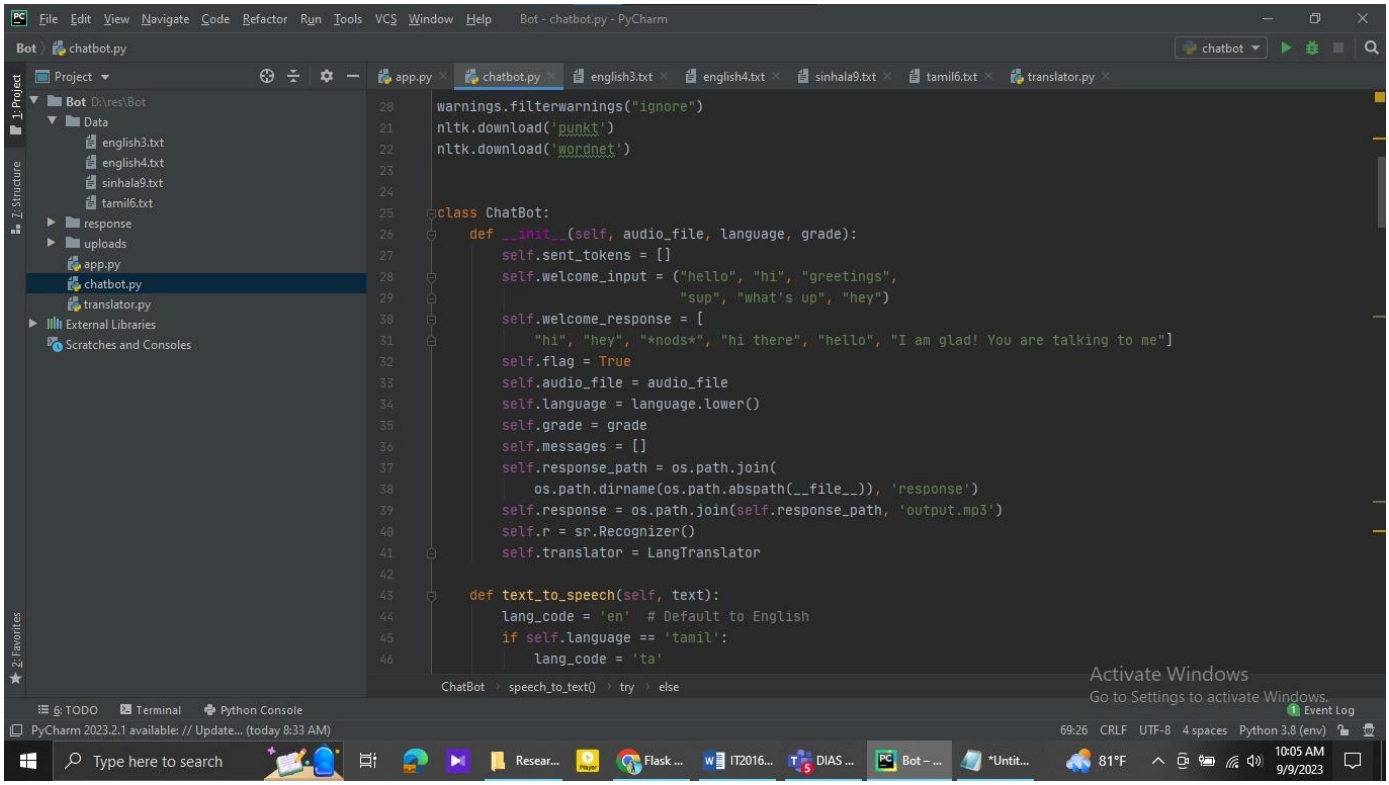

Figure 5:Implementation of chatbot

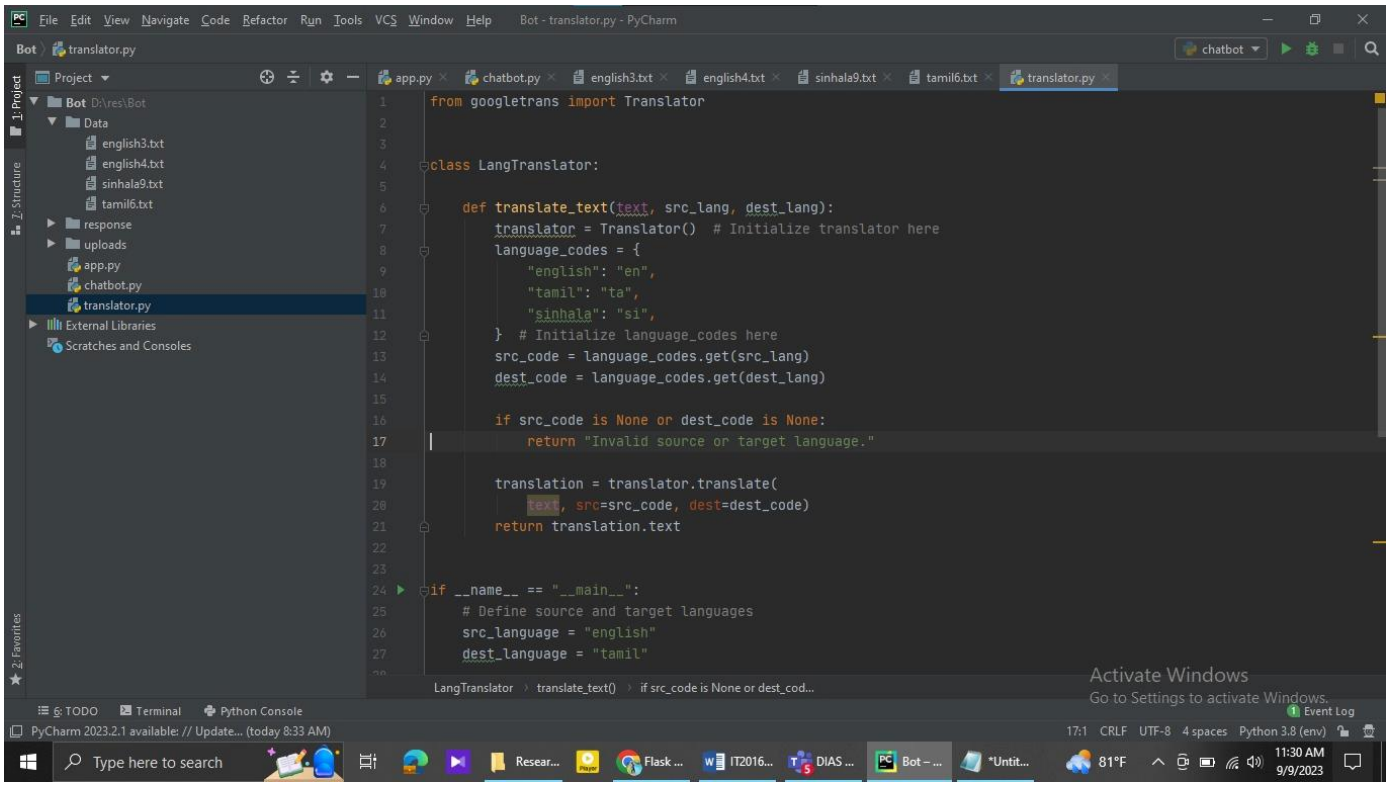

Figure 6:Implementation of chatbot

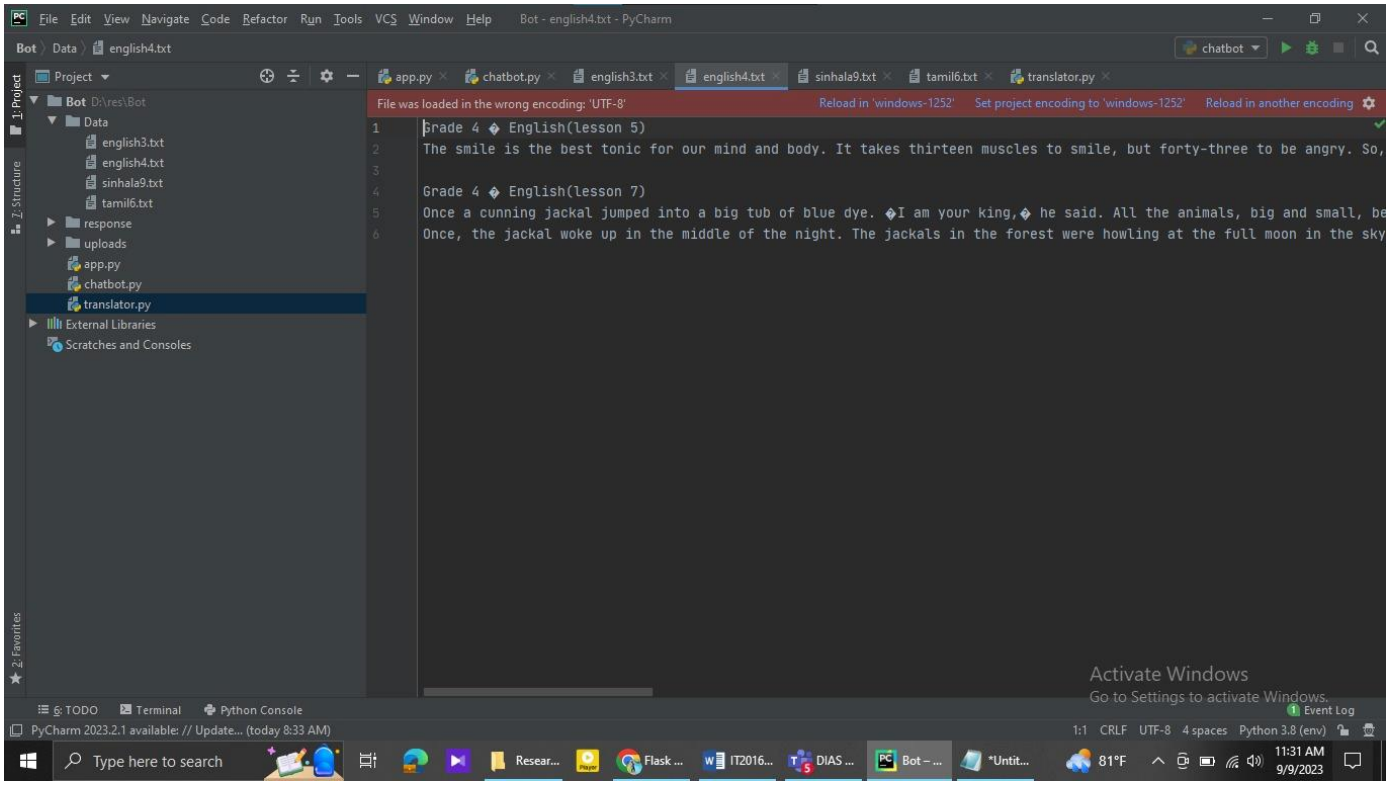

Figure 7:English data collection

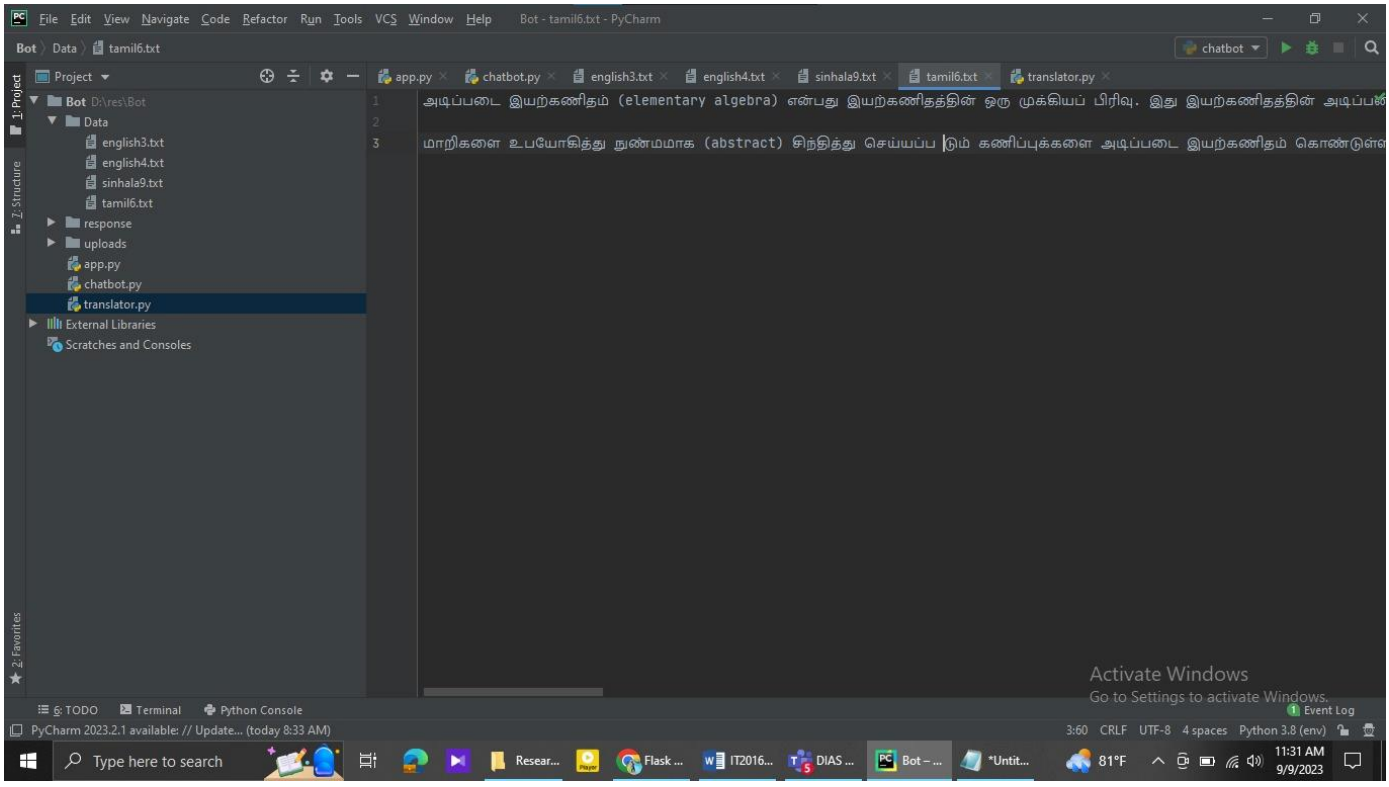

Figure 8:Tamil data collection

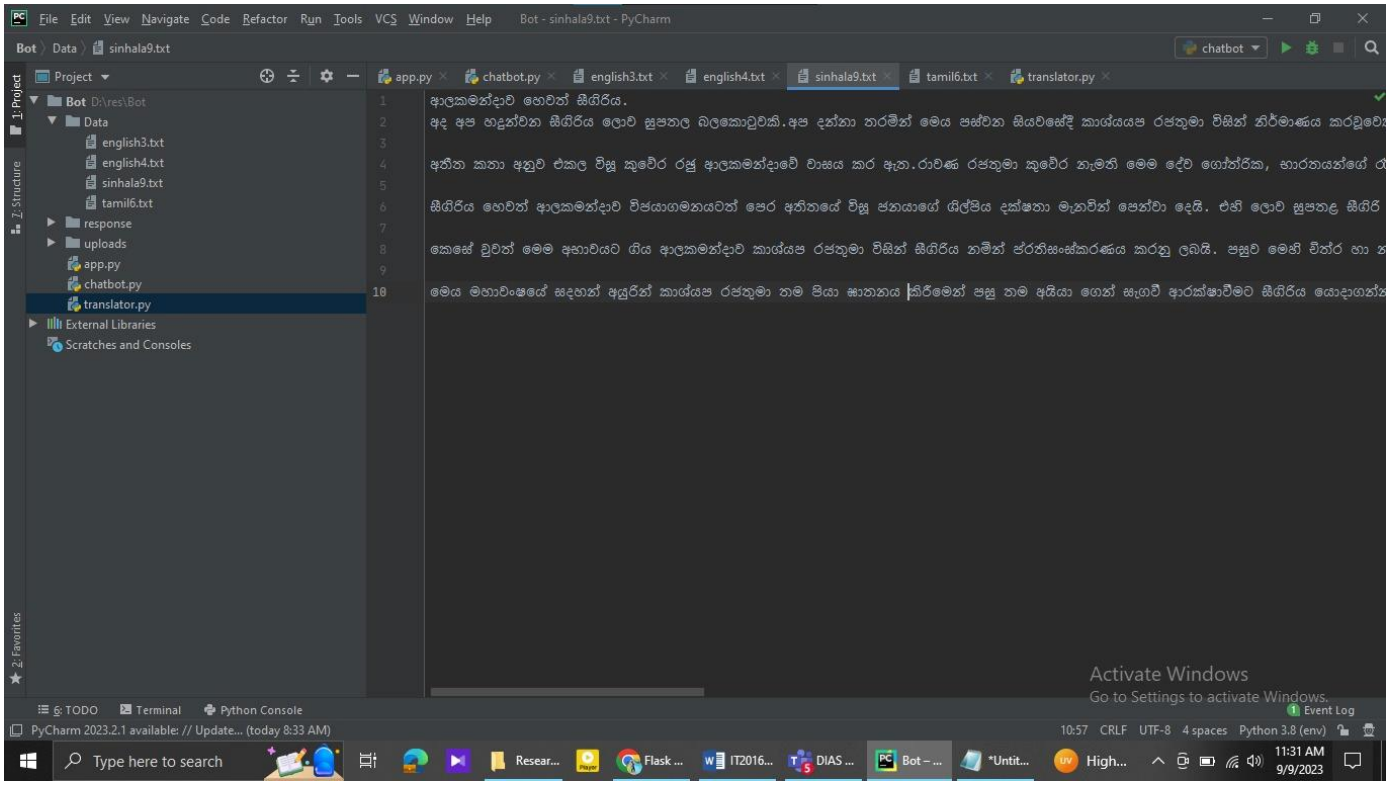

Figure 9: Sinhala data collection

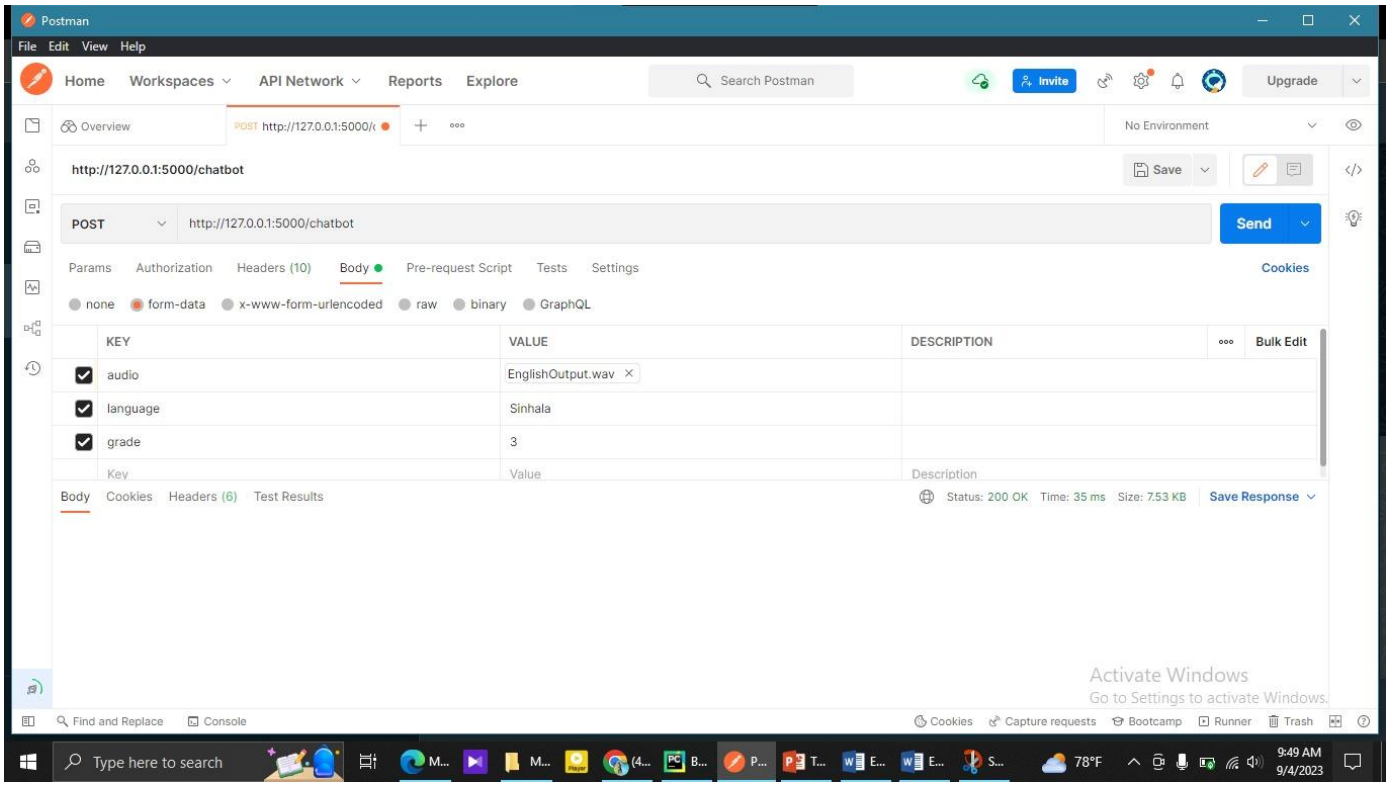

Figure 10: Flak API

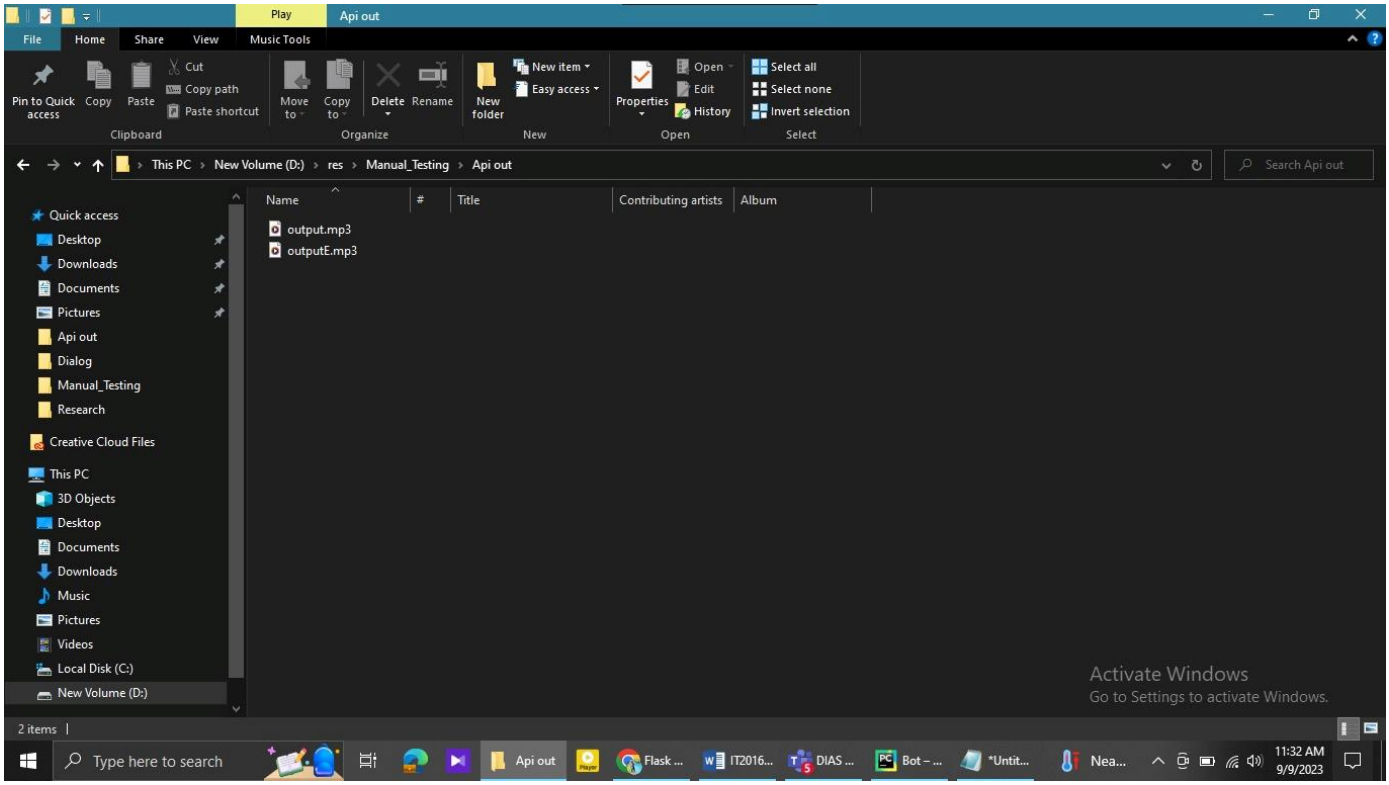

Figure 11:API outputs

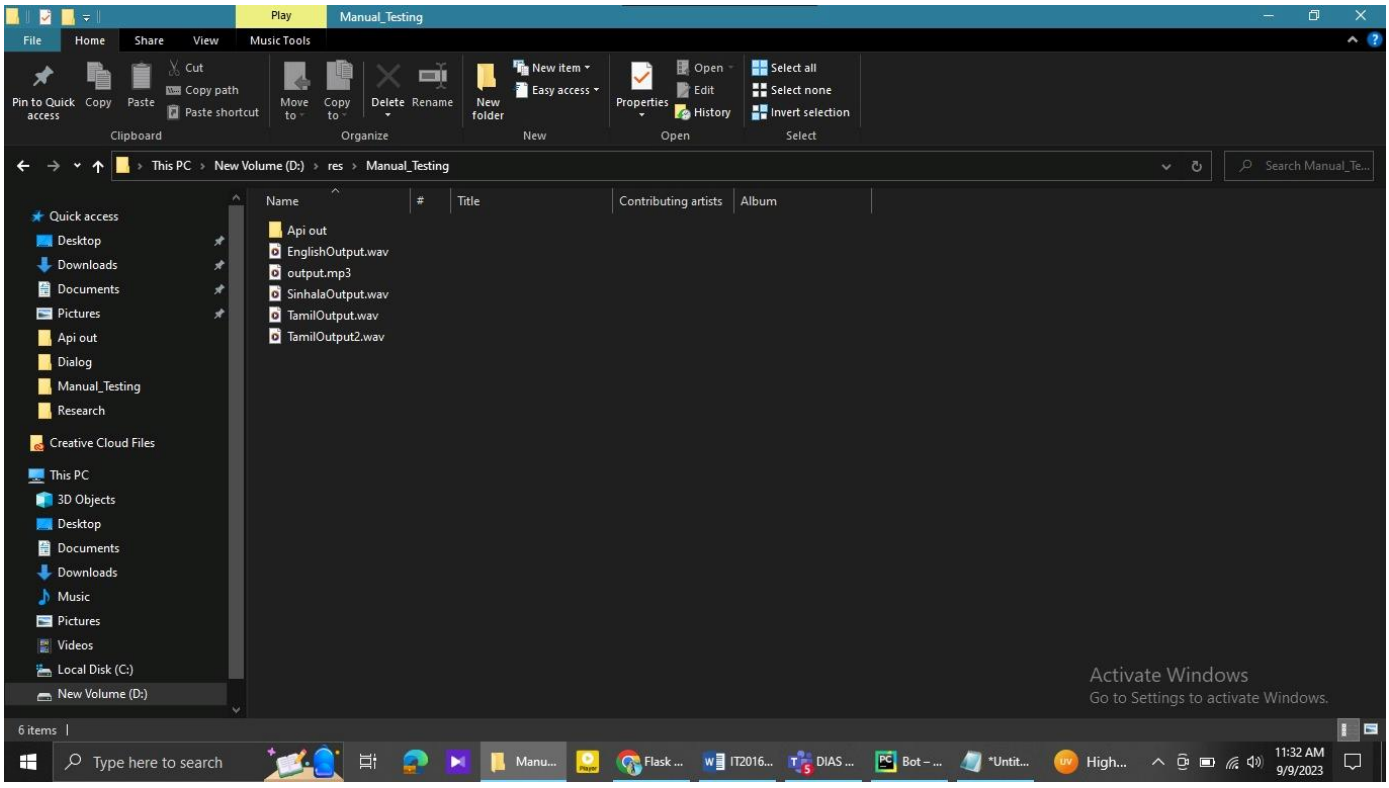

Figure 12:API inputs

4.1 Commercialization of the Product

The environment of educational technology is rapidly changing, and there is a noticeable demand forming within this dynamic arena for e-learning solutions customized to the needs of elementary-level visually impaired pupils. This need spans a wide range of educational institutions, including standard elementary schools, specialist special education facilities, and online learning platforms. To properly serve this growing need, it is critical that the development of e-learning systems considers the various needs of the visually impaired community.

The major goal of this endeavor should be to offer an e-learning platform that is not only pedagogically robust but also inherently accessible. To achieve this level of accessibility, features and capabilities that are expressly developed to address the unique issues experienced by visually impaired pupils must be meticulously integrated. These features include, but are not limited to, audio explanations for content comprehension, a High Contrast Mode to improve visual clarity, a Text-to-Speech mode for auditory support, a magnified mode to enlarge text and graphics, and a slew of other innovations aimed at creating an inclusive and empowering learning environment.

However, it is critical to note that the scope of this program extends well beyond the kids. The role of instructors in the educational ecosystem, as well as the support network given by parents or guardians, are critical to the academic growth and development of elementary visually impaired pupils. As a result, it is critical that the e-learning system not only meets the needs of primary students, but also reaches out to instructors and parents or guardians, providing them with the tools and support needed to facilitate a collaborative and productive learning experience.

In a larger sense, the intended market and audience for an e-learning system designed for visually impaired elementary children extend beyond the confines of a particular educational institution. This audience includes primary schools dedicated to the education of visually impaired children, visually impaired students who aspire to learn and excel, educators dedicated to nurturing their potential, parents or guardians who provide unwavering support, and organizations dedicated to serving and advocating for the needs of the visually impaired population. Ensuring inclusivity and accessibility for all stakeholders within this community is critical to the e-learning system's success and effect.

Simultaneously, the commercialization of such an e-learning system raises strategic concerns. Revenue-generating opportunities must be investigated in order to sustain the application's development and maintenance. This could include charging users for access to the program, providing premium features and

services for a cost, or employing monetization tactics such as in-app advertising. Furthermore, utilizing the power of social media platforms to raise awareness and involvement within the visually impaired community can be beneficial not only in extending the user base but also in promoting a sense of belonging and collaboration.

To summarize, developing and deploying an e-learning system for visually impaired elementary pupils is a difficult task that necessitates a comprehensive strategy. It demonstrates the dedication to inclusive education by recognizing that access and empowerment in the sphere of education should be offered to all, regardless of visual impairments. This journey involves a variety of stakeholders and takes careful consideration of both pedagogical and commercial issues in order to build an impactful and long-term solution that meets the unique needs of the visually impaired community.

5. Software Specifications

5.1 Software Solution

Agile project management is a dynamic, iterative style that has emerged as a game changer in project management. Initially intended for software development, Agile's influence has gone beyond its origins and garnered significant adoption across a variety of industries. Its main concepts are based on flexibility, collaboration, and an unshakable dedication to customer satisfaction, which marks a substantial shift from traditional project management approaches' strict and organized processes.

Agile management places a premium on encouraging regular and meaningful communication among all stakeholders, including team members and clients. This unwavering commitment to open discussion fosters a climate suitable to rapid prototyping and a constant feedback loop, allowing teams to quickly adapt to changing requirements while delivering high-quality goods or services. Agile is distinguished by its method to divide work into manageable and focused iterations known as "sprints." The major goal of these sprint cycles is to incrementally provide functional components of the project, allowing for continuing review and modification.

The Agile Manifesto is the foundation of Agile management, embodying the essential ideals and concepts that guide its execution. These are the guiding principles:

1. Individuals and interactions over processes and tools: Agile recognizes that the underlying motivator behind successful projects is the people engaged and their interactions. While processes and tools are important, Agile prioritizes the human aspect and the collaborative attitude that drives development.
2. Working software over comprehensive documentation: Agile prioritizes the practical expression of ideas through working software above exhaustive documentation. While documentation is still important, the greatest indicator of progress is concrete output that adds value.
3. Customer collaboration over contract negotiation: Agile reshapes the client relationship by emphasizing active collaboration throughout the project's lifespan. Rather than depending on fixed contracts, Agile promotes continuous and iterative contact with customers or clients to maintain alignment with changing needs and expectations.
4. Responding to change in accordance with a plan: The greatest distinguishing feature of Agile is its adaptability. Agile teams value the ability to respond efficiently to changes in needs and priorities above sticking to a strict plan. This responsiveness enables companies to adapt to changing conditions

with agility and resilience.

In conclusion, Agile project management is a paradigm shift that promotes adaptation, cooperation, and value delivery through working increments. Its application extends far beyond software development, making it a versatile methodology applicable to a wide range of sectors. In a world of perpetual change and uncertainty, Agile provides businesses with the tools they need to negotiate complexity while remaining committed to delivering great results and promoting innovation.

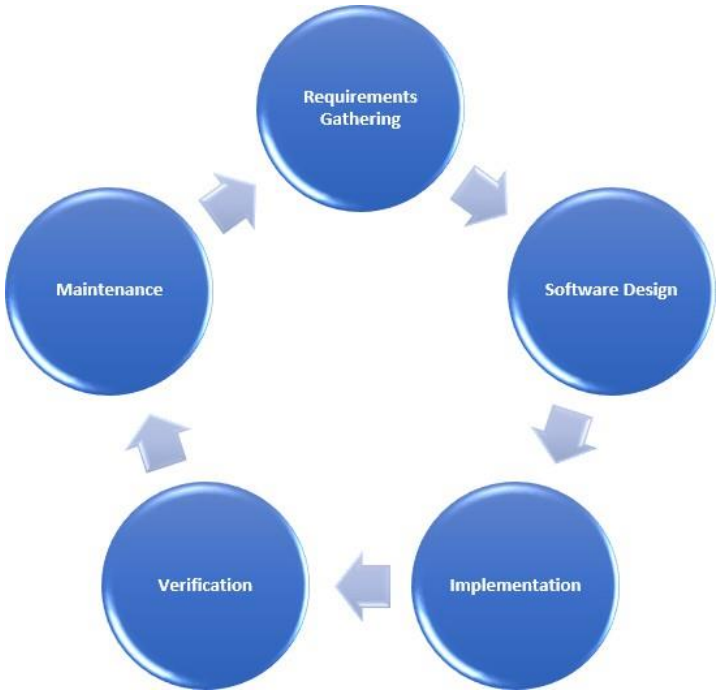

Figure 13

1. **Requirement Gathering**

    - User-Centric Approach: During this early phase, the emphasis is on actually understanding the reality of visually impaired pupils rather than just collecting technical specifications. This entails empathizing with their daily struggles, understanding the importance of accessible education, and adapting the program to their specific requirements.

    - Workshops for Collaboration: Collaboration workshops with stakeholders, educators, and visually impaired students themselves allow for an in-depth investigation of their experiences. This cooperative effort guarantees that no key needs are missed.

    - Accessibility Compliance: Ensuring that the software adheres to accessibility standards such as WCAG (Web Content Accessibility Guidelines) is an important component of gathering requirements. It entails determining the exact accessibility elements required to improve usability for visually impaired people.

2. **Software Design**

    - Inclusive Design concepts: Inclusive design concepts are heavily emphasized during the software design phase. It attempts to establish an environment in which the speech bot is not only functional, but also intuitively accessible and friendly to visually impaired users.

    - Mockups & Prototyping: Creating mockups and prototypes of the user interface before digging into production enables for early user feedback. This iterative design process guarantees that the interface of the speech bot is straightforward and simple to use, especially for those with visual impairments.

    - Database Optimization: Database design is about more than just organizing data; it is also about optimizing data retrieval to provide quick responses to user requests.

3. **Implementation**

    - Accessible Code: During the coding phase, it is important to write code that is not only functional but also accessible. This may entail using semantic HTML for web-based components and ensuring that voice bot responses are screen reader compatible.

- Adaptable User Interfaces: Implementing adaptable user interfaces is critical for visually challenged pupils. User preferences, such as font size, speech speed, and contrast settings, should be dynamically adjusted in these interfaces.

- Continuous Integration and Delivery (CI/CD) pipelines ensure that code changes are merged, tested, and released on a frequent basis, allowing for quick modifications and speedy improvements.

4. Verification

- User-Centered Testing: Extensive user-centered testing is included in verification, with a broad group of visually impaired students actively participating in the testing process. Their feedback is crucial in fine-tuning the performance and usefulness of the voice bot.

- Benchmarking performance: Ensuring that the speech bot works efficiently under various loads and scenarios is an important aspect of verification. This entails stress testing, load testing, and performance tuning to ensure a consistent user experience.

- Security audits are performed in addition to functionality and performance to safeguard user data and protect against potential vulnerabilities.

5. Maintenance

- User Feedback Loop: Maintenance is more than just addressing problems; it is also about keeping an open and responsive channel for user feedback. Continuous feedback collection and action guarantees that the software remains aligned with changing user needs.
- Scalability and Future-Proofing: As user bases expand, software must be scalable to meet greater demand. This entails architectural considerations as well as constant monitoring.
- Regulatory Compliance: Keeping up with changing accessibility standards and regulatory regulations is critical for long-term upkeep.

To summarize, the development of software solutions for visually impaired students is a complete and ongoing process. It is distinguished by a strong commitment to diversity, a constant pursuit of accessibility, and a deep devotion to improving the educational experiences of visually impaired

students. This method is about altering lives through technology and education, not just generating software.

5.2 Tool and Technology

Tools

PyCharm

Figure 14

PyCharm is an integrated development environment (IDE) for Python programming. It includes code analysis, a graphical debugger, an integrated unit tester, integration with version control systems, and Django support. JetBrains, a Czech firm, created PyCharm.

VS Code

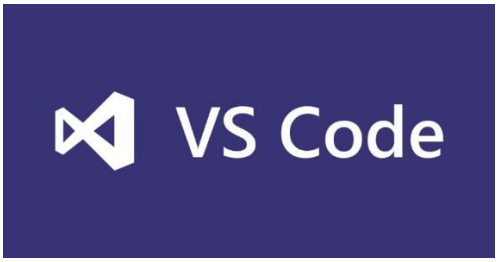

Figure 15

Visual Studio Code, usually known as VS Code, is a source-code editor for Windows, Linux, and macOS that was created by Microsoft utilizing the Electron Framework. Among the features are debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and

embedded Git.

Technology

React Native

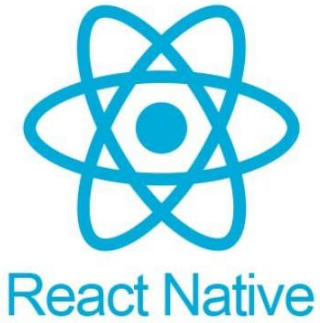

Figure 16

Facebook built React Native, a prominent open-source mobile application development framework. It enables developers to create cross-platform mobile applications for iOS, Android, and the web from a single codebase. React Native is based on the ReactJS library, which is used to create online applications.

Natural Language processing

Figure 17

NLP is used to analyze text and train machines how to speak like humans. Automatic text summarization, sentiment analysis, subject extraction, named entity recognition, parts-of-speech tagging, relationship extraction, stemming, and more real-world applications are available.

Python

Figure 18

Guido van Rossum designed Python, an interpreted programming language with a focus on code readability, and it was initially released in 1991. It is well-known for its general-purpose capabilities and innovative use of substantial whitespace.

5.3 Functional Requirements

The design and deployment of a comprehensive speech bot system aimed at improving the educational experience of visually impaired students entails a number of critical features and functionalities. One of the most important parts of ensuring inclusion and accessibility for a varied student body is the incorporation of multilingual support inside the voice bot. This includes creating a voice bot that can converse in three languages: Sinhala, English, and Tamil. This multilingual flexibility is critical for accommodating students from diverse linguistic backgrounds, providing an inclusive educational environment, and allowing them to engage with learning content in their preferred language, so enhancing comprehension and engagement.
Another critical feature of this new speech bot system is its ability to integrate with existing curriculum. This curriculum integration feature is intended to give students not just a voice-guided learning experience, but also relevant information and constructive comments on specific topics covered in their coursework. Students can receive targeted support and guidance by connecting the voice bot's capabilities with the curriculum, resulting in a more unified and enhanced learning process.
Furthermore, ensuring accessibility on mobile applications is a top priority in the creation of this voice bot system. In this regard, the use of an accessibility mode is required. High Contrast option, which improves visual clarity, Text-to-Speech Mode, which gives aural support, and a magnified option for expanded text are all included in this mode. These accessibility features are critical for meeting the different demands of visually impaired students, ensuring that they can interact with the mobile application smoothly and effectively regardless of their individual visual needs.
In conclusion, creating a comprehensive voice bot system for visually impaired students requires a diverse strategy that stresses inclusivity, relevance, and accessibility. The mobile application's combination of multilingual assistance across three languages, curriculum alignment, and accessibility options all contribute to the creation of an empowering and fulfilling educational experience. These elements help to bridge the accessibility gap and enable visually impaired students to effectively interact with their education, encouraging independence, confidence, and academic achievement.

5.4 Non -Functional Requirement

1.1.1. Usability

- The application should be able to achieve user's required goals efficiently and effectively.
- The application should have a user-friendly interface that is easy to navigate and understand.

1.1.2. Reliability

- The application output accuracy should be error free, and the code should be bug free.so the translation output could be reliable.
- The voice bot should be reliable and available 24/7 to assist students.

1.1.3. Performance

- The application should be able to respond to user requests quickly and efficiently, without lag or delays.

1.1.4. Security and privacy

- The administrative application should be protected from unauthorized access.
- The database should be protected from attacks and unauthorized access.
- The interface should be protected from attacks.
- All passwords should be stored as a secure hash of the administrator password.

1.1.5. Scalability

- The application should be able to handle a large number of users and requests without crashing or experiencing downtime.

1.1.6. Maintainability

- The application should be designed in a way that makes it easy to maintain, update, and fix bugs over time.

1.1.7. Speed

- The voice bot should respond quickly to student requests to provide timely assistance.

1.1.8. Portability

- The application should be able to run on multiple platforms and devices, without requiring major modifications or changes.

5. Conclusions

The creation and deployment of a helpful speech bot designed exclusively for visually impaired pupils is a significant step forward in the field of accessible education. This cutting-edge technology has the ability to significantly impact visually impaired students' educational journeys, improving their entire learning experience and promoting greater independence in their academic endeavors.

Voice bots use cutting-edge technologies such as natural language processing and speech recognition to make learning more accessible and engaging for visually impaired pupils. These vocal bots may reply to voice commands and enquiries, effectively acting as virtual assistants. They help students navigate their material, stay organized, and stick to their study routines, effectively acting as individual study partners.

One notable feature of this helpful voice bot system is its multilingual functionality, which includes Sinhala, English, and Tamil. This feature ensures that students can interact with the software in the language of their choice, removing language barriers and promoting a more fluid learning experience. This personalization is especially important for visually impaired students because it allows them to interact with instructional content in a way that feels comfortable and familiar to them.

Furthermore, the advantages of helpful voice bots go beyond ease and accessibility. They have the potential to alter the lives of visually impaired pupils, particularly those who struggle in regular school environments. Voice bots can dramatically improve these students' entire quality of life by allowing them to manage their educational journey with greater independence, confidence, and self-sufficiency. They reduce students' dependency on outside aid, providing them a sense of autonomy and control over their education.

Furthermore, the introduction of helpful speech bots helps to bridge the educational accessibility gap that many visually impaired students confront. This technology expands learning options and ensures that all students have an equal opportunity to realize their full academic potential. It is a great instrument for encouraging diversity and leveling the playing field in education.

Finally, implementing a helpful voice bot designed for visually impaired students is a critical step toward improving their education and enriching their learning experiences. Voice bots are poised to become an increasingly important component of education for visually impaired individuals as technology advances. These advances have the potential to transform the accessibility and inclusion of education, ushering in a new era of empowerment and opportunity for visually impaired students.

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6. APPENDICES

6.1 Work Breakdown Structure

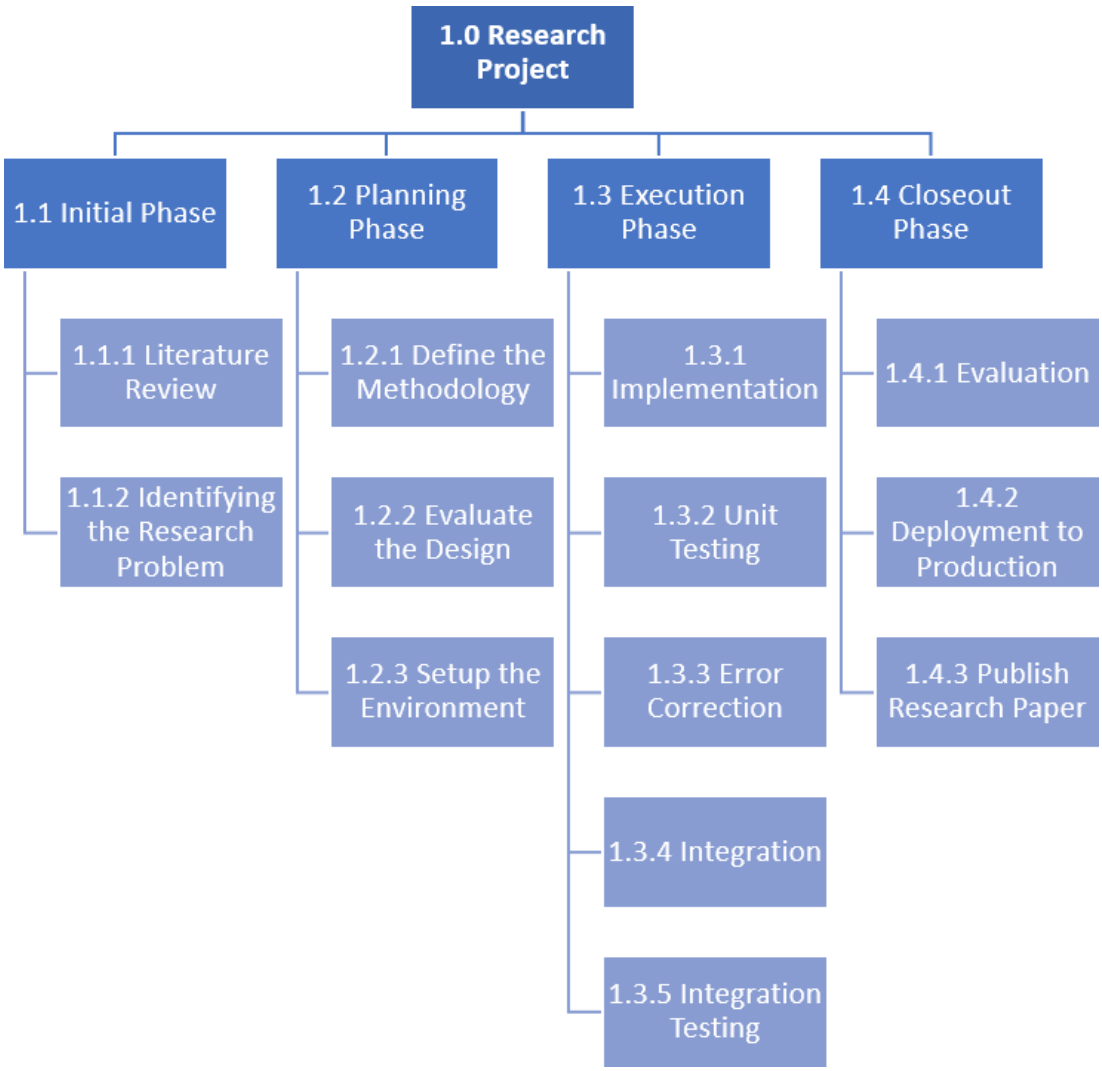

Figure 19

6.2 Gantt Chart

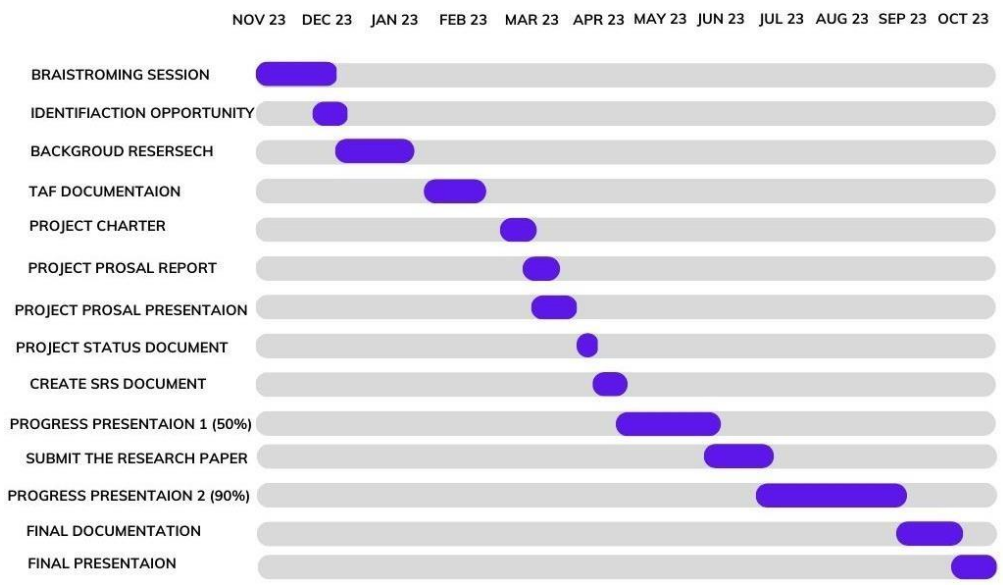

Figure 20

6.3 System Overview

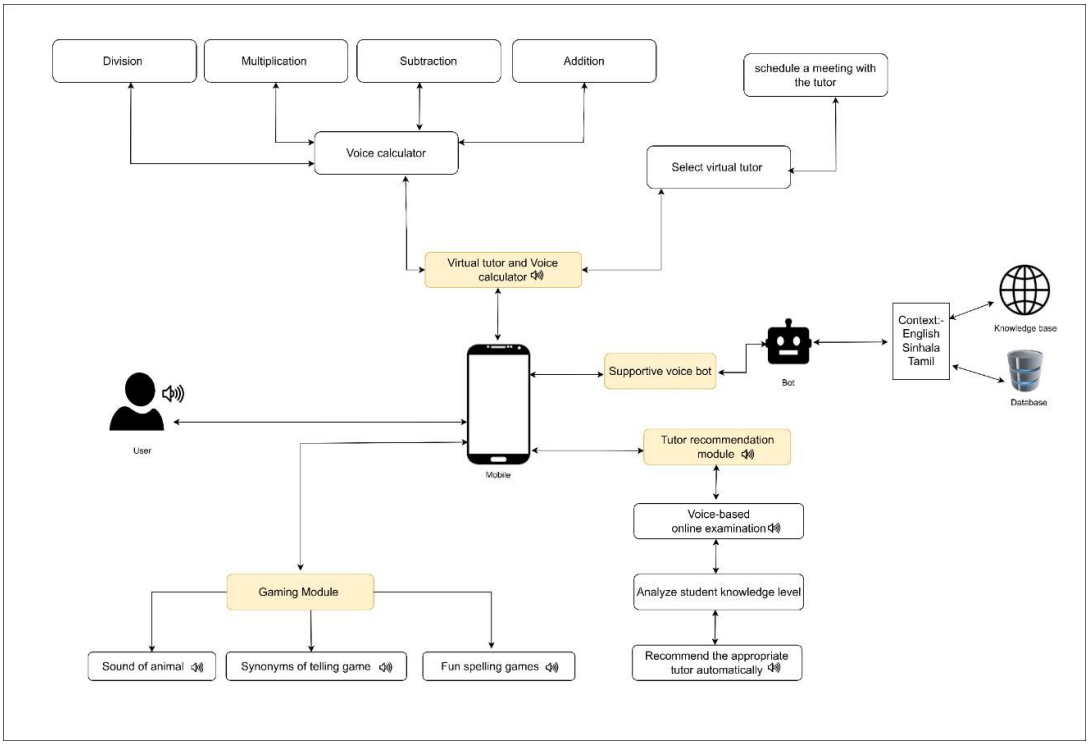

Figure 21

6.4 Blind school images

We went to a Ratmalana blind school to interview instructors and children and learn more about them, such as the challenges they face, the features they are expected to include in mobile application, and so on.

Figure 22


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THE SCHOOL FOR THE BLIND
RATMALANA
விழிப்புலனற்றோர் பாடசாலை

Figure 23