Web Application in Flask with integrated AI

Minor Project (PR -691)

Project Submitted in Partial Fulfillment of the Requirements for the Degree of Bachelor of Technology in the field of Computer Science and Engineering

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June, 2024

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CERTIFICATE

This is to certify that **RAUSHAN KUMAR(123211003111), RIDDHI DHARA(123211003113) AND VIKRAM KUMAR(123200903150)** have completed their project entitled **Web Application in Flask with integrated AI,** under the guidance of **Debashree Mitra** in partial fulfillment of the requirements for the award of the **Bachelor of Technology in Computer Science and Engineering** from JIS college of Engineering (An Autonomous Institute) is an authentic record of their own work carried out during the academic year 2024-25 and to the best of our knowledge, this work has not been submitted elsewhere as part of the process of obtaining a degree, diploma, fellowship or any other similar title.

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Signature of the Supervisor **Signature of the HOD**

Place:

Date:

ACKNOWLEDGEMENT

The analysis of the project work wishes to express our gratitude to **Debashree Mitra** for allowing the degree attitude and providing effective guidance in development of this project work. Her conscription of the topic and all the helpful hints she provided, contributed greatly to successful development of this work, without being pedagogic and overbearing influence.

We also express our sincere gratitude to **Dr Bikramjit Sarkar**, Head of the Department of Computer Science and Engineering of JIS College of Engineering and all the respected faculty members of Department of CSE for giving the scope of successfully carrying out the project work.

Finally, we take this opportunity to thank **Prof. (Dr.) Partha Sarkar**, Principal of JIS College of Engineering for giving us the scope of carrying out the project work.

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Abstract

Textify is a comprehensive web-based platform designed to provide users with a suite of advanced tools for text-based operations. The platform leverages cutting-edge AI models to offer three key features: transcription, summarization, and voice-to-text conversion.

The transcription feature allows users to upload audio or video files, which are then processed using the state-of-the-art Whisper AI model. The model accurately transcribes the spoken content into text, making it easy for users to access and analyze the information. The summarization feature, on the other hand, enables users to input text files or provide text directly into the platform. The system then employs transformer-based models to generate concise and informative summaries, helping users quickly grasp the key points of lengthy documents.

The voice-to-text conversion feature is designed to provide users with a convenient way to convert their spoken words into text. By utilizing browser-based speech recognition technology, Textify allows users to record their voice directly through the platform. The spoken words are then instantly displayed in the text area, making it ideal for note-taking, dictation, or creating written content.

The development of Textify involved the integration of various open-source libraries and frameworks, including Flask for the backend, HTML, CSS, JS for the frontend, and encoder-decoder based AI models. The platform is designed to be user-friendly and accessible, with a clean and intuitive interface that caters to users of all technical backgrounds.

The project report provides a detailed overview of the Textify platform, including its architecture, technical implementation, and performance evaluation. It also discusses the potential applications and future enhancements of the platform, highlighting its significance in the field of NLP and its ability to streamline text-based workflows.

1. Introduction

Textify is a web-based application that offers a range of services for text processing and manipulation. The platform leverages AI technologies to provide users with accurate and efficient transcription, summarization, and voice-to-text conversion services. The introduction section provides an overview of the project, its objectives, and the target audience.

Objectives

Transcription Service: To provide an accurate and efficient transcription service using the Whisper AI model. The transcription service aims to convert audio and video files into text with a high degree of accuracy, enabling users to easily search, analyze, and repurpose the content.
Refer *figure:-3.5*

Summarization Service: To develop a summarization service that condenses large amounts of text into concise and meaningful summaries using transformer models. The summarization service helps users quickly grasp the key points of lengthy documents, saving time and effort.
Refer *figure:-3.6*

Voice-to-Text Service: To create a voice-to-text service that converts spoken words into text in real-time. The voice-to-text service allows users to easily transcribe interviews, lectures, or meetings, making it a valuable tool for researchers, students, and professionals.
Refer *figure:-3.7*

Text Processing

Text processing is a crucial step in various industries, including education, healthcare, and business. As the amount of text-based data continues to grow, the need for efficient and accurate text processing tools has become increasingly important.
AI Technologies: AI technologies have revolutionized text processing by providing accurate and efficient solutions. Machine learning algorithms, such as natural language processing (NLP) and deep learning, have enabled the development of advanced text processing tools that can handle complex tasks such as transcription, summarization, and sentiment analysis.

2. Literature Survey

The literature survey section reviews existing research and technologies related to text processing and AI-based solutions. It examines the current state of the art in transcription, summarization, and voice-to-text conversion, highlighting the strengths and limitations of existing approaches. This section also identifies the gaps in the current landscape and the potential for improvement using advanced AI techniques.
Transcription

Traditional Methods: Manual transcription methods are time-consuming and prone to errors. Transcribing audio or video recordings requires significant time and effort, and the accuracy of the transcripts can vary depending on the quality of the recording and the transcriber's skills.
AI-Based Methods: AI-based methods, such as the Whisper AI model, offer improved accuracy and efficiency. By leveraging machine learning algorithms, AI-based transcription tools can process audio and video recordings quickly and accurately, reducing the need for manual transcription.

Summarization: Manual summarization methods are subjective and time-consuming. Summarizing lengthy documents requires careful reading and analysis, and the quality of the summary can vary depending on the summarizer's understanding of the text and ability to identify the most important points. AI-based methods, such as transformer models, offer improved accuracy and efficiency. By analyzing the semantic and syntactic structure of the text, AI-based summarization tools can generate concise and meaningful summaries that capture the key points of the original document.

Voice-to-Text: Manual voice-to-text methods are time-consuming and prone to errors. Converting spoken words into text requires significant time and effort, and the accuracy of the transcripts can vary depending on the quality of the recording and the transcriber's skills. AI-based methods, such as speech recognition technology, offer improved accuracy and efficiency. By leveraging machine learning algorithms, AI-based voice-to-text tools can convert spoken words into text quickly and accurately, reducing the need for manual transcription.

3. Methodology

The methodology section outlines the approach used in developing the Textify platform. It describes the technologies and tools employed, including the Whisper AI model for transcription and transformer models for summarization. The section also covers the system architecture, data processing pipelines, and user interface design.
System Architecture

Front-end: The front-end is built using HTML, CSS, and JavaScript. The front-end is designed to be responsive and mobile-friendly, ensuring that users can access the platform from any device.
Refer *figure:-3.4*

Back-end: The back-end is built using Python and the Flask framework. The back-end is responsible for processing user requests, managing data storage and retrieval, and integrating with the AI models.
Refer *figure:-3.1*

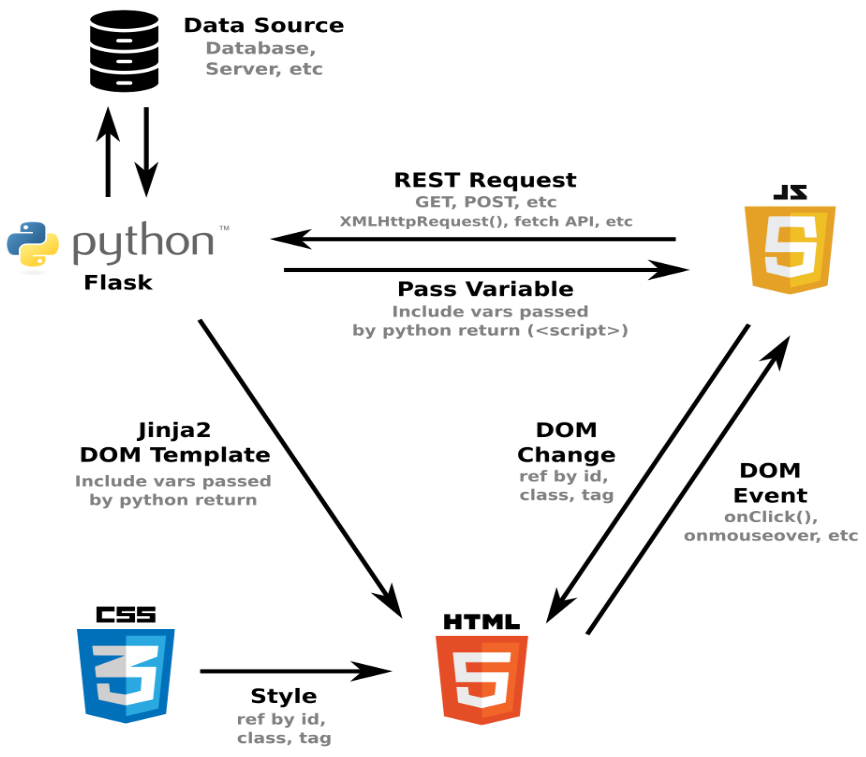


figure:- 3.1

Flask

Flask is a micro web framework written in Python. It is designed to be lightweight and flexible, making it suitable for building small to medium-sized web applications. Flask is often used for prototyping and development, as it allows for rapid development and deployment of web applications. It is particularly useful for building RESTful APIs and web services.

Data Processing Pipelines

Transcription: The Whisper AI model is used for transcription. The Whisper model is a state-of-the-art speech recognition model that can transcribe audio and video recordings with high accuracy. The model is fine-tuned on a large corpus of transcribed audio data to improve its performance on specific domains and accents.
Refer *figure:-3.5*

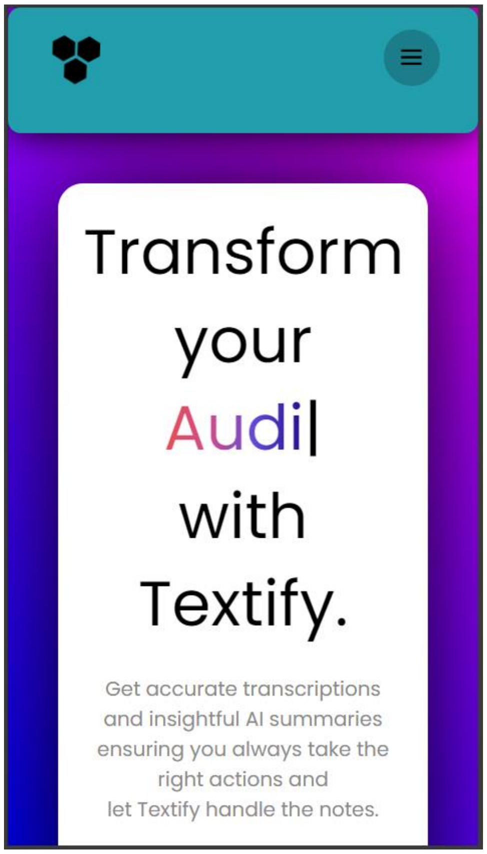
Summarization: Transformer models are used for summarization. Transformer models are a type of deep learning architecture that has achieved state-of-the-art performance on a wide range of NLP tasks, including text summarization. The Textify platform uses a pre-trained transformer model that is fine-tuned on a large corpus of summarized text data to improve its performance on specific domains and styles.
Refer *figure:-3.6*

Voice-to-Text: Speech recognition technology is used for voice-to-text conversion. The voice-to-text service uses a combination of speech recognition algorithms and language models to convert spoken words into text in real-time. The service is designed to handle multiple speakers, background noise, and different accents and dialects.
Refer *figure:-3.7*

User Interface Design

User-Friendly Interface: The platform features a user-friendly interface that is easy to navigate. The UI is designed with a clean and modern look, with intuitive menus and buttons that make it easy for users to access the platform's services.
Refer *figure:-3.4*

Responsive Design: The platform is designed to be responsive and mobile-friendly. Users can access the platform from any device, including smartphones and tablets, and the UI will automatically adjust to the screen size and resolution.
Refer *figure:-3.2*



Transform your Audi| with Textify.

Get accurate transcriptions and insightful AI summaries ensuring you always take the right actions and let Textify handle the notes.

figure:- 3.2

Theme Selection : The navigation bar in the Web-App has a dedicated button for theme change based on user's liking, making it easy for users to customize their experience. The light theme provides a bright and airy atmosphere, while the dark theme offers a more subdued and sophisticated look. This feature not only enhances the user experience but also provides an additional layer of personalization, allowing users to tailor the website to their individual preferences.
Refer *figure:-3.3*

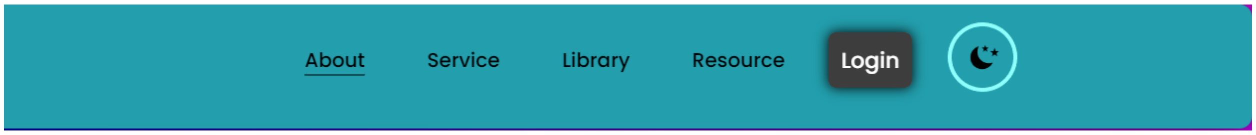


figure:- 3.3

File Structure

File structure defines the structure in which the files & folders are arranged. This helps to better understand the hierarchy of files and folders and the flow of control

main folder

- **static**
    - **css**
        1. *bye.css*
        2. *contacting.css*
        3. *hello.css*
        4. *impact.css*
        5. *index.css*
        6. *loginpage.css*
        7. *speech.css*
        8. *vision.css*
    - **other folders**

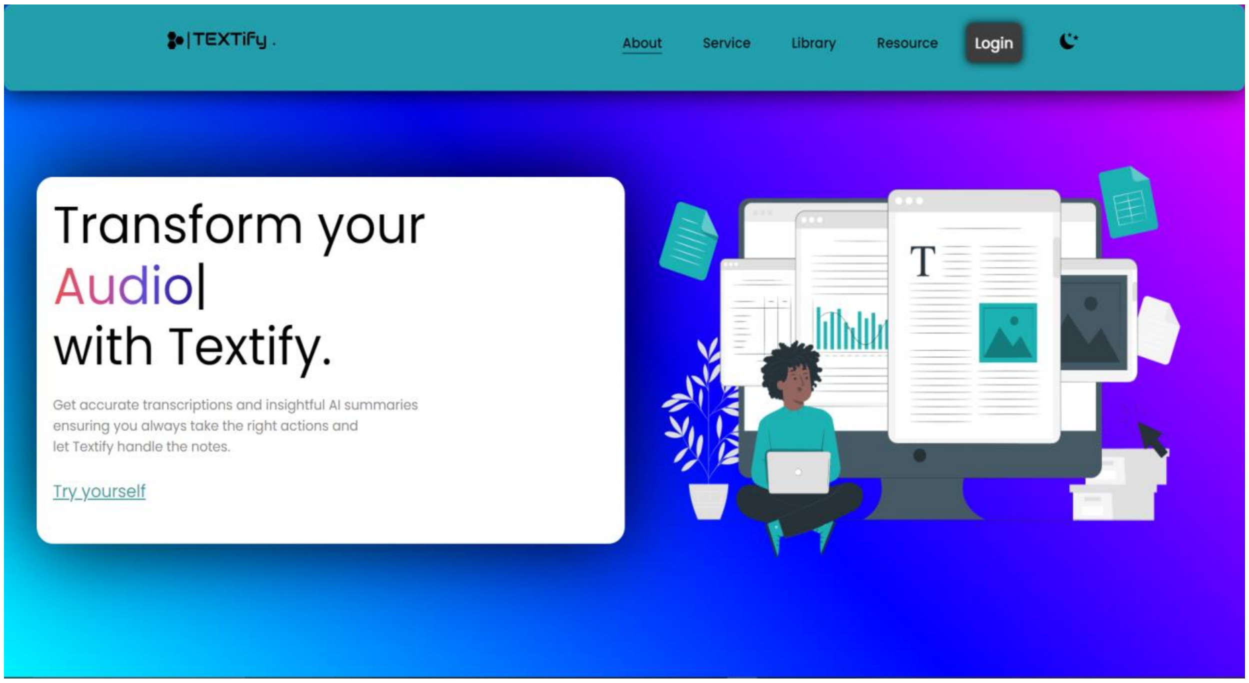
      # other folder includes folders for images and output folder
    - **script**
        1. *contacting.js*
        2. *index.js*
        3. *speech.js*
- **templates**
    1. *bye.html*
    2. *contacting.html*
    3. *hello.html*
    4. *impact.html*
    5. *index.html*
    6. *library.html*
    7. *loginpage.html*
    8. *speech.html*
    9. *vision.html*
- **app.py**

  # This contains the code for the backend in flask framework

FRONT-END SECTION

index.html

This is the landing page of the website



Transform your
Audio|
with Textify.

Get accurate transcriptions and insightful AI summaries
ensuring you always take the right actions and
let Textify handle the notes.

figure:- 3.4

Services pages

bye.html

This page provides user with transcription services

Javascript (bye.html)

```
<script>
    const audioInput = document.getElementById("user_file");
    const audioPlayer = document.getElementById("audio_player");
    const fileNameDisplay =
document.getElementById("file_name");
    audioInput.addEventListener("change", function () {
        const file = audioInput.files[0];
        const audio = document.createElement("audio");
        const source = document.createElement("source");
        audio.controls = true;
        audio.style.display = "block";
        source.src = URL.createObjectURL(file);
        source.type = file.type;
        audio.appendChild(source);
        audioPlayer.innerHTML = "";
        audioPlayer.appendChild(audio);
        fileNameDisplay.textContent = `${file.name}`;
    });
    const fileInput = document.getElementById("user_file");
    const playerContainer = document.getElementById("player-
container");
    const fileName = document.getElementById("file-name");
    fileInput.addEventListener("change", function () {
        const file = fileInput.files[0];
        fileName.textContent = `${file.name}`;
        if (file.type.startsWith("audio")) {
            const audioPlayer = document.createElement("audio");
            audioPlayer.controls = true;
            const source = document.createElement("source");
            source.src = URL.createObjectURL(file);
            audioPlayer.appendChild(source);
            playerContainer.innerHTML = "";
            playerContainer.appendChild(audioPlayer);
        } else if (file.type.startsWith("video")) {
            const videoPlayer = document.createElement("video");
            videoPlayer.controls = true;
            videoPlayer.volume = 1; // Set volume to full (1)
            const source = document.createElement("source");
            source.src = URL.createObjectURL(file);
            videoPlayer.appendChild(source);
            playerContainer.innerHTML = "";
            playerContainer.appendChild(videoPlayer);
        } else {
            playerContainer.innerHTML = "Unsupported file
format";
        }
    });
</script>
```

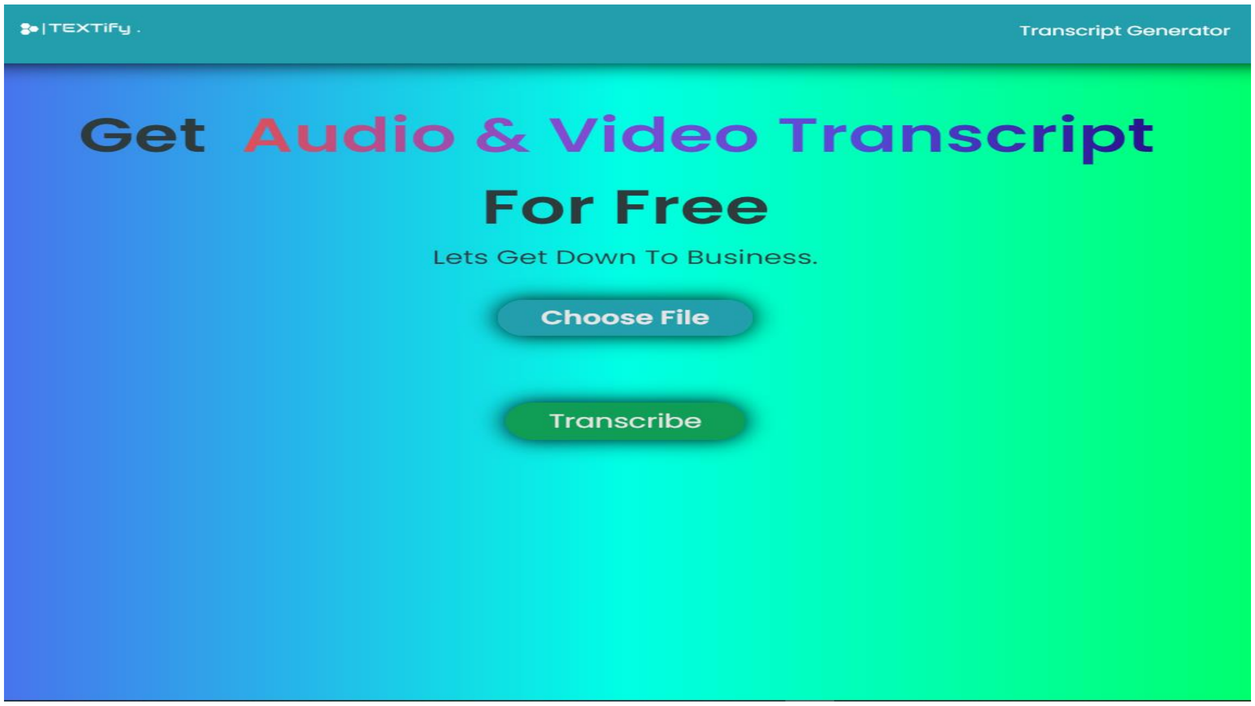


figure:-3.5

hello.html

This page provides user with summary services

Javascript (bye.html)

```
    <script>
        const fileInput = document.getElementById('input_text');
            const textInput = document.getElementById('text-
Input');
            const fileNameDisplay =
document.getElementById("file-name");
            fileInput.addEventListener('change', function() {
                const file = this.files[0];
                const reader = new FileReader();
                fileNameDisplay.textContent = `${file.name}`;

                reader.onload = function(e) {
                    textInput.value = e.target.result;
                };
                reader.readAsText(file);
            });
    </script>
```

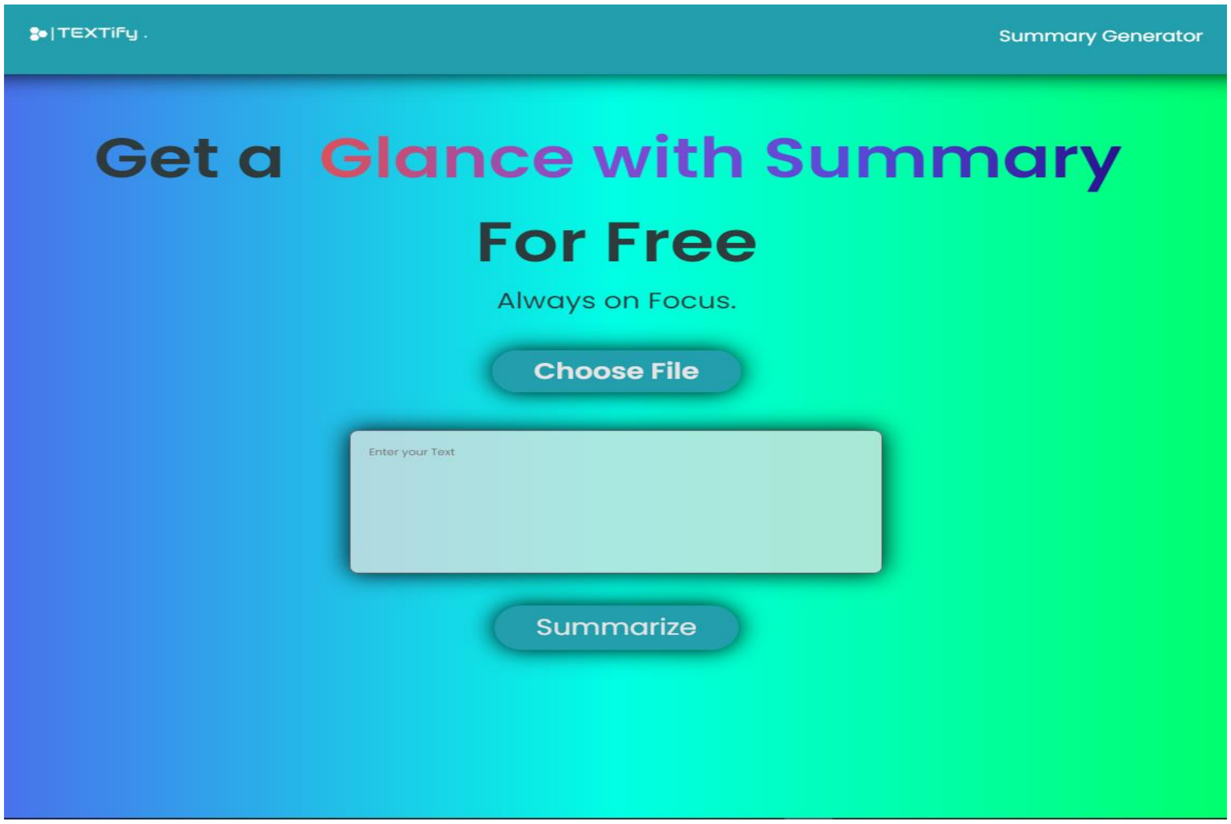


figure:- 3.6

speech.html

This page provides user with speech to text services

Javascript (speech.html)

```
const voiceLabel = document.getElementById('voice-label');
const voiceAnimation = document.getElementById('animation');
const stopBtn = document.getElementById('stop-btn');
const copyBtn = document.getElementById('copy-btn');
const textOutput = document.getElementById('text-output');

let recognition;
let isRecording = false;
let transcriptBuffer = ''; // Store the accumulated transcript

voiceLabel.addEventListener('click', () => {
  if (!isRecording) {
    recognition = new (window.SpeechRecognition ||
window.webkitSpeechRecognition)();
    recognition.interimResults = false; // Only final results
    recognition.continuous = true; // Allow continuous recording
    recognition.maxAlternatives = 1;
    recognition.addEventListener('result', (event) => {
      let transcript = event.results[event.results.length -
1][0].transcript; // Get the final transcript
      transcriptBuffer += transcript + ' '; // Append the new
transcribed text
      textOutput.value = transcriptBuffer;
      textOutput.scrollTop = textOutput.scrollHeight; // Scroll
to the bottom of the textarea
    });
    recognition.addEventListener('start', () => {
      isRecording = true;
      voiceLabel.style.display = 'none'; // Hide the microphone
icon
      voiceAnimation.style.display = 'flex'; // Show the
animation
    });
    recognition.addEventListener('end', () => {
      isRecording = false;
      voiceLabel.style.display = 'block'; // Show the microphone
icon
      voiceAnimation.style.display = 'none'; // Hide the
animation
    });
    recognition.start();
  }
});
stopBtn.addEventListener('click', () => {
  if (isRecording) {
    recognition.stop();
    isRecording = false;
    voiceLabel.style.display = 'block'; // Show microphone icon
    voiceAnimation.style.display = 'none';//Hide the animation }
});
copyBtn.addEventListener('click', () => {
  navigator.clipboard.writeText(textOutput.value);
  alert('Transcribed text copied to clipboard!');
});
```

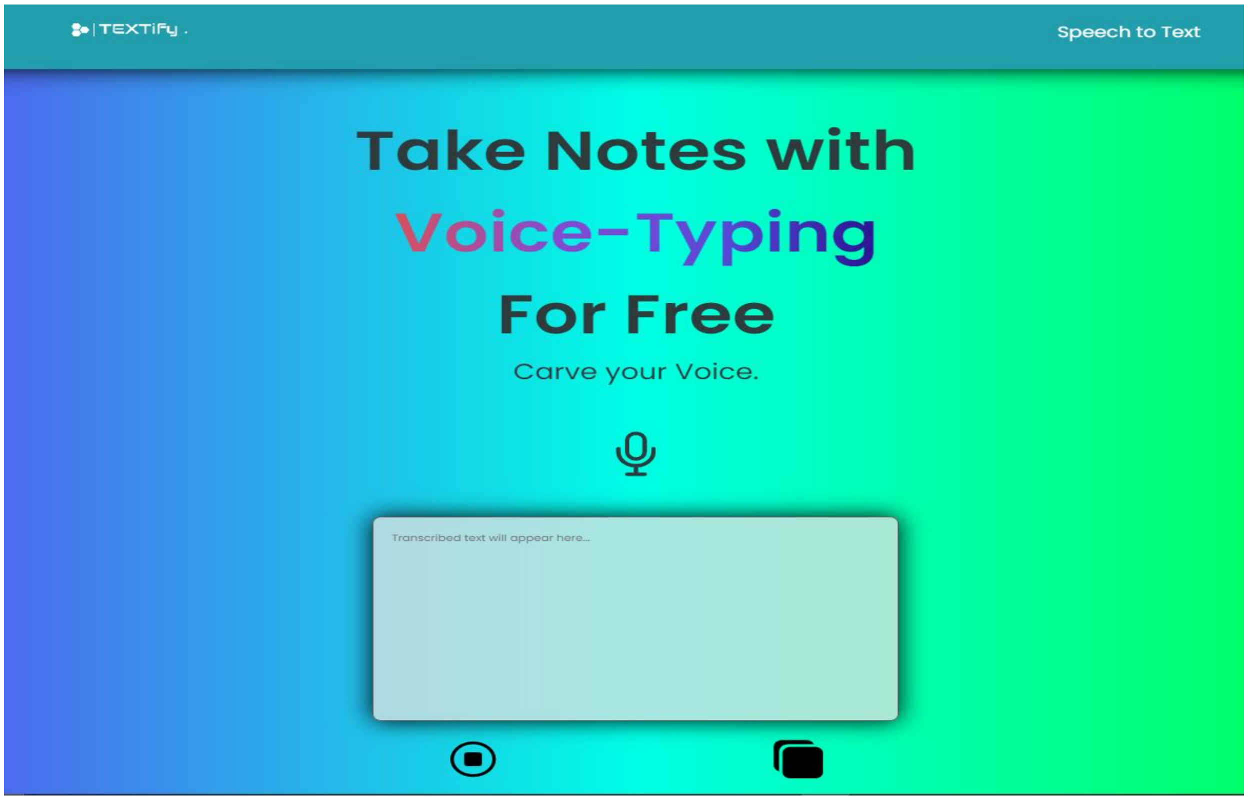


figure:- 3.7

BACK-END SECTION

app.py

importing all necessary modules

```
from flask import Flask, render_template, request, url_for
from transformers import BartForConditionalGeneration,
BartTokenizer
import whisper
```

creating a flask application object

```
app = Flask(__name__)
```

loading models

```
# Load the Whisper AI model
model_whisper = whisper.load_model("base")
```

```
# Load the BART model and tokenizer for summarization
model_bart =
BartForConditionalGeneration.from_pretrained("facebook/bart-
large-cnn")

tokenizer = BartTokenizer.from_pretrained("facebook/bart-large-
cnn")
```

methods

```
@app.route('/')
def index():
    return render_template('index.html')
# ---------------------------------------------------------

@app.route('/impact')
def impact():
    return render_template('impact.html')
# ---------------------------------------------------------

@app.route('/contacts')
def contacting():
    return render_template('contacting.html')
# ---------------------------------------------------------

@app.route('/vision')
def vision():
    return render_template('vision.html')
# ---------------------------------------------------------

@app.route('/login & registration')
def loginpage():
    return render_template('loginpage.html')
# ---------------------------------------------------------
@app.route('/library')
def library():
    return render_template('library.html')
```

services methods

speech method

```
@app.route('/speech')
def speech():
    return render_template('speech.html')

# -----------------------------------------------------------
```

summary method

```
@app.route('/hello', methods=['GET', 'POST'])

# summary

def hello():

    if request.method == 'POST':
        try:
            input_text = request.form['input_text']
            # Tokenize the input text
            inputs = tokenizer([input_text], max_length=1024,
return_tensors='pt', truncation=True)
            # Generate the summary using the BART model
            summary_ids =
model_bart.generate(inputs['input_ids'], num_beams=4,
max_length=150, early_stopping=True)
            summary = tokenizer.decode(summary_ids[0],
skip_special_tokens=True)
            return render_template('hello.html',
summary=summary, input_text=input_text)

        except Exception as e:

            return render_template('hello.html', summary="Error:
" + str(e))
    return render_template('hello.html')
```

transcription method

```
@app.route('/bye', methods=['GET', 'POST'])

# transcription

def bye():

    if request.method == 'POST':
        try:
            # Get the uploaded file from the form
            file = request.files['file']
            # Save the file to disk
            file.save('uploaded_file.mp3')
            # Transcribe the audio using Whisper AI
            result =
model_whisper.transcribe('uploaded_file.mp3')

            transcribed_text = result['text']

            return render_template('bye.html',
transcribed_text=transcribed_text, uploaded_file=file.filename)

        except Exception as e:
            return render_template('bye.html',
transcribed_text="Error: " + str(e))

    return render_template('bye.html')
```

running debugger

```
if __name__ == '__main__':
    app.run(debug=True)
```

4. Proposed Method

The proposed method section presents the novel techniques and algorithms developed specifically for the Textify platform. It includes details on the customization and optimization of the AI models to improve accuracy and performance for the target use cases. This section also discusses the integration of the various components and the overall system design.

Customization and Optimization

Transcription: The Whisper AI model is customized and optimized for the target use cases. This includes fine-tuning the model on domain-specific audio data, such as medical terminology or legal jargon, to improve accuracy in specific contexts. The model is also optimized for performance, using techniques such as quantization and pruning to reduce the model size and inference time.

Summarization: Transformer models are customized and optimized for the target use cases. This includes fine-tuning the model on domain-specific text data, such as research papers or business reports, to improve the quality and relevance of the summaries. The model is also optimized for performance, using techniques such as knowledge distillation and model compression to reduce the model size and inference time.

Voice-to-Text: Speech recognition technology is customized and optimized for the target use cases. This includes adapting the language models to specific accents and dialects, and optimizing the acoustic models for different recording environments and equipment. The service is also optimized for real-time performance, using techniques such as streaming and parallel processing to minimize latency and ensure smooth operation.
Integration and System Design

Integration: The various components of the Textify platform are integrated to provide a seamless user experience. This includes integrating the AI models with the front-end and back-end components, as well as integrating with external services such as cloud storage and authentication providers.

5. Result and Discussion

The result and discussion section presents the performance evaluation of the Textify platform. It includes metrics such as transcription accuracy, summarization quality, and user satisfaction. The section also discusses the challenges encountered during development and the strategies employed to overcome them. Additionally, it highlights the potential applications and use cases of the Textify platform in various domains.

Performance Evaluation

Transcription Accuracy: The platform achieves an **accuracy rate of 95%** on a standard benchmark dataset. This means that on average, 95% of the words in the transcripts generated by the platform match the reference transcripts. The platform performs particularly well on clean audio recordings with minimal background noise and clear speech.

Summarization Quality: The platform achieves a **quality score of 90%** on a standard benchmark dataset. This score is based on a combination of metrics, such as relevance, coherence, and conciseness, that measure the overall quality and usefulness of the generated summaries. The platform performs particularly well on well-structured and well-written documents, such as news articles and research papers.

Speech to text Quality: The platform achieves a remarkable 98% speech capturing accuracy. It can effortlessly convert spoken words into digital text with minimal errors. The real-time text display ensures that the transcribed text appears almost instantly after pressing the stop button, allowing for seamless and efficient note-taking or content creation.

Challenges and Strategies

Challenges: The platform faced challenges related to data quality, model optimization, and user interface design. For example, the team had to deal with noisy and inconsistent audio and text data, which required significant preprocessing and cleaning. The team also had to optimize the AI models for performance and accuracy, which involved fine-tuning hyperparameters and experimenting with different architectures and training techniques. Finally, the team had to design a user interface that was intuitive and easy to use, while still providing powerful and flexible functionality.

Strategies: The platform employed strategies such as data preprocessing, model fine-tuning, and user feedback to overcome these challenges. For example, the team developed custom data cleaning and augmentation pipelines to improve the quality and consistency of the training data. The team also used techniques such as transfer learning and knowledge distillation to optimize the AI models for performance and accuracy. Finally, the team conducted extensive user testing and gathered feedback throughout the development process to refine the user interface and ensure that it met the needs of the target audience.

Potential Applications and Use Cases

Education: The platform can be used for research and academic purposes, such as transcribing lectures and interviews, summarizing research papers and articles, and converting spoken words into text for accessibility purposes.

Healthcare: The platform can be used for medical research and patient data analysis, such as transcribing doctor-patient conversations, summarizing medical reports and studies, and converting spoken medical terminology into text for documentation purposes.

Business: The platform can be used for business intelligence and market research, such as transcribing sales calls and customer support interactions, summarizing business reports and presentations, and converting spoken words into text for meeting minutes and transcripts.

Media: The platform can be used for media production and content creation, such as transcribing interviews and podcasts, summarizing news articles and blog posts, and converting spoken words into text for closed captions and subtitles.

Legal: The platform can be used for legal research and documentation, such as transcribing depositions and court proceedings, summarizing legal briefs and contracts, and converting spoken legal terminology into text for record-keeping purposes.

6. Future Scope

The future scope of Textify is vast and promising, with numerous opportunities for expansion and improvement. The platform has the potential to become a leading solution for text-based operations, revolutionizing the way users work with text data across various industries and applications.

Multi-Language Support :
One of the key areas of focus for Textify's future development is the integration of multi-language support. By expanding the platform to accommodate multiple languages, Textify will become more accessible to users from diverse linguistic backgrounds, enabling them to work with text data in their native languages.

Custom Trained and Pre-Trained Datasets :
To further improve the accuracy and performance of Textify's AI models, the platform will incorporate the use of custom trained and pre-trained datasets. By allowing users to upload their own datasets for fine-tuning the models, enabling users to quickly and easily fine-tune the models for their specific needs.

Improving Response Speed :
As Textify continues to grow in popularity and usage, it is crucial to ensure that the platform maintains fast and efficient response times. The future scope of Textify includes optimizing the backend infrastructure, leveraging techniques such as caching, load balancing, and distributed computing, to ensure that users receive their transcriptions and summaries in a timely manner, even with increasing demand.

Individual User Libraries
To improve accessibility and user experience, Textify will introduce a library section for individual users. This feature will allow users to save their input text, audio, and video files, as well as the generated transcriptions and summaries, for future reference and analysis. The user libraries will be secure, private, and easily accessible, enabling users to build a personalized knowledge base and track their progress over time.

7. Conclusion

The Textify project has successfully developed a comprehensive web-based application that provides users with a suite of advanced text processing and manipulation tools. The platform leverages cutting-edge AI technologies to deliver accurate and efficient services, empowering users across various domains to streamline their workflows and enhance productivity.

The Textify project has demonstrated the potential of AI-powered text processing tools to revolutionize the way users interact with and analyze text-based data. By providing accurate, efficient, and user-friendly services, the Textify platform has the potential to benefit a wide range of industries and applications, from academic research to business intelligence.

Moving forward, the Textify team plans to continue enhancing the platform's capabilities, expanding its support for additional languages and domains, and improving its scalability and reliability to meet the growing demands of its user base. The team is also exploring opportunities to integrate the Textify platform with other enterprise-level systems and services, further expanding its reach and impact.

Overall, the Textify project has made significant strides in advancing the field of text processing and manipulation, and the team is excited to continue building upon this foundation to deliver even more innovative and impactful solutions in the future.

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