Project Report

Indian Institute of Information Technology, Kalyani

COMPUTER NETWORK LAB (CSC-611)

AI-Enhanced Multi-Client Chat Summarization Application

Group Members:

- **Shirish Manoj Bobde (812)**
- **Anubhav Ranjan (774)**
- **Chinmay Bhagat (781)**

Project Details

Problem Statement

Develop a chat application with multiple clients. The server will summarize the discussion at the end of chatting.

Project Description

Developing a chat application capable of accommodating multiple clients simultaneously. The application comprises a server component responsible for managing the communication among clients and summarizing the discussions at the conclusion of each chat session.

Key Requirements:

Chat Application: Developing a user-friendly chat interface allowing multiple clients to exchange messages in real-time. The interface supports basic features such as sending/receiving messages, creating chat room, and managing user connections.

Server Module: Implementing a robust server module to facilitate communication between clients. The server is capable of handling multiple client connections concurrently and managing the flow of messages between them. Additionally, the server will maintain chat room information and user statuses.

Summarization Feature: Designing a functionality within the server to summarize the discussions that occur during each chat session. The summarization process analyzes the exchanged messages and generate a concise overview or recap of the key points discussed.

By addressing these requirements, the goal is to develop a robust and feature-rich chat application that enables seamless communication among multiple clients while providing a summarization feature to capture the essence of the discussions held during each chat session.

Architecture

The chat application comprises two main components: the client and the server. These components interact with each other to facilitate communication between users. Here's an overview of the architecture:

Client Component:

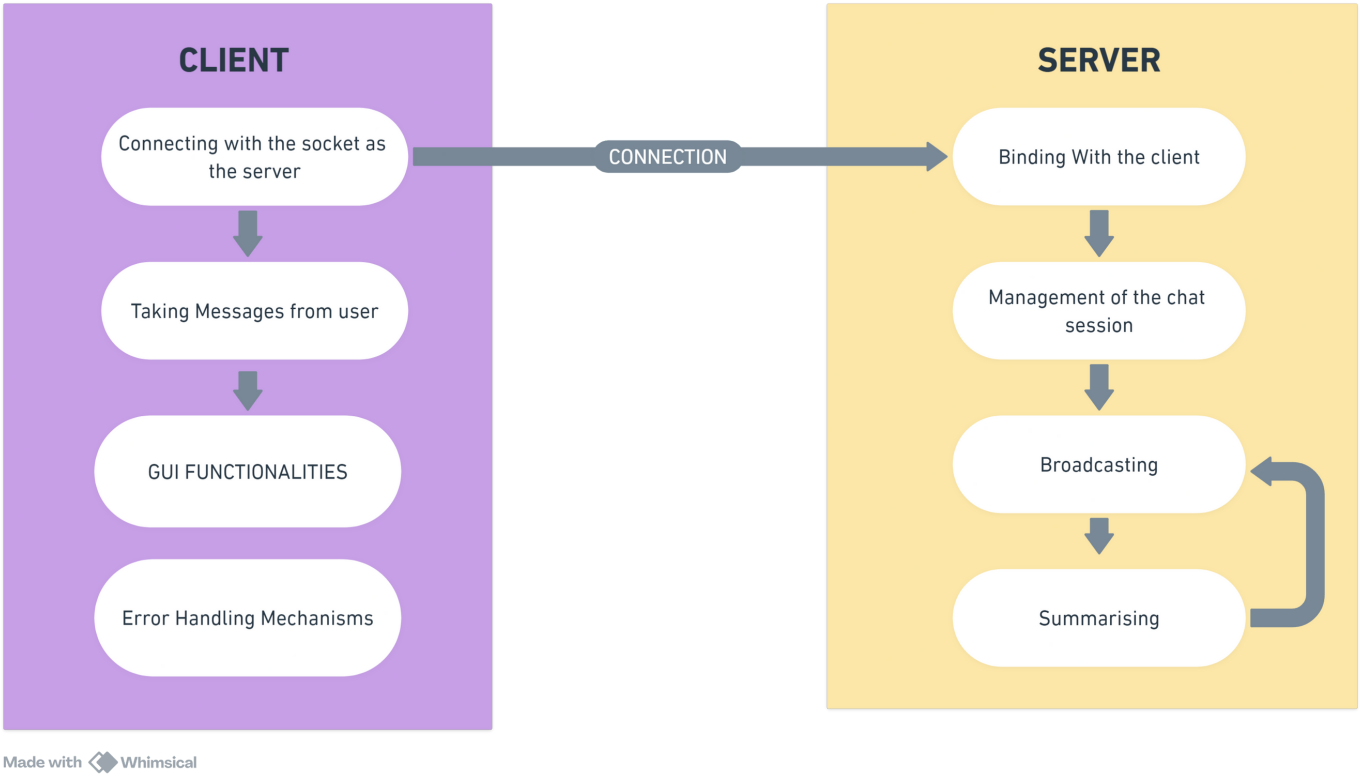
- The client component is responsible for initiating the chat interface and communicating with the server.
- It includes the GUI (Graphical User Interface) built using the Tkinter library in Python.
- The client GUI provides a login window for users to enter their name before joining the chat.
- After logging in, the main chat window is displayed, allowing users to send and receive messages.
- The client component also includes threading functionality to handle sending and receiving messages concurrently.
- Additionally, error handling mechanisms are implemented to handle exceptions during message transmission.

Server Component:

- The server component listens for incoming connections from clients and manages the chat sessions.
- It runs a TCP server socket that binds to a specific host and port.
- Upon connection, the server requests the client's nickname and maintains a list of connected clients and their nicknames.
- The server handles incoming messages from clients, broadcasting them to all connected clients.
- It also implements functionality for summarizing dialogues upon request using a pre-trained summarization model.
- Threading is employed to handle multiple client connections simultaneously, ensuring efficient communication.
- The server performs error handling to manage client disconnections and other exceptions gracefully.

Communication Flow:

- The client initiates a connection to the server by providing the server's IP address and port number.
- Upon successful connection, the client enters a nickname and joins the chat.
- The server receives the client's nickname, acknowledges the connection, and broadcasts a notification to all clients about the new user.
- Users can exchange messages by typing in the chat interface.
- When a user requests a summary of the dialogue, the server processes the entire conversation history and sends back a summarized response to the requesting client.
- The chat session continues until users disconnect or exit the application.



Algorithm

SERVER:

Import Necessary Libraries:

- Import the socket and threading modules for socket communication and handling multiple clients concurrently.
- Import the pipeline function from the transformers library for text summarization.

Connection Data Setup:

- Define the host and port variables for server configuration.

Load Summarization Pipeline:

- Load the summarization pipeline using the pipeline function from the transformers library.

Start Server:

- Create a socket object and bind it to the specified host and port.
- Listen for incoming connections.

Initialize Lists:

- Initialize lists to store client connections, nicknames, and dialogue history.

Broadcast Function:

- Define a function broadcast to send messages to all connected clients.

Handle Function:

- Define a function handle to handle messages from clients.
- Continuously receive messages from the client.
- If a message is received, split it into name and text.
- Print the message to the server.
- Broadcast the message to all clients.
- If the message starts with "/summarize", call the summarize_dialogue function.
- Otherwise, add the dialogue to the dialogue history.
- Remove the client if an error occurs, handling exceptions.
- If there is no client left, then summarize the chat.

Summarize Dialogue Function:

- Define a function summarize_dialogue to summarize the dialogue upon request.
- Check if there is enough dialogue history to summarize.
- Concatenate all dialogues into a single string.
- Summarize the text using the loaded pipeline.
- Print the summary.
- Send the summary to the client.

Summarize Dialogue End Function:

- Define a function summarize_dialogue_end to summarize the dialogue at the end of the chat.
- Check if there is dialogue history.
- Concatenate all dialogues into a single string.
- Summarize the text using the loaded pipeline.
- Print the summary.

Receive Function:

- Define a function receive to handle incoming connections from clients.
- Continuously accept client connections.
- Request and store the client's nickname.
- Broadcast the client's nickname.
- Start a thread to handle the client.

Start Receiving Function:

- Call the receive function to start accepting connections.

CLIENT

Import Necessary Libraries:

- Import the socket, threading, and Tkinter modules for socket communication, threading, and GUI development.

Define Connection Parameters:

- Set up the server's IP address, port number, and message format.

Create Client Socket:

- Create a socket object for the client and connect it to the server.

Define GUI Class:

- Define a class named GUI to handle the graphical user interface of the chat application.
- Initialize the GUI by creating a hidden chat window and a login window.
- Set up the login window with input fields for the user's name and a continue button.

Handle Login:

- Define a method goAhead to handle the login process.
- Destroy the login window and call the layout method to set up the main chat layout.
- Start a thread to receive messages from the server.

Main Chat Layout:

- Define a method layout to set up the main chat window.
- Configure the chat window with labels, text boxes, entry boxes, and buttons for sending messages.
- Set up a scrollbar for scrolling through the chat history.

Handle Sending Messages:

- Define a method sendButton to handle sending messages.
- Disable the text box, retrieve the message, clear the entry box, and start a thread to send the message.

Handle Receiving Messages:

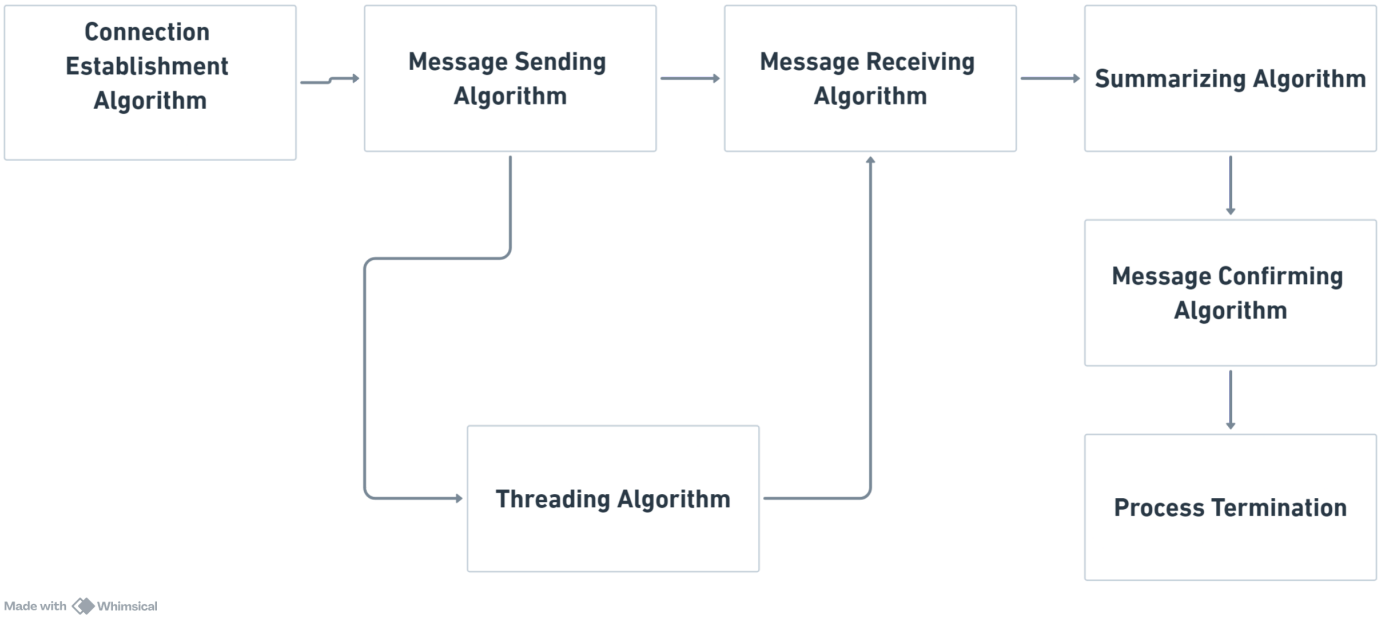
- Define a method receive to continuously receive messages from the server.
- If the received message is 'NAME', send the client's name to the server.
- Otherwise, insert the received message into the text box.

Handle Sending Messages:

- Define a method sendMessage to send messages to the server.
- Encode the message and send it to the server.

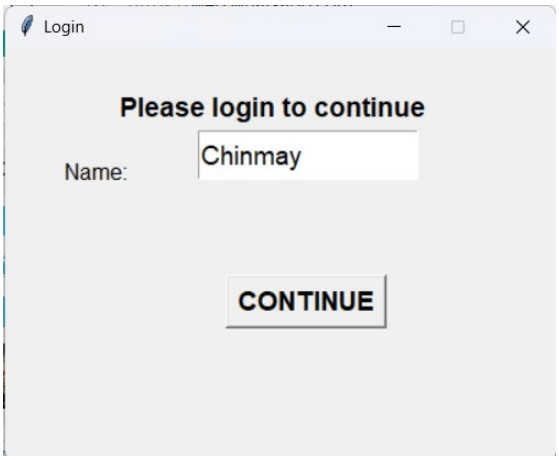
Create GUI Object:

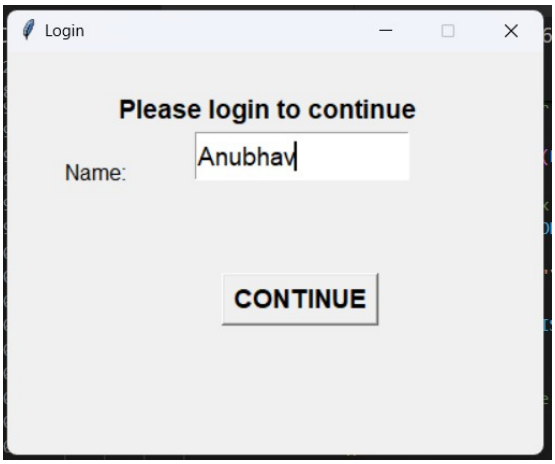
- Create an instance of the GUI class to start the chat application.



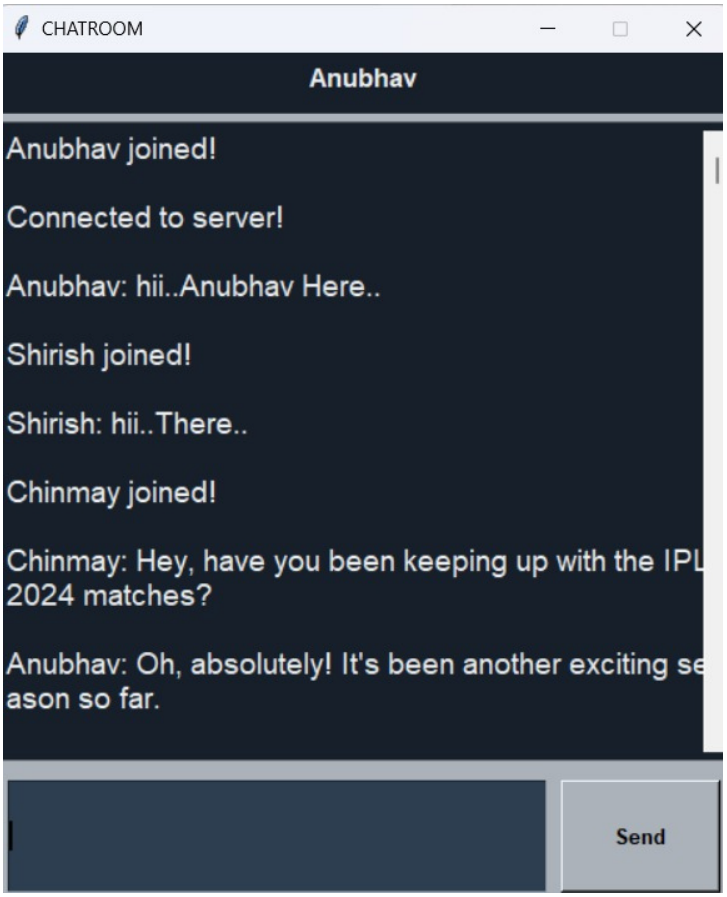
Output

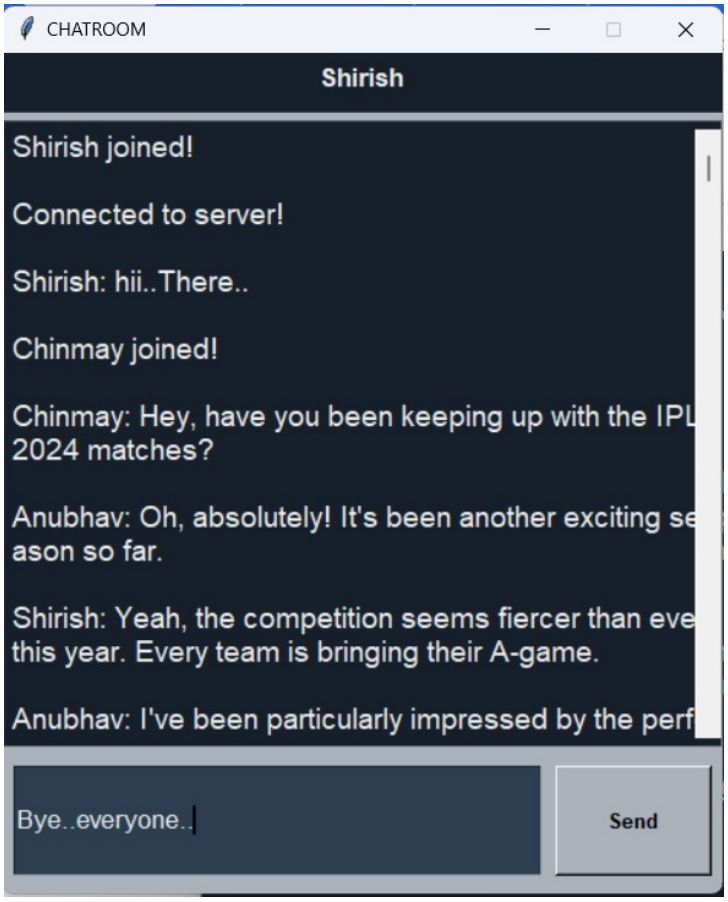
- Joining chat room


Login
Please login to continue
Name:
Chinmay
CONTINUE


Login
Please login to continue
Name:
Anubhav
CONTINUE

- Chats


CHATROOM
Anubhav
Anubhav joined!
Connected to server!
Anubhav: hii..Anubhav Here..
Shirish joined!
Shirish: hii..There..
Chinmay joined!
Chinmay: Hey, have you been keeping up with the IPL
2024 matches?
Anubhav: Oh, absolutely! It's been another exciting se
ason so far.
Send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Shirish
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Connected to server!
Shirish: hii..There..
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Chinmay: Hey, have you been keeping up with the IPL
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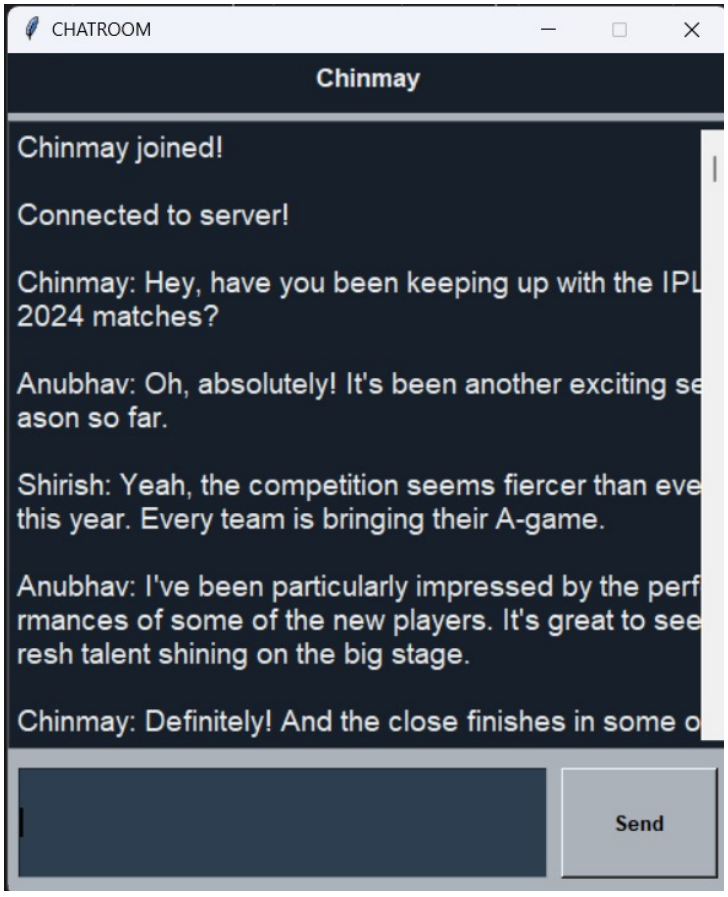
Shirish: Yeah, the competition seems fiercer than eve
this year. Every team is bringing their A-game.
Anubhav: I've been particularly impressed by the perf
Bye..everyone..
Send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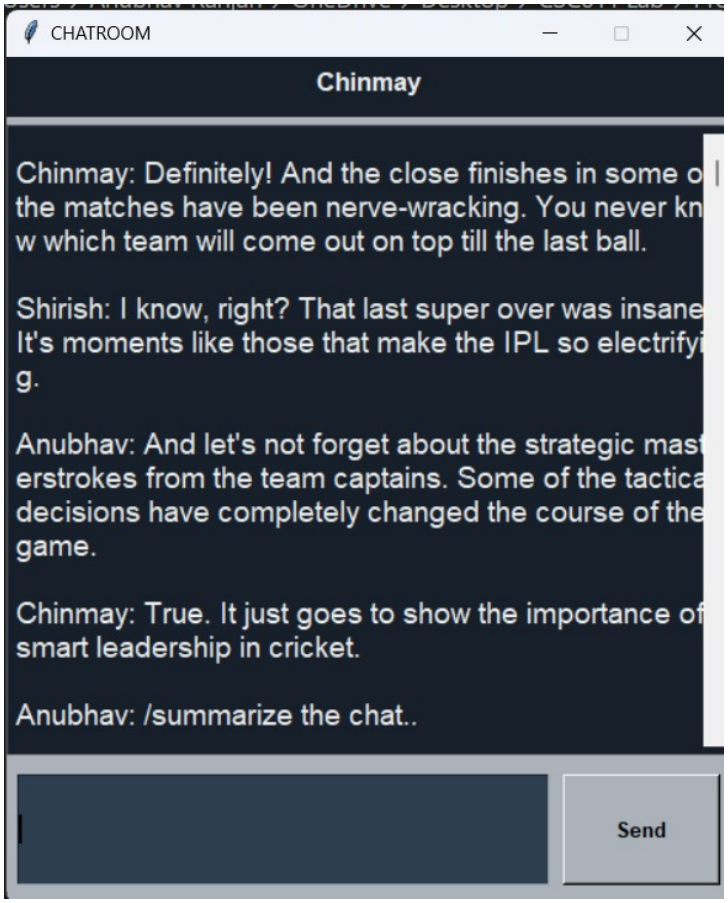
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Shirish: I know, right? That last super over was insane
It's moments like those that make the IPL so electrifyi
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Anubhav: And let's not forget about the strategic mast
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decisions have completely changed the course of the
game.
Chinmay: True. It just goes to show the importance of
smart leadership in cricket.
Anubhav: /summarize the chat..
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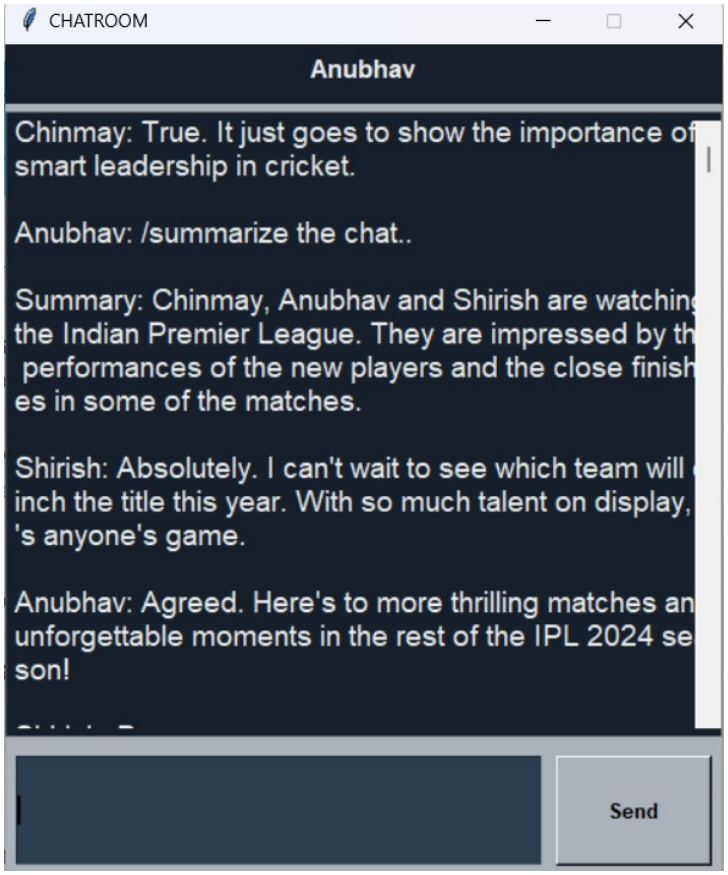
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Summary: Chinmay, Anubhav and Shirish are watching
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Shirish: Absolutely. I can't wait to see which team will
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Anubhav: Agreed. Here's to more thrilling matches an
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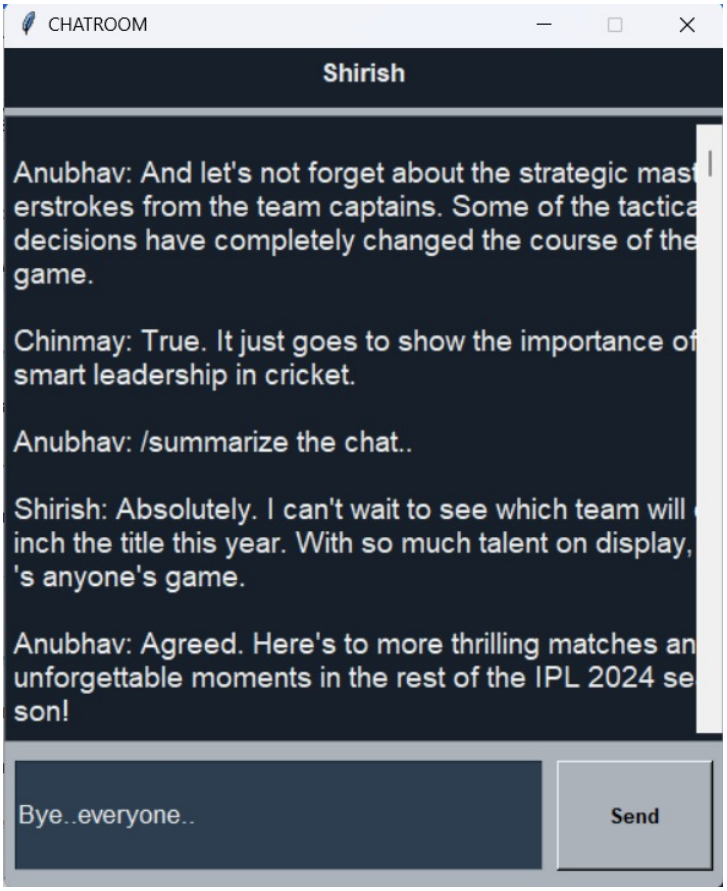
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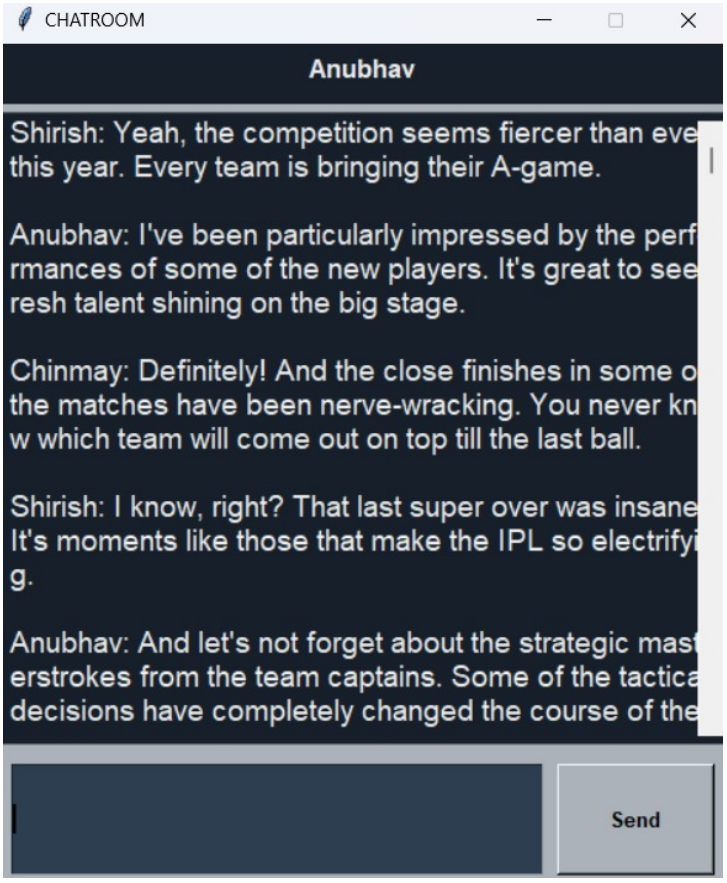
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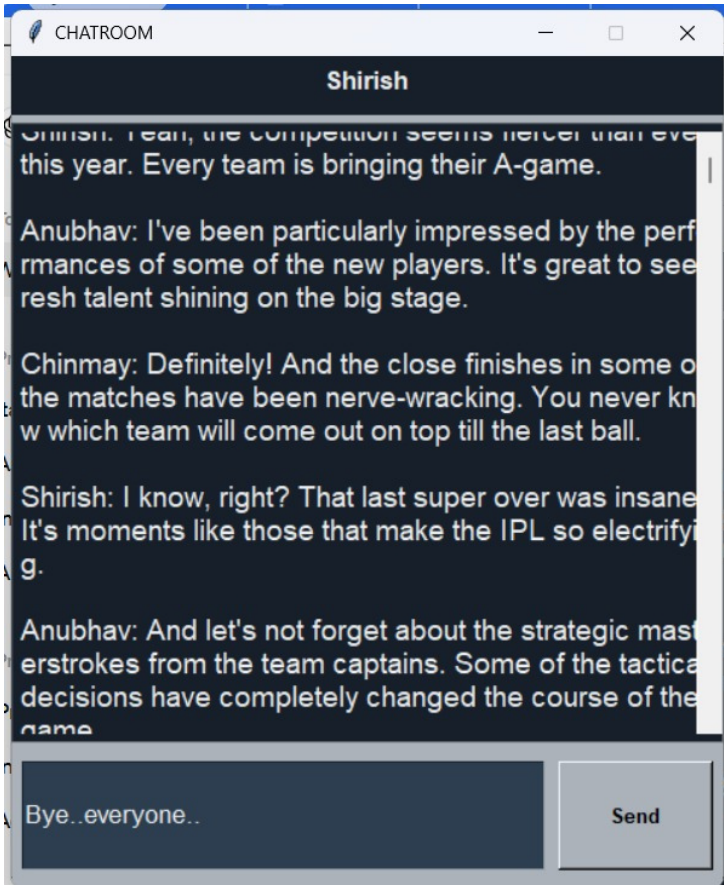
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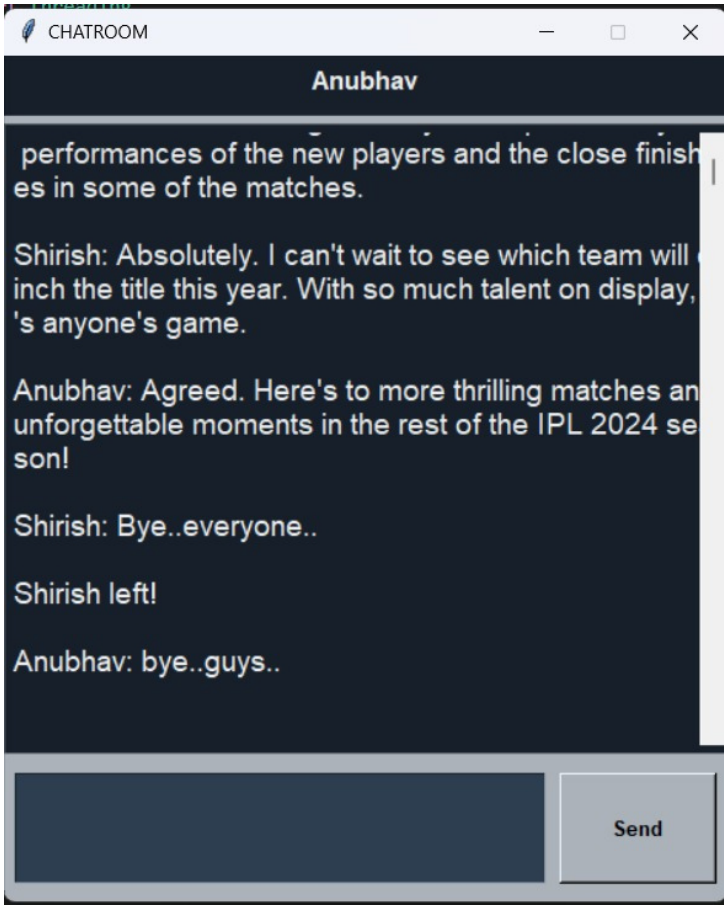
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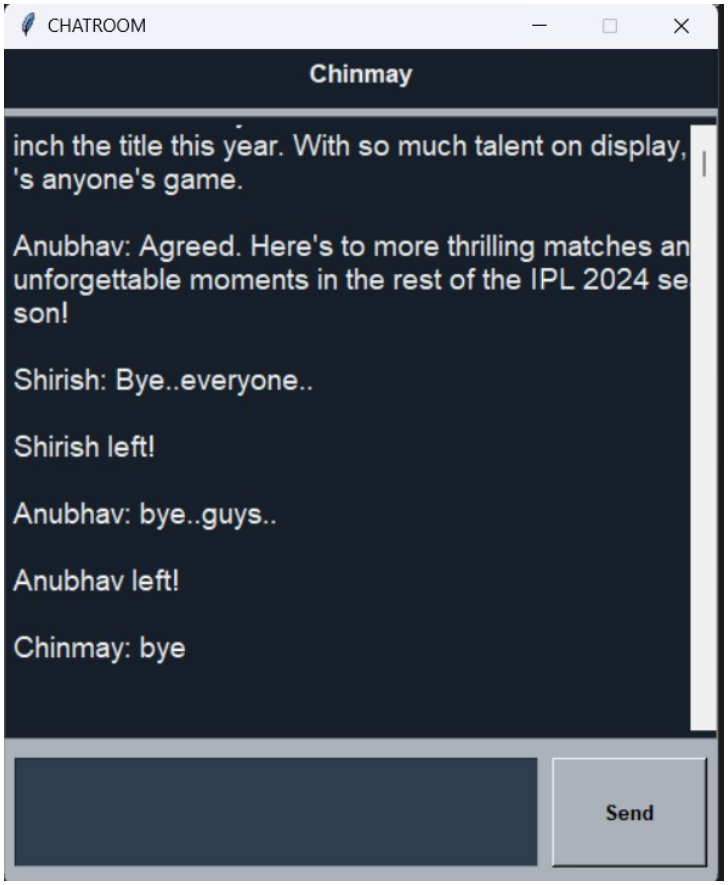

- Server terminal

```
PS C:\Users\Anubhav Ranjan> & "C:/Users/Anubhav Ranjan/AppData/Local/Prog
rams/Python/Python312/python.exe" "c:/Users/Anubhav Ranjan/OneDrive/Deskt
op/CSC611 Lab/Project/chatapp/server.py"
2024-04-05 23:43:47.986197: I tensorflow/core/util/port.cc:113] oneDNN cu
stom operations are on. You may see slightly different numeesults due to
floating-point round-off errors from different computation orders. To tur
n them off, set the environment variable `TF_ENABLE_ONEDNN_OPTS=0`.
2024-04-05 23:43:49.886510: I tensorflow/core/util/port.cc:113] oneDNN cu
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.
WARNING:tensorflow:From C:\Users\Anubhav Ranjan\AppData\Local\Programs\Py
thon\Python312\Lib\site-packages\tf_keras\src\losses.py:2976: The name tf
.losses.sparse_softmax_cross_entropy is deprecated. Please use tf.compat.
v1.losses.sparse_softmax_cross_entropy instead.

WARNING:tensorflow:From C:\Users\Anubhav Ranjan\AppData\Local\Programs\Py
thon\Python312\Lib\site-packages\tf_keras\src\backend.py:873: The name tf
.get_default_graph is deprecated. Please use tf.compat.v1.get_default_gra
ph instead.

2024-04-05 23:43:58.050589: I tensorflow/core/platform/cpu_feature_guard.
cc:210] This TensorFlow binary is optimized to use available CPU instruct
ions in performance-critical operations.
To enable the following instructions: AVX2 FMA, in other operations, rebu
ild TensorFlow with the appropriate compiler flags.
All PyTorch model weights were used when initializing TFBartForConditiona
lGeneration.

All the weights of TFBartForConditionalGeneration were initialized from t
he PyTorch model.
If your task is similar to the task the model of the checkpoint was train
ed on, you can already use TFBartForConditionalGeneration for predictions
 without further training.
```

```
Server is Listening...
Connected with ('127.0.0.1', 54096)
Anubhav: hii..Anubhav Here..
Nickname is Shirish
Shirish: hii..There..
Connected with ('127.0.0.1', 54108)
Nickname is Chinmay
Chinmay: Hey, have you been keeping up with the IPL 2024 matches?
Anubhav: Oh, absolutely! It's been another exciting season so far.Shirish
: Yeah, the competition seems fiercer than ever this year. Every team is
bringing their A-game.
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Anubhav: Agreed. Here's to more thrilling matches and unforgettable momen
ts in the rest of the IPL 2024 season!
Shirish: Bye..everyone..
Anubhav: bye..guys..
Chinmay: bye
```

- Summary

```
Summary: It's been another exciting season of the Indian Premier League.
Anubhav and Shirish are impressed by the performances of the new players
and the close finishes in some of the matches. They are looking forward t
o more thrilling matches and unforgettable moments in the rest of the IPL
 2024 season. Chinmay and Shirish hope that their team will clinch the ti
tle this year.   They are going to see each other in the next episode of
the show.  They will talk later.
```

Discussion

In this project, we developed a chat application with text summarization capabilities using Python. Using Multi-threading, the server managed multiple client connections concurrently, ensuring smooth communication. Hugging Face's Transformers library facilitated text summarization, with the BART model generating concise summaries of chat dialogues. Tkinter was employed to create an intuitive graphical interface for the client, enhancing user experience. But it wasn't all smooth sailing; we had to tackle some challenges, like making sure the server and clients could talk to each other smoothly and seamlessly integrating the summarization feature. Looking ahead, we see potential for improving the accuracy of our summaries and beefing up security features. Plus, it would be great to make the server even more robust to handle even more users. Looking ahead, we see room to make our summaries better and add more security stuff. Also, it would be nice to make the server stronger to handle more users. This project mixes together networking, language processing, and user interface design to make something practical and cool. It shows how combining different tech can lead to neat solutions for making online communication better.