SECURE CHAT APP WITH END TO END ENCRYPTION

Submitted By

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1. Motivation

The motivation to build this project was to develop a Secure Central Chat Room Application that can handle multiple users simultaneously from different devices connected to the central server. This project also excites us to learn how to implement end-to-end encryption of messages applied to a real-world project.

2. Overview

The main objective of this project was to achieve one-to-one and one-to-many communication between different clients.

2.1 Significance of the Project

The importance of this project lies in a real-world scenario where it can be seen as a platform to connect with different people on a single platform to communicate, discuss, chat, and connect with friends. This also has significance from an academic point of view, such that it comes to showcases our skills in computer networking and encryption. One of the challenges faced in this project was the implementation of an end-to-end encryption algorithm as it was a new exposure for our team, but it was a valuable learning experience, especially in the field of networking. This project will be a good platform for online direct communication.

2.2 Description of the Project

This project is about a chat application that allows users on different devices to communicate with each other in real time. The main problem it handles is the need for private, direct communication between clients without any third party being able to read the messages. To solve this, **socket programming approach is used** to build an application where messages are encrypted and only readable by the intended recipients, ensuring that no one, including the server, can see the content of the messages. The system supports direct private messaging, group chats, and other chat features, all while focusing on end-to-end security and privacy aspects.

2.3 Background of the Project

To develop this project, a good and proper amount of research and review was done using several reliable online resources to understand socket programming, secure communication protocols, and real-time messaging systems. The primary goal was to enable encrypted, peer-to-peer communication using Python sockets, ensuring that only the concerned recipients could read or see the actual messages.

Background materials and tools used in this project are:

Socket Programming Documentation:

The official python socket programming documentation for syntax and functions:

https://docs.python.org/3/howto/sockets.html

GitHub Repositories: Several open-source repositories on GitHub provided valuable insights on the aes encryption algorithm.

https://github.com/boppreh/aes

YouTube Tutorials and Videos: Various YouTube tutorials on building chat applications using sockets were helpful in visualizing step-by-step implementation and debugging techniques. Also, take help from YouTube channels to understand the core concepts of aes algorithm.

https://youtu.be/gyPuAJfOnGk?si=Txk5KGgwhsQW0jII

Stack Overflow: Use this platform to resolve and address issues related to specific code problems and implementation. Finding people's answers related to specific problems.

https://stackoverflow.com/questions/72565884/how-to-use-threading-in-sockets-in-python

Chat GPT: Use AI tools like GPT for debugging and resolving code issues, and troubleshooting any fixes in code.

2.4 Project Category

This project falls under the **Product-Based** category. It involves the development of a functional software application. The focus is on building a usable communication system that ensures integrity and accessibility across different devices, and finally, developing this in the form of an application.

3. Features / Scope / Modules

Unlike the other chat applications running on a simple client-server architecture, this is completely different. The architecture used in this project is client-to-client with a central server. The main highlights of this project, which make it distinct, are different types of chat features like broadcasting, message tampering checks, and group messaging, and all of this can be done between multiple devices simultaneously in real time.

1. **AES ENCRYPTION ALGORITHM**

This feature is an **Advanced Encryption Standard** algorithm implemented to maintain a symmetric encryption using a shared key. The algorithm loads the AES key from the environment file, and this key is used by only clients to first encrypt messages before sending to the server and decrypting only upon receiving the message. Making sure that even the server cannot see and read the actual message, but gets encrypted messages.

2. **Multiple Users Handling**

Threading technique and management help to achieve multiple client connections with the server, and can communicate smoothly without any delay or problem. The users can connect to the server by their name, and the server allocates a proper socket to each name.

3. **Message Tampering Validation**

This feature depends on the probability chance set to 10% that determines whether the server can modify the encrypted message or not. The server uses a random method to add content in an encrypted message to modify it. This will notify the client of the tampering in the message done by the server. The server cannot see the actual message, but can modify the encrypted message 10% of the time.

4. **Broadcast Message**

Send a message to all the clients currently connected to the server except for the sender itself. Helps to send a message to all users at once.

5. **Selective Broadcast**

Works similarly to broadcast cast but with a modification that allows users to select other clients according to their choice from the current connected list and send them a message at once. It works like selecting recipients (not all) and sending them the same message.

6. **Private One-One Messaging**

Simple and typical one-to-one way of communication between the sender and receiver while maintaining secure transfer of messages. Works like one user sends a message to a particular recipient, and the receiver gets the message, and no third person is involved and can see the message.

7. **Multi-Device Support**

Configure the system in a way that you can have multiple users operating from different devices with the same wifi connectivity connected to one local server ip address.

8. **Group Chat Creation**

The client can create a group chat and add connected clients to this chat. Maintains a dictionary for the creator name, the person who is the admin of the group, and members record list with their names. Provides a group discussion environment to users. After creating a group, all members are notified that they are now added to this group.

9. **Remove from Group**

The admin who is the creator of the group can only remove members. Normal members of the group do not have the authority to remove anyone from the group chat. After removing a member, a prompt will be sent to the member that they are removed from the group.

10. **Group Chat Messaging**

The user can send messages to only members of the group. Each member can see the group messages and can send messages to other members. Works like a group of users discussing something in common.

11. **Real Time Message Edit**

After writing a message, a message is displayed whether the message needs to be sent directly or should be edited and sent, and a timer of 20 seconds starts. If a user wants to edit the message, they can edit the message and send it, or can send it directly. If there is no response from the user within 20 seconds, then the message is automatically sent.

12. **Message Delivery Status**

Indicating whether the message is delivered to the recipient properly or not. Checks and verifies that the message sent is original or that the server tampered (modified) the message before sending it to the receiver. If there is no tampering, then the message is successfully delivered and the sender receives the acknowledgement that message delivery is successful, but in case of any modification, the message will not be sent to the recipient and the sender receives

the acknowledgement that the message was not sent and modified by the server. The sender has to resend it.

13. Get Online Users

Basic feature that returns the current online users connected to the server. Also, notify each user with a display message when someone joins the chat and leaves the chat.

14. Typing Indicator

Indicates to the concerned users that a sender is typing something with a notification message.

4. Project Planning

Phase 1 - Environment and Project Setup: (1-2 days)

Set up the development environment (VS Code, Python). Configure the Git repository for proper maintenance of code and contribution to the project through commits.

This was done by both group members to properly initialize work distribution and contributions in the project.

Phase 2 - Basic Client-Server and Encryption Integration : (2-3 days)

Implement basic client-server messaging with encryption (AES). Integrate multithreading for concurrent communication. Anas initiated the basic architecture of the program by building simple clients to send and receive messages. Ibrahim works to integrate and extend threading techniques for multiple client support.

Finalize encryption mechanisms and test message security. Conduct initial testing of encrypted messages.

Both group members equally participated in building this encryption feature, as it is a core and most important feature.

Phase 3 - Messaging Modes And Group Chat Management : (2-3 days)

In this phase, proper features for messaging modes were built. Anas contributed to developing broadcast features and Ibrahim developed private one-to-one communication with selective broadcast features.

Group management features were developed. Ibrahim worked on features of group creation and removing participants from the group, while Anas handled the functionality for sending group messages properly.

Phase 4 - Edit messages , Tampering , User Status : (1-2 days)

Add user status (online) indicators functionality developed by Anas. Ibrahim ensured the secure message delivery and worked on the message tampering feature and edit message feature.

Phase 5 - Typing indicator , Message Delivery Status : (1 -2 days)

Implementation of typing notification message and a proper message delivery system by Anas.

Phase 6 - Final Testing and Multi-Device Testing: (1 day)

Conduct final testing of all features and now testing the system on multiple devices, done by both members of the group, to ensure quality of the code and project to make it maintainable.

5. Project Feasibility

- **Technical Feasibility**

  The project is technically feasible with current tools and technologies. Developed using Python and socket programming, it applies cryptography through a custom AES algorithm along with libraries like threading. The system is modular and easily maintainable in case of any modifications or adding functionalities in the future.

- **Economic Feasibility**

  The project is completely possible when it comes to economic feasibility. Use tools like VS Code IDE and Git, which are open source and free software for project environments. Some important factors are completely economically feasible, including a Local PC server with ip, developers are group members, and a laptop or desktop with an internet connection helps to build this project successfully with no requirement for any additional cost.

- **Schedule Feasibility**

The project is scheduled to be feasible and can be completed within the planned time frame. The development work is divided into clear, manageable phases as mentioned in the work plan above, each with a realistic estimated time. The total estimated time for all phases is approximately 10–12 days, which includes setup, development, testing, and finalization. Both group members contributed equally and distributed tasks effectively, ensuring steady progress of the project.

6. Hardware and Software Requirements

The hardware requirements for this project included:

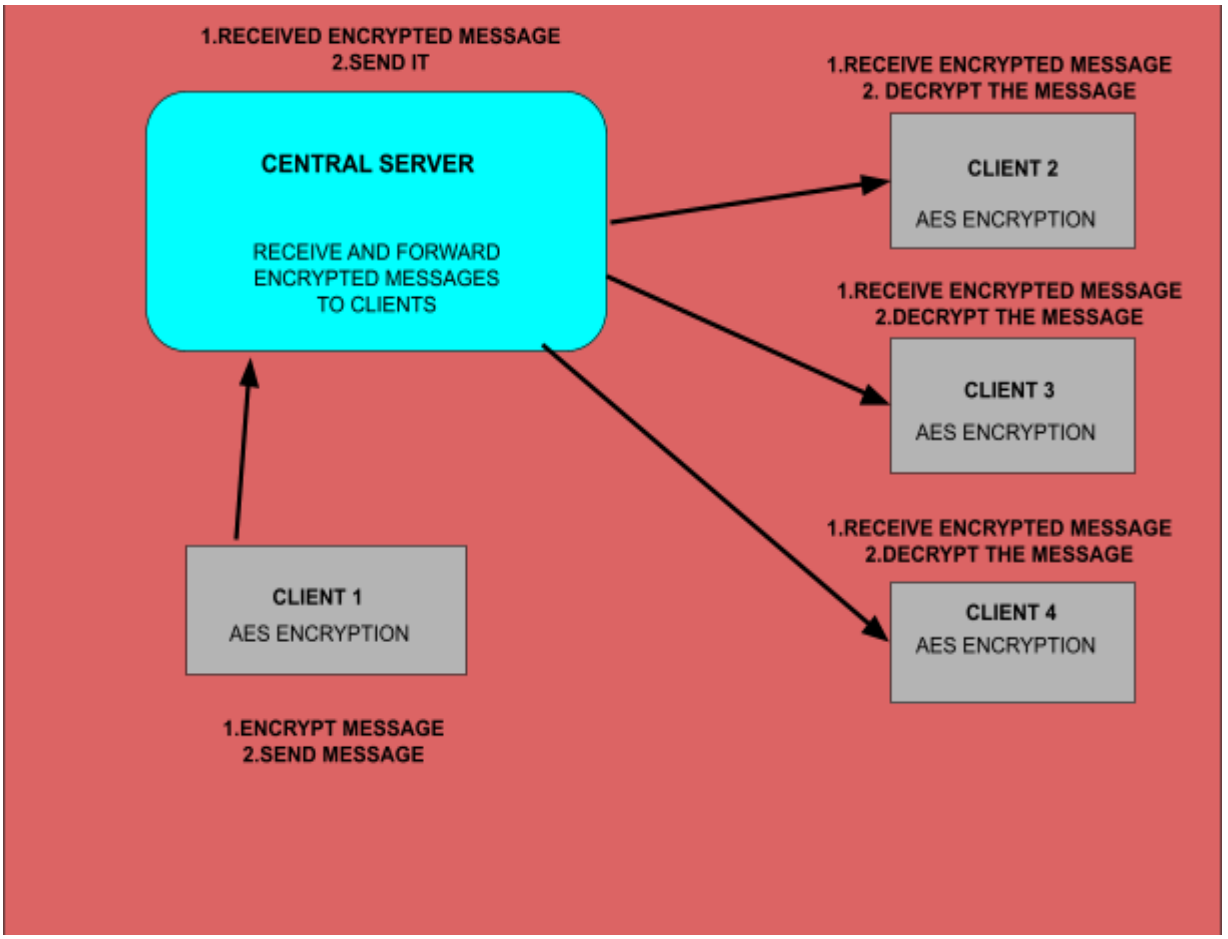
- Two PCs/Laptops
- High-speed internet connection
- Minimum 2-4 GB RAM
- Multi-core CPU (preferable)

The software requirements for this project include:

- Windows operating system
- Python 3.12.1
- Sockets library
- VS Code IDE

7. Diagrammatic Representation of the Overall System

Figure 1. The following is a figure about the architecture of the project i.e. single central server is used by which all clients are connected, and each client can communicate with one or many clients. The client first writes the message, encrypts it, and sends it to the server. The server receives the encrypted message and then forwards it to the proper clients as shown in the figure given below. Finally, the receiver client(s) first received the message and then decrypted it to read it properly.

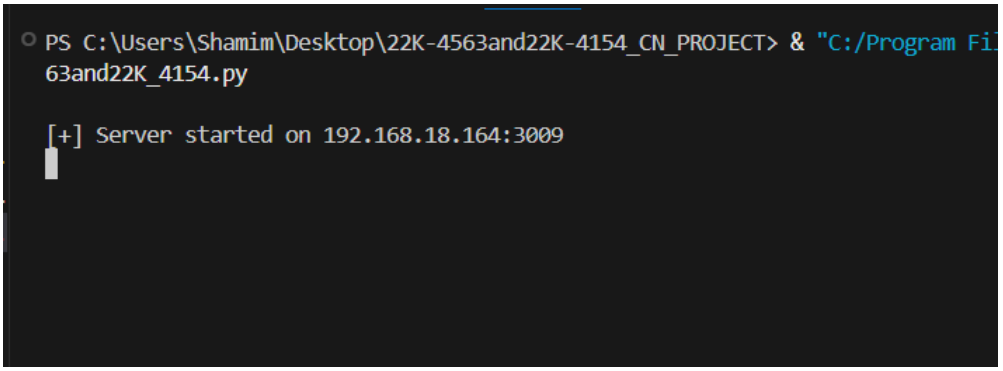


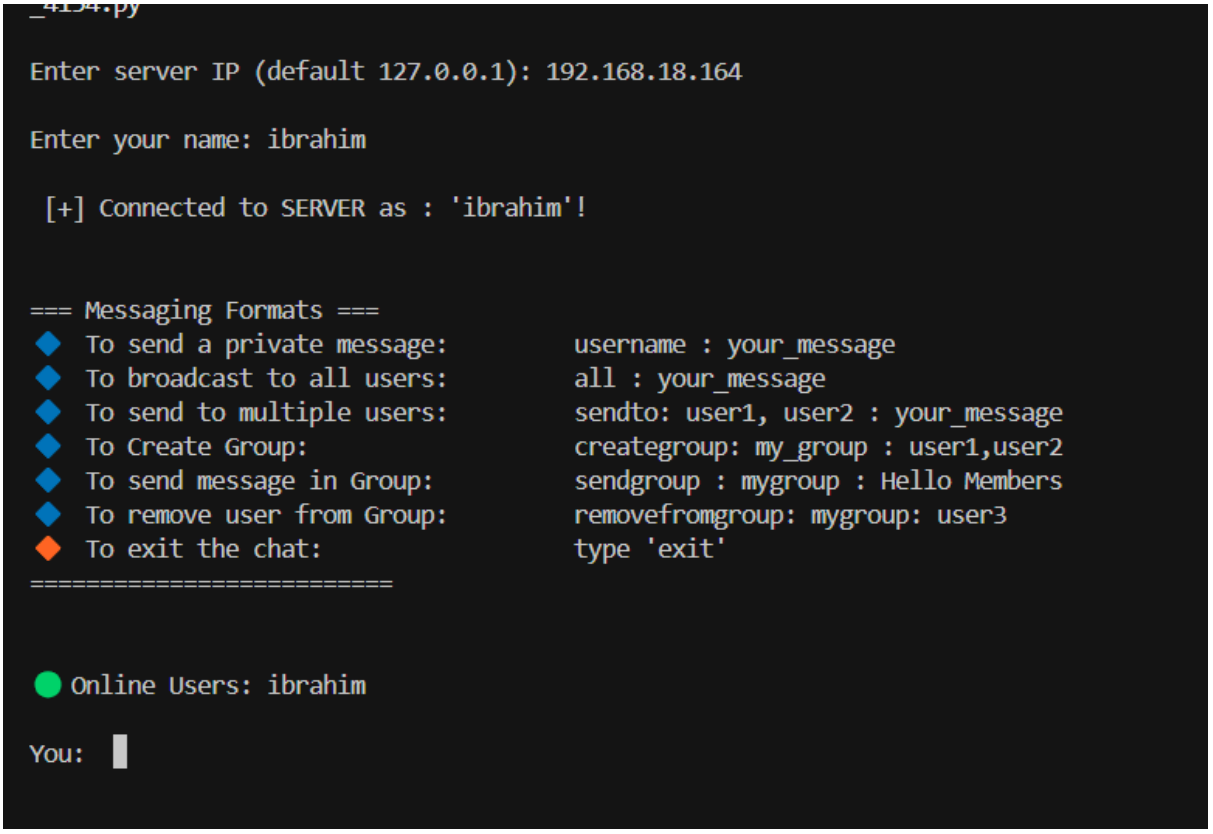
8. References

1. Kurose, J. W., & Ross, K. W. (2021). *Computer Networking: A Top-Down Approach* (8th ed.). Pearson.

2. Tanenbaum, A. S., Feamster, N., & Wetherall, D. J. (2021). *Computer Networks* (6th ed.). Pearson.

9. Screenshots of the working Demonstration





```
Enter server IP (default 127.0.0.1): 192.168.18.164

Enter your name: anas

 [+] Connected to SERVER as : 'anas'!


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
=========================


🟢 Online Users: ibrahim, anas

You:
```

```
Enter server IP (default 127.0.0.1): 192.168.18.164

Enter your name: ali

 [+] Connected to SERVER as : 'ali'!


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
=========================


🟢 Online Users: ibrahim, anas, ali

You:
```

```
[+] Server started on 192.168.18.164:3009

[+] ibrahim connected from ('192.168.18.164', 60862)

[+] anas connected from ('192.168.18.164', 60885)

[+] ali connected from ('192.168.18.164', 60896)
```

```
🟢 Online Users: ibrahim

You:
[+] anas has joined the chat!

🟢 Online Users: ibrahim, anas

[+] ali has joined the chat!

🟢 Online Users: ibrahim, anas, ali
```

```
You:  anas: hello anas bhai


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
========================


🕒 Do you want to edit this private message or send it now? (Type 'edit' to modify or 'send' to continue)
⏳ Auto-sending in 20 seconds...

You:  send
```

```
🔸 To exit the chat:                    type 'exit'
============================

✅ Message delivered to anas.

You:
```

```
🟢 Online Users: ibrahim, anas, ali

[ibrahim] is typing...

ibrahim says : hello anas bhai
```

```
You:  anas: hello anas

=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔸 To exit the chat:                 type 'exit'
========================

🕐 Do you want to edit this private message or send it now? (Type 'edit' to modify or 'send' to continue)
⏳ Auto-sending in 20 seconds...

You:  send

=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔸 To exit the chat:                 type 'exit'
========================

✅ Message delivered to anas.

You:
```

```
lient2.py
lient3.py
lient4.py

==========

✅ Message delivered to ['ibrahim'].

You:
[*] You have been added to the group 'fastains' by ibrahim.

[anas] is typing...

[Group:fastains] anas: this is fastaingroup chat


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔸 To exit the chat:                 type 'exit'
==========

You:
[*] You have been removed from the group 'fastains' by ibrahim.


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔸 To exit the chat:                 type 'exit'
==========

You:
[ibrahim] is typing...

ibrahim (Broadcast): good evening
```

```
Enter server IP (default 127.0.0.1): 192.168.18.88

Enter your name: ibrahim

 [+] Connected as 'ibrahim'!


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔸 To exit the chat:                 type 'exit'
==========


🟢 Online Users: ibrahim

You:
[+] anas has joined the chat!

🟢 Online Users: ibrahim, anas

[+] hamza has joined the chat!

🟢 Online Users: ibrahim, anas, hamza


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔸 To exit the chat:                 type 'exit'
==========

You:
[hamza] is typing...

hamza (Selective Broadcast) : testing cn project now
```

```
Enter server IP (default 127.0.0.1): 192.168.18.88

Enter your name: hamza

 [+] Connected as 'hamza'!


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
========================


🟢 Online Users: ibrahim, anas, hamza

You:  sendto: ibrahim: testing cn project now


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
========================


You:
🕐 Do you want to edit this selective message or send it now? (Type 'edit' to modify or 'send' to continue)
⏳ Auto-sending in 20 seconds...
send


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
========================


✅ Message delivered to ['ibrahim'].

You:
```

```
🕐 Do you want to edit this private message or send it now? (Type 'edit' to modify or 'send' to continue)
⏳ Auto-sending in 20 seconds...

You:  send


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
========================


✅ Message delivered to ibrahim.

You:  ibrahim: testing message tamper


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
========================


🕐 Do you want to edit this private message or send it now? (Type 'edit' to modify or 'send' to continue)
⏳ Auto-sending in 20 seconds...

You:  send


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
========================


⚠️ [!] Your private message was tampered by the server before delivery!
❌ Message Not sent..

You:
```

```
PROBLEMS   OUTPUT   DEBUG CONSOLE   TERMINAL   PORTS

[+] hamza has joined the chat!

● Online Users: ibrahim, anas, hamza


=== Messaging Formats ===
◆ To send a private message:        username : your_message
◆ To broadcast to all users:        all : your_message
◆ To send to multiple users:        sendto: user1, user2 : your_message
◆ To Create Group:                  creategroup: my_group : user1,user2
◆ To send message in Group:         sendgroup : mygroup : Hello Members
◆ To remove user from Group:        removefromgroup: mygroup: user3
◆ To exit the chat:                 type 'exit'
======================


You:
[hamza] is typing...

hamza (Selective Broadcast) : testing cn project now


=== Messaging Formats ===
◆ To send a private message:        username : your_message
◆ To broadcast to all users:        all : your_message
◆ To send to multiple users:        sendto: user1, user2 : your_message
◆ To Create Group:                  creategroup: my_group : user1,user2
◆ To send message in Group:         sendgroup : mygroup : Hello Members
◆ To remove user from Group:        removefromgroup: mygroup: user3
◆ To exit the chat:                 type 'exit'
======================


You:  creategroup: fastains: anas, hamza

[!] Target 'creategroup' not found.


=== Messaging Formats ===
◆ To send a private message:        username : your_message
◆ To broadcast to all users:        all : your_message
◆ To send to multiple users:        sendto: user1, user2 : your_message
◆ To Create Group:                  creategroup: my_group : user1,user2
◆ To send message in Group:         sendgroup : mygroup : Hello Members
◆ To remove user from Group:        removefromgroup: mygroup: user3
◆ To exit the chat:                 type 'exit'
----------------------


[+] Group 'fastains' created successfully with members: anas, ibrahim, hamza

You:
```

```
Go   Run   Terminal   Help                                   Untitled (Work

PROBLEMS   OUTPUT   DEBUG CONSOLE   TERMINAL   PORTS

PS D:\anas\uni\Semester 6\cn\project\CN_PROJECT_SECURED_CHAT_APP> & C:/Users/Anas/AppData/Local/

Enter server IP (default 127.0.0.1): 192.168.18.88

Enter your name: anas

 [+] Connected as 'anas'!


=== Messaging Formats ===
◆ To send a private message:        username : your_message
◆ To broadcast to all users:        all : your_message
◆ To send to multiple users:        sendto: user1, user2 : your_message
◆ To Create Group:                  creategroup: my_group : user1,user2
◆ To send message in Group:         sendgroup : mygroup : Hello Members
◆ To remove user from Group:        removefromgroup: mygroup: user3
◆ To exit the chat:                 type 'exit'
======================


● Online Users: ibrahim, anas

You:
[+] hamza has joined the chat!

● Online Users: ibrahim, anas, hamza

[*] You have been added to the group 'fastains' by ibrahim.
```

```
🕒 Do you want to edit this group 'fastains' message or send it now? (Type 'edit' to modify or 'send' to continue)
⏳ Auto-sending in 20 seconds...

You:  send


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
------------------------

Message sent to group.


✅ Message delivered to fastains.

You:
```

```
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
------------------------


You:  creategroup: fastains: anas, hamza

[!] Target 'creategroup' not found.


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
========================


[+] Group 'fastains' created successfully with members: anas, ib

You:
[anas] is typing...

[Group:fastains] anas: this is fastaingroup chat
```

chat_app_server.py - CN_PR...

client1.py - Untitled (...

```
[+] Group 'fastains' created successfully with members: anas, ibrahim, hamza

You:
[anas] is typing...

[Group:fastains] anas: this is fastaingroup chat


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
🔹 To broadcast to all users:        all : your_message
🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
🔹 To send message in Group:         sendgroup : mygroup : Hello Members
🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
======================


You:  removefromgroup: fastains: hamza

[!] Target 'removefromgroup' not found.


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
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🔹 To send to multiple users:        sendto: user1, user2 : your_message
🔹 To Create Group:                  creategroup: my_group : user1,user2
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🔹 To remove user from Group:        removefromgroup: mygroup: user3
🔶 To exit the chat:                 type 'exit'
======================


[+] hamza removed from group 'fastains'.

You:
```

```
=== Messaging Formats ===
🔹 To send a private message:        username : your_message
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======================


✅ Message delivered to ['ibrahim'].

You:
[*] You have been added to the group 'fastains' by ibrahim.

[anas] is typing...

[Group:fastains] anas: this is fastaingroup chat


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
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🔹 To remove user from Group:        removefromgroup: mygroup:
🔶 To exit the chat:                 type 'exit'
======================


You:
[*] You have been removed from the group 'fastains' by ibrahim.
```

```
⚠️ [!] Your message was tampered by the server before broadcasting!
❌ Message Not sent..


--- Messaging Formats ---
🔹 To send a private message:        username : your_message
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🔶 To exit the chat:                 type 'exit'
========================


You:  all: good morning


=== Messaging Formats ===
🔹 To send a private message:        username : your_message
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🔹 To Create Group:                  creategroup: my_group : user1,user2
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🔶 To exit the chat:                 type 'exit'
========================


🕒 Do you want to edit this broadcast message or send it now? (Type 'edit' to modify or 'send' to continue)
⏳ Auto-sending in 20 seconds...

You:
⏰ Time's up! Sending the message as is...

✅ Message delivered to all.
```

```
View  Go  Run  Terminal  Help                    CN_PROJECT_SECURED_CHAT_APP

PROBLEMS   OUTPUT   DEBUG CONSOLE   TERMINAL   PORTS

PS D:\anas\uni\Semester 6\cn\project\CN_PROJECT_SECURED_CHAT_APP> & C:/Users/Anas/AppData/Local/Programs/Python/Python311

[+] Server started on 192.168.18.88:3009

[+] ibrahim connected from ('192.168.18.88', 52138)

[+] anas connected from ('192.168.18.88', 52142)

SERVER GOT THE DATA FROM CLIENT :  TYPING:anas

SERVER GOT THE DATA FROM CLIENT :  anas : da1d704b078980d6ce37211dc21f7f4edaa30ca7baeeaa155810d0660cfb9621

SERVER GOT THE DATA FROM CLIENT :  TYPING:ibrahim

SERVER GOT THE DATA FROM CLIENT :  ibrahim : da1d704b078980d6ce37211dc21f7f4edaa30ca7baeeaa155810d0660cfb9621

SERVER GOT THE DATA FROM CLIENT :  TYPING:ibrahim

SERVER GOT THE DATA FROM CLIENT :  ibrahim : da1d704b078980d6ce37211dc21f7f4edaa30ca7baeeaa155810d0660cfb9621
```