PROJECT REPORT

In this Haskell stack app, a social network model is simulated by implementing concurrent computation with the use of 10 independent threads acting as social media users. This app is modelled with user and message data types which are used in a random selection of usernames and share message exchanges between them. On the design front, a list of users has been created with standard nomenclature (names like Alpha, Bravo, Charlie), multiple newMVar variables are declared and linked for each user who adds the exchanged messages to these variables.

Using forkIO, a set of 10 lightweight threads are created in the Haskell runtime system and these threads enable concurrency which allows the communication of users with each other in a synchronized fashion. Thread synchronization was one issue that I faced while building this app and adding a thread delay of a set time interval fixed that concern. A newEmptyMVar variable is created to hold the status of these threads on which putMVar variable sets to true once all the thread executions are completed in this process. Here, putMVar is chosen since it waits until MVar is empty, only then it adds the value. Using the pseudo-random number generator from System.Random library, a random selection of users is performed by using the randomR. The randomR works on a given range of users and delivers uniformly distributed random values within them. A list of predefined messages is constructed and using mkStdGen, a random user is picked and sent a random message at random intervals. The number of sent messages is continuously recorded and incremented in messagesCount using putMVar when these 100 message exchanges are simulated. takeMVar is implemented here for messages count calculation since it waits until the MVar is full and takes the value from it. All threads are executed concurrently for 100 messages recorded and put to a halt once the limit is reached. Once threads processes are completed, a summary is displayed with the list of usernames with the total count of messages they received.

In addition to the given basic requirements, a set of conversational phrases were loaded and randomly tagged along the concurrent threads for displaying in the output. On top of this, the time stamps were also recorded along with the data in the UTC format, so that there is an actual track of the time when these messages were exchanged. Sending a message to self is also added as a feature as they have become very common and implemented even in modern messaging platforms like Whatsapp.

```
<-----Welcome to instaNetwork----->

<-----Starting the Message exchange process----->
2023-01-19 21:43:02.7520379 UTC  ::  Bravo sent this message to John  ::   <<<< You look cute today >>>>
2023-01-19 21:43:02.7520379 UTC  ::  Charlie sent this message to John  ::   <<<<  How do you like it? >>>>
2023-01-19 21:43:02.7520379 UTC  ::  Alpha sent this message to Victor  ::   <<<< Come on in! Have a drink! >>>>
2023-01-19 21:43:02.7520379 UTC  ::  John sent this message to Mike  ::   <<<< Come on in! Have a drink! >>>>
2023-01-19 21:43:02.7520379 UTC  ::  Delta sent this message to John  ::   <<<< Good luck >>>>
2023-01-19 21:43:02.7520379 UTC  ::  Romeo sent this message to Alpha  ::   <<<< Hi! Great to see you >>>>
2023-01-19 21:43:02.7520379 UTC  ::  Steve sent this message to Bravo  ::   <<<< Hows the family >>>>
2023-01-19 21:43:02.7520379 UTC  ::  Mike sent this message to Bravo  ::   <<<< Come on in! Have a drink! >>>>
2023-01-19 21:43:02.7520379 UTC  ::  Victor sent this message to Delta  ::   <<<< Hey! What a surprise >>>>
2023-01-19 21:43:02.7520379 UTC  ::  Oscar sent this message to Victor  ::   <<<< Good luck >>>>
2023-01-19 21:43:02.7590498 UTC  ::  Bravo sent this message to John  ::   <<<< Hi! Great to see you >>>>
2023-01-19 21:43:02.7727944 UTC  ::  Bravo sent this message to Romeo  ::   <<<< Have a great day! Bye >>>>
2023-01-19 21:43:02.7727944 UTC  ::  Alpha sent this message to Delta  ::   <<<< Come on in! Have a drink! >>>>
2023-01-19 21:43:02.7727944 UTC  ::  Oscar sent this message to Delta  ::   <<<< Its a pleasure to meet you >>>>
2023-01-19 21:43:02.7727944 UTC  ::  Delta sent this message to Romeo  ::   <<<< Good luck >>>>
2023-01-19 21:43:02.7727944 UTC  ::  John sent this message to Bravo  ::   <<<< You look cute today >>>>
2023-01-19 21:43:02.7727944 UTC  ::  Victor sent this message to Bravo  ::   <<<< Hows the family >>>>
2023-01-19 21:43:02.7727944 UTC  ::  Charlie sent this message to Romeo  ::   <<<< You look cute today >>>>
2023-01-19 21:43:02.7727944 UTC  ::  Mike sent this message to Charlie  ::   <<<< You look cute today >>>>
2023-01-19 21:43:02.7827886 UTC  ::  Bravo sent a message to himself  ::   <<<< Hows the family >>>>
2023-01-19 21:43:02.7827886 UTC  ::  Steve sent this message to Alpha  ::   <<<< Have a great day! Bye >>>>
2023-01-19 21:43:02.7727944 UTC  ::  Romeo sent this message to Delta  ::   <<<< Hey! What a surprise >>>>
2023-01-19 21:43:02.7827886 UTC  ::  Bravo sent this message to Alpha  ::   <<<< Hi! Great to see you >>>>
2023-01-19 21:43:02.8028208 UTC  ::  John sent this message to Romeo  ::   <<<< You look cute today >>>>
2023-01-19 21:43:02.8028208 UTC  ::  Mike sent this message to Steve  ::   <<<< Good luck >>>>
2023-01-19 21:43:02.8028208 UTC  ::  Romeo sent this message to Steve  ::   <<<< Its a pleasure to meet you >>>>
2023-01-19 21:43:02.8028208 UTC  ::  Bravo sent this message to Victor  ::   <<<< Hi! Great to see you >>>>
2023-01-19 21:43:02.8028208 UTC  ::  Charlie sent this message to Alpha  ::   <<<< Have a great day! Bye >>>>
2023-01-19 21:43:02.8028208 UTC  ::  Victor sent this message to Romeo  ::   <<<<  How do you like it? >>>>
2023-01-19 21:43:02.8028208 UTC  ::  Steve sent this message to Alpha  ::   <<<< Good luck >>>>
2023-01-19 21:43:02.8028208 UTC  ::  Alpha sent this message to Delta  ::   <<<< Hey! What a surprise >>>>
2023-01-19 21:43:02.8028208 UTC  ::  Delta sent a message to himself  ::   <<<< Hi! Great to see you >>>>
2023-01-19 21:43:02.8028208 UTC  ::  Oscar sent a message to himself  ::   <<<< Good luck >>>>
2023-01-19 21:43:02.8158578 UTC  ::  Delta sent this message to John  ::   <<<< Hows the family >>>>
```

```
2023-01-19 21:43:02.9129717 UTC  ::  Romeo sent this message to Bravo   ::   <<<< Hi! Great to see you >>>>
2023-01-19 21:43:02.9129717 UTC  ::  Oscar sent this message to Bravo   ::   <<<< Hows the family >>>>
2023-01-19 21:43:02.9229585 UTC  ::  Victor sent this message to Charlie  ::   <<<< You look cute today >>>>
2023-01-19 21:43:02.9229585 UTC  ::  Charlie sent this message to Victor  ::   <<<< Its a pleasure to meet you >>>>
2023-01-19 21:43:02.9229585 UTC  ::  Bravo sent this message to Mike    ::   <<<< Hey! What a surprise >>>>
2023-01-19 21:43:02.9429874 UTC  ::  Oscar sent a message to himself    ::   <<<< Hey! What a surprise >>>>
2023-01-19 21:43:02.9429874 UTC  ::  Steve sent this message to Mike    ::   <<<< Good luck >>>>
2023-01-19 21:43:02.9429874 UTC  ::  Romeo sent this message to Delta   ::   <<<< You look cute today >>>>
2023-01-19 21:43:02.9429874 UTC  ::  Mike sent this message to Oscar    ::   <<<< Its a pleasure to meet you >>>>
2023-01-19 21:43:02.9429874 UTC  ::  John sent this message to Charlie  ::   <<<< Good luck >>>>
2023-01-19 21:43:02.9429874 UTC  ::  Delta sent this message to Victor  ::   <<<< Its a pleasure to meet you >>>>
2023-01-19 21:43:02.9429874 UTC  ::  Alpha sent this message to Mike    ::   <<<< You look cute today >>>>
2023-01-19 21:43:02.9429874 UTC  ::  Victor sent this message to Charlie  ::   <<<< I thought I would drop in and say hello >>>>
2023-01-19 21:43:02.9429874 UTC  ::  Bravo sent this message to Victor  ::   <<<< Its a pleasure to meet you >>>>
2023-01-19 21:43:02.9429874 UTC  ::  Charlie sent this message to Mike  ::   <<<< I thought I would drop in and say hello >>>>
2023-01-19 21:43:02.9458506 UTC  ::  Oscar sent this message to Mike    ::   <<<< Good luck >>>>
2023-01-19 21:43:02.9558063 UTC  ::  Steve sent this message to Alpha   ::   <<<< Hi! Great to see you >>>>
2023-01-19 21:43:02.9608026 UTC  ::  Delta sent this message to Charlie  ::   <<<< Hows the family >>>>
2023-01-19 21:43:02.9608026 UTC  ::  Mike sent this message to Oscar    ::   <<<< Come on in! Have a drink! >>>>
2023-01-19 21:43:02.9608026 UTC  ::  Bravo sent this message to John    ::   <<<< Hey! What a surprise >>>>
2023-01-19 21:43:02.9608026 UTC  ::  Victor sent this message to Mike   ::   <<<< I thought I would drop in and say hello >>>>

2023-01-19 21:43:02.9608026 UTC  ::  Romeo sent this message to Mike    ::   <<<< Come on in! Have a drink! >>>>
<----Message exchanges ends---->

Alpha received 8 text messages
Bravo received 11 text messages
Charlie received 9 text messages
Delta received 11 text messages
Mike received 15 text messages
Oscar received 9 text messages
Romeo received 8 text messages
Victor received 12 text messages
John received 8 text messages
Steve received 9 text messages

Hope you had a good time with the App! Connecting people socially like never before!
```