EGGS ON THE DOOR

CENG 491

Detailed Design Report

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1 Introduction

1.1 Problem Definition

In the recent years millions all over the World have been using the Internet for different purposes. One of the main objectives of Internet usage is communication and recently the video chat feature is the most popularly used Internet application. Those applications not only used for business or education purposes but also a popular tool for entertainment. In our market search we realized that people like to play online games and video chat at the same time but a popular application which will satisfy this kind of interaction is not present for more than two people at this moment. Which brings us to the aim of our project we plan to create an environment that people can make video chat and play games at the same time our main goal is to create an application which will serve for more than two people at the same time.

1.2 Purpose

The purpose of preparing this document is to explain complete design details of our project Audiovisual Gaming Network. According to the standards determined by IEEE, the Software Design Report indicates how the proposed software system will be structured in order to satisfy the requirements identified in the Software Requirements Specifications document. To be more explanatory, it can be stated that the objective of this document is to translate software requirements predetermined in SRS document into a representation of software components, interfaces and data to be used as a guide later in implementation phase of the project.

1.3 Scope

This detailed design report will mainly contain the general definition and features of the project, design constraints, the overall system architecture and data architecture. Additionally, a brief explanation about our current progress and schedule of the project will be provided in related sections. Design of the system and subsystems/modules will be explained both verbally and visually by means of UML diagrams, in order to help the programmer to understand all information stated in this document correctly and easily. However, since every software design is open to changes and modifications, it is highly possible to make changes during implementation and update SRS and SDD documents accordingly.

1.4 Overview

Readers get a clear understanding of the project and basic design choices by examining this detailed design report. With the help of several UML diagrams, the modular architecture of the system is clearly defined in the document. Which public methods that modules have are listed in class diagrams, indicating the possible ways of interactions between modules.

1.5 Definitions and Abbreviations

CLI: Command Line Interface

GUI: Graphical User Interface

MPEG: Moving Picture Experts Group

H.261 : the video coding standard of the ITU
IDR : Initial Design Report

1.6 References

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Raghuveer A., Kang N., David H. C. *"Techniques for Efficient Streaming of Layered Video in Heterogeneous Client Environments."* Dept. of Computer Science & Engg. School of Computer Science & Engg. Dept. of Computer Science & Engg , University of Minnesota Chung-Ang University University of Minnesota Minneapolis, MN 55455 South Korea Minneapolis.

2 System Overview

Our target software has three main functionalities. The first functionality is supplying communication between any group of people whose number of members does not exceed 6. In our system, this communication is supplied with the help of direct IP connection. In order to make this facility available, we are going to use some libraries of C# programming language and make use of fundamental network algorithms.

The second functionality is providing the software users with the capability of involving in audiovisual conversation. In order to reach that aim, we consider using some streaming algorithms that are explained further in following sections. Also, since our system's audiovisual ability is available to 6 people, we need to decrease the streaming size. Therefore, in order to make sampling rate considerable, we will use some compression algorithms. Moreover, to enhance the compressed video streams, we plan to use filter algorithms mentioned in subsequent sections of our document.

The last functionality of our software is supporting many multi-player Java games which can communicate with the software with the help of Game Play Interface. Therefore, after the software gets in use, Java games could be classified as "supported" and "unsupported" with respect to their abilities to connect the main software.

In order to make a not complex design to reach these aims, we are supposed to follow a modular approach. Namely, dividing the system into some sub-modules with regards to different functionalities not only ease the project development steps, but also helps us to make our product reliable, efficient and consistent.

Our project is divided into two main modules (*Network* and *GamePlay*) which are clearly explained in *"Architectural Design"* part.

3 Design Considerations

3.1 Design Assumptions, Dependencies and Constraints

Our project aims to entertain people in an audiovisual interactive environment. As a result, one of our goals is to design a system that could not bother people by long response times, latencies and software problems. Hence, system constraints are defined according to this platinum base.

Firstly, we aim to design a system which is capable of responding six people in a suitable time. We choose not to exceed this player limit at our first version of software, since the greater the number of input streams, the heavier the load on the network.

Secondly, each user has different bandwidth limitations. However, the total web cam streams are too big to be received and to be sent, as 6 people are considered. Therefore, we need to reduce the amount of data to keep the system consistent. To get over the limitation problems, we use compression algorithms in order to handle 6 people on the system at the same time.

Thirdly, as we are multi-casting and working with the streams with different qualities, we should find a solution which is suitable in that kind of heterogeneous inputs. To handle this problem, we used the layered multi-casting streaming technique which serves best for our needs. Layered multi-casting streaming divides the video into different layers by filtering, quantization and down-sampling. Then, a basic low-quality image is sent to the receivers. On the computer of clients, with the help of filtering, the images are decompressed. Next, according to the existing hardware and software system of the receiver, the video is filtered and tried to be shown similar to the old quality. Using that kind of streaming technique decreases the data load on the network. To sum up, our goal is to keep the system stable without losing too much data during the compression and filtering processes, and keep the video in a reasonable quality level.

3.2 Design Goals and Guidelines

Our first goal of design is to implement a system that communicates a few users consistently without synchronization problems with suitable response time and image quality. After we manage to establish the connection between users, we are going to embed the game play module in the system. The goal of this module is to contain an interface which will be a powerful tool to connect different kinds of games to the system. As an external game, we will implement the taboo game (which is the default game) in our project. The reason why we have chosen this game is that it requires visual interaction between the players during the game. Finally, if we have time, we will try to code different games for our system.

4. Data Models and Design

Since we do not have a database in our software, we do not have any complex relations between data and objects. In this section, we are to explain the trivial data types of our software.

4.1 Network Settings & GamePlay Settings & Preferences

In our system, a user has the capability of changing some system features. This ability makes our software much more user friendly.

These settings are going to be included in a single “settings.set” file. That file is supposed to contain each setting on each newline.

In case of error in the setting file, default setting options are going to be chosen by our system.

4.2 Friend List

In our software, each user is capable of constructing his/her friend list. According to our design, this friend list is going to be included in “friend.xml” file. This file is going to include “Friend” objects in the system.

We do not prefer using database here, since we think that a single user on each computer could not have more than 10000 friends. Only an index file is adequate for such a case. This index file is named as “index.dat”. Each line of file includes information only for one “Friend” object.

The system does not allow a friend list to have more than 10000 friend objects. Moreover, in case of file errors, the system uses the blank friend list.

4.3 Chat Diaries & Game Results

A user may save her/his conversation details in external files. This ability is included in Graphical User Interface of Network module. The details of each conversation are written to an external file whose name is determined by the user. The external files of conservations are contained in “diary” sub-directory.

A user may save her/his game results also. Also this ability is included in GUI. The game result reports are designed to be written by external games. However, a user must give permission to make the reports written. The details of each game are included in an external file whose name is determined by the user. The external files of conservations are contained in “results” sub-directory.

4.4 Extra Data Types

4.4.1 IP

As we know, a standart IP has a type like “a.b.c.d”. Here, a, b, c and d are unsigned integers ranging between 1 and 255. Likely, our IP data type has such a structure.

IP:
unsigned int: a
unsigned int: b
unsigned int: c
unsigned int: d

4.4.2 Friend

“Friend” data type consists of three members with primitive data types:

IP: user_ip
char[20]: username
char[30]: notes

5 System Architecture

5.1 Architectural Design

Our Audiovisual Gaming Software is divided into two main modules: *Network* and *GamePlay* modules. While *Network* module mainly focuses on the network communications between server and clients, video streaming, compression and filtering, *GamePlay* module supports various games with the help of designed interface.

Network is the key module of the system which is separated into four sub-modules: *Streaming*, *Filter, Compression* and *NetworkSettings*.

GamePlay module is responsible for connecting with game executables designed for this software. There are going to be many games supported by our product. Therefore, in order to link these games to the software, we need a powerful interface in this module. There are two sub-modules of *GamePlay*: *GamePlayInterface* and *GamePlaySettings*.

One of the most crucial parts of our software is *compiled Java games* supported by our software. By the help of those, people may play enjoyable games during audiovisual conversation. Any game communicating with *GamePlayInterface* module with correct interface messages are supported by our software. As default game in our software, we include Taboo game to be played.

The overall scope of the project is given on *Figure1*.

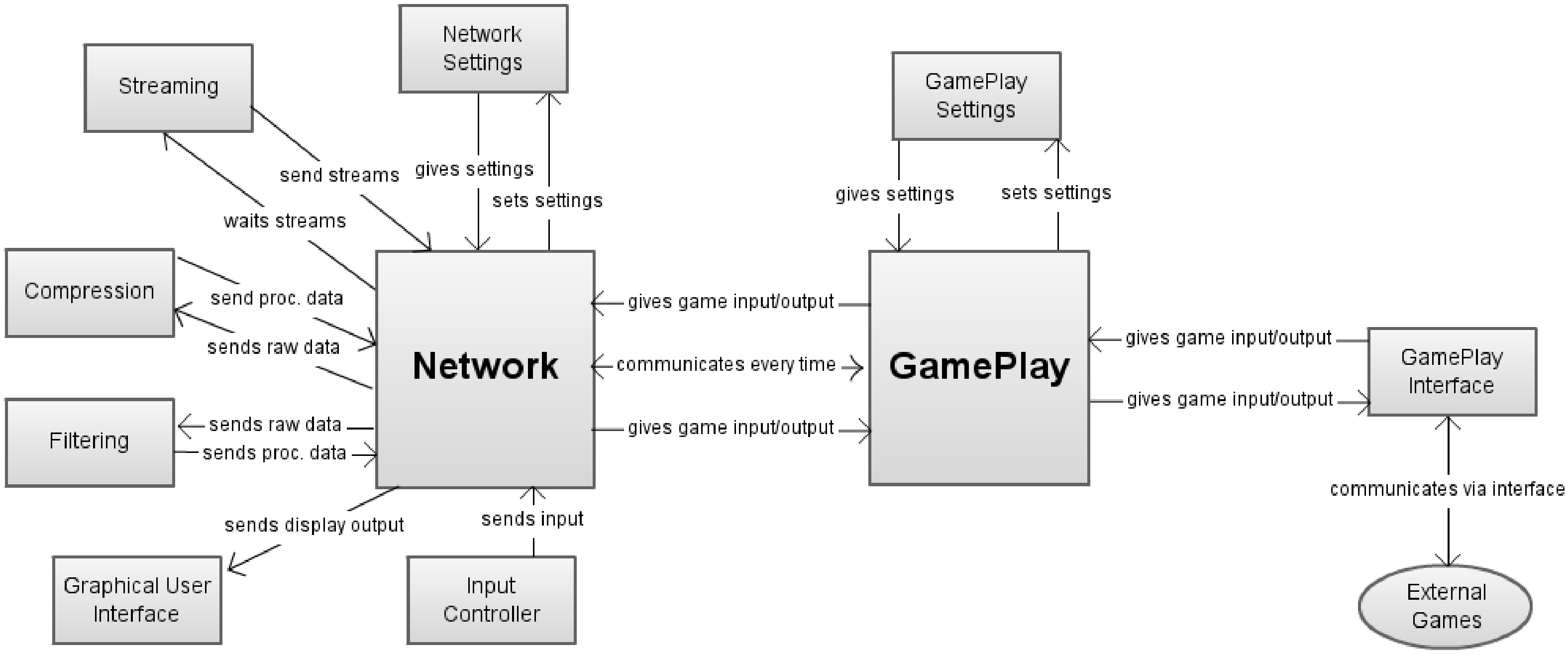


Figure 1: Architectural Context Diagram

5.2 Description of Components

5.2.1 Network Module

Definition:

The purpose of this main module is to constitute a skeleton for our software. Network Module is one of the two main modules in the system. It executes some crucial operations like filtering, streaming, compressing and communicating with the user. Network module also uses these operations properly in order to get the system synchronized in games and audiovisual conversations. Network module is divided into five sub-modules in order to be executed less error prone, since we know that traditional design of system components are more prone to system errors.

Responsibilities:

The main responsibility of the network module is to get the users to communicate with each other via network connection. In order to reach that aim, TCP/IP protocols and communication libraries must be used properly to get desired results. Network module must be designed so well that the disconnections between users must be trivial in numbers. This reliability property is vital in our software, since we propose a new type of enjoyable activities. Therefore, we cannot get the users to be nervous during use of the program.

The second responsibility of the network module is to provide the users with audiovisual conferencing ability. This property is the key property of our software. Without audiovisual abilities, we could not say that we propose a new generation gaming network.

The last responsibility of the network module is to get users and the software connected via designed graphical user interface.

Constraints:

In order to achieve the main responsibility of the module, which is providing reliable platform to users, we need to put a constraint on the number of users. As we know that, P2P connection between large number of users is problematic. For example, if we consider the game of “The Age of Empires II”, we can see that only 8 people are supported to play the same game simultaneously. Likewise, in our project, we put the connection limit as 6, which is smaller than the game's, since audiovisual connection is needed to be established.

In order to achieve the second responsibility of the system, we need to use some compression techniques in our software in order to support many users simultaneously, which leads the loss of quality in the software.

Composition:

The module is divided into four sub-modules to make the software less error prone.

Uses/Interactions:

Since the network module is the main module and we consider this module as skeleton, we can think that the network module is in interaction with the other main module *GamePlay,* its own sub-modules and the users.

Resources:

This module uses mostly network resources in order to establish a communication. Also this module requires the frequent use of CPU in order to achieve compression and filtering tasks.

Processing:

This module is not involved in direct processing of data. We consider this module as skeleton and general interface of network sub-modules and users. The member functions are included in Section 7 of this document.

5.2.1.1 Compression Sub-Module

Definition:

The purpose of this sub-module is to minimize the data before sending it to the remote computers. The module produces small sized packages of data.

Responsibilities:

The main responsibility of this sub-module is to reduce the amount of data, before sending it through the network without losing too many details. This sub-module is one of the vital pieces of the system with regards to response/execution times of software. Namely, the load on the network the video quality, how many people could be handled on the system is directly dependent on the compression sub-module. The data flows through the network should be packed before being sent. All the data (images, chat data and the data coming from the *GamePlay* module) is packed in this sub-module. To provide the efficient flow of data, it is important to process the data in little time and reduce the size. Also the synchronization to be provided and all the compressed data should be sent in correct order. In order to do this, the packages created by the compression sub-module are numbered. The numbering system is also a safety precaution against the failures of receiving packages. All the clients process the same numbered packages at the same time. In case of one of the clients received the packages later than others and there are more than one package to be processed, it processes the data which is being processed by the other clients, which provides the system with synchronization, even if there are some latencies or faults in the network.

Constraints:

The compression sub-module is directly related to the compression algorithms. The main constraint of the sub-module is the compression ratio. The compression ratio is the ratio that we will minimize our data accordingly. In this system, two algorithms will be used which are namely MPEG and H 261. The MPEG format includes compressing the images with a ratio of 30:1 and H 261 compresses with ratio 50:1. On the other hand, as the system uses filters, the data amount of the images will be reduced too. Therefore, after compression, the images will be compressed more than those ratios. The second constraint is that the compression process should not take too much time, and the images ought to be sent in a suitable duration. The compression algorithms work on the client sides and on their own machines, so that the host is not loaded to compress the data coming from the clients. In case of too much latency is caused by the processes the quality of and the size of the images may be reduced to decrease the computation time.

Composition:

This sub-module is not divided into smaller sub-modules or components it consist of a main compression module and all the work is done in this module.

Uses/Interactions:

The compression sub-module compresses the data and produces packages of compressed data. Before the compression module process the image data is passed from filtering sub-module to reduce the data size by means of noises and tiny details in the image. These processes can be called as the encoding period processes. After the encoding period is finished, the encoded data is sent through the network. Then, in the receivers' computers, decoding part is started. The compressed image should be decompressed and a fine quality image should be displayed on the users screen. The decompressed data is a basic quality image because of the loss of details during the compression. In order to display the images in a finer quality than the basic image, the images are again filtered in the receivers' computers; therefore, the data which comes as the streams is first processed by the compression sub-module for decoding and then, it is sent to the filtering sub-module for further process. Those two sub-modules work in collaboration with the compression sub-module.

Resources:

The resources used by this module are the processors used to handle the compression. Since the packaged data is sent and it is not saved in computer, not too much memory space is required. In addition, the encoding and decoding libraries of MPEG format and H261 format are used. During the compression, the problems could occur on the decoding and encoding periods. Another race condition will be process speed that may differ in the different client computers. Being aware of the heterogeneous system, we are handling the images that flows on the network that are basic quality images not loading the processor too much.

Processing:

There are two algorithms which can be used in the system: MPEG and H 261. The details of these algorithms are given in section 7 of the document.

5.2.1.2 Streaming Sub-Module

Definition:

The streaming sub-module is responsible for sending and receiving data and providing the communication of the host and the clients. The data flow on the network is done via streams. Image data, gaming module data, chat data and also voice data are divided to streams and those streams are sent and received by the host and the clients.

Responsibilities:

The streaming sub-module is responsible for the data flow on the network. The data which is processed by the compression sub-module is sent to the streaming sub-module as packages after being compressed. This sub-module provides the communication between the users by means of any kind of data that is present in the system. The streaming module is also responsible for the synchronization of the system. The packaged data should be sent in the correct order in order to provide sharing without too much latency.

Constraints:

The bandwidth limitations of the network are the main constraint of the streaming sub-module. The bandwidth limitations may change in different network systems. In our system, we plan to handle at most 6 people at same time. In accordance with bandwidth load on the system, the user number that system handles may change due to the limit. The image quality changes with respect to the video device used in the system. To fit the in the bandwidth limitations, images may be reduced in size before being sent or the quality could be decreased by using some filters. However, that kind of operations brings complexity in the process, and increases the processing time of every frame. Moreover, the quality of the images reduces too much. To accomplish the system's consistency before losing too much data our system may have to handle less users in such a case.

Composition: The streaming sub-module does not have smaller sub-modules or components.

Uses/Interactions:

The streaming sub-module belongs to network module and it works in collaboration with the compression and filtering sub-modules. Our system is a multi-layered multi-casting streaming system. The data is firstly divided into different layers and after that all those layers are compressed by the compression sub-module. The compressed layers are then sent to the receivers by the streaming module. Finally, in the decoding part, in the receivers' computers, the streams are handled by the compression and filtering modules.

Resources:

The streams are created from the data of the chat system, gaming module, video and also the other necessary information needed to provide system synchronization. To handle the multi-layered multi-casting streaming, the C# streaming libraries will be used.

Processing:

The multi-layered multi casting streaming is used to send streams to more than one receiver at the same time. In our system, the host receives all the inputs from all the clients and sends all the coming inputs to other clients, which means that the host is the one accumulating all the data and serving it to clients. As our system is a heterogeneous system, which means that the computer resources of every user is different. To ensure that the system will handle the data the images, the basic quality of the images are sent to all the users with the necessary information to increase the quality by means of difference frames and filter information. The layers consist of this information to increase the quality one step further, if the computation power of the system is enough to handle all the filters in time that will not disrupt the synchronization with the other users. The details are given in section 7 of the document.

5.2.1.3 Filtering Sub-Module

Definition:

The purpose of the filtering sub-module is to reduce the size of the data produced from the videos by using some techniques and algorithms before compression and streaming.

Responsibilities:

The filtering sub-module is responsible of reducing the noises in the video and the data amount on the system and increasing the quality of the basic images received from sender on receivers' computers.

Constraints:

According to the processor power and the complexity of the filtering algorithm, the process time in filtering sub-module changes. As the system should work in real time, the complexity of the algorithms should not be in a level to cause latencies in the system. As a result, after testing the filtering sub-module, some of the filtering algorithms may be changed to stick to the time complexity.

Composition:

The filtering sub-module does not have any smaller sub-modules but it uses de-blocking filter, down-sampling and quantization algorithms. The de-blocking filter is applied to blocks in decoded video to improve visual quality and prediction performance by smoothing the sharp edges which can form between macro blocks when block coding techniques are used. The filter aims to improve the appearance of decoded pictures. Down-sampling could be done for every data which helps to represent the data in smaller sizes.

Uses/Interactions:

The filtering sub-module works in corporation with the filtering and streaming sub-modules. The filters are processed on the image before and after the compression period. In the encoding process, the data is filtered to reduce the size and then it is sent to the compression and filtering sub-modules. In the receivers side, the filtering module works on their own. The received data is passed from filters, after decoding is done to increase the quality of the images.

Resources:

The filtering algorithms have mathematical computations generally, and they are done in ALU of the processors. Therefore, the higher the computational power of the processors the faster the filtering operations is done. As the filters process the images frame by frame, the operation does not require too much memory use or an external database.

Processing:

The filtering sub-module uses the de-blocking filter. The details of filter and other techniques are listed in Section 7 of the document.

5.2.1.4 Network Settings Sub-Module

Definition:

Network Settings module includes the settings for network connection between the system and remote users.

Responsibilities:

This sub-module is responsible for applying to the system some network choices like compression detail ratio and maximum number of users that can connect.

This sub-module has to cooperate with the other sub-modules of the network module.

Constraints:

No constraints exist.

Composition:

No sub-modules exist.

Uses/Interactions:

This sub-module is in interaction with other sub-modules of *Network* module, and in direct relationship between the settings of whole main module.

Resources:

This sub-module does not need any big amount of system resources.

Processing:

This sub-module neither does nor needs any specific algorithms. Only set and get methods are defined. Member functions are described in Section 7 of the document.

5.2.2 GamePlay Module

Definition:

This module is the one of the main modules of the system providing the software the ability of executing many multi-user turn-based games. Therefore, this module includes a specific interface, a setting module, many supported games and interface functions for network connections.

Responsibilities:

The main responsibility of this module is to get the system to execute many supported external Java games. In order to reach that aim, GamePlay module consists of a fast interface having 10-12 interface functions.

The second responsibility of this module is to get the game data transferred from external games to the other remote computers via Network main module in order to arrange turns in turn-based games.

The last responsibility of this module is to embed downloaded games to the software, which help the system to execute the game properly.

Constraints:

The main drawback of this interface design is that the software could not execute the Java games not having interface commands in it. Therefore, in order to operate properly, it is a must for games to connect to the system via designed interface.

The second drawback is that this module supports only one game to be played at the same time. If a user does not end a game, he/she cannot start a new one.

Composition:

This main module has two sub-modules which inherits some methods of this main module.

Uses/Interactions:

The module interacts with external games via designed interface, and communicates with *Network* module via member functions. All the game data must be sent to Network module in order to be delivered.

Resources:

The module mostly uses CPU resource in order to execute the external Java games. However, the amount that is needed is not so much. Therefore, any computer could easily execute this module's operations.

Processing:

Since the module's aim is mainly to be the part of the skeleton of software, no specific algorithms are used directly in this module. Member functions are defined in Section 7 of this document.

5.2.2.2 GamePlaySettings Sub-Module

Definition:

GamePlaySettings module includes the settings for network connection between the system and remote users.

Responsibilities:

This sub-module is responsible for applying game choices to the games that are to be played. There are some game choices like sound and visual options to be considered.

Constraints:

No constraints exist.

Composition:

No sub-modules exist.

Uses/Interactions:

This sub-module is in interaction with other sub-modules of *GamePlay* module, and in direct relationship between the settings of whole main module.

Resources:

This sub-module does not need any big amount of system resources.

Processing:

This sub-module neither does nor needs any specific algorithms. Only set and get methods are defined. Member functions are described in Section 7 of the document.

5.2.2.3 GamePlayInterface Sub-Module

Definition:

GamePlayInterface module includes the interface functions that a game uses in order to communicate with the software. By the help of this interface, the system could support many turn-based external Java games.

Responsibilities:

The main responsibility of this sub-module is to connect external games via designed interface correctly. If this sub-module cannot be reliable and produces some errors, the external games could not be executed properly. Moreover sometimes, synchronization problems may occur.

Constraints:

In order to reach this interface aim, our sub-module includes basic 10-12 functions to be used by games. If a game wants to communicate with our software, the game must use these command line functions properly.

The second constraint of this module is that only one game can interact with the software via this interface

Composition:

No sub-modules exist.

Uses/Interactions:

This sub-module is in interaction with other sub-modules of *GamePlay* module, and in direct communication with the external Java games.

Resources:

The sub-module mostly uses CPU resources to function properly. However, no extensive use of CPU is needed, which makes our software portable to any kind of standards of system resources.

Processing:

This module uses a standard command line parser in order to communicate. This parsing algorithm is really simple and is not computationally complex. Which member functions and external interface commands that the sub-module have is described in Section 7 of the document.

6 User Interface Design

6.1 Overview of User Interface

For our software, the type of user interface that will be implemented is a graphical user interface that will provide users with effective operation on the software. While designing the GUI, several criteria are taken into consideration to increase the usability and user friendliness of the GUI as much as possible. For instance, the system should always keep users informed about their state through appropriate feedback written in a suitable part of the GUI. Moreover, in case of an error occurs, GUI helps users to recognize, diagnose and recover from errors. In addition to this a help documentation will be available through the GUI menu. Additionally, system uses the platform conventions, i.e., the system does not oblige users to wonder whether different words, situations, or actions mean the same thing.

The system functions designed to answer all the needs of the users are listed below. They are mainly grouped into two: One group of functions stands for general operations, and the other includes the system functions.

6.1.1 General System Functions

- ***Select Game***

Users are able to select the games that have been embedded into system already. The system function *Select Game* initializes the system state according to the chosen game. The properties such as, the number of users, the game board interface, etc, are set depending on selected game via the *Select Game* system function.

- ***List Existing Conversations***

A user, in case of not he/she does not prefer to create his/her conversation, can join existing conversations. The *List Existing Conversations* system function displays the sessions that have already been created.

- ***Start Conversation***

It is used to start a conversation. User using this functionality turns out to be *Host.*

- ***Join***

User may prefer to join an existing game instead of creating ones on her/his computer. *Join* system function handles that case during system progress.

- ***Invite***

Additional users may be invited to an existing conversation. The invitation can be sent by the host to the users who have not joined any game session yet.

- ***Respond to Invitation***

Invited user may or may not attend to the game to which she/he has been invited. *Respond to Invitation* system function returns the information whether or not the invited user will join the game.

- ***Set Minimum Number of Players***

Sets the required number of players value to predetermined default value.

- ***Get Minimum Number of Player***

This system function returns the default number representing the minimum number of players in order for the host to start the game.

- ***Set Maximum Number of Players***

By sending invitations to users or accepting the demands of the users who wants to join the game, the maximum number of the players can be changed. *Set Maximum Number of Players* system function handles the situation.

- ***Get Maximum Number of Players***

This system function returns the current maximum number for a particular conversation.

- ***Open up Camera View Window for the User***

For each newcomer user a sub-window where the user's camera view is displayed is opened up. The size and orientation of this window is determined according to the number of users who have joined the game at that time.

- ***Leave Conversation***

Users, except the host, can leave the session they have been joint. Hosts are not allowed to leave the session unless they are not received the approval from the other participants.

More detailed explanations given in the related parts.

- ***End Conversation Demand***

In case of the user who wants to leave the conversation is the host for the current conversation, he/she has to make the others know that the session will end. The *End Conversation Demand* system function operates together with another system function, namely *Respond to End Conversation Demand.*

- ***Respond to End Conversation Demand***

Respond to End Conversation Demand system function returns the information whether or not participants approved the host's demand to end the conversation.

- ***Start Game***

After the conversation is established between all participants by joining to existing conversation or accepting the invitations, users may start to play. *Start Game* system function can only be used by the *Host* of conversation.

- ***Respond to Start Game Demand***

Before the game is started by the *host*, the *clients* respond him/her to give the information whether they will join or not. Depending on the result of this system function, a new game is started or not.

- ***End Game***

End Game system function enables the host to terminate the current game. This system function requires the approval of the end game demand by the clients.

- ***Respond to End Game Demand***

Like the *Respond to Start Game Demand* case, this system function also operates to inform the participants, in case the host demands to end the current game. The current game is ended according to the return value of this function.

- ***Send Chat Message***

There will be an area visible to all users, via which all the players can chat each other. *Send Chat Message* function provides group based communication in written case.

- ***Send Personal Message***

Users are capable of sending messages only to the ones that they choose. A call to *Send Personal Message* function prompts the chat feature for only the chosen users.

- ***View Chat Diary***

Logs of chats are kept by the system. The public logs can be accessed by all the users of a certain session, however, the personal chat logs are made visible only to the participants of that conversation, as it is supposed to be.

- ***Show Chat Details***

Some details, such as, when the conversation was done, who were the participants, etc, are kept by the system and these data are obtained via the *Show Chat Details* function call.

- ***Delete Chat***

The logs of chats are deleted when demanded via the *Delete Chat* system function.

- ***View About Us***

This parts includes information about our group **'Eggs on the Door'**, members, and the project.

- ***View Help Contents***

A manual will be made available to users to help them while using the software.

- ***Download Game***

This system function exists for the users to get the executable of the software.

- ***Communicate with Us***

Via this system function, the users communicate with us, the members of Eggs on the Door.

- ***Learn Self IP***

Undertaking the task, the host may need to know his/her IP to supply some users with this data and make them connect to his/her conversation. The function call *Learn Self IP* gives this opportunity to the users in some cases, if they demand this.

- ***Find in Text***

Users can search their logs and chats via *Find in Text* system call.

6.1.2 Taboo-Related System Functions

Since we are going to visualize our software on Taboo game, we indicate some system functions that are required to solve the Taboo- related issues. The following ones are called only in case of the chosen game is Taboo.

- ***Change Current Card***

Users are allowed to change the cards that they want to skip. Pressing the *change card* button calls this system function.

- ***Show Remaining Time***

This system function is periodically called after the stopwatch is set by a user, which indicating that the time is started for the player trying to explain the word.

- ***Pause Stopwatch***

In case of users press the pause button, this system function is called in order to keep the remaining time for the user.

- ***Resume Stopwatch***

When the pause button has already pressed ones, meaning that the time is paused for that player's turn, pressing that button again calls *Resume Stopwatch* system function to start the stopwatch where it has been stopped.

- ***Mark Card as Correct***

When one of the teams correctly guesses the word that one of their players has been trying to depict that card is needed to be marked as correct in order to be added to the points of the team.

- ***Mark Card as Taboo***

In case of the player depicting the word written in the current card, uses one of the taboo word accidentally, the *Mark Card as Taboo* system function is called by pressing *taboo* button.

- ***Activate Drawing Mode***

When the players turn is to depicting the word by drawing, the user presses *draw* button, calling the *Activate Drawing Tool* system function.

- ***Activate Puppet Performing Mode***

When the players turn is to depicting the word by using the puppet, the user presses *puppet* button, calling the *Activate Puppet Performing* system function.

- ***Activate Default Mode***

By pressing *default* button and thereby calling the *Activate Default Mode* system function, the player exits the puppet or the drawing mode.

- ***Drag Puppet***

After activating puppet performing mode, the *Drag Puppet* system function is called when the puppet is moved by the player.

- ***Draw***

Draw system function is called in order to use the functionality in drawing mode.

6.2. Screen Images

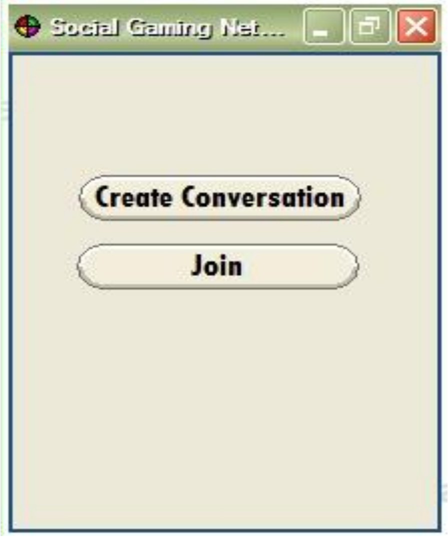
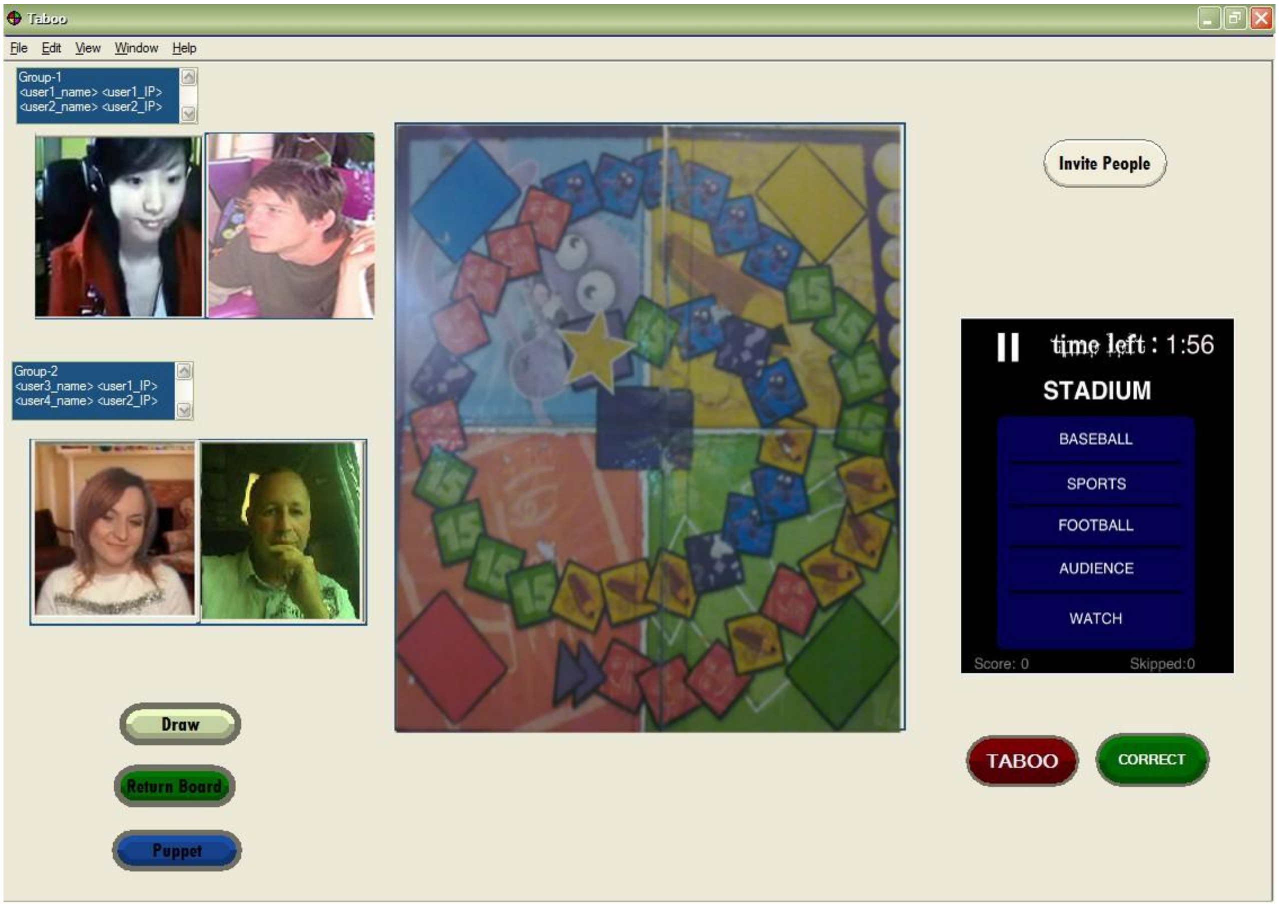


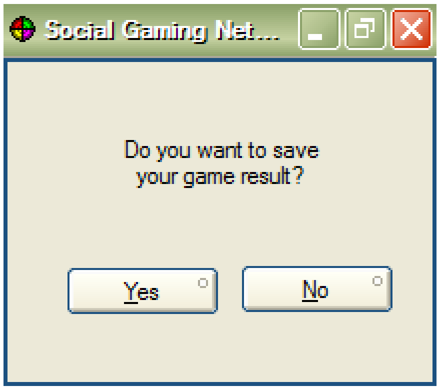
Figure 28: Initial window



Group-1
<user1_name> <user1_IP>
<user2_name> <user2_IP>

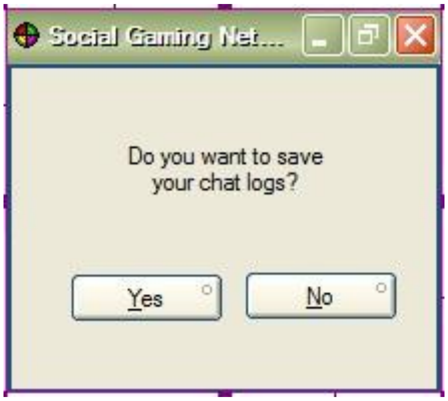
Group-2
<user3_name> <user1_IP>
<user4_name> <user2_IP>

Figure 29: Taboo Game GUI



Do you want to save your game result?

Figure 30: Save Game Results GUI



Do you want to save your chat logs?

Figure 31: Save Chat Results GUI

6.3. Screen Objects and Actions

By system functions expressed above the GUI buttons are controlled. In that sort, the objects composed of the GUI parts.

7 Detailed Design

7. 1 Network Module

Network Module Attributes:

- **Ip:** Ip is an integer which keeps the is of the user
- **user_name:** User name is a string which keeps the user name information
- **func_state: EKSİK**
- **no_of_players:** Is the number of players which will join in the game that integer is kept to arrange the user interface and the gaming module accordingly.
- **active_players:** Active players is the integer to keep the number of players currently active on the system.
- **Current_game_id:** Current game id is the integer which is kept to keep track of the games currently played.

Network Module Methods:

- **int GetPlayercount():** Get player count is the method which returns the number of active players.
- **int getPlayerOrder(int player_id):** Get player order method returns the integer value of the order which is the user plays in the game.
- **bool setPlayerPositions(string string):** set player positions method sets the positions of the players on the game board according to the string value (which is the current order) it takes as the argument and returns true if the operation is successful false if it fails.
- **bool setGameWİndow(int coord_x , int coord_y , int width , int height):** Sets the position of the game window on the user interface and returns true if it operates successfully false otherwise.
- **bool startGame():** Start game method starts a game returns true if it is successful false otherwise.
- **bool cancelStart():** This method cancels the start operation which is explained above returns true if it is successful false otherwise.
- **string getRemoteActivity(int player_id):** This method gets the activity of the other players playing the game and invokes other methods. EKSİK
- **bool sendActivity(string activity):** send activity method sends the activity of the player to the other players according to the string it takes as the argument. There are different activities defined in the system.
- **bool EndGame():** Ends a game which is currently played returns true if operation is successful false otherwise.
- **bool startConversation():** starts a conversation with the other users returns true if the operation is successful false otherwise.
- **bool endConversation():** ends the conversation with the other users returns true if the operation is successful false otherwise.
- **bool join(ip host_ip):** join operation takes an ip value and creates a connection with that host (owner of the ip) returns true if the operation is successful false otherwise.
- **bool invitePlayer(ip player_ip):** takes an ip value as the argument and sends an invitation to join the conversation or game to the owner of the ip.
- **bool leaveConversation():** if a user wants to leave a conversation this method is called and the user is deactivated in the conversation window and the connection is closed.

- **bool respondInvitation():** when an invitation is received by a host the user can choose to join or ignore the invitation and this method is called when a user is responded to an invitation. The host is informed by that method. This method returns true if the operation is and successful false otherwise.

- **bool respondLeaveConversation():** When a user wants to leave a conversation and calls the leave conversation method in the host side this method is called and the host responds to that action and closes the connection with that user. This method returns true if the operation is and successful false otherwise.

- **bool disableCamera():** disables the webcam. This method returns true if the operation is and successful false otherwise.

- **bool EnableCamera():** enables the webcam. This method returns true if the operation is and successful false otherwise.

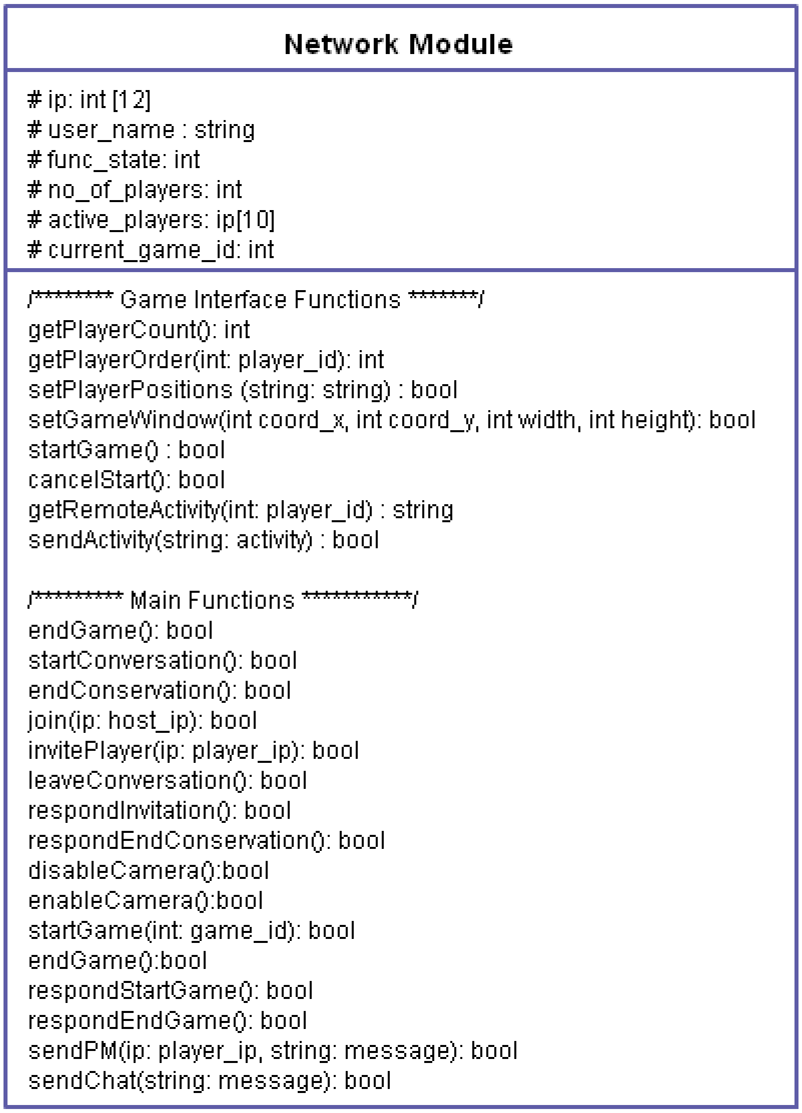
- **bool startGame(int game_id):** starts a chosen game according to the game_id. This method returns true if the operation is and successful false otherwise.

- **bool respondStartGame():** respond start game is the method which is invoked when the host called the start game method in the client sides the this method is called and the game is started if all the users are ready to play. This method returns true if the operation is and successful false otherwise.

- **bool respondEndGame():** This method is called when the host calls the end game method the clients call that method to respond the end game action. This method returns true if the operation is and successful false otherwise.

- **bool sendPM():** EKSİK This method returns true if the operation is and successful false otherwise.

- **bool sendChat(string message):** That method gets the message to be sent as a string argument and send it to the host after processing the message is shown on the screen. This method returns true if the operation is and successful false otherwise.



```
Network Module

# ip: int [12]
# user_name : string
# func_state: int
# no_of_players: int
# active_players: ip[10]
# current_game_id: int

/******** Game Interface Functions *******/
getPlayerCount(): int
getPlayerOrder(int: player_id): int
setPlayerPositions (string: string) : bool
setGameWindow(int coord_x, int coord_y, int width, int height): bool
startGame() : bool
cancelStart(): bool
getRemoteActivity(int: player_id) : string
sendActivity(string: activity) : bool

/********* Main Functions ***********/
endGame(): bool
startConversation(): bool
endConservation(): bool
join(ip: host_ip): bool
invitePlayer(ip: player_ip): bool
leaveConversation(): bool
respondInvitation(): bool
respondEndConservation(): bool
disableCamera():bool
enableCamera():bool
startGame(int: game_id): bool
endGame():bool
respondStartGame(): bool
respondEndGame(): bool
sendPM(ip: player_ip, string: message): bool
sendChat(string: message): bool
```

Figure 32: *Class Diagram – Member Functions*

<u>Friend List Attributes:</u>

- **Friend_list : Friend[] :** This attribute keeps the friends of the user which are added as the contacts as a list.

<u>Friend List Methods:</u>

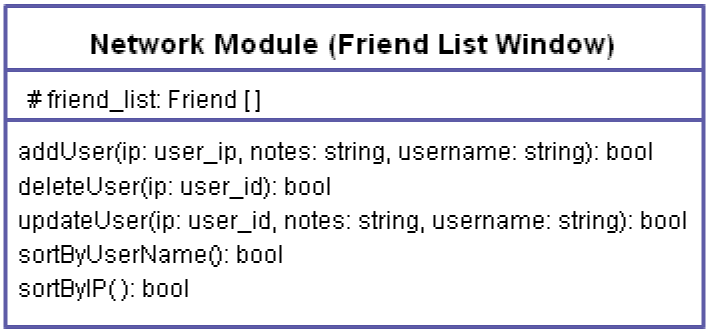
- **bool addUser(ip : user_ip , notes: string , username : string):** adds a friend with its IP and username to the friendlist of the user.

- **bool deleteUser(ip: user_id):** Takes an IP value as the argument and deletes the friend ,which is owner of the ip, from the friendlist of the user.

- **bool updateUser(ip : user_id notes : string , username : string):** Updates the information of an already added friend of the user in the friend list according to the given arguments to the method.

- **bool sortByUserName():** Sorts the friendlist of the user according to the username string values.

- **bool sortByIP():** Sorts the friendlist of the user according to the IP values of the friends in the friendlist.



Network Module (Friend List Window)

```
# friend_list: Friend [ ]
```

```
addUser(ip: user_ip, notes: string, username: string): bool
deleteUser(ip: user_id): bool
updateUser(ip: user_id, notes: string, username: string): bool
sortByUserName(): bool
sortByIP( ): bool
```

Figure 33: *Class Diagram – Network Module System Functions for Friend List*

<u>Logs & Diaries Window Attributes:</u>

- **Game_play_diary :** It is the diary that the information of the played games by the user is kept.

- **Chat_diary :** It is the diary that the logs of the user are kept.

<u>Logs & Diaries Window Methods:</u>

- **diary viewGamePlayDiary():** Returns the diary that the game results are kept.

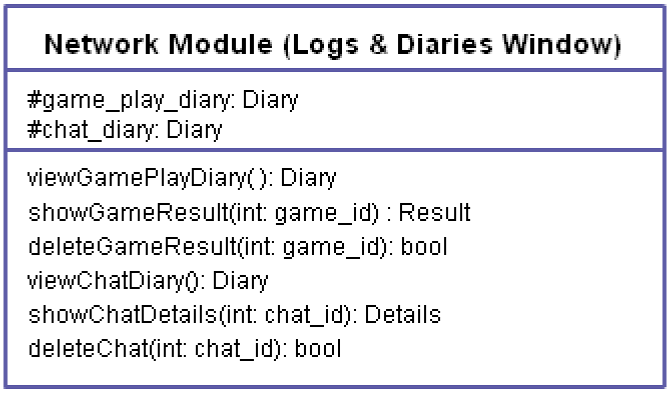
- **result showGameResult():** returns the result kept in the gameResultDiary.

- **bool deleteGameResult():** deletes the game result in the gameResultDiary.

- **diary viewChatDİary():** Returns the chat diary of the user.

- **details showChatDetails():** displays the details in the chat diary.

- **bool deleteChat():** Deletes the chat in the diary



Network Module (Logs & Diaries Window)

#game_play_diary: Diary
#chat_diary: Diary

viewGamePlayDiary( ): Diary
showGameResult(int: game_id) : Result
deleteGameResult(int: game_id): bool
viewChatDiary(): Diary
showChatDetails(int: chat_id): Details
deleteChat(int: chat_id): bool

Figure 34: *Class Diagram – Network Module System Functions for Logs & Diaries*

Miscellaneous Auxiliary Functions Attributes:

No attributes

Miscellaneous Auxiliary Functions Methods:

- **window viewAboutUs():** directs the user to the aboutUs window.
- **contents viewHelpContents():** displays the contents on the user interface.
- **window downloadGames():** directs the user to the window that the currently downloadable games are displayed.
- **communicateWithUs():** directs the user to the page that they can send e-mails to the admins.
- **ip learnSelfIP():** returns the ip of the user.

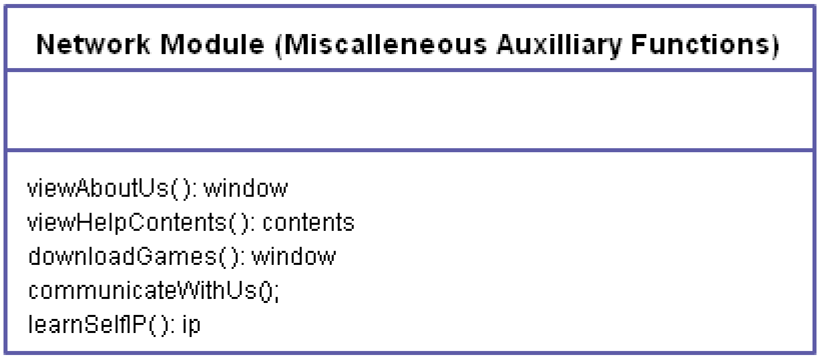


Figure 34: *Class Diagram – Network Module System Functions for Miscellaneous Auxiliary Needs*

7.1.1 Compression Sub-Module

Technical Details

<u>Compression</u>

Compression is one of the most important fields of video processing. Sending the data without losing too much detail is a difficult problem to handle. In our project, as our aim is to design a platform which is going to respond up to 6 people, the less data we send, the less load on the network we have.

Also there are some other constraints to be handled so the ideal compression technique should produce levels of compression rivaling MPEG without objectionable artifacts. These constraints can be expressed in three sentences:

1. Can the system be played back in real time with inexpensive hardware support?
2. Can the system perform under network overload or on a slow platform?
3. Can the system be compressed in real time with inexpensive hardware support?

In the system, according to the bandwidth limitation, the frames we can be sent per second is limited. At that moment, the compression algorithms are needed to send the data in compressed format. There are different compression algorithms which serves different needs. They can be categorized in two forms as lossless and lossy compression algorithms. In our implementation, we will work with the lossy compression algorithms. There are two compression algorithms which will be used in the project in future. Either the one which serves our needs best will be chosen or the both of them may be used in the future.

MPEG

The most of the video compression algorithms takes the video and divides it into images that are not moving and make the compression in a similar manner with the image compression algorithms. In fact, as we are sending those images continuously on the network to more than one people, we need a better compression algorithm. Therefore, compared to the algorithms works, in this manner MPEG compression algorithm is more advantageous. The main advantage is that MPEG algorithm divides the image into different segments. After that, it detects the motion in the images, which means that the segments which do not contain any motion from beginning to the end are not sent in every frame. The motion is detected on the segments, and the parts containing the motion and changes according to that motion are compressed and sent. The technique may be explained with the following image:

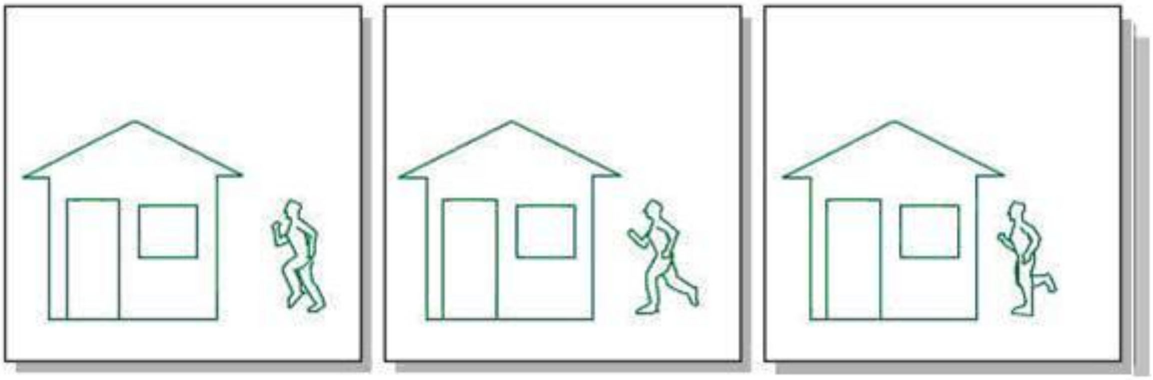


Figure 35: *Segments of video used in MPEG*

The segment which is shown as stripes stands still during the video, so they are still segments and are not needed to be sent in each frame. On the other hand, the man in the frames moves, and the segments which include the man image contains motion. Those motions are detected and the segments containing the motion are sent in each frame.

In our project, the backgrounds of the users during the conferencing are likely to be constant so that compression algorithm is likely to work fine in our situation.

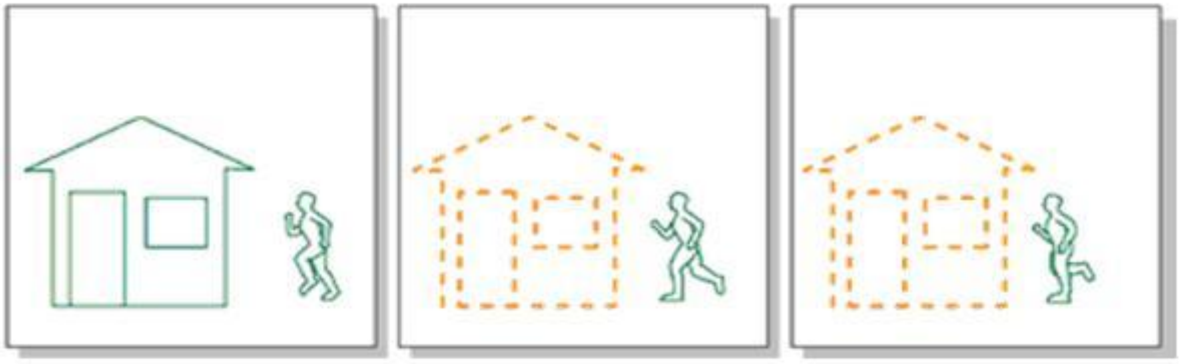


Figure 36: *Motion detection in MPEG*

Here, in the following figure, level 0 data flow diagram of compression is shown, which indicates our steps of processing.

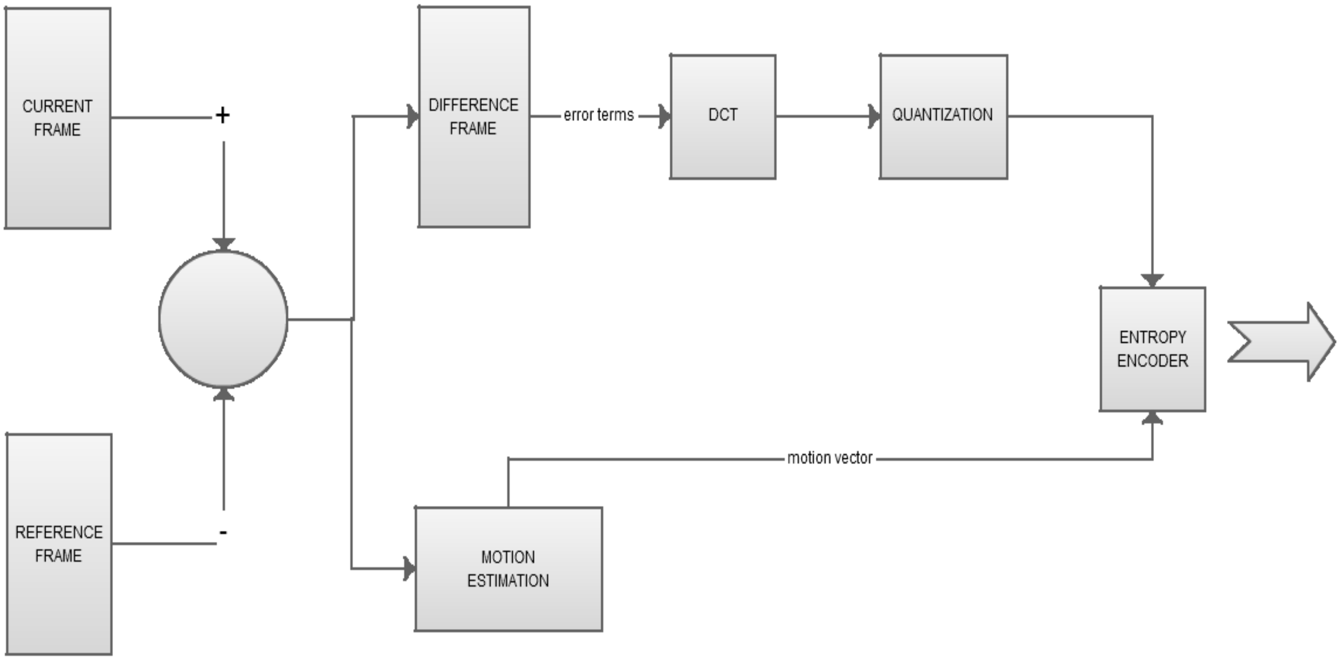


Figure 37: *DFD diagram of compression module level 0*

H.261 / H263

H.261 is video coding standard published by the ITU (International Telecom Union) in 1990. It was designed for data rates which are multiples of 64Kbit/s, and is sometimes called p x 64Kbit/s (p is in the range 1-30). These data rates suit ISDN lines, for which this video codec was designed for.

The coding algorithm is a hybrid of inter-picture prediction, transform coding and motion compensation. The data rate of the coding algorithm was designed to be able to be set to between 40 Kbits/s and 2 Mbits/s. The inter-picture prediction removes temporal redundancy. The transform coding removes the spatial redundancy. Motion vectors are used to help the codec compensate for motion. To remove any further redundancy in the transmitted bit stream, variable length coding is used.

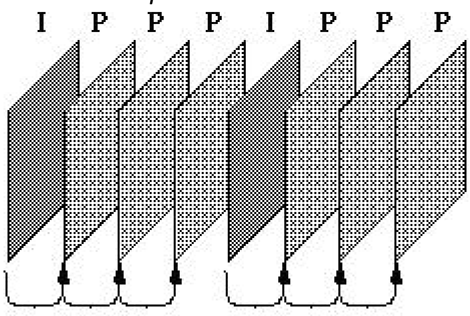
H.261 supports two resolutions, QCIF (Quarter Common Interchange format) and CIF (Common Interchange format).

The video multiplexer structures the compressed data into a hierarchical bit stream that can be universally interpreted. The hierarchy has four layers:

1. *Picture layer:* corresponds to one video picture (frame)
2. *Group of blocks:* corresponds to 1/12 of CIF pictures or 1/3 of QCIF
3. *Macro blocks:* corresponds to 16x16 pixels of luminance and the two spatially corresponding 8x8 chrominance components.
4. *Blocks:* corresponds to 8x8 pixels

The basic approach to H. 261 Compression is summarized as follows:

Decoded Sequence



Frame types are CCIR 601 CIF (352x288) and QCIF (176x144) images with 4:2:0 sub-sampling.

Two frame types: Intra-frames (I-frames) and Inter-frames (P-frames)

I-frames use basically JPEG
P-frames use pseudo-differences from previous frame (predicted), so frames depend on each other.
I-frame provides us with an accessing point.

Protocol Structure - H.261: Video Coding and Decoding (CODEC)

3	**6**	**7**	**8**	**12**	**17**	**22**	**27**	**32bits**
SBIT	EBIT	I	V	GOBN	MBAP	QUANT	HMVD	VMVD

- SBIT - Start bit. Number of most significant bits that are to be ignored in the first data octet.
- EBIT - End bit. Number of least significant bits that are to be ignored in the last data octet.
- I - INTRA-frame encoded data field. Set to 1 if this stream contains only INTRA-frame coded blocks and to 0 if this stream may or may not contain INTRA-frame coded blocks.
- V - Motion Vector flag. Set to 0 if motion vectors are not used in this stream and to 1 if motion vectors may or may not be used in this stream.
- GOBN - GOB number. Encodes the GOB number in effect at the start of the packet. Set to 0 if the packet begins with a GOB header.
- MBAP - Macro block address predictor. Encodes the macro block address predictor (i.e., the last MBA encoded in the previous packet). This predictor ranges from 0-32 (to predict the valid MBAs 1-33), but because the bit stream cannot be fragmented between a GOB header and MB 1, the predictor at the start of the packet can never be 0.
- QUANT - Quantizer field. Shows the Quantizer value (MQUANT or GQUANT) in effect prior to the start of this packet. Set to 0 if the packet begins with a GOB header.
- HMVD - Horizontal motion vector data field. Represents the reference horizontal motion vector data (MVD). Set to 0 if V flag is 0 or if the packet begins with a GOB header, or when the MTYPE of the last MB encoded in the previous packet was not MC.
- VMVD - Vertical motion vector data (VMVD). Reference vertical motion vector data (MVD). Set to 0 if V flag is 0 or if the packet begins with a GOB header, or when the MTYPE of the last MB encoded in the previous packet was not MC.

7.1.2 Filtering Sub-Module

As we are compressing the videos when sending and decompressing them after receiving there are some artifacts occur during these processes. To reduce those artifacts and improve the quality of the video we use de-blocking filter. The filtering part of the video process can be optional or it can be implemented both in the encoding and decoding part of the processing. According to the quality of the videos we had and we needed in our project, we may choose to implement the filters both in the encoding and decoding or we may just use it on the decoding part. In the implementation, we will use the de-blocking filter which is suitable for MPEG and H261 formats.

The De-blocking Filter

The filtering sub-module uses the de-blocking filter.
A de-blocking filter is applied to blocks in decoded video to improve visual quality and prediction performance by smoothing the sharp edges which can form between macro blocks when block coding techniques are used. The filter aims to improve the appearance of decoded pictures.

The de-blocking filter is used both in MPEG format and H261 format. It takes part in both the encoding and decoding process. As the filter is used in both processes, the in-loop effects of the filter is taken into account, and the side effects could be reduced. What filter does is to de-block the data which is divided and packed into blocks during the encoding processes. It uses reference macro-blocks for prediction. During the encoding period, the strength of the filter can be chosen or it can be switched off completely. If the filter is not switched off, the filter strength is chosen according to the coding modes of adjacent blocks, quantization step size, and the steepness of the luminance gradient between blocks. There are luma and chroma planes of each frame. The luma planes are made of the pixels which represents the lightness and the chroma planes are made of the pixels which represents the color value of the frames. The filter operates on both of those planes on the edges of each 4×4 or 8×8 transform block.

Two types of de-blocking are presented in following charts:

Macro Block Coding

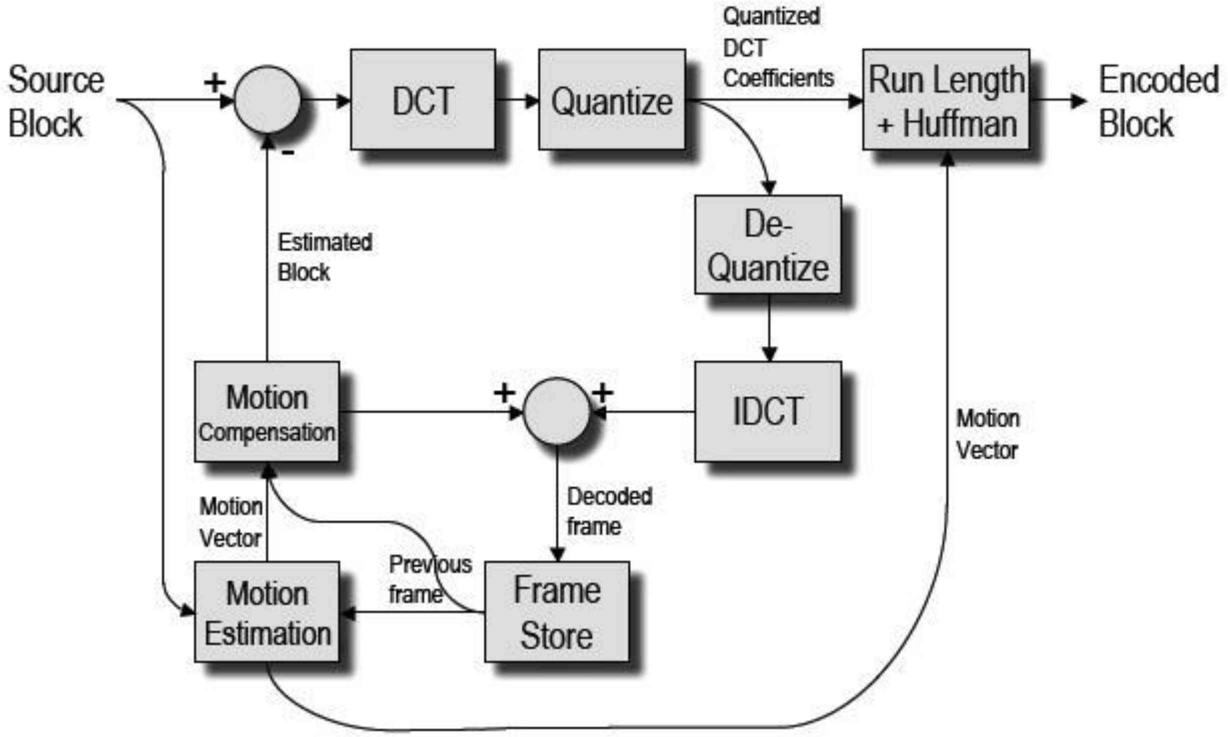


Figure 38: *Inter Block Coding*

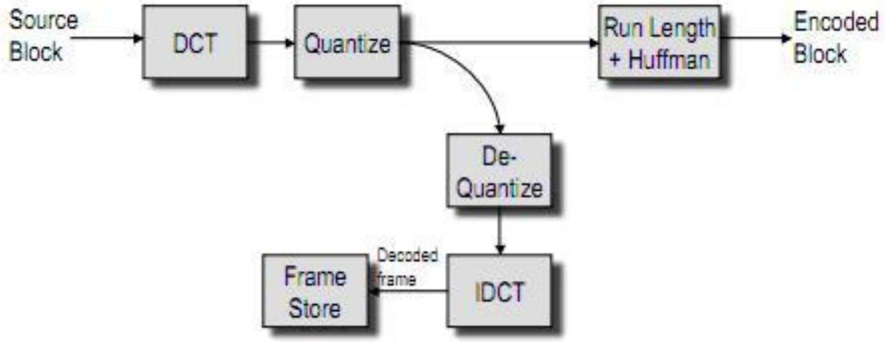


Figure 39: *Intra Block Coding*

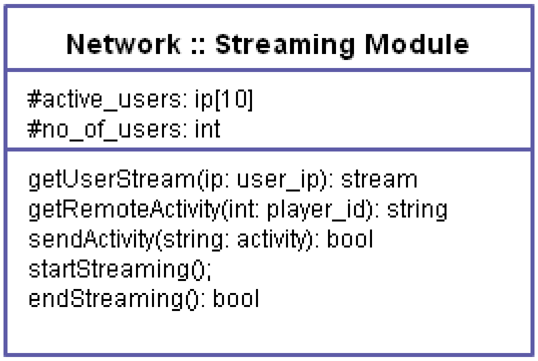
7.1.3 Streaming Sub-Module

Attributes:

- **active_users:ip[10]:** Keeps the ip addresses of the currently active users in an array.
- **no_of_users: int :** Keeps the number of currently active users.

Methods:

- **stream getUserStream(ip: user_ip):**
- **string getRemoteActivity(int: player_id):**
- **bool sendActivity(string: activity):**
- **void startStreaming():**
- **void endStreaming():**



Network :: Streaming Module

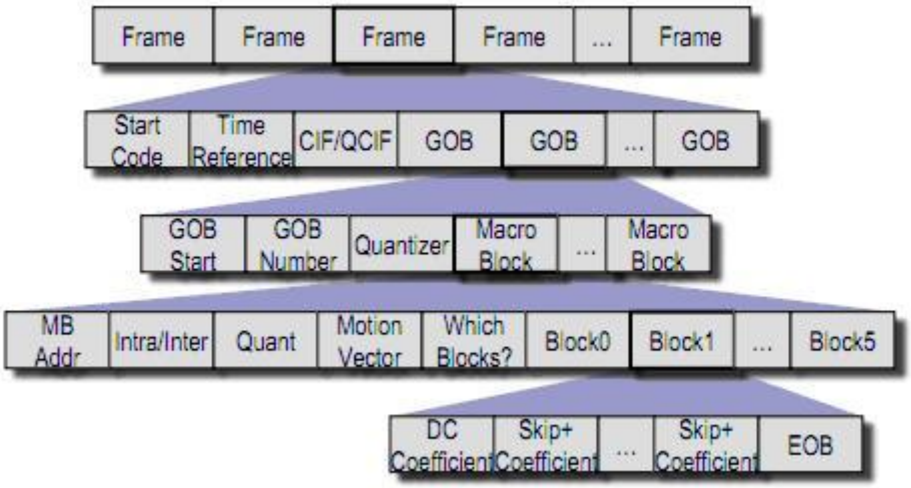
#active_users: ip[10]
#no_of_users: int

getUserStream(ip: user_ip): stream
getRemoteActivity(int: player_id): string
sendActivity(string: activity): bool
startStreaming();
endStreaming(): bool

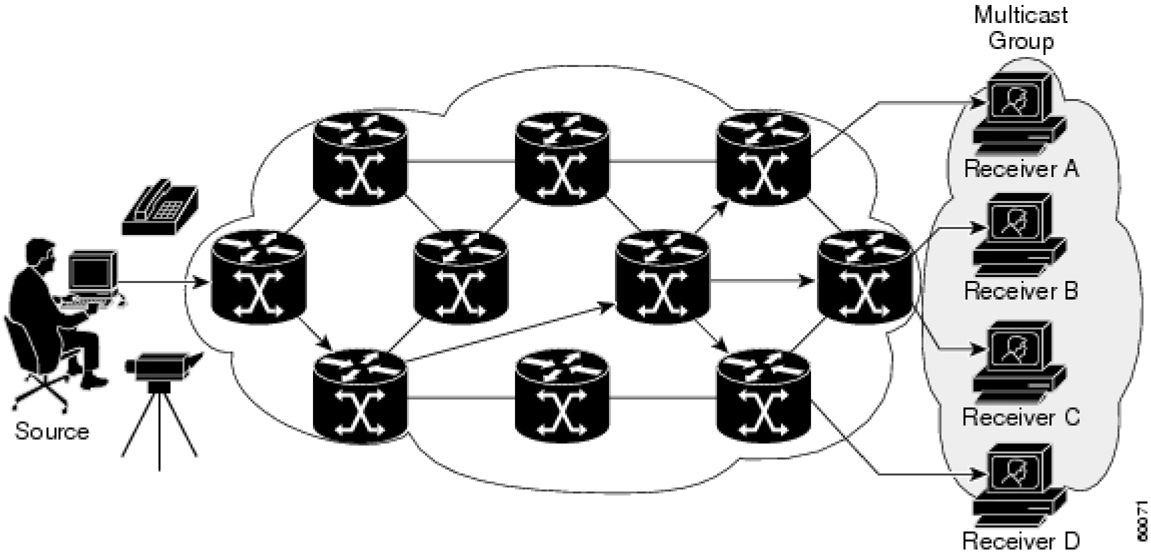
Figure 40: *Class Diagram – Streaming Module*

Streaming Techniques

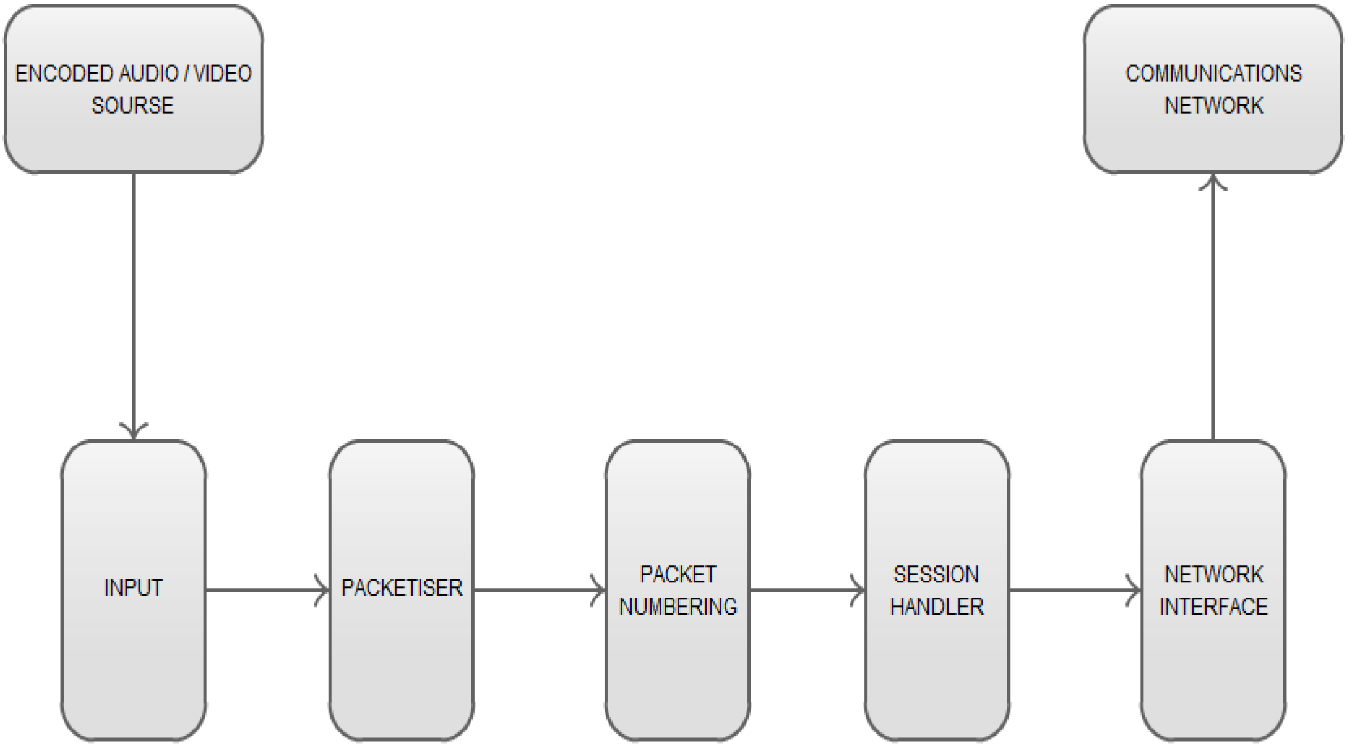
Bit Stream Structure



Layered Multi-cast Streaming



As we will receive videos from the client side in different qualities, we have heterogeneous multi-cast sessions. To come over with that problem, we choose the layered multi-cast streaming method. In layered approach, the raw video is encoded into o set of cumulative (or non-cumulative) layers. The basic layer contains the essential video information with a low basic quality and a set of enhancement layers are used to improve the quality of the received video on client sides. In the MPEG-4 coding, which will be used as our compression format in the project, coding layers can be obtained by applying Temporal scaling, Spatial scaling of fine Granularity scaling. The set of layers are sent over separate multi-cast groups. A receiver joins first the basic layer to obtain the basic video quality and then adapts the rate depending on the capabilities by joining or leaving the enhancement layers. Depending on the set of joined layers, heterogeneous receivers will obtain different video quality. By using that streaming approach we intend to solve the deletion of response time due to the different hardware and software equipments of the users. In addition the commands given by the players during the game the changes on the game interface the outputs of the functions the communication between the players is also sent by the streams. The video sequences and the function outputs will be sent as numbered packages to the receivers. On the receivers side if there are any problems in receiving the package or processing by communicating with the other players and processing the same data package with them the system is tried to be synchronized.



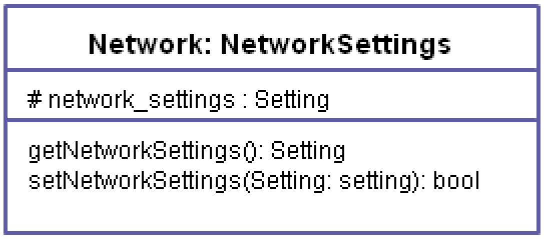
7.1.4 Network Settings Sub-Module

Attributes:

- **Network_settings: Setting :**

Methods:

- **setting getNetworkSettings():**
- **bool setNetworkSettings(Setting: setting):**



Network: NetworkSettings

network_settings : Setting

getNetworkSettings(): Setting
setNetworkSettings(Setting: setting): bool

Figure 41: *Class Diagram –NetworkSettings*

7.2 GamePlay Module

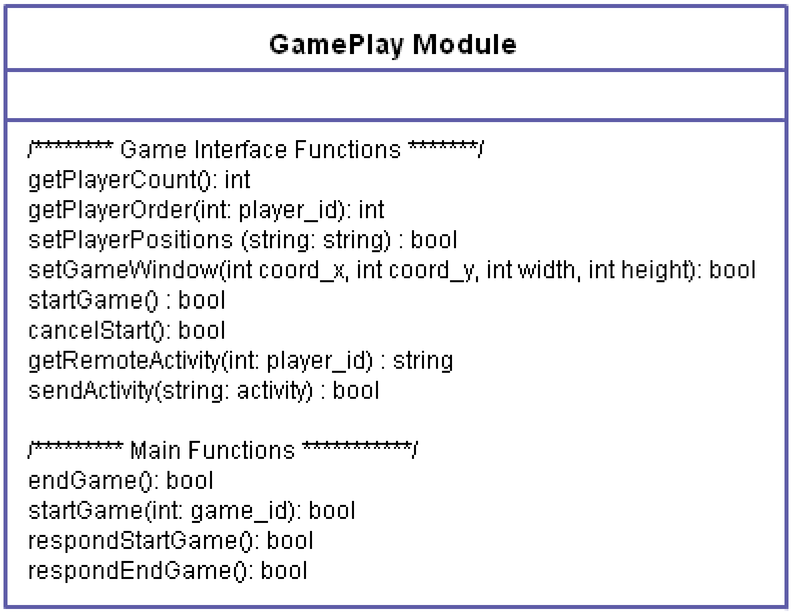
Attributes:

No attribute.

Methods:

- **int getPlayerCount()** : The number of players is a system requirement since the positions of the displays are determined according to this number. This system function returns the number of player to serve the mentioned purpose.
- **int getPlayerOrder(int: player_id):**
- **bool setPlayerPositions(string: string):** The positions of the players on the game window are determined by means of the return value of getPlayerCount system function. setPlayerPosition system function returns false if any exception is encountered.
- **bool setGameWindow(int coord_x, int coord_y, int width, int height):** When the game is started by a user, this system function is called to handle the action.
- **bool startGame():** Users start the game by means of this system call.
- **bool cancelStart():** In case of the user starting the game wants to cancel the game, this system function is called.
- **string getRemoteActivity(int player_id):**
- **bool sendActivity(string: activity):**

- **bool endGame():** When the game is exited, this system function handles the requirements to end the game.
- **bool startGame(int: game_id):** This system function is called when the users press the button start game.
- **respondStartGame():** This system function provides the coordination between GamePlay Module and Network Module in case of an attempt to start a game.
- **respondEndGame():** Similar to respondStartGame system function, this system function provides the coordination between GamePlay Module and Network Module in case of an attempt to end a game.



```
GamePlay Module

/******** Game Interface Functions *******/
getPlayerCount(): int
getPlayerOrder(int: player_id): int
setPlayerPositions (string: string) : bool
setGameWindow(int coord_x, int coord_y, int width, int height): bool
startGame() : bool
cancelStart(): bool
getRemoteActivity(int: player_id) : string
sendActivity(string: activity) : bool

/********* Main Functions ***********/
endGame(): bool
startGame(int: game_id): bool
respondStartGame(): bool
respondEndGame(): bool
```

Figure 42 : *Class Diagram- GamePlay Module*

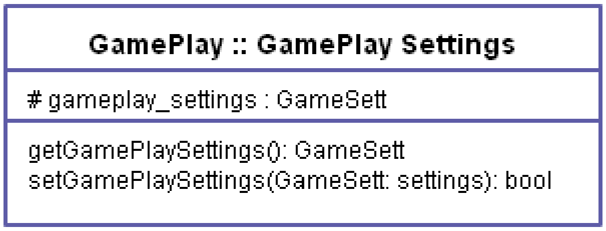
7.2.1 GamePlaySettings Sub-Module

Attributes:

- **gameplay_settings: GameSett:** Keeps the current game's settings in a suitable data structure.

Methods:

- **GameSett getGamePlaySettings():** Returns the gameplay settings for the current game.
- **bool setGamePlaySettings(GameSett: settings):** Sets the currently played game's settings.



```
GamePlay :: GamePlay Settings
# gameplay_settings : GameSett
getGamePlaySettings(): GameSett
setGamePlaySettings(GameSett: settings): bool
```

Figure 42: *Class Diagram- GamePlay Settings*

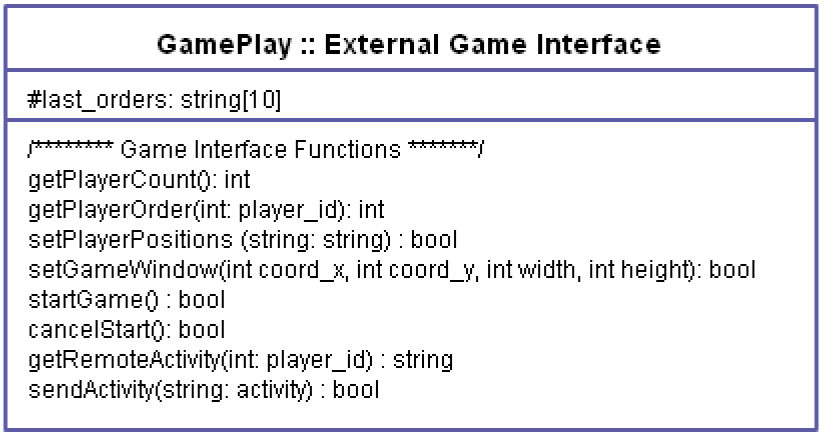
7.2.2 External Game Interface

Attributes:

- **Last_orders: string[10]:**

Methods:

- **int getPlayerCount()** : The number of players is a system requirement since the positions of the displays are determined according to this number. This system function returns the number of player to serve the mentioned purpose.
- **int getPlayerOrder(int: player_id):**
- **bool setPlayerPositions(string: string):** The positions of the players on the game window are determined by means of the return value of getPlayerCount system function. setPlayerPosition system function returns false if any exception is encountered.
- **bool setGameWindow(int coord_x, int coord_y, int width, int height):** When the game is started by a user, this system function is called to handle the action.
- **bool startGame():** Users start the game by means of this system call.
- **bool cancelStart():** In case of the user starting the game wants to cancel the game, this system function is called.
- **string getRemoteActivity(int player_id):**
- **bool sendActivity(string: activity):**



GamePlay :: External Game Interface

#last_orders: string[10]

/******** Game Interface Functions *******/
getPlayerCount(): int
getPlayerOrder(int: player_id): int
setPlayerPositions (string: string) : bool
setGameWindow(int coord_x, int coord_y, int width, int height): bool
startGame() : bool
cancelStart(): bool
getRemoteActivity(int: player_id) : string
sendActivity(string: activity) : bool

Figure 43: *Class Diagram- External Game Interface*

7.3 Activity of System Functions – Sequence Diagrams

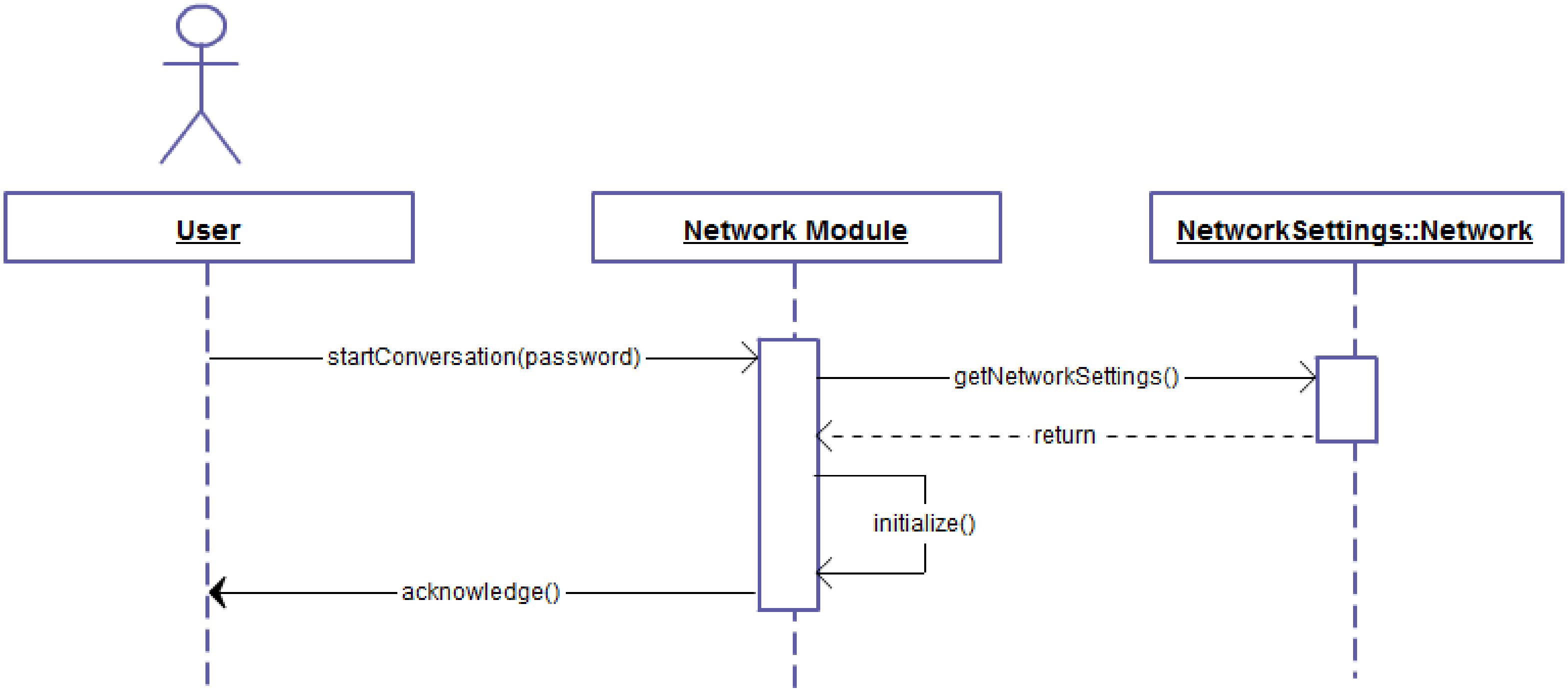


Figure 44: *Start Conversation System Function*

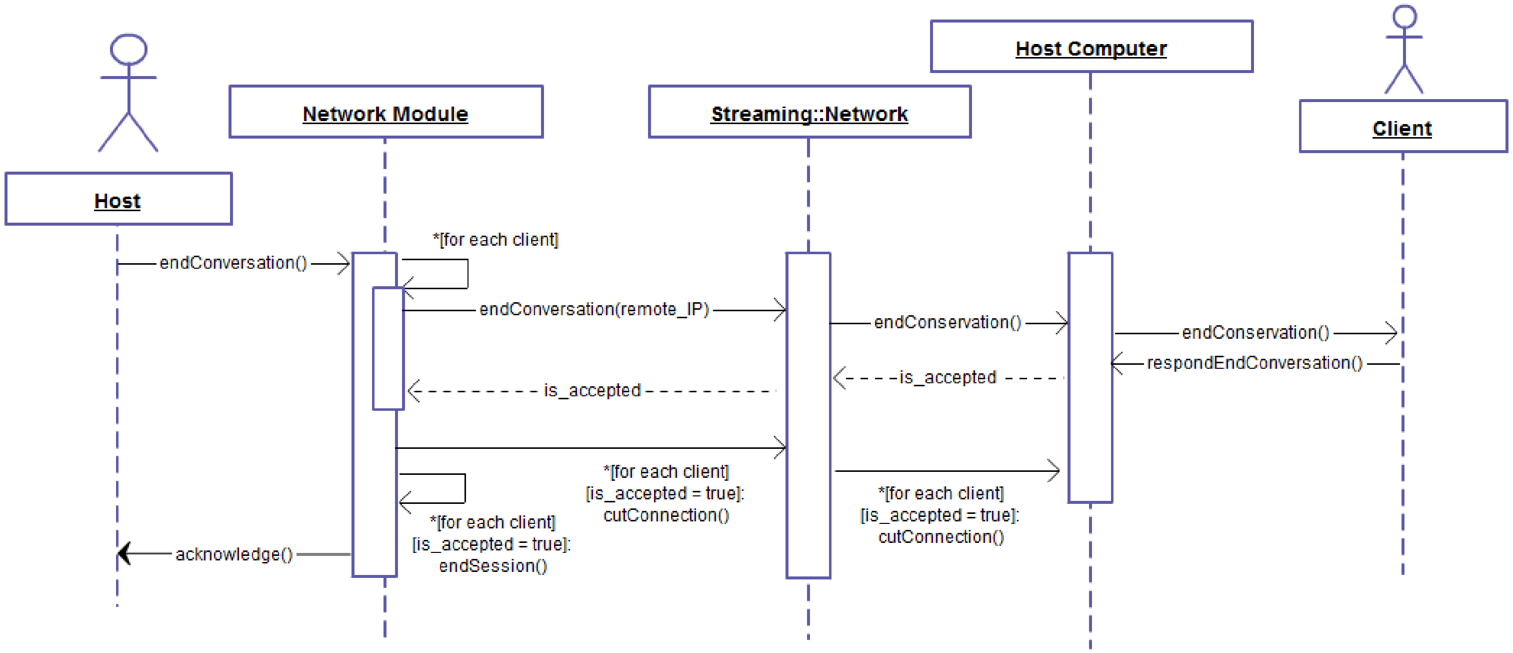


Figure 45: *End Conversation System Function*

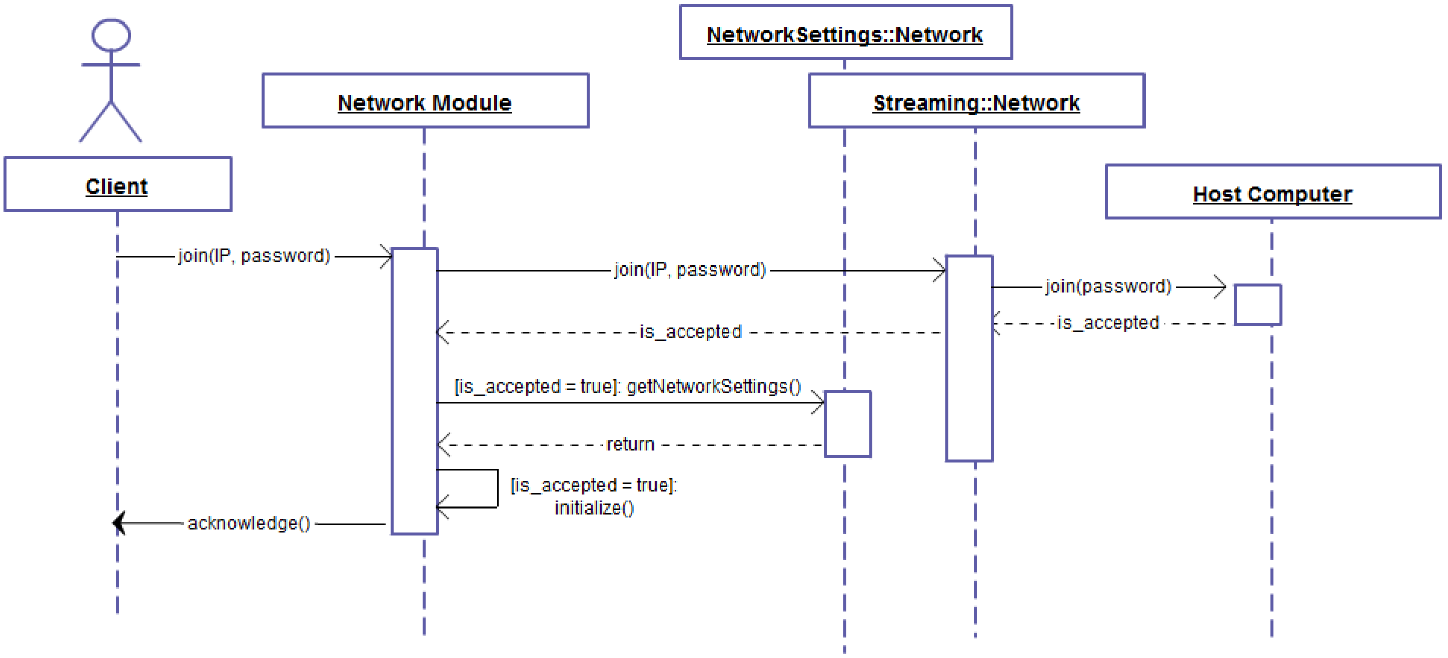


Figure 46: *Join System Function*

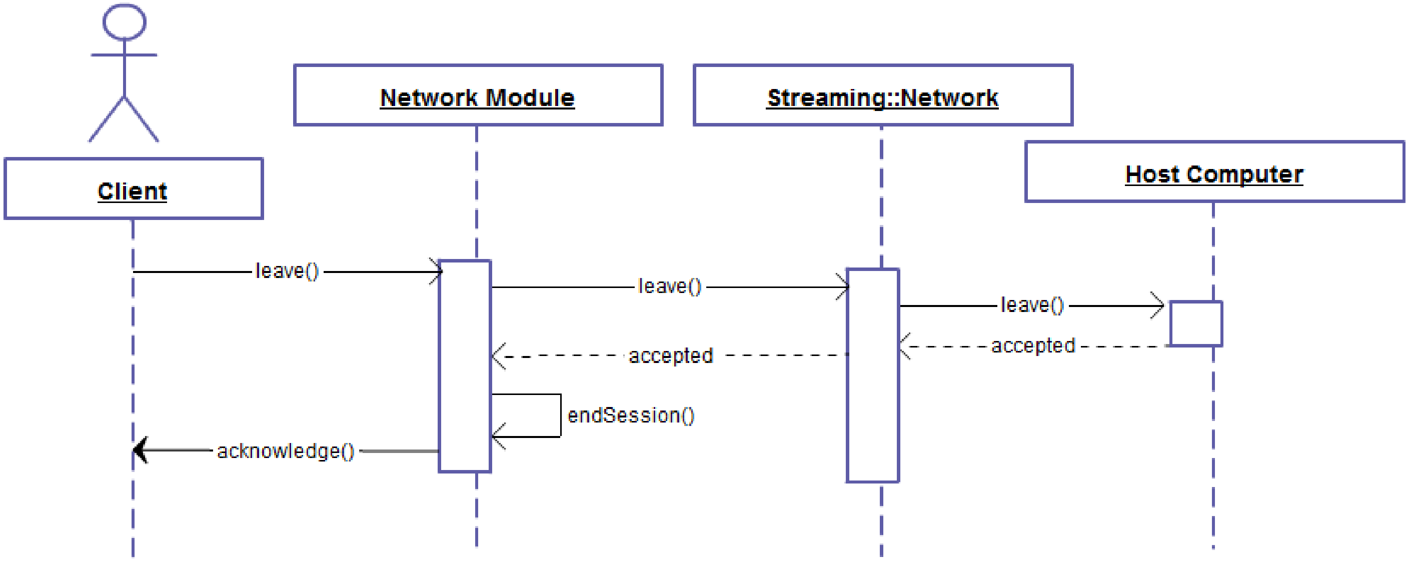


Figure 47: *End Session System Function*

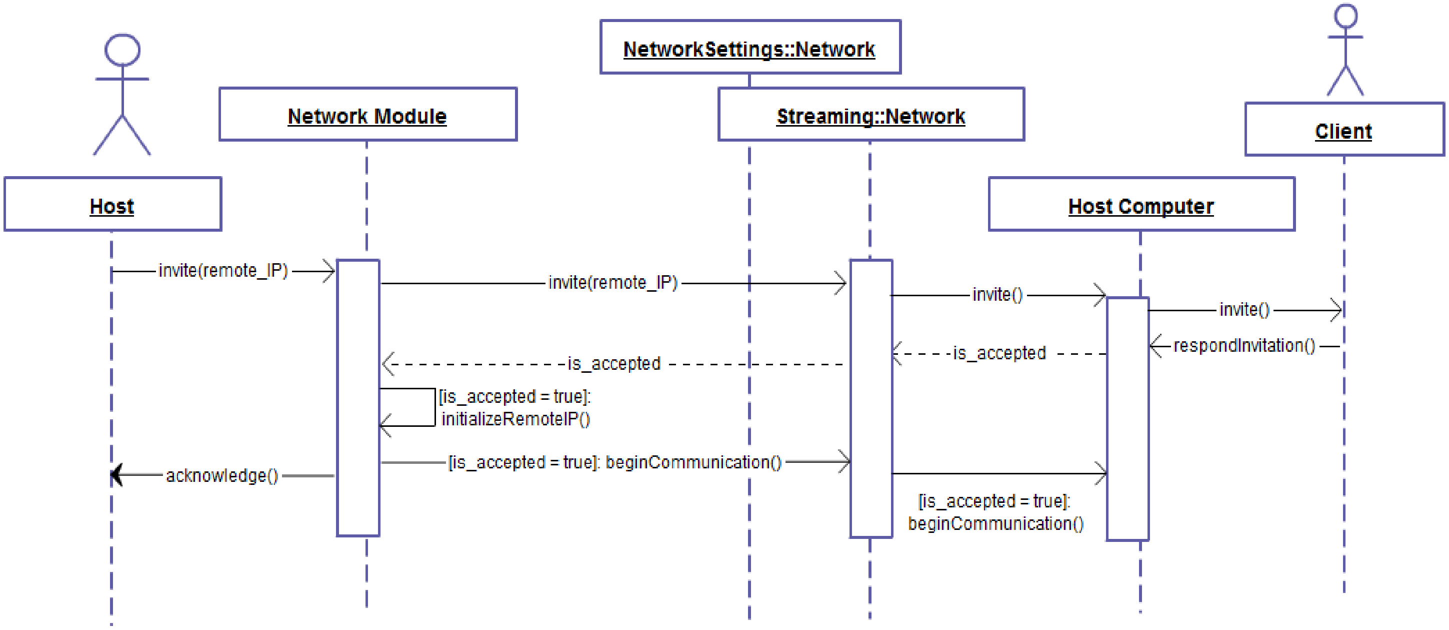


Figure 48: *Invite System Function*

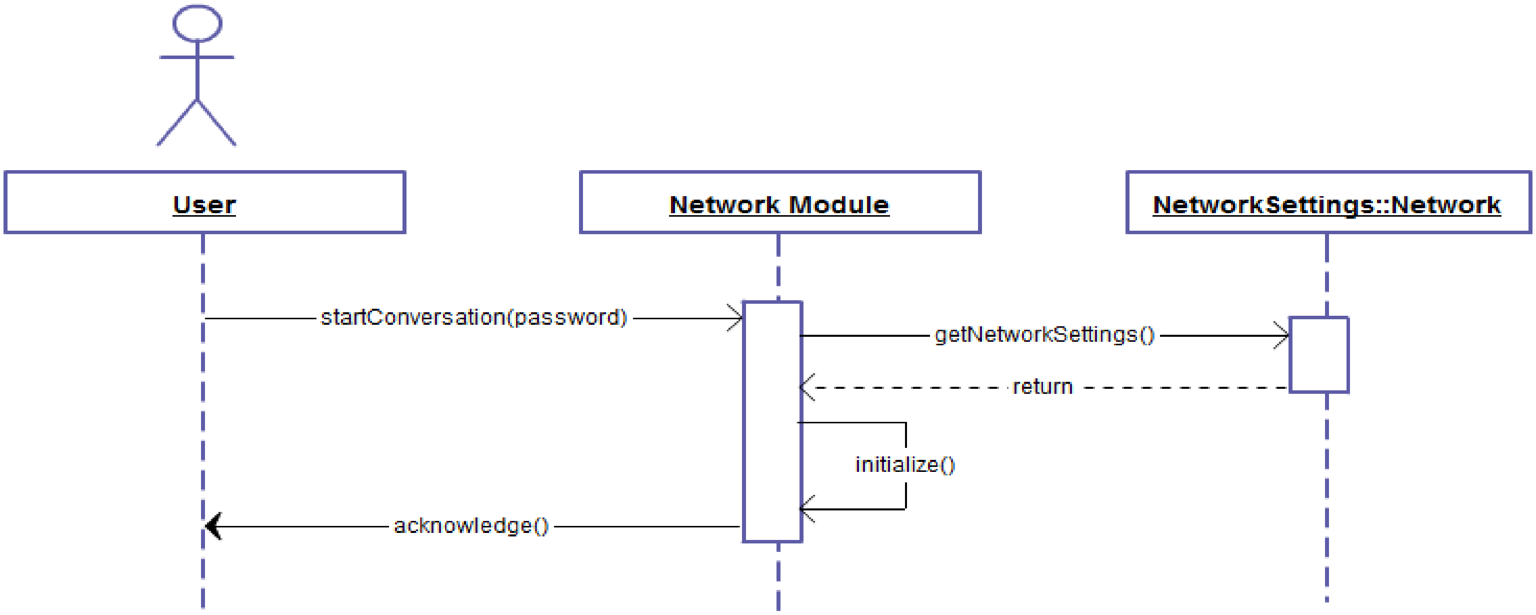


Figure 49: *Start Conversation System Function*

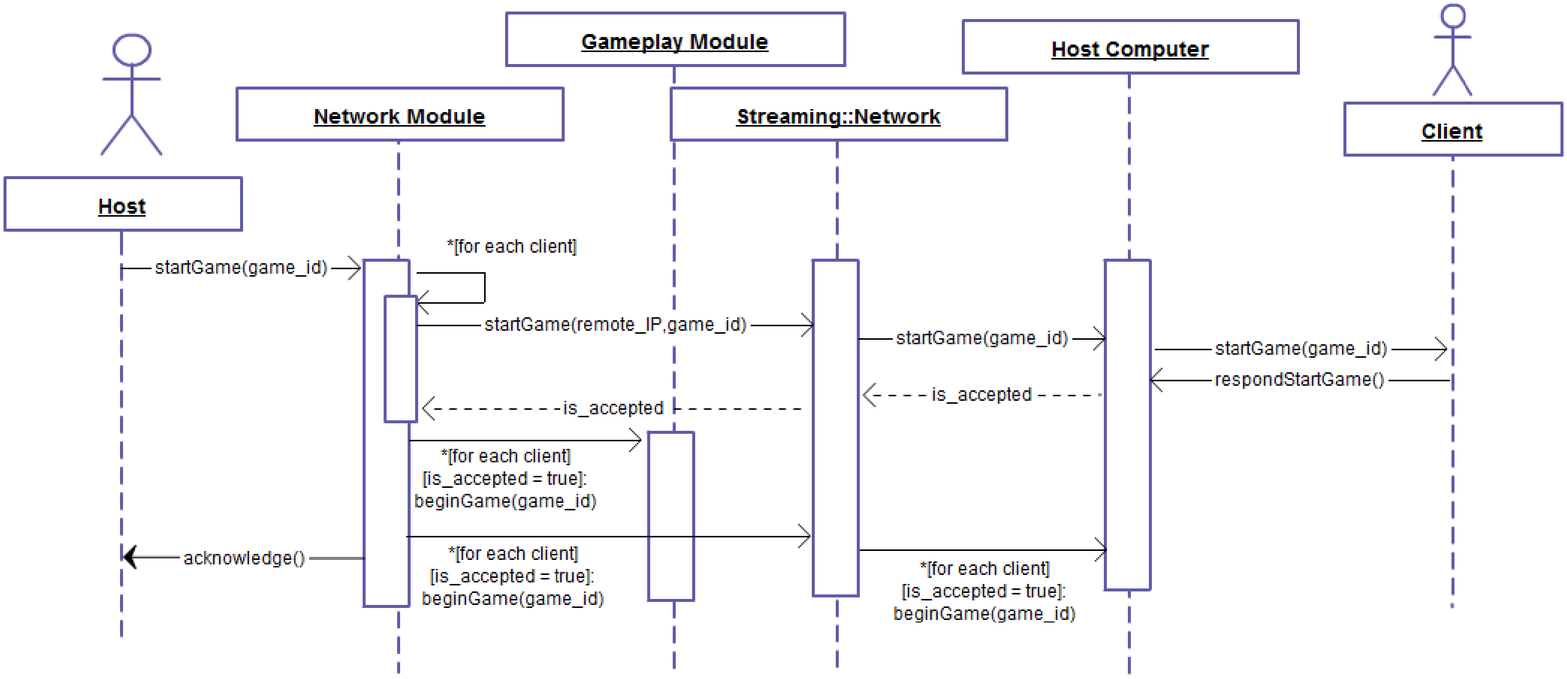


Figure 50: *Join System Function*

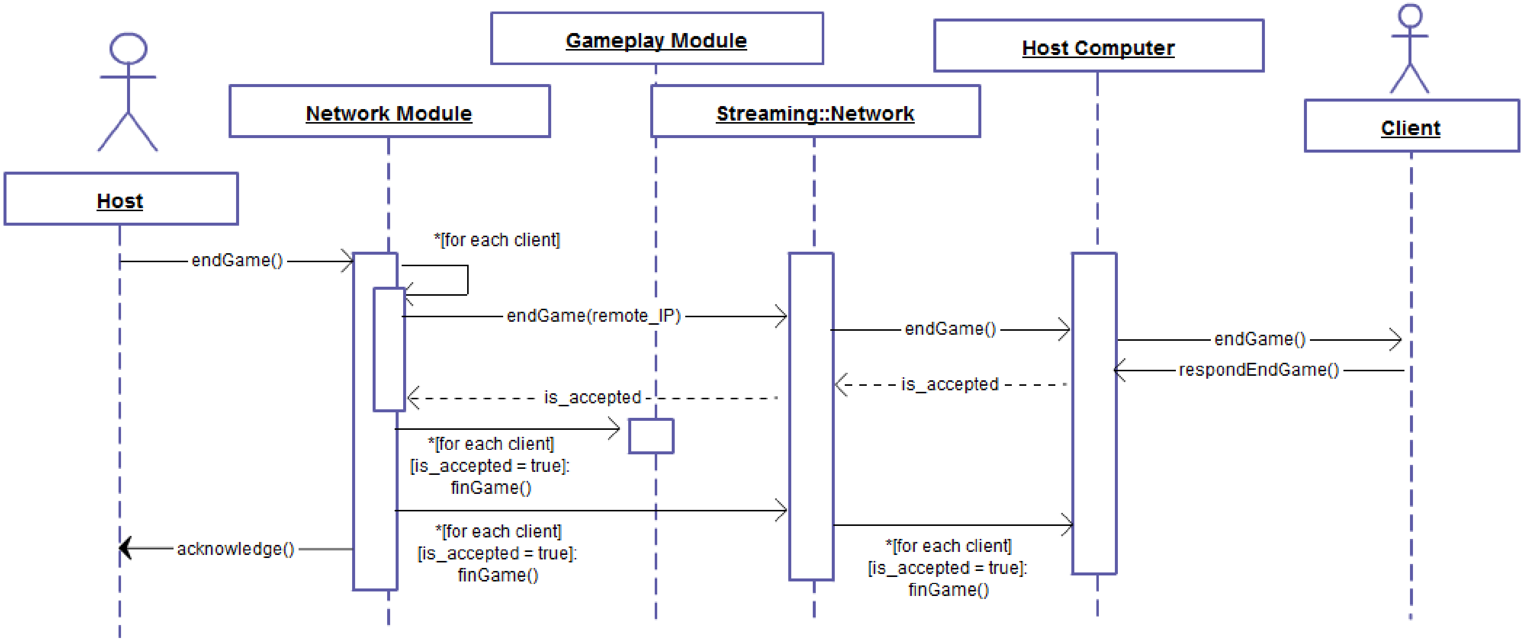


Figure 51: *End Game System Function*

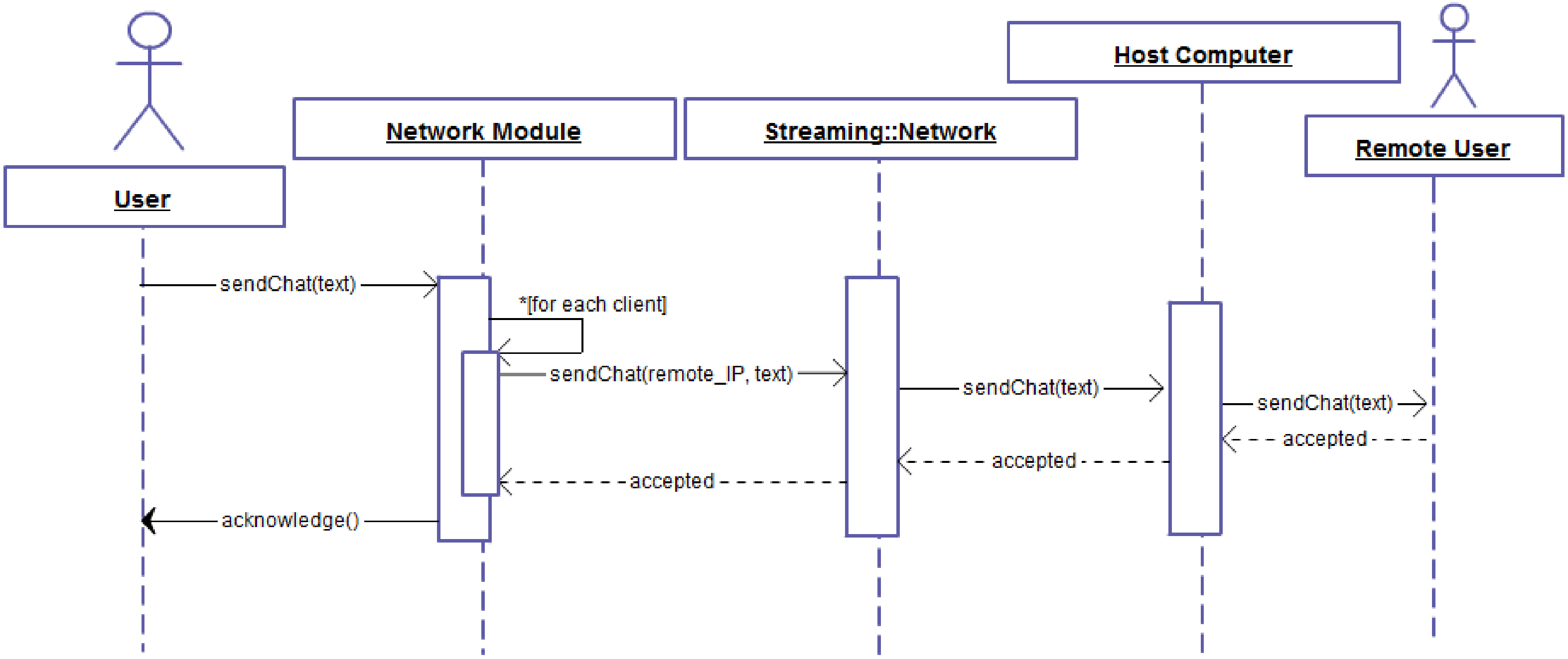


Figure 52: *Send Chat Message System Function*

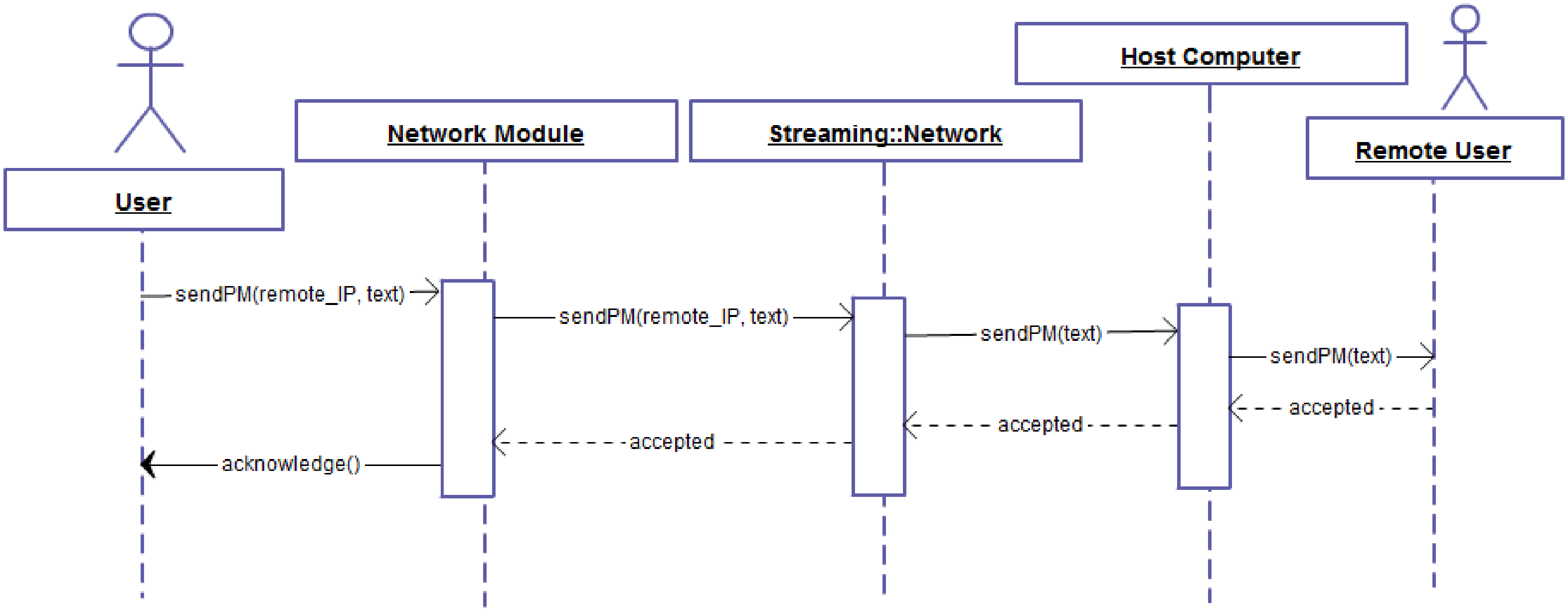


Figure 53: *Send PM System Function*

8 Libraries and Tools

Public MSU video filters

MSU video quality measurement tools

C# streaming libraries

.Net streaming libraries

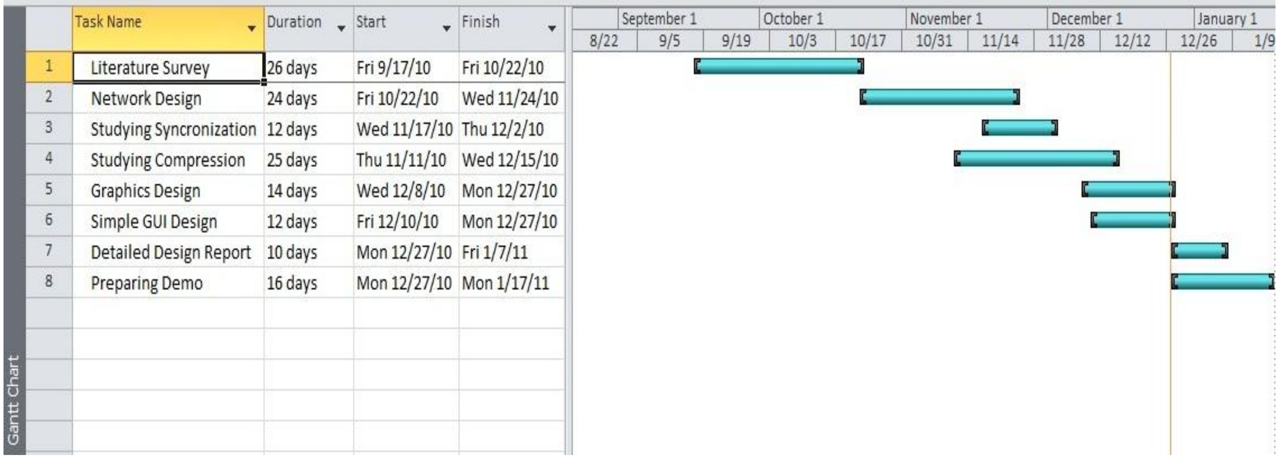
Java for external games

OpenGL for GUI

MS Silverlight for GUI

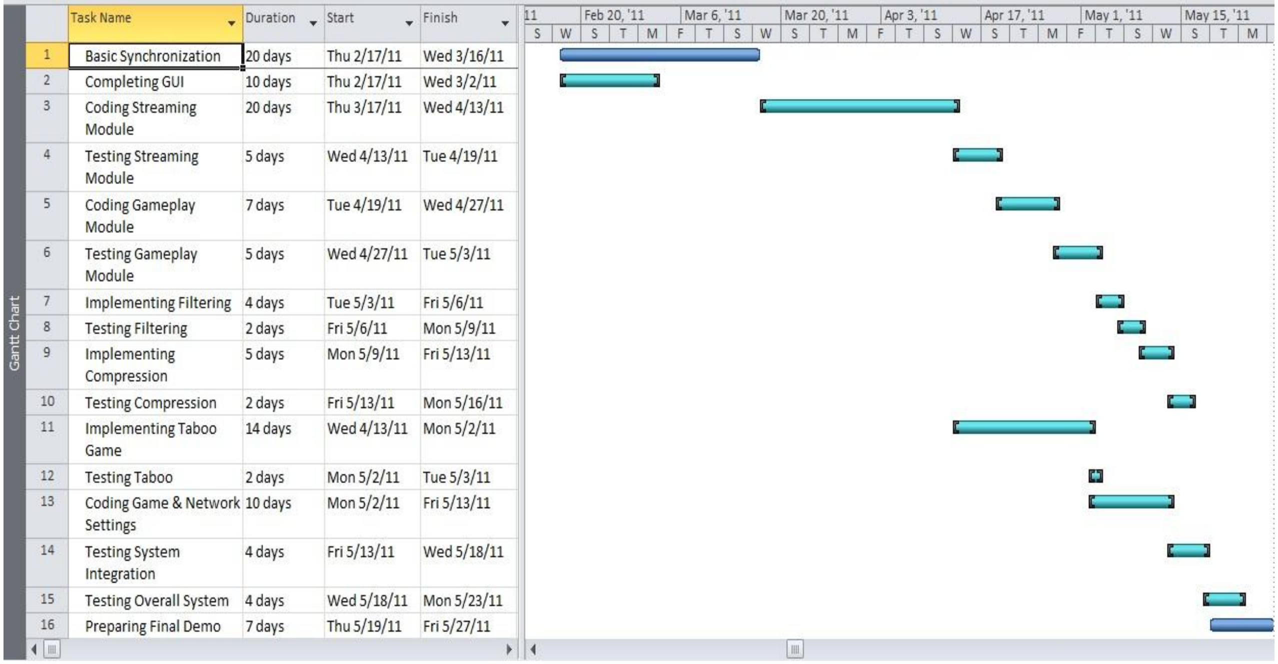
9 Time Planning (Gannt Chart)

9.1 Term 1 Gannt Chart



	Task Name	Duration	Start	Finish
1	Literature Survey	26 days	Fri 9/17/10	Fri 10/22/10
2	Network Design	24 days	Fri 10/22/10	Wed 11/24/10
3	Studying Syncronization	12 days	Wed 11/17/10	Thu 12/2/10
4	Studying Compression	25 days	Thu 11/11/10	Wed 12/15/10
5	Graphics Design	14 days	Wed 12/8/10	Mon 12/27/10
6	Simple GUI Design	12 days	Fri 12/10/10	Mon 12/27/10
7	Detailed Design Report	10 days	Mon 12/27/10	Fri 1/7/11
8	Preparing Demo	16 days	Mon 12/27/10	Mon 1/17/11

9.2 Term 2 Gannt Chart



	Task Name	Duration	Start	Finish
1	Basic Synchronization	20 days	Thu 2/17/11	Wed 3/16/11
2	Completing GUI	10 days	Thu 2/17/11	Wed 3/2/11
3	Coding Streaming Module	20 days	Thu 3/17/11	Wed 4/13/11
4	Testing Streaming Module	5 days	Wed 4/13/11	Tue 4/19/11
5	Coding Gameplay Module	7 days	Tue 4/19/11	Wed 4/27/11
6	Testing Gameplay Module	5 days	Wed 4/27/11	Tue 5/3/11
7	Implementing Filtering	4 days	Tue 5/3/11	Fri 5/6/11
8	Testing Filtering	2 days	Fri 5/6/11	Mon 5/9/11
9	Implementing Compression	5 days	Mon 5/9/11	Fri 5/13/11
10	Testing Compression	2 days	Fri 5/13/11	Mon 5/16/11
11	Implementing Taboo Game	14 days	Wed 4/13/11	Mon 5/2/11
12	Testing Taboo	2 days	Mon 5/2/11	Tue 5/3/11
13	Coding Game & Network Settings	10 days	Mon 5/2/11	Fri 5/13/11
14	Testing System Integration	4 days	Fri 5/13/11	Wed 5/18/11
15	Testing Overall System	4 days	Wed 5/18/11	Mon 5/23/11
16	Preparing Final Demo	7 days	Thu 5/19/11	Fri 5/27/11

10 Conclusion

The initial design report is one of the crucial steps of our project. The designs we have made and wrote in the SRS document are strengthened by the theoretical and practical information. The difficulties we may encounter during the process and possible solutions are determined. In accordance, we shaped our project and chosen to use technologies and algorithms which we believe to be helpful and efficient to deal with those problems. Moreover, the IDR is like a guideline for further detailed design of our project. As we made clear the main aspects of our project choose some algorithms and software technology to for development of our project.

To conclude, this initial design report will be the guideline of our project this year.