DESIGN AND IMPLEMENTATION OF SOCIAL NETWORKING WEBSITE FEATURES

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The Supervisory Committee certifies that this *disquisition* complies with North Dakota State University's regulations and meets the accepted standards for the degree of

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ABSTRACT

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People want to communicate and interact with each other over the internet. There are various websites which are helpful for this kind of socializing. The popularity and adaptability of each website depends on the features it provides to its users. This paper deals with some of features which help users extend their social-networking experience. A social-networking website is designed and developed with features targeting different areas of the social-networking environment like networking, technical support, and profile. This paper focuses on developing features which shall extend the social-networking experience of the user rather than building an entire social-networking website. The website that is developed shows the workings of the above-mentioned features in a social-networking website environment. The result of the paper is a working website with the features mentioned and a survey to get feedback from users. The users' satisfaction level with the features implemented can be obtained from the survey.

ACKNOWLEDGMENTS

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CHAPTER 1. INTRODUCTION

There are many websites that allow people to share information. Making information public in a closed environment is highly preferred. Social-networking websites are one such environment where users create their profiles and share information with other users with whom they are connected. Users can find and share information with other users in the enclosed system.

Social-networking websites have become really popular these days. The number of users for each social-networking website proves that there are many people willing to share their information with others.

The web contains a large amount of data, usually organized by content, whereas social-networking websites are arranged with user-specific content organized around the users. Social networks provide users with an option to share their content with other users with whom they are already connected, to find their old connections, and to find users with similar interests.

Different social-networking websites display information in various ways. Some sites display personal information to other users even though they are not connected, and some sites display personal information only to users connected with each other.

Social-networking websites are playing a major role in day-to-day activities. Social-networking websites not only contain user-specific information, but also

different kinds of applications, advertisements, and many more aspects. There are many applications being developed that target different kinds of users for the social-networking websites. Inventing different applications has attracted users with a variety of interests.

Many social-networking websites do not provide users with a common space where they can get together, share, and find answers for difficulties faced within the website.

Even though the popular social-networking websites contain applications, advertisements, etc., the basic idea is to get different kinds of people together, to share information with specific users, and to find users with the same interests.

In this paper, a social-networking website with certain features is proposed, designed, and implemented. The designed and implemented social-networking website enhances the social networking experience of a user. The users can not only share information with specific users, but they can also view information for a specific group of users at one time.

The designed and developed social-networking website has features where users can create their profile, add friends, create friend groups, send events to friends, and view a pictorial representation of their friends and their friends' friends (connections). The social-networking website also contains a forums section where users can discuss the technicality of the website.

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The major objective of this paper is to provide users with an enclosed system which reduces information overload, find all the users with whom they and their friends are connected, send event invites to all the friends at once, and share their concerns and ideas among themselves.

This paper further discusses the implementation of the website from the design phase. This basic website can be browsed from any computer with internet access. This website emphasizes equally on simplicity for the interface and features.

All the screens are designed following the basic rules of interface design in order to provide the best experience for the user who is interacting with the website. The designed and developed social-networking website has simple screens and smooth transition between pages, which enable novice users to easily understand and use the features.

Even if the users have some difficulty understanding the features, they can always post their questions in the forums section and find the answers. The users can even find the concerns, suggestions, questions, and usage of features posted in the forums section by other users.

The connections menu is where users are provided not only with the pictorial representation of the connections to their friends, but also with the friends of their friends. Connections feature makes it easy for users to find common

friends instead of depending on the random friend suggestions generated by the application.

Connections are represented in the way of pictures to reduce the burden on users to understand just by the names. A pictorial representation of the information with the link of the users' connections can be easily understood when compared to a simple presentation of names.

Users can send an event invite to all their friends simply by entering an event in the Post Events section and submitting it. Posting events to all friends reduces the burden on the user to separately invite each friend to an event. This feature also decreases the chance of forgetting to invite a particular friend to an event.

With most of the existing social-networking websites, users will not be able to go back and check older posts/messages after a certain time period. The developed social-networking website will have an option to check the older posts/messages by date. A user can check the older posts/messages by selecting a particular date from the calendar. Once a date is selected, the posts/messages on that particular date are displayed beside the calendar. This feature will be helpful for users who want to check information from the past.

The rest of the information in the paper is organized as follows:

Chapter 2: High-Level Design: This chapter mainly explains the architecture of the application. All the information related to interface design and database design is explained in this chapter.

Chapter 3: Detailed Design: This chapter explains the detailed design of the implemented social-networking website using Unified Model Language (UML) diagrams. This chapter mainly concentrates on designing all the screens developed.

Chapter 4: Website Interface Illustration: The design and usability of each feature for the implemented social-networking website, with the help of screenshots, are explained in this chapter. The interfaces of the social networking website with procedures followed are also illustrated in this chapter.

Chapter 5: Survey Results Evaluation: This chapter emphasizes mainly on evaluating the implemented social-networking website features from the participants' survey results.

Chapter 6: Conclusions and Future Work: This chapter discusses suggestions for future work based on the paper: design and implementation of social-networking website features.

CHAPTER 2. HIGH-LEVEL DESIGN

The social-networking website has been developed based on a three-tier architecture model. A three-tier architecture is generally utilized in applications which use databases. The designed and developed social-networking website uses a web browser to display the user interface. The application has been developed using Visual Studio 2008, C# for code-behind, ASP.Net, and the Microsoft SQL Server 2008 Database for storing the data. The database stores the user information, messages, events exchanged, and the entire activity within the website. Figure 2.1 represents the general three-tier architecture followed for many applications.

Application	Business Access Layer	Data Access Layer
Or	Or	Or
Presentation Layer	Business Logic Layer	Data Layer
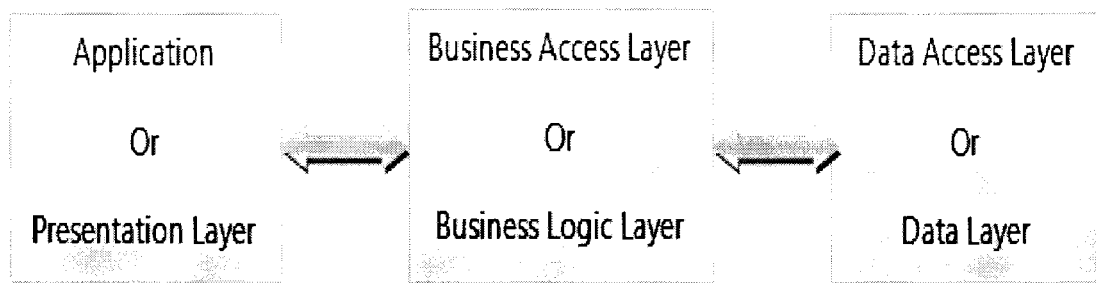
Figure 2.1. Three-tier architecture.

A three-tier architecture is used to separate the Graphical User Interface (GUI) and Business Logic. With two-tier architecture like Client-Server architecture, it is difficult to identify and manage the source code for the User Interface (UI) and Business Logic [2].

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To overcome this problem, a middle tier called the application tier, or application layer, or application server is being introduced between client and server layers [8]. To maintain consistency in terminology in this paper, the tiers will be referred to as layers.

2.1. The Application Architecture

In the developed social-networking website, whenever data are requested by the client or the User Interface (UI), the data are fetched by the middle layer. The middle layer directly interacts with the database layer to get the data.

The middle layer (i.e., the application layer) acts as the communication medium between the client layer and database layer. Figure 2.2 represents the designed and implemented social-networking website schematically.

The three layers in the application are client layer, application layer, and database layer [5]. Tier-1 consists of the client layer which has a Graphical User Interface (GUI) or Web Interface. Tier-2 consists of the application layer, and Tier-3 is the database layer. A specific set of responsibilities has been handled by each layer.

The database layer includes the database management system. Data modifications are performed inside the database layer. The database layer and client layer are connected by the application layer which consists of business logic [3].

Client Layer	GUI, Web Interface
Application Layer	.Net Framework Model Social Networking Website Common Language Runtime and .Net Framework
Database Layer	Database Management System
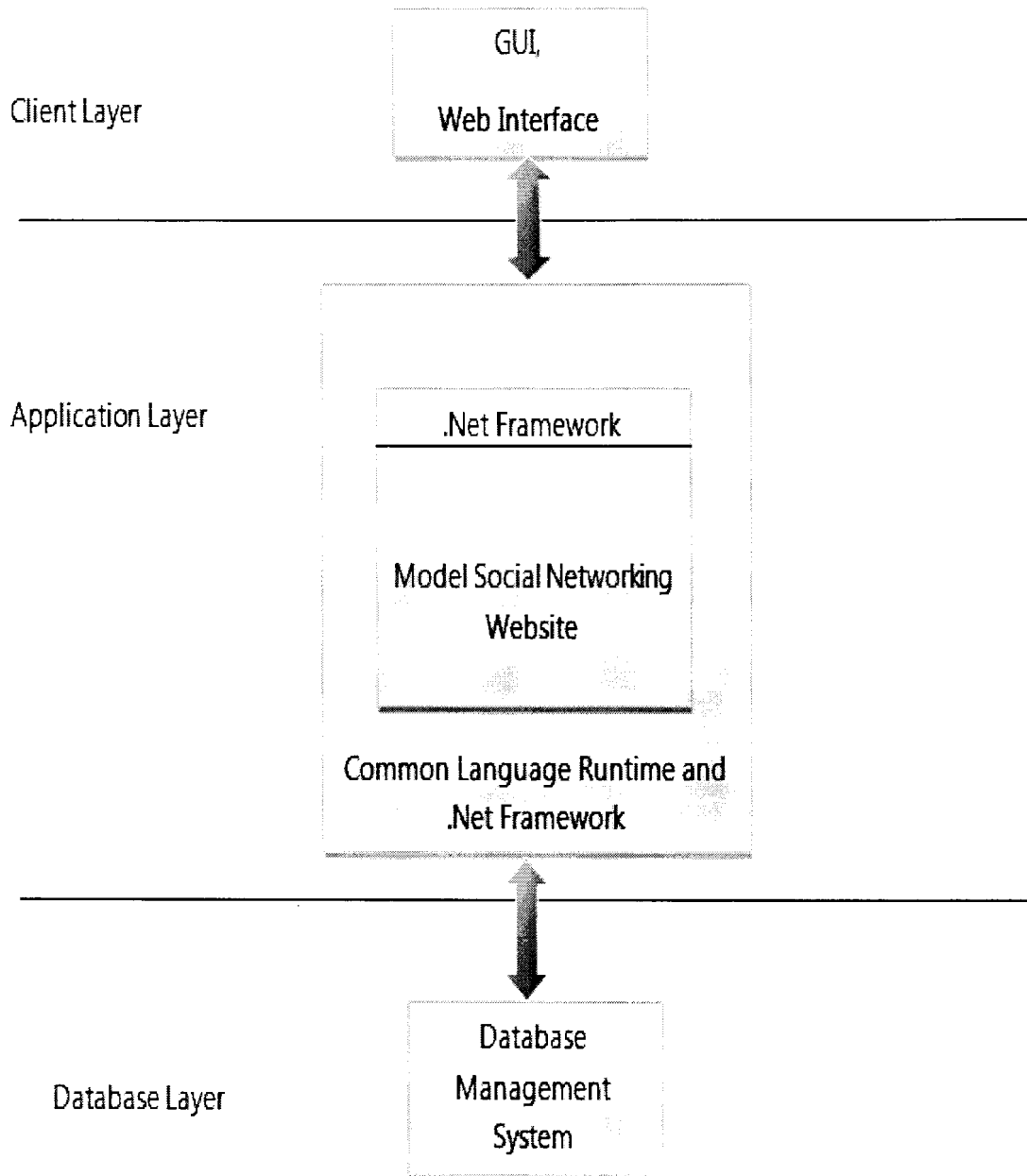
Figure 2.2. Three-tier architecture for the application.

The client layer usually consists of a Graphical User Interface (GUI) which is displayed in the web browser. This is for the end users to interact with the database, request data, and modify existing data with the help of business logic.

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2.1.1. Database Layer

The designed and implemented social-networking website has a database layer that has been named the Data Access Layer (DAL). The database transactions, such as storage and retrieval of data as well as modifying the existing data, are done by the database layer.

The code snippet for saving a friend group that the user created in the database is shown below. A friend group is saved by using the method SaveFriendGroup in the class clsFNDAL:

Public class clsFNDAL()

//Method SaveFriendGroup(parameters)

//Create a SqlConnection using new SqlConnection (Connection object);

//Create a SqlCommand using CreateCommand();

//Open the Connection;

//Specify the Command Type (Stored Procedure);

//Enter the Command Text (Stored Procedure name);

//Pass the parameters to the stored procedure;

//Execute the SqlCommand using the ExecuteNonQuery() method;

//Close the connection to the database;

2.1.2. Application Layer

The user-invoked actions are performed by the application layer which consists of the business logic. The application layer uses the existing logic to perform the operations requested and gives the results to the user. In the same way, if a user wants to save information in the database, the data from the client layer are accepted by the application layer; the application layer communicates with the database layer and stored information.

The basic components of the application layer include the framework which has built-in class libraries with the ability to handle the exceptions. On top of the application layer framework, additional applications such as "Design and Implementation of Social Networking Website Features" can be developed. The business logic can be shared between different applications if they use the same business logic.

The framework used in the development of the social-networking website is .Net Framework 3.5. C# is the programming language used to write the code behind the business logic. In the developed social-networking website, the application layer is named as Business Access Layer (BAL), and the class is named as clsFNBAL. The sample code snippet for the Business Access Layer in the developed social-networking website is presented below.

Public class clsFNBAL

//Method SaveFriendGroup with parameters

    //Calling the SaveFriendGroup method in clsFNDAL class;

    //Get the values returned by the method SaveFriendGroup in clsFNDAL

class;

//Method SaveMessage with parameters

    //Calling the SaveMessage method in clsFNDAL class;

    //Get the values returned by the method SaveMessage in clsFNDAL class;

//Method SaveEvent with parametes

    //Calling the SaveEvent method in clsFNDAL class;

    //Get the values returned by the method SaveEvent in clsFNDAL class;

//Method SaveImage with parametes

    //Calling the SaveImage method in clsFNDAL class;

    //Get the values returned by the method SaveImage in clsFNDAL class;

2.1.3. Client Layer

The client layer for the designed and implemented social-networking website consists of .aspx pages that are displayed in a web browser. The basic features that are available in the client layer of the designed and implemented social-networking website are as follows:

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➢ Users can create their profile.

➢ Users can add friends, create/delete friend groups, and add friends into different groups.

➢ Users can view the friends in their list and view a friend's profile by clicking on the friend's name.

➢ Users can edit their profile and change the display image.

➢ Users can view messages/updates and send messages to friends.

➢ Users can view events posted by friends and send event invitations to friends.

➢ Users can view upcoming birthdays.

➢ Users can view friend requests, and accept or reject friend requests.

➢ Users can create albums, and add or delete images.

➢ Users can view connections.

➢ Users can view forums, add posts, view posts, and delete posts.

➢ Users can view older messages by date.

The client layer, along with the user interface, also possesses the ability to call the business objects when an action is invoked. The sample code snippet for calling the business objects is as follows:

Public class User

//Create the user object;

//Create public property to get and set First Name of the user;

//get { return _FirstName; }

//set { _FirstName = value; }

//Create public property to get and set Middle Name of the user;

//get { return _MiddleName; }

//set { _MiddleName = value; }

//Create public property to get and set Last Name of the user;

//get { return _LastName; }

//set { _LastName = value; }

//In the same way, create the properties for all the user attributes.

The three layers in the developed social-networking website are user (Business Objects), clsFNBAL (Business Access Layer), and clsFNDAL (Data Access Layer). These three classes are shown in Figure 2.3.

The user class has all the business objects. Here, the get and set values for all properties are achieved.

The class (layer) clsFNBAL has all the method definitions. The class clsFNDAL has all the database objects, database connections, parameters, and sql commands.

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user
Class

⊟ Fields
- _AboutMe
- _Address1
- _Address2
- _City
- _CollegeUniver...
- _Country
- _Dob
- _Drinking
- _EmailId
- _FirstName
- _Gender
- _Haircolor
- _Height
- _Homephone
- _LastName
- _MiddleName
- _MimeType
- _Mobilephone
- _Occupation
- _Password
- _Pets
- _Photo
- _RelationshipSt...
- _Secondaryemail
- _Smoking
- _State
- _UserId
- _Weight
- _Zipcode

⊟ Properties
- AboutMe
- Address1
- Address2
- City
- CollegeUniversity
- Country
- CurrentLogin
- Dob
- Drinking
- EmailId
- FirstName
- Gender
- Haircolor
- Height
- Homephone
- IsLogin
- LastLogin
- LastName
- MiddleName
- MimeType
- Mobilephone
- Occupation
- Password
- Pets
- Photo
- RelationshipSta...
- Secondaryemail
- Smoking
- State
- UserId
- Weight
- Zipcode

⊟ Methods
- user

clsFNBAL
Class

⊟ Methods
- ChangePassword
- clsFNBAL
- DeleteAlbum
- DeleteEvent
- DeleteFriendGr...
- DeleteFriendGr...
- DeleteImage
- GetAlbums
- GetCountries
- GetEmailBody
- GetEvents
- GetFilteredUpd...
- GetFilteredUpd...
- GetFriendGrou...
- GetFriendGroups
- GetFriendRequ...
- GetFriends
- GetImagesforAl...
- GetLoginDetails
- GetMessages
- GetStates
- GetUpComingB...
- GetUpdateTrack
- RandomString
- SaveAlbum
- SaveEvent
- SaveFriendGroup
- SaveFriendGro...
- SaveFriendReq...
- SaveFriends
- SaveImage
- SaveMessage
- SaveUser
- SearchUsers
- SendEmail
- UpdateImage
- UpdateUser
- VerifyEmail
- VerifyLogin

clsFNDAL
Class

⊟ Fields
- conString

⊟ Methods
- ChangePassword
- CheckBoolean
- CheckDateTime
- CheckDouble
- CheckInt
- CheckString
- clsFNDAL
- DeleteAlbum
- DeleteEvent
- DeleteFriendGr...
- DeleteFriendGr...
- DeleteImage
- GetAlbums
- GetCountries
- GetEvents
- GetFilteredUpd...
- GetFilteredUpd...
- GetFriendGrou...
- GetFriendGroups
- GetFriendRequ...
- GetFriends
- GetImagesforAl...
- GetLoginDetails
- GetMessages
- GetStates
- GetUpComingB...
- GetUpdateTrack
- SaveAlbum
- SaveEvent
- SaveFriendGroup
- SaveFriendGro...
- SaveFriendReq...
- SaveFriends
- SaveImage
- SaveMessage
- SaveUser
- SearchUsers
- UpdateImage
- UpdateUser
- VerifyEmail
- VerifyLogin

Figure 2.3. Three layers in the website.

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2.2. Back-End Design

The developed social-networking website uses C# for the back-end design and the SQL Client for the database. Effective back-end design is necessary for the application to be efficient. The database operations are performed efficiently and accurately with effective back-end design. A Database Management System (DBMS) and scripting are the main components for the back end of the developed social-networking website.

2.2.1. Database Management System (DBMS)

There are many reasons for using a Microsoft SQL Server database when compared to the other database management systems available. The ability to manage very large amounts of data makes the Microsoft SQL Server the top on the priority list. Many advantages and advanced features are included in the Microsoft SQL Server. The advantages of the Microsoft SQL Server include better performance, better security, scalability, Business Intelligence tools, and low costs [6].

The database used in the design and implementation of social-networking website features is a relational database. The tables in the database are connected to each other. In general, each table consists of several records, and each record is made of fields with related information. The administrators design the database management system in order to manage the database in an effective manner. All

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operations, such as adding data, deleting data, and modifying data, can be performed in the database. Table 2.1 shows a sample database table structure.

Table 2.1. Sample database table structure

COLUMN NAME	DATA TYPE	PRIMARY KEY	AUTO-INCREMENT
Record1Column1	Record1Column2	Record1Column3	Record1Column4
Record2Column1	Record2Column2	Record2Column2	Record2Column4

2.2.2. The Developed Social Networking Website Database Structure

The SQL Server 2008 Enterprise edition is used as the database for the developed social-networking website. The database is divided into different tables with related information. Each table is connected to the others. Some tables in the database are as follows: tblUsers, tblFriends, tblMessages, tblFriendRequests, tblAlbums, tblEvents, tblFriendGroups, Forums, ForumTopics, etc. The tblUsers table is designed to store the profile information for all users. The tblFriends table is designed to store the user-specific friends. The tblMessages table contains all messages exchanged between friends. In the same way, all other tables contain specific information, and every table is related to the others. For example, the tblUsers table has information about all users, and this table is connected to the tblFriends table because the tblFriends table contains information about the users' friends.

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All the tables in the database are dynamic; they allow users to add new records. When a user sends a message to his/her friends, the message is stored in the tblMessages table. In the same way, if a user creates a friend group, this information is stored in the tblFriendGroups table. A record is added to the tblUsers table when a new user registers for the website. Two or more tables are linked to each other with a common field; for example, the tblUsers and tblFriends tables are linked to each other with the common field UserID. Table 2.2 shows the schema for the tblFriends table in the database used.

Table 2.2. Schema for tblFriends table

COLUMN NAME	DATA TYPE	PRIMARY KEY	AUTO-INCREMENT
ID	Int	Yes	Yes
UserID	Int	No	No
FriendID	Int	No	No
CreatedDate	DateTime	No	No

In addition to designing and creating tables in the database design, several stored procedures and triggers have been used. A stored procedure consists of a set of SQL queries; each stored procedure is compiled once by the SQL Server. Then, the same execution plan is used every time the stored procedure is called. The advantages of stored procedures are less time, reusability, security, and less

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traffic [7]. Triggers are used to execute a specific code set whenever there is an insert; updated or deleted operations are performed on the specified table.

For the developed social-networking website to be more efficient, stored procedures and triggers are used extensively. Using stored procedures results in an efficient use of resources, less response time to get and store the data in the database, and code reusability. Some of the stored procedures used in the database for the developed social-networking website are as follows: sp_UserRegistration, sp_SearchUsers, sp_SaveFriends, sp_ModifyUser, sp_GetFriends, and many more. The sample code snippet for creating a stored procedure is as follows:

//Create procedure [Stored Procedure Name]

// (Variables Declaration (if any))

//AS

//BEGIN

//SQL Query

//SQL Query continued

//End

CHAPTER 3. DETAILED DESIGN

The Unified Modeling Language (UML) is one of the most widely used tools in software engineering for analysis purposes. The design of the software product is represented mostly in graphical notations using UML. UML is one of the most widely used tools in both database modeling and software modeling. UML includes use case diagrams, class diagrams, interaction diagrams (sequence diagram and collaboration diagram), state diagrams, activity diagrams, and physical diagrams (component diagram and deployment diagram) [4].

3.1. Use Case Diagram

Use case diagrams provide different views of the system functionality. The actions are represented in a simple way; use case diagrams helps the users to easily understand the system and its functionality without any technical details.

The entire system is divided into actors, use cases, and the relationships between them. In general, the actor represents the user, or the external system, that interacts with the system. The operations that can be performed by the actors are called use cases. The solid lines that are used to connect the Actors and the use cases represent the relationships. In a use case diagram, Actors are connected to the use cases to perform actions. Figure 3.1 shows the use case diagram for the developed social-networking website. The Actor for this application could be any

user interested in utilizing the designed and implemented social-networking website features.
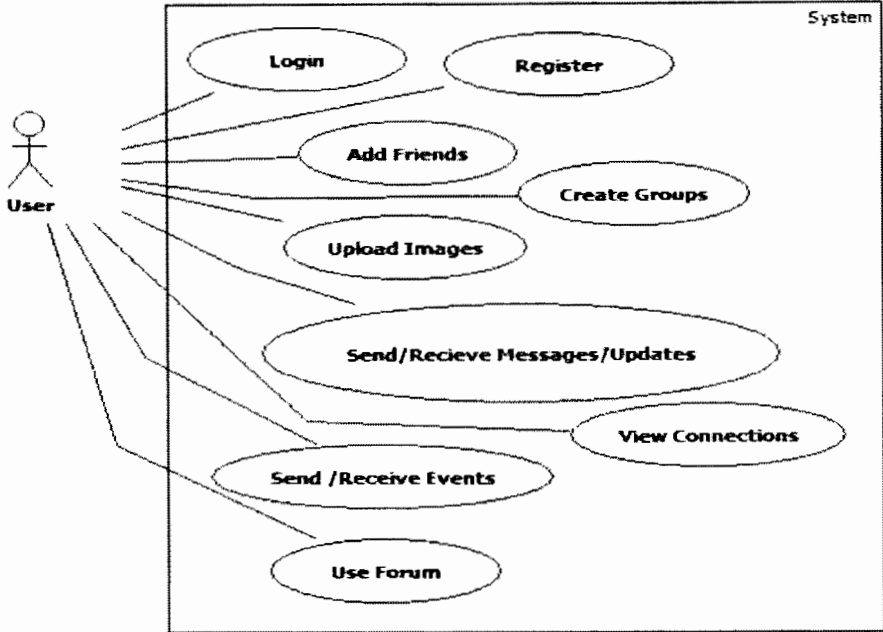
Figure 3.1. Use case diagram.

Some of the actions that an actor can perform in the system are as follows:

Register: An actor interested in the system should register. Once the registration is confirmed, the actor will be able to perform all the other actions.

Login: After successful completion of the registration process, the user will be able to login into the system to access the profile and other features.

Add Friends: For interaction, the actor could add other users in the system to the friend list.

Create Groups: The actor can create groups and add friends to particular groups.

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Send/Receive Messages/Updates: The actor can send messages/updates to friends and can receive messages/updates from friends. The user can filter the messages/updates based on the friend group.

Upload Images: The user can create albums and upload images to the albums. The actor will be able to delete images from the album.

Send/Receive Events: The actor can invite friends to an event and receive event invitations from friends.

View Connections: The actor could view the connections which represent a connection among the actor, friends, and their friends. The connections are showed in pictorial representation.

Use Forum: The actor can view the forums section in the website. The forums section contains the technicality of the website.

3.2. Class Diagram

The class diagrams show the classes of the system, their interrelationships, and the attributes and operations [1]. Classes are represented in the boxes of three sections: the top-most section has the name of the class; the attributes and properties are displayed in the middle section; and the bottom section has the methods of which the class consists. Figure 3.2 shows the class diagram of the designed and implemented social-networking website.

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New User

Existing User

Registration

+firstName
+middleName
+lastName
-userName
-password

+btnRegister_Click()

Login

-userName
-password

+Page_load()
+btnLogin_Click()

1...1

Connections

-friendId
-subFriendId

+fillTree()
+getImage()

1...1

1...1

UserAccount

+firstName
+middleName
+lastName
-userName
-password
+country
+state

+Page_Load()

1...1   Accesses

FriendsList

-uId
-friendId

+Page_Load()
+BindFriends()
+SetFriendImage()
+SetFriendName()

1...1

0...*   Consists of

1...1   Accesses   1...1

Forums

-uId
+message
+createDate

+addTopic()
+recent()
+mderator()

1...1

Consists of

1...1

1...1

Accesses

1...1

Consists of

1...1

Group

+GroupName
+CreatedDate

+BindFriendGroup()
+GetImagePath()
+btnAdd_Click()
+gvFriendGroup_RowDataBound()

1...*

Consists of

1...1

MyProfile

+firstName
+middleName
+lastName
+gender
+dob
+city
+state
+country
+zipcode
-userName
-password
+occupation
+relationshipStatus
+homePhone
+mobilePhone
+photo
+secondaryEmail

+editProfile()
+btnUpdate_Click()

MyImages

+imageTitle
+isAlbumCover
+created

+bindAlbum()
+getImagePath()
+btnUpdatePhoto_Click()

Friend

-friendId

+setProfile()
+bindFriends()
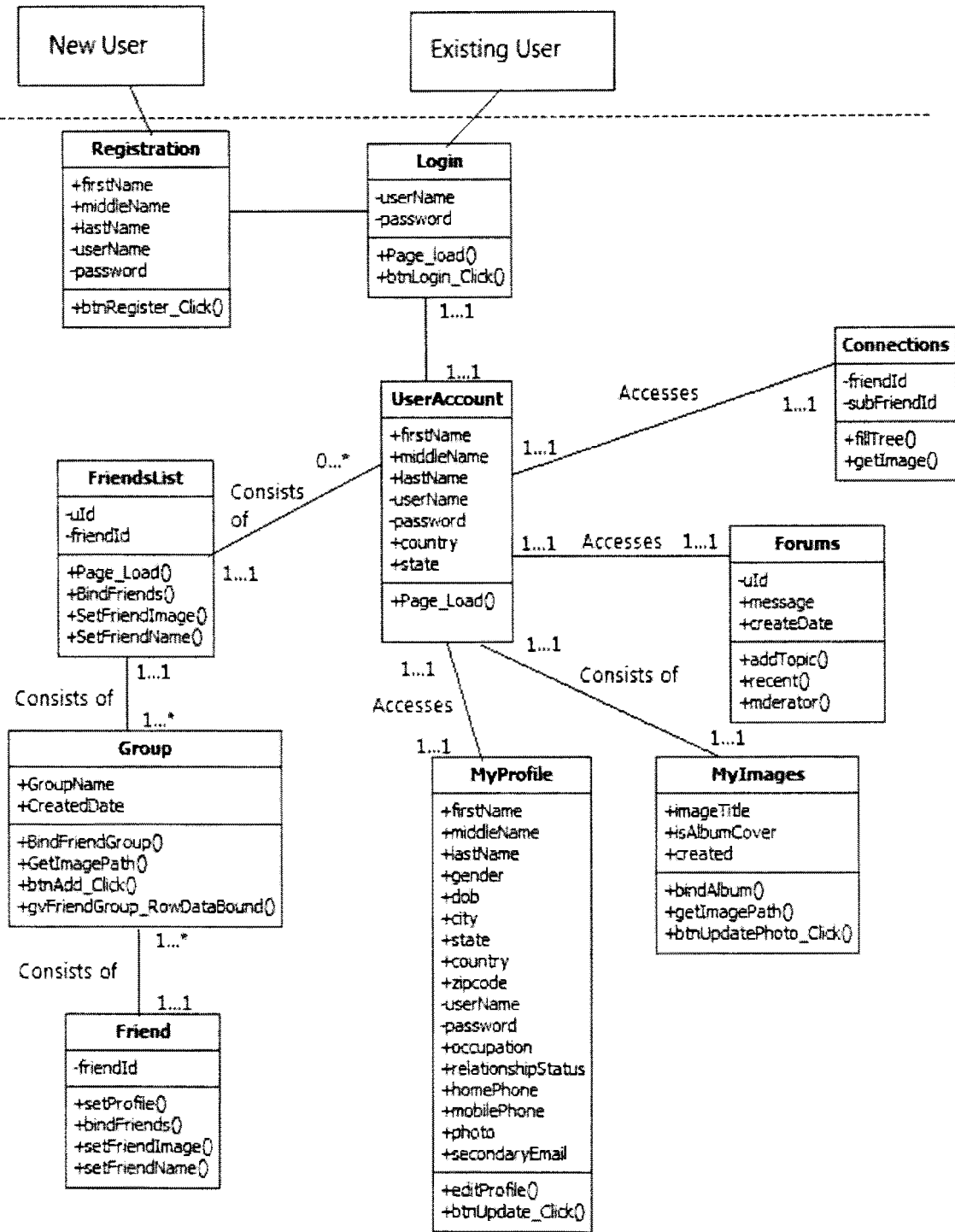+setFriendImage()
+setFriendName()

Figure 3.2. Class diagram.

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The developed social-networking website has several classes. Some of the classes in the developed social-networking website are UserAccount class, Login Class, Register class, Friend class, MyProfile class, Group class, FriendsList class, MyImages class, Forums class, and Connections class. All the classes have a specific set of attributes, and methods and classes are related to each other. The development has been done with a huge emphasis on efficiency.

3.3. Sequence Diagram

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows the order in which the processes operate with each other. It is a construct of a Message Sequence Chart [9].

The sequence diagrams show the flow of logic for a task performed in the system. In general, a sequence diagram contains parallel vertical lines which represent processes or objects that exist at the same time, horizontal arrows, and the messages exchanged between the processes in the order of their occurrence. The sequence diagram for adding friends to a group is shown in Figure 3.3.

Friends can be added to a group once the group is created. A user will have an option to add all the friends in the friend list to different groups. A user has an option to add a friend group, add friends to existing friend groups, and delete a friend group.
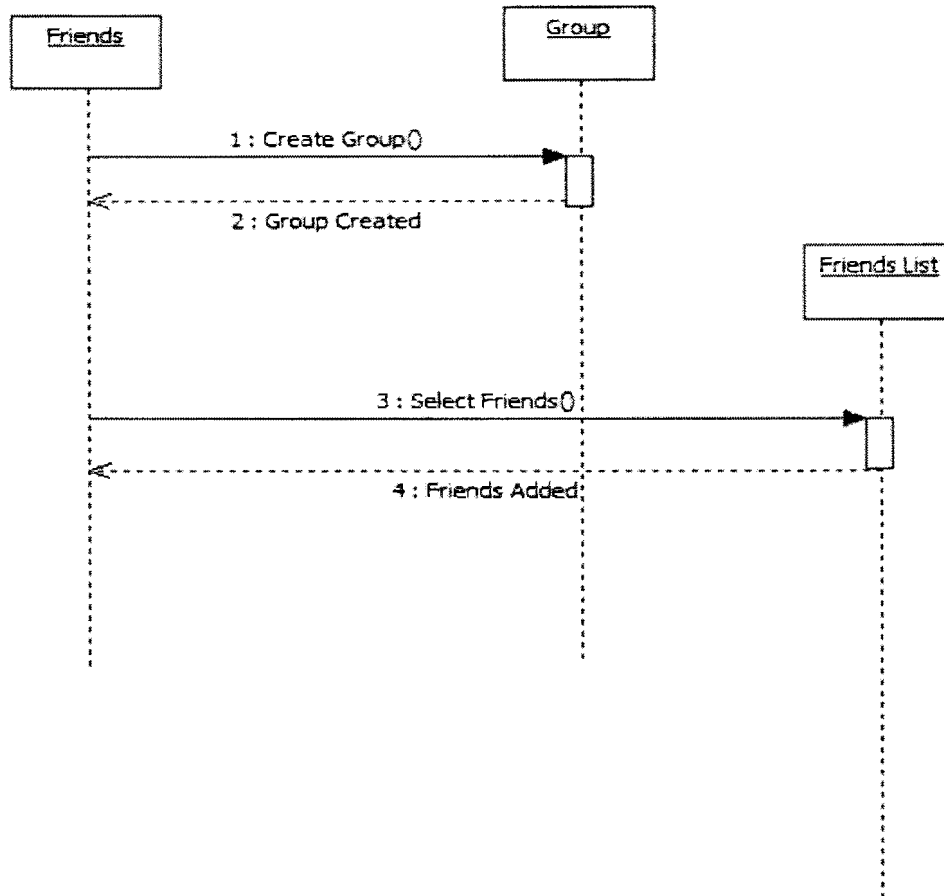
Figure 3.3. Sequence diagram to add friends to a group.

In the implemented social-networking website, the user can add friends to a group. To add friends to a group, the user should first create a group and select the friends to be present in that group. The user can directly add the friend to a group if the group already exists.

The developed social-networking website gives the users an option to add friends to multiple groups. A friend can be added to one or more groups.

The Send Messages/Events operation in the developed social-networking website can be performed by the user to send messages and events to all friends in the friend list. The user should create a message and submit the message so that the message is sent to all the friends in the friend list. In the same way, the user should create an event and submit the event so that the event is posted to all friends in the friend list. Figure 3.4 represents the sequence of actions that are to be performed by the user in order to send messages and events.
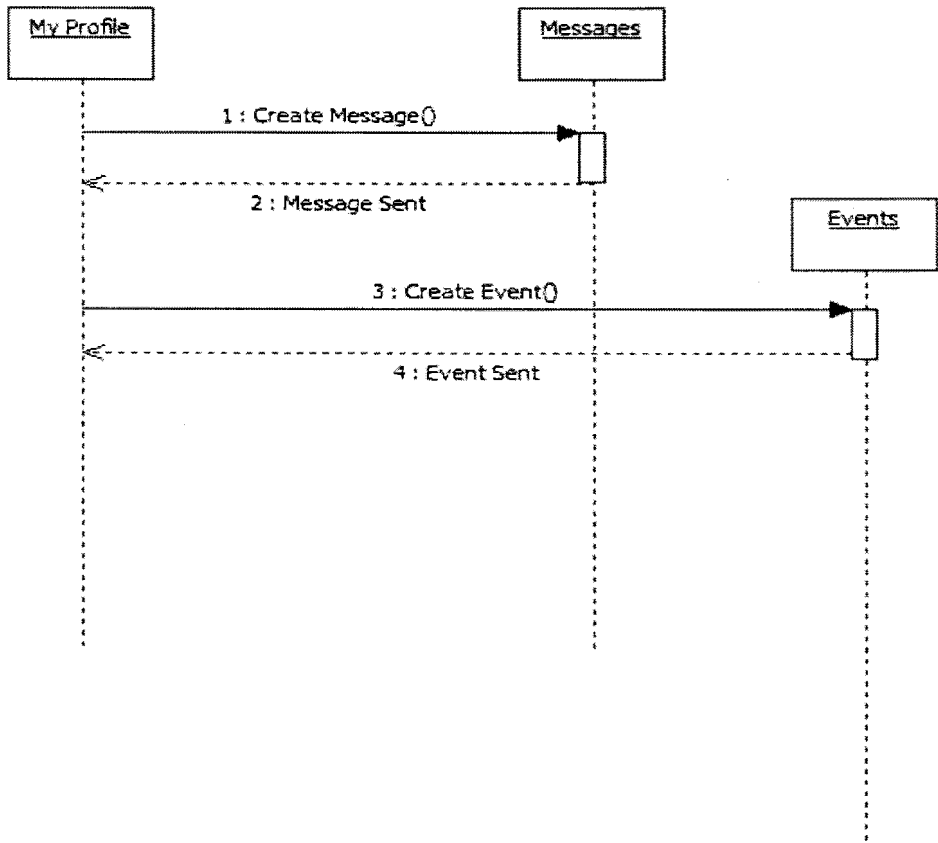

Figure 3.4. Sequence diagram to send messages/events to friends.

The View or Add Posts operation in the forum section of the designed and implemented social-networking website has several options. The user can view the existing posts by browsing the posts section; all posts are displayed in the forums. The user can add new posts. Figure 3.5 shows the sequence of actions performed to view existing posts and to add new posts in the forums section of the designed and implemented social-networking website.
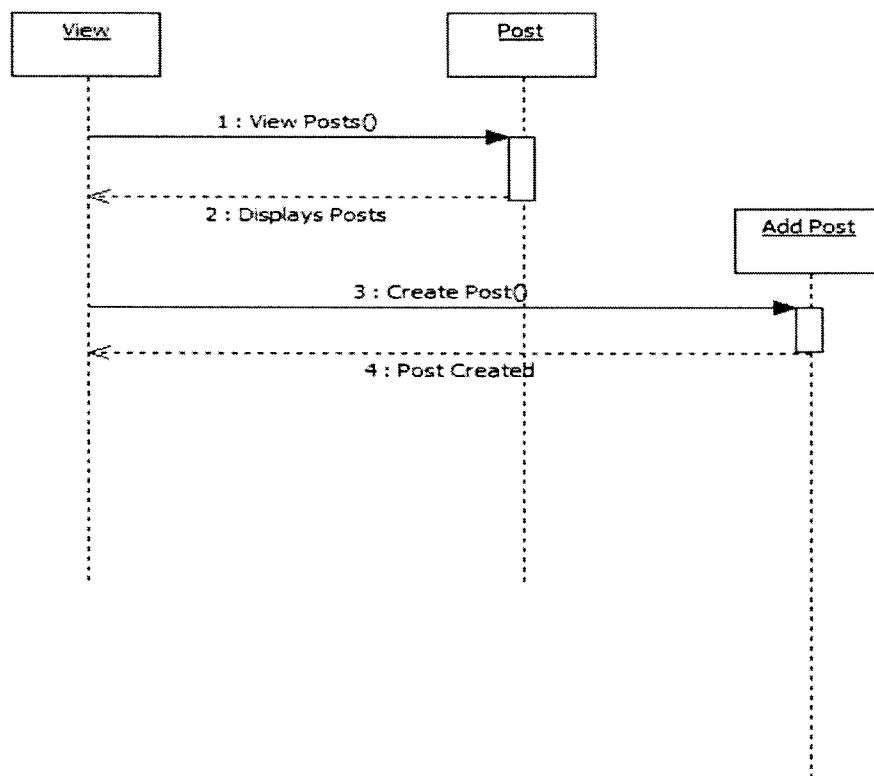

Figure 3.5. Sequence diagram to view/add posts in the forum.

A user will be able to view the existing posts after browsing the forums section. To add a new post, a user should click the link provided.

CHAPTER 4. INTERFACE ILLUSTRATION

The developed social-networking website has several different options for the users. This chapter explains, in detail, the options available. Occasionally, screenshots are used for better understanding of the interface.

4.1. Registration

The developed social-networking website is a place where registered users share information in an enclosed system. Figure 4.1 shows the registration page of the designed and implemented social-networking website. Users are required to fill in the required information for registration to be successful. The first name, last name, email id, password, and confirm password fields are mandatory.

Figure 4.1. Registration page.

The developed social-networking website follows a systematic error-handling procedure. If the user does not provide valid information, then the user

will be notified with a meaningful message. If the user who is trying to register does not provide information in any of the required fields, the system displays a dialog box letting the user know. Required fields display a red asterisk along the textboxes to get the user's attention when the required field textboxes are left empty. The messages are clearly shown in Figure 4.2.
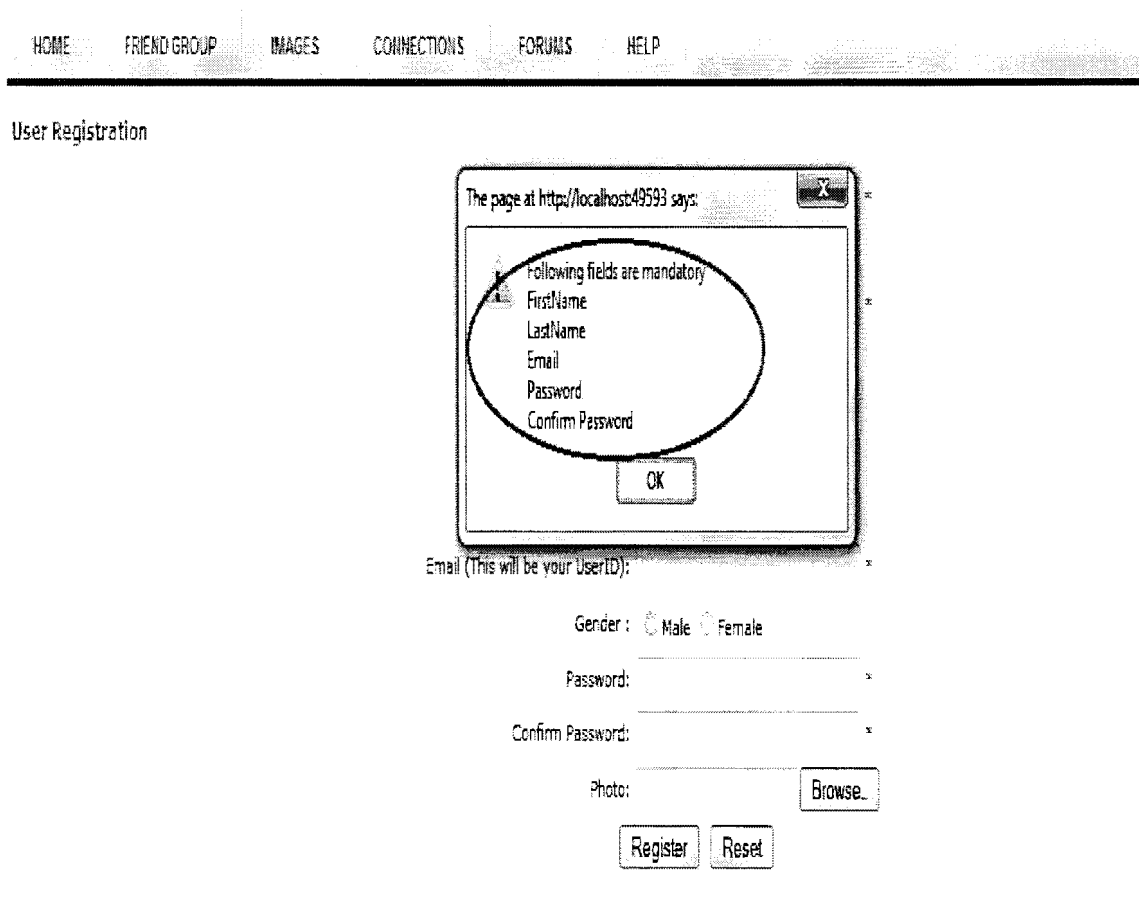

Figure 4.2. Error message when required fields are not filled.

For additional security, whenever a user registers successfully, an email is sent with a verification code and the link to confirm the registration. Once the user clicks the verification link, the registration process will be completed.

4.2. Login

The developed social-networking website has simple a login screen with fields to enter the UserID and Password. The UserID will be the email address provided during the registration process. After successful verification of the registered user, the user can login using the email address and the password provided during the registration process.

4.3. Home Menu

The main screen after the user logs in into the system is shown in Figure 4.3. All features in the application can be browsed from this menu. The design of this screen enables novice users to understand and utilize the application features easily. The layout of the screen is simple and easily understandable. The user and the user's friends are displayed on the left side of the screen. A user can add a friend by clicking the link to add friends. A user will be able to change the profile picture by clicking on the link to change a photo. The option to edit the profile is beside the change photo option. Posting messages, receiving messages, and the update feature are in the center of the screen. The right side of the screen has the option to send event invites to friends, and events received from friends are below the post event to friends section.

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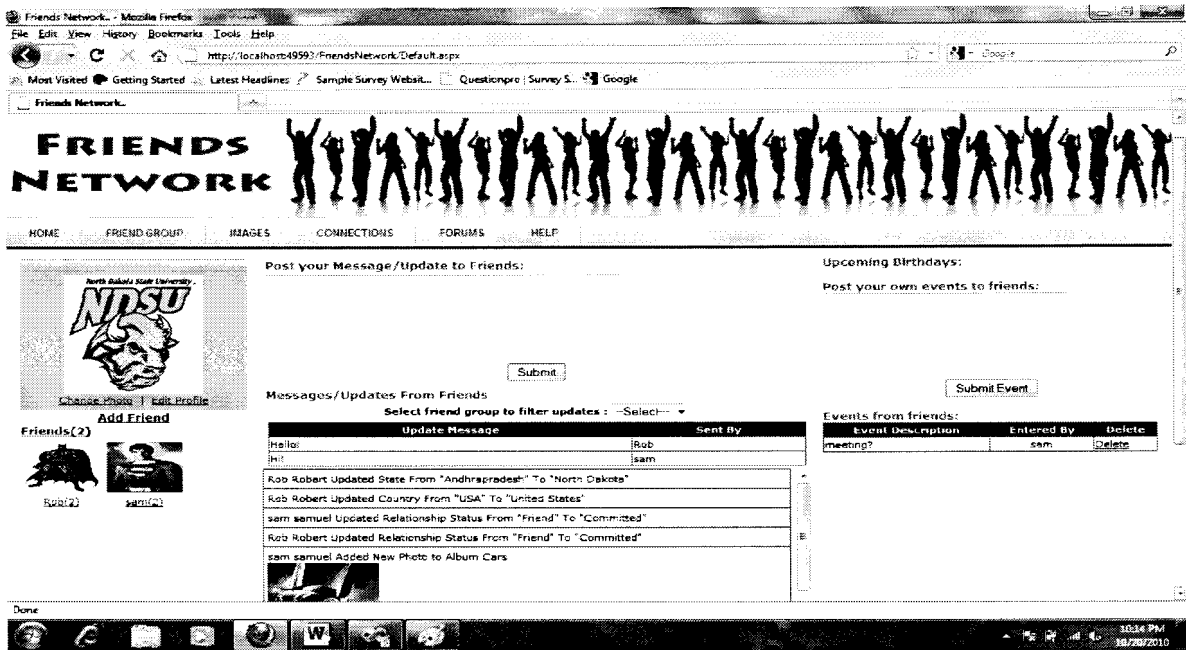
Figure 4.3. Home menu.

Friend requests, if any, are displayed on the right side of the screen below the events received from the friends section. Upcoming birthdays are displayed above the post event invite to friends section.

The menu bar enables users to navigate within the website easily. The menu bar is made up of the home, friend group, images, connection, forums, and extras sections.

Users can navigate within the website by clicking on the above-mentioned links. The features on the home screen are discussed in detail.

4.3.1. Add Friend

Just below the user display image on the home screen, there is a link to add a friend to the friend list. Figure 4.4 highlights the option to add a friend. When a user clicks on the Add Friend link, a page where the user can search for the friend with the first name, middle name, or last name is displayed.
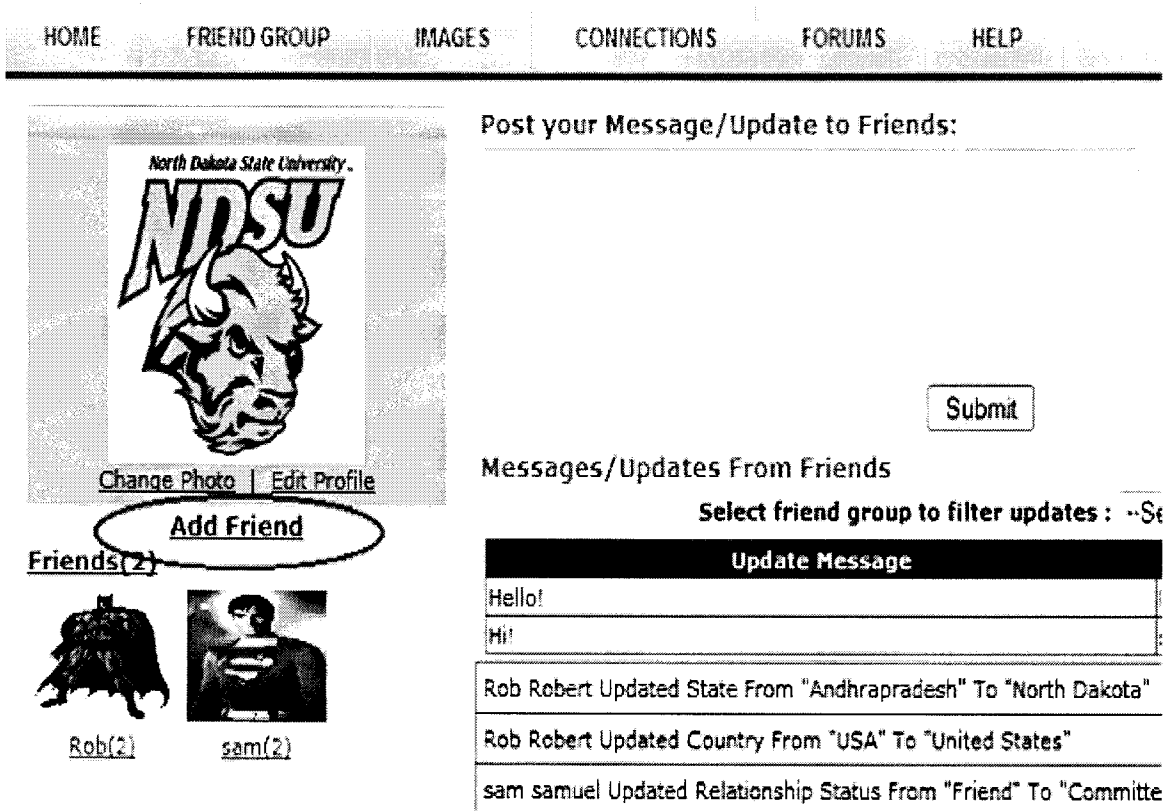

Figure 4.4. Option to add a friend to the friend list.

Once the user finds the friend, there is a link called Add Friend. By clicking on this link, the friend is added to friend list. Figure 4.5 shows the option to search and add a friend to the friend list.

Search User :

First Name: test

Middle Name:

Last Name:

Search

	First Name	Middle Name	Last Name
Add as Friend	Test		Yahoo
Add as Friend	TestNDSU		NDSU webmail

Figure 4.5. Option to search and add a friend.

4.3.2. Post and Receive Messages/Updates

The user can post messages to friends and receive messages/updates from friends. Profile updates for a user are automatically posted to friends in the friend list. When viewing messages/updates from friends, the user has an option to filter the messages/updates based on the friend group. The users will be able to view updates from specific friend group. This feature reduces the information overload that is caused when a user has a high number of friends and when there are many messages/ updates from the friends. This option is highlighted in Figure 4.6

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Post your Message/Update to Friends:

North Dakota State University.

NDSU

Change Photo | Edit Profile
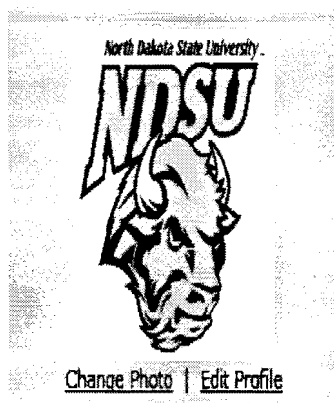
Add Friend

Friends(2)

Rob(2)   sam(2)

Submit

Messages/Updates From Friends

Select friend group to filter updates : —Select—▼

Update Message		Sent By
Hello!	Select	
Hi!	Batman	
	NDSU	

Rob Robert Updated State From "Andhrapradesh" To "North Dakota"	▲
Rob Robert Updated Country From "USA" To "United States"	
sam samuel Updated Relationship Status From "Friend" To "Committed"	
Rob Robert Updated Relationship Status From "Friend" To "Committed"	▼

Figure 4.6. Option to filter messages based on the friend group.

Once a user selects a friend from the dropdown list, the messages/updates

from friends in the selected group are displayed in the messages/updates section.

The dropdown list to filter the messages has all the groups that exist in the

user's profile. A user can select a specific group to view the message/updates.

This feature reduces the information overload caused due to a huge number

of messages from all the friends in the friend list. This feature also helps the users

to read few updates at a time.

4.3.3. Send and Receive Events

The developed social-networking website has an option to send event invites to friends and to receive events from friends. This option is shown in Figure 4.7.

Post your own events to friends:

Submit Event

Events from friends:

Event Description	Entered By	Delete
meeting?	sam	Delete

Figure 4.7. Send and receive events.

The user can enter the event in the space provided and click the submit button. Clicking the submit button sends the event to all friends in the friend list.

Once the event is submitted, the message "Event Added to all Friends" is displayed. The events received from friends are displayed below the submit event option.

The user has an option to keep the event, delete the event, or delete the event once the event is completed. This feature gives the user an option to keep track of all events received.

4.3.4. Edit Profile

In the developed social-networking website, the user has an option to edit the details. When a user clicks the edit profile link on the home page, the page with the option to edit details is displayed as shown in Figure 4.8. The user details are divided into different sections: Personal Information, Contact Information, Education, Phone, and Work. Once the user is done editing the profile information and after clicking the update button, the "Profile Updated" message is displayed on the screen; the edited details are posted in the update section for the friends.
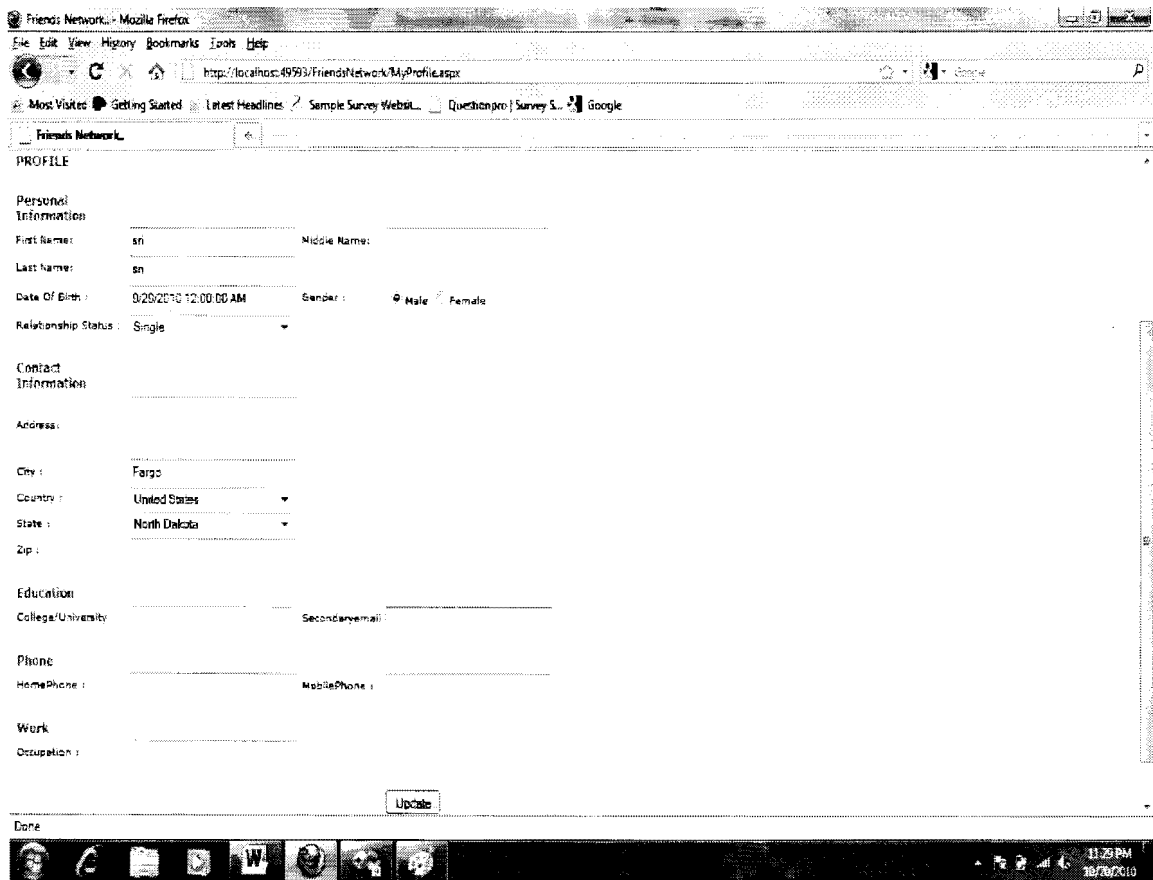

Figure 4.8. Option to edit profile.

4.3.5. Change Profile Picture

Figure 4.9 shows the option where a user can change the profile picture. Below the user profile picture on the home screen, there is a 'Change Photo' link. By clicking the 'Change Photo' link, a dialog box with the option to change a profile image is displayed.
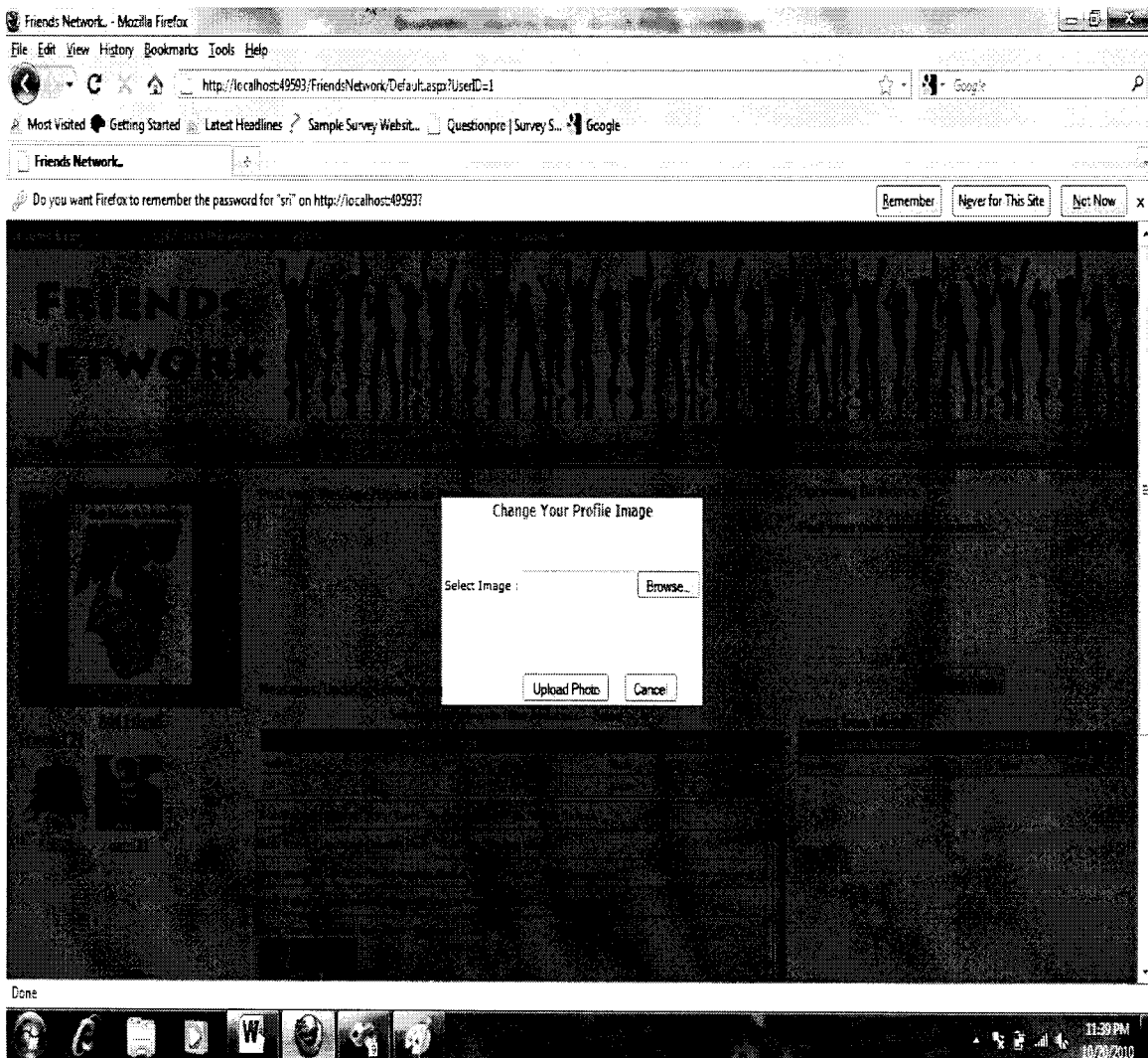

Figure 4.9. Option to change the profile picture.

A user can browse the desired image by clicking the 'Browse' button and clicking the 'Upload Photo' button to upload the image. Once the image is uploaded, an "Image Uploaded" message is displayed to confirm the user's change. After the image is uploaded, the changed image with user details is displayed in the updates section for the user's friends.

4.4. Friend Group Menu

In the developed social-networking website, a user has an option to add friend groups and add friends to the friend group. This option helps the user organize friends into desired groups.

The option to add friend groups and to add different friends to a group enables the user to view messages and updates from a particular friend's group. This feature reduces the information overload caused by having all messages and updates from different friends in a single place. The user can select the friend group from whom the user wants to view the messages/updates.

Also, a user can add the same friend to one or more groups. After adding friends to different groups, a user will be able to filter the messages and updates based on the friend groups.

The friend groups feature will enable a user to organize friends into different groups based on criteria considered by the user. Once a group is created, desired friends can be added in that group.

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4.4.1. Add New Group

The developed social-networking website has an option to create new a friend group; this option is shown in Figure 4.10. A user can enter the group name, enter a group description, and upload an image for the group. Once the user has all this information, the new group is created when the user clicks the 'Add Group' button. The existing groups are displayed below the create friend group section.
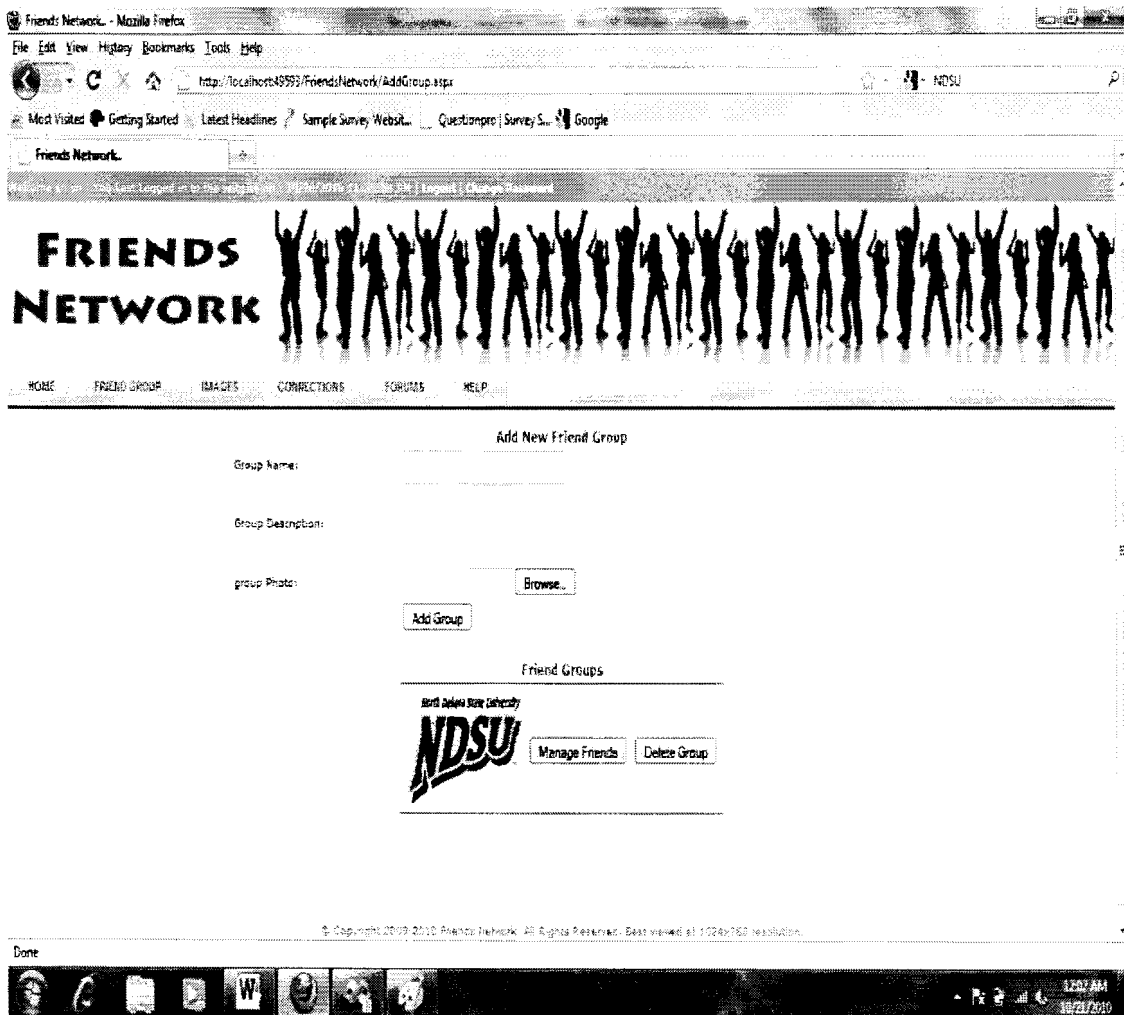

Figure 4.10. Option to create a friend group.

4.4.2. Add Friends to Group

Once a friend group is created, a user can manage the friends in the group by clicking on the 'manage friends' button beside the friend group image in the friend groups section.

After clicking on the 'manage friends' button, a page with the group members option is displayed. In this section, all the friends with their profile pictures and names are displayed with an option for the user to select the friends that he or she wants in that group.

Once a friend is selected to be in a group, the "Friend added to friend" message is displayed on the screen. This message notifies the user about the addition of a friend to a group. This message is shown in Figure 4.11. The user can have the same friend in several groups.
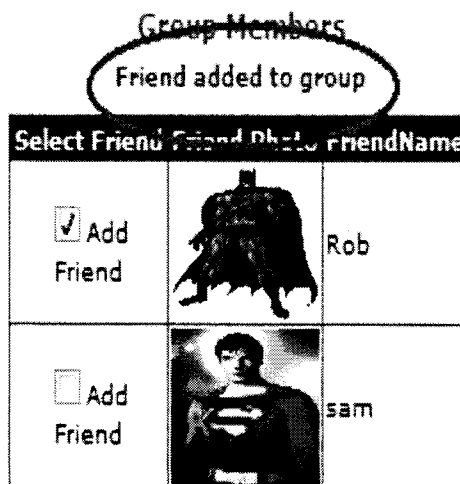
Figure 4.11. Adding friends to a group.

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4.5. Images Menu

A user can browse the Images section by clicking the images menu bar item on the main menu bar. A user can create a new album, delete an existing album, delete images from the existing album, and add photos to the existing album.

A user can add a new album by clicking the 'Create Album' button in the Images section. The user can also name the album.

A user will be able to add images to the existing albums by clicking the 'Edit' button beside the album cover image. The user can add the album title when uploading an image.

A user can delete the existing album by clicking on the 'Delete' button beside the album cover image in the albums section. Figure 4.12 shows the options to create a new album, delete an existing album, and add images to an existing album.

A user will be able to delete an image by clicking the 'Delete' button that is provided just below every image. Once an image is deleted, an "Image Deleted" message is displayed on the screen to confirm the action. These messages are designed to get the user's attention.

Also, a user has the option to select an image from the album to be the album cover. The album cover is displayed with the album name below it.
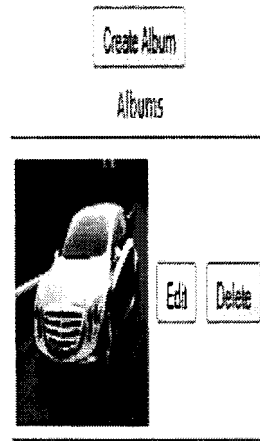
Figure 4.12. Images menu.

4.6. Connections Menu

The connections menu is the option where users can find the connection between their friends and the friends of their friends. The users can browse this page by clicking the connections tab in the main menu bar of the website.

Once a user clicks the connections tab, a page with all friends and the friends of their friends is displayed in a pictorial view. Figure 4.13 shows the connections section for the user. Pictorial representation of friends will be very helpful when a user has a huge number of friends in the friends list and when a user is trying to find the missing friends.

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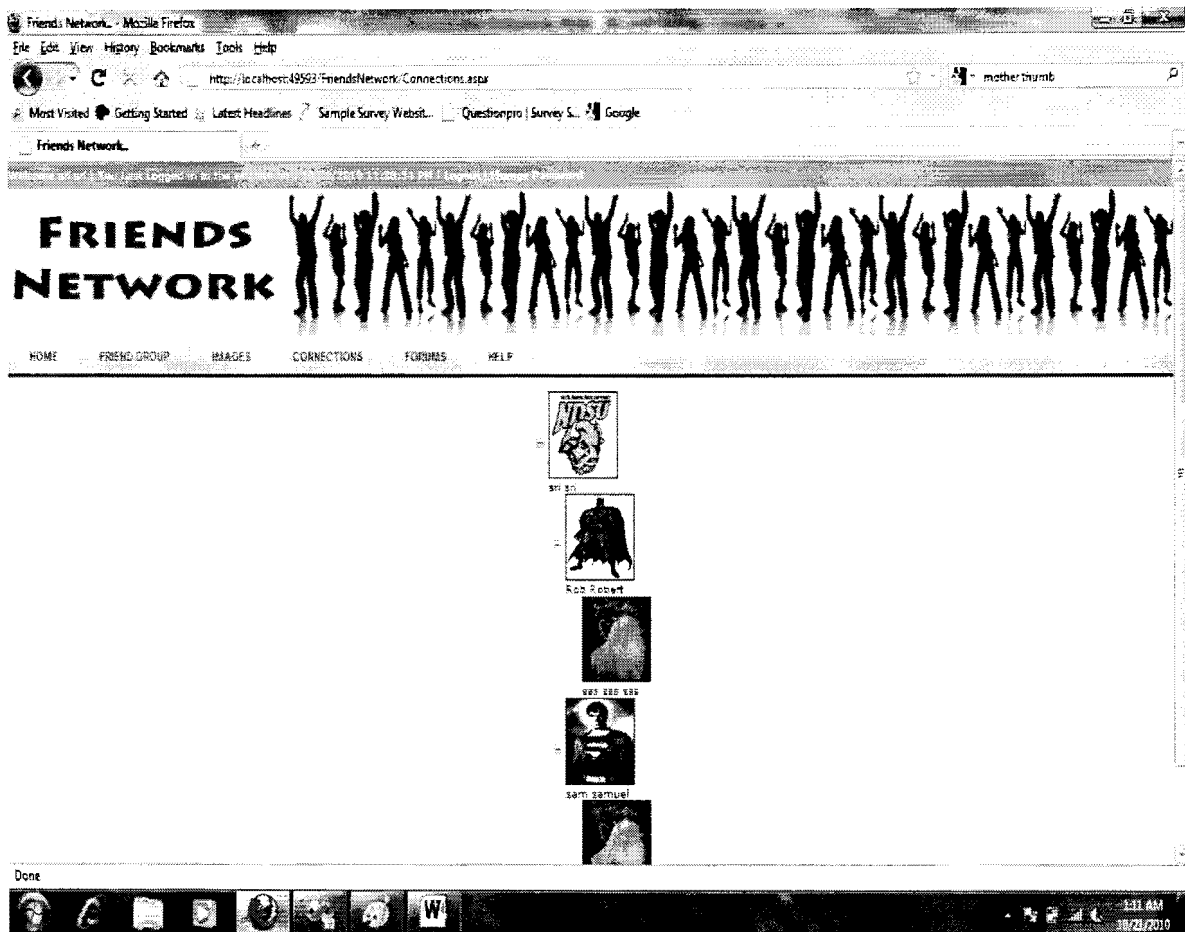
Figure 4.13. Connections menu.

The connections menu helps users to find friends and the friends of the users' friends in an easy way. The pictorial representation of connections enables the users to easily get to know the friends of their friends and to find common friends among their friends.

The connections feature will be really helpful for users to find the friends who are missing in their friend list. The pictorial representation gives a clear idea about missing friends, instead of just following the random friend suggestions generated by other social-networking websites.

4.7. Forums

The users can browse the forums section by clicking the 'Forums' tab on the main menu bar. The Forums option will enable users to share the technicality of the website. They can post their concerns and issues in the forums section, and they can obtain answers from other members within the network. The users have several different options in the forums section. The users can view existing posts, create new posts, view existing topics, search for a specific topic, view recent posts, view recent topics, etc. Some users can be assigned as the moderators of the forums section so that they will be able to make changes. Figure 4.14 shows the overall idea of the forums section in the developed social-networking website.
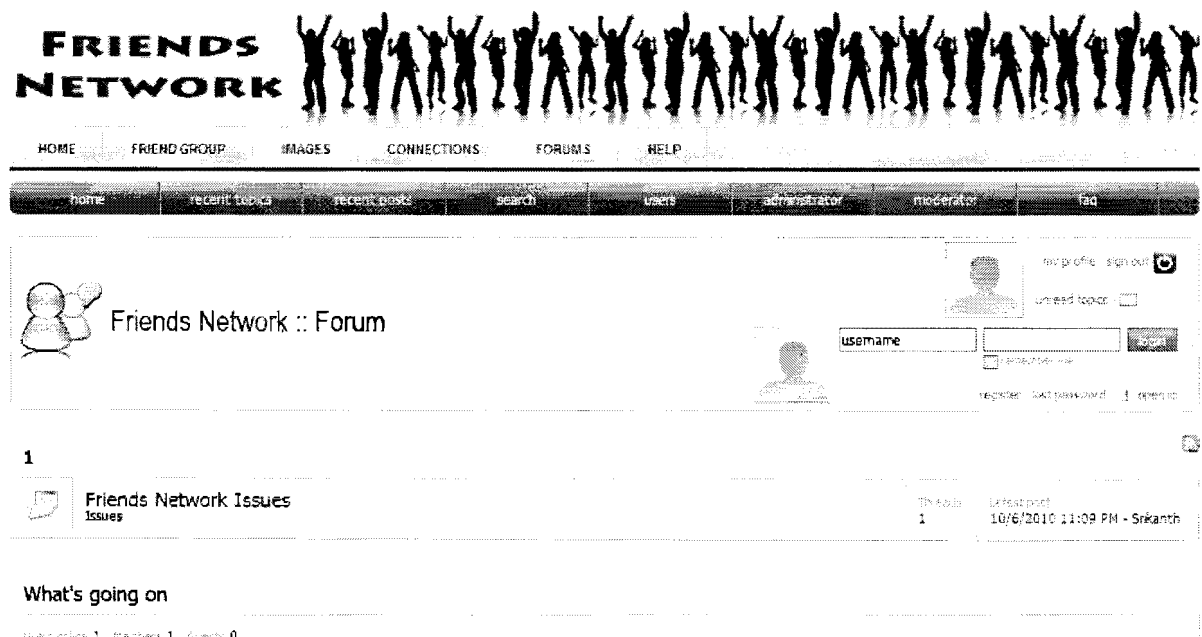

Figure 4.14. Forums section.

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Users can browse through the existing topics, leave posts, and find answers for the questions. If the issue that a user is having is not reported, then the user can create a new topic and post the issue. Any user can answer questions posted by other users. The forums section can also be used to share information not only with the friends of the user, but also with other members within the network.

The forums section can also be used by the site administrators to find common problems faced by users in the network. This section will help the administrators make necessary changes for the website to be more user-friendly and to provide features for which the users are more interested. The site administrators can also take suggestions from the users by using the forums section.

4.8. Old Posts by Date

Many social-networking websites does not provide users with an option to view older posts/messages after a certain time period. Here, a user can view older posts/messages by selecting the date. If a user wants to view a message from a friend which was sent in the past, the user can click the date in the calendar provided, and the messages/posts for the selected date are displayed.

CHAPTER 5. SURVEY RESULT ANALYSIS

A survey was conducted to evaluate the features implemented in the social-networking website. In this section, the results of the survey conducted to evaluate the social-networking website are analyzed. The volunteers who participated in the survey were asked to answer a questionnaire with 14 questions. There were a total of 36 participants for the survey.

Questions 1 to 4: The first four questions were general questions. The participants' were asked about the social-networking websites they use often, the frequency and purpose for which they use social-networking websites and their familiarity with features in the social-networking websites that they use often.

Of the 36 participants, 75% used Facebook; 77.8% of the participants visited the social-networking website daily. The question regarding the reason for using the social-networking website had an option for participants to give more than one answer from the list of answers.

Participants gave several reasons for using social-networking websites; 86% of the participants used a social-networking website "To stay connected with friends"; 33% used a social-networking website "To make new friends"; and 33% used a social-networking website as a hobby.

Figure 5.1 shows the participants' response to the question 4. This question was about familiarity with the features in the social-networking website they use.

Please rate your level of familiarity with the features in social networking website that you use
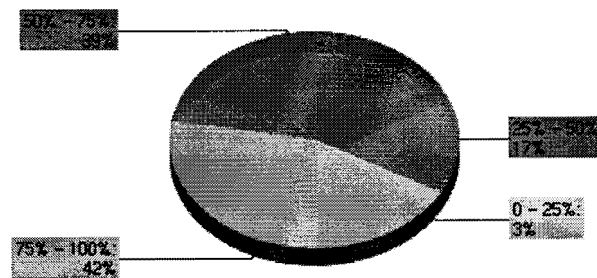
Value	Count	Percent %	Statistics	
75% - 100%	15	41.7%	Total Responses	36
50% - 75%	14	38.9%		
25% - 50%	6	16.7%	Sum	1,975.0
0 - 25%	1	2.8%	Average	56.4
			StdDev	18.27
			Max	75.0

Figure 5.1. Participants' familiarity with the features.

Questions 5-14 were based on the developed social-networking website. The questions were divided into three different categories: design, functionality, and ease of access.

Question 5: The participants' average rating for the design of the feature to post and receive messages/updates was 4.11 out of 5.

Question 6: On average, the participants' level of satisfaction with the feature for posting and receiving messages/updates was 4.1 out of 5. More specifically, 41.7% of the participants were extremely satisfied; 33.3% were satisfied;

and 19.4% of the participants were neutral. Table 5.1 shows the cross relation between the features, design, and satisfaction level of the users.

Table 5.1. Cross relation between features, design, and satisfaction level

Rating / Feature	Design	Satisfaction level
Posting and receiving messages and updates	4.11	4.11
Connections	4.06	4.2

Question 7: 97.2% of the participants' thought that the feature posting and receiving messages and updates is easy to use. 35 out of the 36 participants had this opinion. Only 1 out of 36 participants thought the design of the feature posting and receiving messages and updates is not easy to use.

Question 8: Figure 5.2 shows the response to the question about if filtering messages and updates based on friend groups reduced information overload. Figure 5.2 shows that 47.2% of participants have strongly agreed and that 41.7% of the participants agreed with the opinion that filtering messages would reduce the information overload. Out of the remaining participants, 8% of the participants were neutral about their opinion and only 3% of the participants disagreed that filtering messages and updates based on friend groups will reduce information overload.

Filtering messages and updates based on friend groups will reduce information overload?
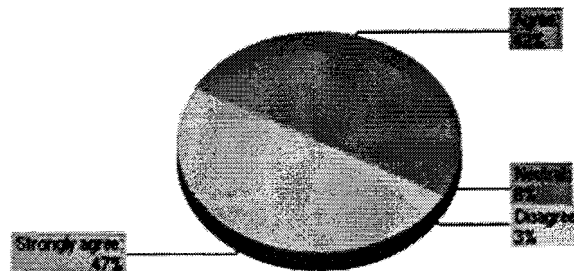

Figure 5.2. Participants' response to question 8.

Question 9: In this question, the participants were asked about the design of the feature to filter messages and updates; 97.2% of the participants had the opinion that the filtering messages and updates feature is easily understandable. This response shows that even novice users can easily use the feature. Table 5.2 shows the cross relation between the feature, design, and usage of the feature for filtering messages and updates based on friend groups.

Table 5.2. Cross relation between feature, design, and usage

% Feature	Design	Usage
Filtering messages and updates based on friend group	97.2% were of the opinion; design makes it easy to use.	61.2% were of the opinion; they would use it very frequently or frequently.

Question 10: Figure 5.3 shows the participants' responses to the question about how often they would use the feature for filtering messages and updates

based on the friend groups; 61.2% of the participants were of the opinion that they

would use the feature to filter messages and updates based on the friend group

either very frequently or frequently. Some participants (19.4%) were neutral about

usage of the feature.

How often would you use the feature filtering messages and updates based on the friend group?
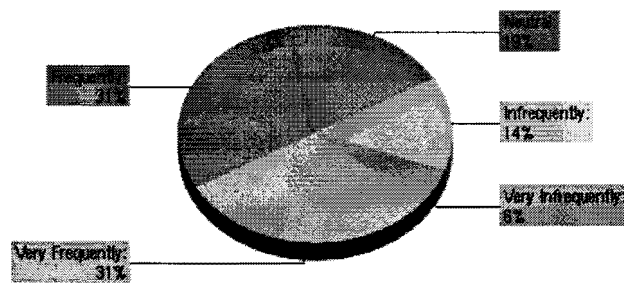
Value	Count	Percent %	Statistics	
Very Frequently	11	30.6%	Total Responses	36
Frequently	11	30.6%		
Neutral	7	19.4%		
Infrequently	5	13.9%		
Very Infrequently	2	5.6%		

Figure 5.3. Usage of the feature to filter messages and updates.

Question 11: About 78% of the participants were of the opinion that

posting events to all friends will reduce the burden of inviting friends separately to

an event. Figure 5.4 shows the statistical analysis of the responses. Of the

remaining 23% of respondents, 17% of the participants had a neutral opinion.

Question 12: The average participants' rating for the design of the feature

connections is 4.06, which shows that most of the participants were satisfied with

the design. This feature connections design is done in a way that users who are

utilizing the social-networking website for the first time can easily understand the

website. Figure 5.4 shows the participants' responses to question 11.

Posting the events to all the friends will reduce the burden of separately inviting each and
every friend to an event?

Value	Count	Percent %	Statistics	
1		0%	Total Responses	36
2	1	2.8%		
3	6	16.7%	Sum	149.0
4	11	30.6%	Average	4.3
5	17	47.2%	StdDev	0.84
NA	1	2.8%	Max	5.0

Figure 5.4. Participants' responses to question 11.

Question 13: In this question, participants were asked whether the pictorial

representation of their friends will enable them to find missing friends easily. About

91% of the participants either strongly agreed or agreed with the opinion that a

pictorial representation of friends and their friends' friends will enable them to find

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missing friends easily. About 6% of the participants had neutral opinion. This response can be clearly seen from Figure 5.5.

Pictorial representation of your friends and their friends will help you find the common friends missing in your profile easily?
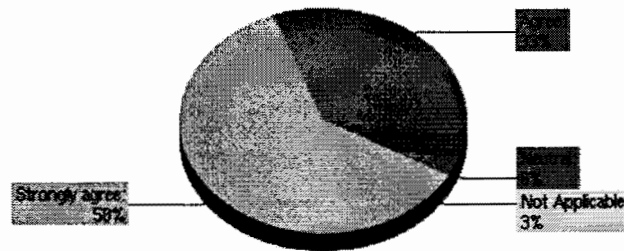
Value	Count	Percent %	Statistics	
1		0%	Total	36
2		0%	Responses	
3	2	5.6%	Sum	159.0
4	12	33.3%	Average	4.5
5	21	58.3%	StdDev	0.60
NA	1	2.8%	Max	5.0

Figure 5.5. Responses about pictorial representation.

Question 14: In the last question of the survey, the participants were asked to rate their overall satisfaction level with the website. The results are shown in Figure 5.6.

Of the total 36 participants, 29 participants, who accounted for 80.5% of the respondents, were either very satisfied or satisfied with the website. Of the remaining 7 participants, 6 participants, accounting for 17% of respondents, were

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neutral about their opinion. Only 1 of 36 participants were dissatisfied with the website.

Please rate your overall satisfaction level with the website
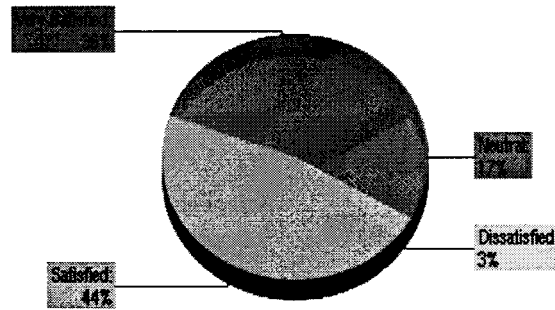
Value	Count	Percent %	Statistics	
5	13	36.1%	Total	36
4	16	44.4%	Responses	
3	6	16.7%	Sum	149.0
2	1	2.8%	Average	4.1
1		0%	StdDev	0.79
NA		0%	Max	5.0

Figure 5.6. Responses to question 14.

In the survey for the evaluation of the website, many participants were either very satisfied or satisfied with the website. Some of the participants' were neutral.

CHAPTER 6. CONCLUSIONS AND FUTURE WORK

6.1. Conclusion

The developed social-networking website is an easy-to-use solution for users interested in utilizing social-networking websites. The features are developed to help every user easily understand and utilize the features with utmost comfort. Novice users can enhance their social-networking experience by using the developed website.

In this paper, we discussed the features being implemented, the design of the application, and the architecture used. The website was illustrated with the help of the developed interface.

To evaluate the application, a survey was conducted with volunteers. Fourteen questions were framed to evaluate the website and its features. The data collected from the survey were analyzed to evaluate the website based on the design, functionality, and ease of access.

About 80.5% of the participants were either very satisfied or satisfied with the website, and 17% of the participants' were neutral. Although 2.8% of the participants were dissatisfied with the website, we are positive that, when the same evaluation is conducted with more subjects, the neutral and dissatisfied participants' ratings would, to a large extent, be minimized.

6.2. Future Work

In this paper, we have concentrated on some of the important features that would be beneficial to users and made the features easy to use. Numerous enhancements can be made to the existing features.

The present application does not include a feature where users can chat with each other. Although normal chat features exist in most social-networking websites, a feature where users can video chat with each other would be very beneficial. The video-chat feature is not available in most of the existing social-networking websites.

The social-networking website does not include a feature where users can maintain a mailbox to send and receive emails. Although most social-networking websites have an option to send messages, it would be very beneficial for users if they could be able to incorporate their existing email into the developed social-networking website. By adding this feature to the website, users will be able to maintain all their emails, messages from friends in their friend list, and event invites in a single place.

The present application does not include a feature for users to maintain blogs. Adding blogs to the website would be very helpful for the users.

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APPENDIX I

This appendix contains details of the questions asked to the users:

1) Which social networking website do you visit most often?

    a) Facebook

    b) MySpace

    c) Not listed

    d) None

2) How frequently do you visit social networking website

    a) Daily

    b) 2-4 times a week

    c) Weekly

    d) Once in two weeks

    e) None of the above

3) Why do you use social networking website

    a) To stay connected with friends

    b) Make new friends

    c) Hobby

    d) Do not know

4) Please rate your level of familiarity with the features in social networking website that you use

     a) 75% - 100%

     b) 50% - 75%

     c) 25% - 50%

     d) 0 - 25%

5) Rate the design of the feature posting and receiving messages and updates

     Rating 1 to 5

6) How satisfied are you with the feature posting and receiving messages?

     a) Very Satisfied

     b) Satisfied

     c) Neutral

     d) Dissatisfied

     e) Very Dissatisfied

     f) Not Applicable

7) The feature posting and receiving messages is easy to use

     a) Yes b) No

8) Filtering messages and updates based on friend groups will reduce information overload?

     a) Strongly Agree

b) Agree

c) Neutral

d) Disagree

e) Strongly Disagree

f) Not Applicable

9) The design of the feature filtering messages and updates based on the friend

groups makes it easily understandable.

a) Yes b) No

10) How often would you use the feature filtering messages and updates based on

the friend group?

a) Very Frequently

b) Frequently

c) Neutral

d) Infrequently

e) Very Infrequently

11) Posting the events to all the friends will reduce the burden of separately

inviting each and every friend to an event.

a) Strongly Agree

b) Agree

c) Neutral

d) Disagree

e) Strongly Disagree

f) Not Applicable

12) Please rate the design of the feature connections

Rating 1 to 5

13) Pictorial representation of your friends and their friends will help you find the
common friends missing in your profile easily?

a) Strongly Agree

b) Agree

c) Neutral

d) Disagree

e) Strongly Disagree

f) Not Applicable

14) Please rate your overall satisfaction level with the website
a) Very Satisfied

b) Satisfied

c) Neutral

d) Dissatisfied

e) Very Dissatisfied

f) Not Applicable

APPENDIX II

NDSU

NORTH DAKOTA STATE UNIVERSITY

Institutional Review Board
Office of the Vice President for Research, Creative Activities and Technology Transfer
NDSU Dept 4000
1735 NDSU Research Park Drive
Research 1, P.O. Box 6050
Fargo, ND 58108-6050

701-231-8995
Fax 701-231-8098

In accordance with NDAA 8.18.13
Exempt from 45 CFR 46.101

Monday, September 27, 2010

Dr. Weiyi Zhang
Computer Science
IACC 258

Re: IRB Certification of Human Research Project:

       "Evaluating the social networking website developed"
       Protocol #SM11037

Co-investigator(s) and research team   Jun Kong, Srikanth Goud Aakula, Stephanie Sculthorp

Study site(s): **NDSU**   Funding: n/a

It has been determined that this human subjects research project qualifies for exempt status (category # 2) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, *Protection of Human Subjects*). This determination is based on the protocol form received 9/13/2010 and consent/information sheet received 9/13/2010 and training documentation received 9/27/2010.

Please also note the following.

- This determination of exemption expires 3 years from this date. If you wish to continue the research after 9/26/2013, the IRB must re-certify the protocol prior to this date.
- The project must be conducted as described in the approved protocol. If you wish to make changes, pre-approval is to be obtained from the IRB, unless the changes are necessary to eliminate an apparent immediate hazard to subjects. A *Protocol Amendment Request Form* is available on the IRB website.
- Prompt, written notification must be made to the IRB of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
- Any significant new findings that may affect the risks and benefits to participation will be reported in writing to the participants and the IRB.
- Research records may be subject to a random or directed audit at any time to verify compliance with IRB policies.

Thank you for complying with NDSU IRB procedures; best wishes for success with your project.

Sincerely,

Kristy Shirley, CIP
Research Compliance Administrator