Investigation of the Enhancement of Security in Social Networks by Modifying Privacy Policy among Users

GRADUATE PROJECT REPORT

Submitted to the Faculty of
The School of Engineering & Computing Sciences
Texas A&M University-Corpus Christi
Corpus Christi, TX

in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Computer Science

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Spring 2015

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ABSTRACT

Online social networking sites (OSNs), offer an easy and inexpensive way for users’ to maintain communication across the globe. They help the users in finding the new friends and communicating with the old ones. The application enables user flexibility, privacy and security policies in terms of authorization and authentication. Social networking sites are more vulnerable to various threats such as disclosure of information, privacy issues and attacks. And hence it requires new policies or enhanced settings for each user profile such that it enhances and strengthens the data security.

The Web application implements enhanced privacy settings for the users by allowing the users to set different privacy settings for different users based on their roles (owner, contributors, and stakeholder) over the resources. It also implements decision voting mechanism to allow for sharing and denial based on the privacy settings which will be enforced on user profile. These privacy settings are evaluated each time when the other users of application (who are not the owner of resources) try to access the uploaded data. Overall, it implements simple and highly secure feature for the user to protect their information identity and privacy over online social networking sites by providing user control privacy settings.
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1. BACKGROUND AND RATIONALE

In today’s world of technology online social networks are growing in demand and popularity. Moreover, they come under most frequently browsed Websites in the world. It provides a virtual community for the users to interact with each other. Online Social networks (OSN’s) are the websites which allow the users from all over the world to connect with their friends and family over the internet. These websites allows the user to maintain their existing relationships and make new relationships [12]. They also allow the users to share photos, videos and post messages. These are very easy to setup and use. If a user wants to be on social networks then the user has to create an account by registering on these websites. The users on social networks are identified by their profile name which contains information about the user like name, date of birth, age and contact information. After the registration the user will have username and a profile page which is also known as wall where message can be posted and pictures can be shared. Moreover, these websites not only used to communicate with people but also they are used by various business organization, educational organizations and colleges/universities to share information, resolve issues etc.

As Social networking sites deals with large amounts of user data (personal information, contact information, photos etc.). It should prevent unauthorized access of these data. Hence privacy is the main concern of these Websites [3]. The project analyses and addresses the privacy issues which will make the social networking Websites more secure for the users.
1.1 Types of Social Networks:-

The following are some of the most popular social networks:-

1) Bebo:- It was launched in 2005 and became a popular social network where users can publicly or privately share their stories, photos and journals over the internet.[13]

2) Classmate: - It is one of the largest online social networks consists of graduated students as users. It allows the graduated students from high schools to keep in touch with their friends in future. It has a very simple interface. During the account creation it ask the user about the state, city and high school from which they graduated and it will display all the classmate of that particular high school provided by the user[13].

3) Facebook: - One of the most popular and only online social networks with over one billion active registered users [14]. It allows users to create their own virtual space called profile where they can share post, photos, and videos. Moreover it allows the user’s to connect with their friends and make new friends. It also has different media information such as Bollywood/Hollywood star fan pages, groups and news where users can get the latest information about their interest.

4) LinkedIn: - An online social network which allows the user’s to connect with their past, current and future co-workers. It also creates a network which connects the companies and the employers [13]. During the new user registration it ask the user to enter their area of interest in education and working experience if any which helps the companies to find better employees for their organization.
5) Twitter: - Another most popular online social network where users can post 140 character long messages known as tweets about any event happens in the world [13].

6) StumbleUpon: - An online social network not as much popular as other social networks where users can rate a website. If the user likes a particular website they have to hit thumbs up button or thumbs down button. The users can view top rated website in an area of their interest [13].

7) Instagram: - It is an online mobile social network which allows the users to take picture and videos, share them. It also allows the users to edit their photos, apply visual effects and filters to overall increase the quality of pictures [13].

1.2 Usage of Social Networking:-

There has been a growth in the usage of online social networks mostly by the young adults. A recent survey in September 2014 conducted by Pew research Centre showed that there is rapidly a growth in the usage of online social networks, among the most popular websites Facebook is mostly used [15]. The survey was conducted in United States of America and it includes the following information.

1) 52% of American adults use two or more social networking sites which increased from 2013. These results conclude that multi-platform usage of social networks is increasing.

2) 56% of adults between 65 and older use Facebook as of 2014.

3) 53% of young adults aged between 18 and 29 use Instagram out of which 49% use it daily.
4) 50% of college students use LinkedIn social network [15]. The Figure 1.1 shows the statistics of social media usage between 2012 and 2014.

![Figure 1.1 Statistics of Social Media Usage](image)

From the Figure 1.1 it is clear that Facebook social networks leads in the usage of social networks. In 2012 the percentage of online adults for Facebook was 67% which rise to 71% in 2014. Similarly the usage of other social networks can be seen in the statistics figure 1.1.

**1.3 Benefits of Online Social Networks:**

Some of the benefits of using Social Networks are [16]:-

1) Now day’s social networks are used as medium to spread information faster than any other medium.

2) It is also used by the law enforcement to catch and prosecute criminals.

3) It helps the students to perform better in their studies by sharing their views and finding useful information. Students can discuss educational topics over social networks and share their views.
4) It allows the people to improve their relationships and make new relationships.
5) They help the organization in finding new employees and vice versa.
6) They help the teachers and students to keep in touch outside the classroom.

### 1.4 Disadvantages of Social Networks:

Some of the disadvantages of using online social networks are [16]:-

1) Sometimes social networks are responsible for spreading false and unreliable information.
2) Social networks lacks in the privacy of user’s information, they exposes the user’s information which in turn violates the privacy of the user.
3) These sites are used by the student to improve their performance at school but too much usage tends to effect student grades.
4) More usage of online social networks can cause severe stress and it can affect the real life relationships.
5) The usage of these sites will cause brain disorder which will effect face to face interaction of a person.

### 1.5 Privacy Concerns in Online Social Networks

As Social networks contain huge personal and sensitive information these websites are always subjected to threats and risks. Generally, the users of social networks are responsible for disclosure of information because when a user want to use any of online social networks, then the users have to sign an agreement about the policy of use which states that the information over online social networks can be stored on profiles of different users or even shared with the third parties [17]. Online Social Networks should
provide privacy and security mechanism to protect the sensitive data from attackers or unauthorized use. Indeed, they provide some privacy settings to the users through which they can control the access to their data, but it’s not user defined, the users have to rely on their providers or online social networks to enforce these settings to their profile [2]. Moreover, there exist no privacy or security settings for the application providers in online social networks. The existing privacy policies provided by these Websites protect the data that resides only on user profile, but what about the privacy of the data that resides on other’s profile (For example tagging, comments, likes..etc.). As these online social networks are free of cost to the users, it uses user’s personal information such as demography, to support their large storage infrastructure which in turn violates the privacy of the user data.

1.5.1 Rise in Privacy Problems of Online Social Networking

Online social networks contains large amount of log and user generated data, the attacker or unauthorized person can understand the user behavior by doing a research on it. These data helps the attackers in frauds such as identity theft, phishing schemes and security breaches. In the past year these frauds have overall increased. Some general examples are:–

1) 4.7 million Users of Facebook liked a page “Health conditions or treatments” the attacker or insurer may get the users information from Facebook and can use against the users [1].

2) 4.8 million Users on Facebook said they are going to a certain place on a certain day; this information can be helpful for burglars [1].
3) 20.4 million Facebook users specified their Birthdate which can be used by attackers as identity theft [1].

Some specific examples of privacy risks and attacks are:-

1) Identity Theft: - This is the most common theft over online social networks. As the users include their personal information like name, age, date of birth and contact information over these websites. The included information can be misused by thieves. Most of the users use passport style photographs as their profile picture which increases and makes the identify theft easy [18]. A recent survey conducted by Javelin strategy and Research center showed that over 12 million people in United states of America have been targeted of identity theft which includes 34% from Florida, 24% Georgia and 20% from California. The survey also shows that 93% of users include their full name, 60% includes their family name, 33% users include their current employer and 4% includes their home address. The unawareness of profile setting and privacy setting make Identity theft possible. Identity theft is increasing because 10% of users use similar passwords for online social networks and financial accounts. Moreover, 39% use similar kind of passwords for different accounts.

Some real time examples of Identity theft:-

i) Identity theft of school director via twitter social network:- In 2013, Ira Trey Quesenberry III, an 18 year old student of Sullivan Central High School was charged for identity theft of school director. The accused created an account of school director Dr. Jubal Yennie with a profile photo
and sent tweets which were embarrassing in nature. Dr. Yennie contacted the police and the accused was caught [19].

ii) A woman was accused in New Jersey after creating a fake Facebook account (Identity theft) of her ex-boyfriend. An identity theft (fake account) represented her ex-boyfriend as a drug addict, a sexual deviant and a narcotics agent [20].

iii) A student in California was caught after posting sexual content on his classmate’s account by stealing the password which is another identity theft [21].

2) Sexual predators: - This is another type of attack over online social networks which are growing rapidly. Sexual predators are the people who commits sex crimes such as rape and child sex abuse using the information about the victim from online social networks. Some of the real time examples of sexual predators are [22]: -

i) In 2009, a 17 year old girl was raped and murdered by a man named Peter Chapman that created a fake profile and added over 3000 friends.

ii) A man was caught by FBI who kidnapped a 12 year old girl after chatting with her over an online social network.

3) Stalking: - As social networks allows the user to create a web of friends and share personal information over the internet. Most of the users share too much personal information which makes easy for stalkers. According to the recent survey 63% of users over online social networks display their profile to public and they are unaware of being a victim of stalking. If a profile is displayed as public then
anyone can google profile name and can access the user information without the knowledge of the user [23].

4) Unintentional fame: - This is another type of privacy concern over online social networks. Various activities have been established which uses online social networks to spread a false fame about the users of online social networks. The real time example of unintentional fame is: -

- In 2002, a video was posted over online social network which showed a Canadian teenager using a golf club as light sabre which gained him unintentional fame and made him popular as star war kid [24].

5) Catfishing: - Catfishing is developing a social relationship with an unknown person over online social networks. This can be done because of loneliness or to take some revenge. The common signs includes the person cannot be contacted in real life, the person uploads highly edited photographs as profile picture and their personal information keeps changing [25].

1.6 Social Networking Architecture:-

Social networks follows a structure which allows the user’s to share their feeling, photos, stories and even meet new people of their interest. Using these platforms users can interact with each other by various means such as instant chatting via message or writing it on blog (wall). The structure basically includes profiles, friends, blogs, comments and likes.
i) Profile: - It is used to define the user. It contains user information such as name, date of birth, age, phone number etc. Each user on a social networking site is identified by its profile and can contact new people by their profile names.

ii) Friends: - These are the trusted members of a particular user who are allowed to comment and like on the user personal data. In LinkedIn social network, these friends are referred as connections.

iii) Groups: - People of similar interest over social networking sites are put together which are known as groups. If a user post something in a group then the entire users of that group can comment, like and share that post. Facebook Social network refer these groups as networks.

iv) Blog: - Another feature of social networks is blog where users can share their current status about their activities.

v) Wall: - A wall is a virtual space allotted to a user when the user creates a profile. In a wall the users can post photos, status and messages [26].

1.7 Literature Review

In Online social networking Websites access control model controls the access of the data and resources of the users (who and how the sensitive information can be accessed). There are some existing access control mechanisms.

1) Carminati[2] proposed a trust based access control mechanism for online social networks in which the authorized users are represented in terms of depth, relationship type and the trust level between the users. The main disadvantage of this mechanism is it communicates only with the central node.
2) Caraminati et al. proposed a method to overcome the drawback of the previous method by introducing a rule based approach [3] for defining the access control policies on the user data. It follows a semi decentralized structure in which the access control policies are defined on the user’s side. This enforcement mechanism can provide control over the sharing of information in online social networks. The drawback of this system is it very difficult to implement and time consuming.

3) N. Talukder et al. Proposed a D-FOAF [4], a distributed identity management system in which relationships are considered as the main factor to measure the level of trust. In this method access rights are defined based on the social network structure and they are fine grained because of notion access right delegation.

4) Gates[5] introduced a relationship based access control mechanism and Fong[6] implemented this mechanism on social networks, in which authorization decision is made on the relationship between the owner of the data and the accessors who are trying to use that data. Generally it tracks the interpersonal relationships between the users and makes access control policies according to tracked relationships.

All of the proposed methods will not work in online social networks which follow collaborative mechanism for data sharing. Hongxin Hu [7] proposed a simple and effective mechanism for collaborative data sharing in online social networks, which considers the privacy policies of multiple associated users to maintain the privacy control and data sharing policies.
1.8 Existing Local Projects

The following are the list of existing local projects:-


2) Implementation of an Android Application to Enhance Security in Mobile Social Networks [10].

The major dissimilarity between existing local projects is that they are mobile application build on Android operating system. Moreover, the existing applications are integrating different social networks (Facebook, Twitter, etc.) and email (Gmail) under one platform and cloud structure has been implemented to store the data. The developed application is a Web based application where the user data and profiles are stored on a local database and it will implement user control privacy settings. User control privacy settings will allow the different users to set different setting on a particular data shared over the network.
2. NARRATIVE

2.1 Project Objective

The idea of the project is to protect the user data over online social networks. To protect the data in online social networks access control mechanism is the central point. In order to enhance the privacy of access control mechanism some of the properties should be considered.

1) The access control mechanism should provide the user, a proper access control to its profile; making sure that user data is not exposed or used without the user’s knowledge.

2) The access control mechanism should adopt a user friendly interface, making easy for the users to define their access control policies.

Generally in online social network a new user has to register. When the user gets registered, online social network structure provides that user, a virtual space to store the user’s personal information. A registered user can enforce privacy policies provided by online social network for the data that resides in the user’s own virtual space or profile. The application will allow different user’s to enforce privacy policies for different users on the data.

2.2 Goals of the Project:-

The main aim of the application is:-

1) To maintain security protocol.

2) To control unauthorized access to the data.
3) Allow multiple users of the same data to provide their privacy policies for authorization.

4) To provide user control privacy in online social network.
3. SYSTEM DESIGN

The system encapsulates online social networking paradigm, where networking happens between different users by means of sharing, commenting and adding data. Along with these it enables securing personal information and the data which gets uploaded over these Web applications (e.g. Photos).

3.1 System Architecture

The system is designed to protect the privacy of the data which will be uploaded on the application. Depending on the settings customized on a user profile, the system will decide whether the data or the information uploaded by the user can be shared or not. Data sharing mechanism is applied whenever user messages or the data which is uploaded over the system is fetched by clicking user profile links. Figure 3.1 shows the structure of user profile on the web application. Generally the user profile represents the account of the user. It stores the information about all the data uploaded over the application and the information about the privacy settings enforced on the uploaded data. The user profile is the main attribute of the web application as it stores user’s information and data.
Figure 3.1 User Profile Structure
The system architecture shows the various activities and flow of the system. In order to use the developed web application the user has to register by entering the username, email and password. Then the web application will send an activation link to the email id provided by the user. The username account will be activated by clicking the activation link from the email. Then the user can enter the username and password to log in to the web application. If the user enters a valid username and password then it will be redirected to home page otherwise, a message to enter valid information will be displayed. On the home page the user can add friends, upload photos, view uploaded photos, can view uploaded photos by all other user, set privacy settings and log out. All the information will be stored on a local database.

Once the requestor who is trying to access the resources of the owner is validated against the rules and decision mechanism, depending on which the result will be displayed to the requestor. Figure 3.2 represents the system architecture.
Figure 3.2 Architecture
3.2 MVC Architecture:-

MVC (Model-View-Controller) is an architecture used for developing web based applications. It is most popular and widely used architecture. This architecture is composed of 3 different sections they are [27]:-

i) Model

ii) View

iii) Controller

The description of each module is explained as follows.

i) Model: - This is the lowest level in the architecture and it represents the data such as database objects and SQL queries. Whenever controller needs any data, it calls model and it will return the requested data.

ii) View: - This level is responsible for displaying all the data to the user of the web applications which is represented by the model level. Generally it is the interface of the web application and it contains HTML,CSS,etc. It is also responsible for sending all the user actions such as mouse click, button click in the web pages to the next level which is controller. It also deals with the logics and rules implemented in the application.

iii) Controller: - Controller is the first level in the architecture. It controls the flow of the program and it is the main component of architecture. Whenever a user wants to access a particular web page then the user has to enter URL of that page. When the user enters the URL, controller is called and similarly it will interact with model and view in the architecture. This module is responsible
for evaluating and holding all the software code which controls the interaction between the model and view. Figure 3.3 represents the MVC architecture:

![Figure 3.3 Model-View-Controller Architecture](image)

3.3 Software Requirements:

The following are the software’s and development environment which have been used for developing the application.

- **Eclipse framework**: Eclipse Luna is an Integrated Development Environment used to develop java applications. It gives the developer a workspace to create web applications and it also allows the developers to use different plugins to enhance the functionality of application which is being developed. By installing other plugins it can also be used to develop web application in other languages such as c++, javascript, php, perl, etc.
The eclipse software development kit contains java development tools which have the built in compiler and it also provide model for java source code [28].

- **Tomcat Web server:-**
  It is an open source and most widely used server developed by apache organization. This server provides an environment which is used to implement java servlets and java server pages. This server can be used as a standalone server or it can be used with other servers such as Netscape server, Microsoft Internet Information Server (IIS), and Microsoft personal web server [29]. It provides a default port 8080 to execute the applications and it requires java run time environment to execute the applications. Tomcat web server contains two directories such as deployment and development directories. Deployment directive allows the programmer to store the software code of the web application. Development directory allows the developer to write, modify and debug the application code.

- **MySQL:-**
  MySQL is widely used relational database management system. It is a powerful and open source database. Generally, it is used to store the data from the web application. For example, when a new user registers then the user details like username, password and email are stored in database [30]. To access the database or the information stored in the database structured query language is used. Any changes made to the user information over the web application will also be updated in the MySQL database. Database stores
the information from the web application into the tables. The application contains four tables named as follows:-

- User details Table
- Friends Table
- Message Table
- Sharing Table

- User detail Table: - This table contains the information about the users over the web application such as userid, username, password, email and the location of the directory where all the contents of the user are stored. The top left area is sql query area, the right area is database area and the bottom left is result area. In the sql query area the user can enter the sql statements to check the information about the data stored in the userdetail table. The database area shows the information about the database, such as name of the database and all the tables created in the database. The result area displays the result after executing the sql statement in the sql query area. In this table it displays the information stored in userdetail table such as userid, username, password, email and the location of the directory where all the data uploaded by users are stored. Figure 3.4 represents the screen shot of the User detail table.
Friends Table: This table contains the information about the friends of the user. If a user is friend with the other user then the friend id and friend name will be stored in this table. The top left area is sql query area, the right area is database area and the bottom left is result area. In the sql query area the user can enter the sql statements to check the information about the data stored in the friend table. The database area shows the information about the database, such as name of the database and all the tables created in the database. The result area displays the result after executing the sql statement in the sql query area. In this table the result area displays the information such as id, name, sharing, status and friend name.

Figure 3.5 shows the screen shot of Friend table which represents three different areas.
• Message table: This table stores all the messages or status messages uploaded by different users over the application. It contains two fields such as message id and message. Figure 3.6 represents the screen shot of message table.

- Sharing table: This table contains the information about the privacy setting of the users. Figure 3.7 represents the screen shot of sharing table. The result area
shows the information such as sharing id, filename, path of the directory where
the file is stored, sharing setting related to all the users and sharing settings of
friends.

<table>
<thead>
<tr>
<th>id</th>
<th>Sharing</th>
<th>username</th>
<th>Filename</th>
<th>dirid</th>
<th>Sharing</th>
<th>Fsharing</th>
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<td>11</td>
<td>sneha</td>
<td>sneha</td>
<td>lighthouse.jpg</td>
<td>C:/Users/hizam/Desktop/...</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>16</td>
<td>sneha</td>
<td>beautiful_flower.jpg</td>
<td>C:/Users/hizam/Desktop/...</td>
<td>NO</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>nizam</td>
<td>parrot.jpg</td>
<td>C:/Users/hizam/Desktop/...</td>
<td>NO</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3.7 Sharing Table

3.4 Unified Modeling Language: -

Unified modeling language is a standard approach to represent the design of the
application. It includes different diagrams which represents the behavior of the
application [31].

1) Use case Diagrams: - It represents the overall functions of the application.

   Generally it shows the interaction between the user and the application. Use case
diagrams have two components actor and use cases. Actor is the users of the
application and use cases represent the functionality of the application [31]. Use
cases are represented by oval shape. Figure 3.8 shows the use case diagrams for
registration/login page.
It consists of one actor and four use cases. The four use cases are Registration, confirm by email, login and validate username and password.

i) Registration: - The new user has to register in order to use the application.

ii) Confirm by email: - When the user registers they will get an email confirmation.

iii) Login: - Existing users can enter the username and password to log in to the system.

iv) Validate username and password: - The entered username and password will be validated.

- Home Page:

Figure 3.9 represents the use case diagram of home page which consists of one actor and 6 different use cases. The different use cases are post message, upload images, update profile, view uploaded images, my wall and log out.

i) Post message: - This use case represents the action performed by a user to post a message.
ii) Upload images: - This use case represents the actions performed by the user to upload images.

iii) Update profile: - This use case represents the actions performed by the user to set the privacy settings on the uploaded images.

iv) View uploaded images: - This use case represents the actions performed by the user to view uploaded images.

v) My wall: - It represents the actions of user to view the uploaded images by different users after evaluation of privacy settings.

vi) Log out: - This use case represents the action taken by the user to log out from the application.

Figure 3.9 Home Page Use case Diagram

Class Diagram: - The class diagrams represent the relationships between different classes and object in the application. It generally represents the structure of the system
with all the classes and methods. It also shows the internal interactions between the different classes, methods and objects. Figure 3.10 represents the class diagram of the application.

Figure 3.10 Class Diagram

It represents Upload file class, CrudDao class, FCrudDao class, Mail sender class, Dconnection class, Fcontroller class and controller class. The object class creates all the objects to access the methods defined in the classes of the system.
• The uploadfile class has all the different parameters such as Userid, directory and uploadfile method. This class stores the userid, directory where all the uploaded images of a particular user will be stored. Whenever a user uploads an image on the application uploadfile class will be called and an object to access the methods will be created.

• Similarly the FcrudDao class has attributes such as friendid, name and friend method. Whenever a user sends a request to add other friend this class will be called and it will store friendid and friend name.

• The mail sender class has a mailsender method which will be called during the registration of a new user. This class will send confirmation and activation link to the mail id of the new user.

• The Dconnection class control and is responsible for maintain all the connections of various classes to the database.

• The CrudDao class stores the activities of the users such as uploading a photo, deleting a photo, enforcing privacy settings and displaying the images.

• The Controller class and Fcontroller class is responsible for handling all the methods in CrudDao and FcrudDao classes. The various web pages in the application will call controller and Fcontroller class which will invoke other classes as required.
4. IMPLEMENTATION OF THE MODULES

The main modules of the application are as follows:-

- Registration module
- Image upload module
- Privacy module
- Wall module

Registration module: - When a new user wants to use the application then the user has to register by entering the information such as username, email-id and password in the corresponding fields. When a user enters the username in the username field it gets validated on mouse click. The application checks whether the entered username is existing or not. If it is not an existing username then the new user can proceed and enter remaining information. If it is an existing username then the new user will be prompted to enter a different username. After entering all the required information the user account with the entered username and password will be created. When the user enters valid username, email id and password an account will be created successfully and activation link will be sent to user email id provided during the registration.

Image upload module: - This module allows the user to upload an image and share it with friends. The user has to specify the location of image and select a particular image to be uploaded. After the successful upload the application will display a message saying that “Image has been uploaded successfully”.

Privacy Module:- This is the main and most important module of the application as it contains the privacy settings provided by the user over data/photos. This
module allows the user to set their own privacy settings on a particular data/photo when the user uploads it over the application. When the user uploads an image then privacy settings can be enforced as share with friends or not and share with particular friends. Whenever a user logs into the application, privacy settings are evaluated then the application will display results according to the privacy settings enforced on the data. If a user or owner of the image sets the privacy settings as “Not to share with particular friend” then that particular friend will not be able to see that image.

- Wall module: - This module displays all the images uploaded by different users on the application. Whenever a user click on this module the privacy setting of each user gets evaluated and the results will be displayed accordingly.

**User Interface:**

The user interface represents the design of the application. In order to use the application the user has to register. Then the user will be able to log in by entering the username and password. After successful login the user will be redirected to home page. If the user enters incorrect username or password then a message “Incorrect username or password” will be displayed. The registration page has four fields such as username, Email, password and re-type password. Figure 4.1 represents the screen shot of the registration page.
Figure 4.1 Registration Page

By entering the valid username and password then by clicking log in button the user will be able to log in to the application. Figure 4.2 represents the screen shot of login page.

Figure 4.2 Login Page
After successful log in the user will be redirected to home page. The home page has a space where user can enter the status or message which will be displayed to all other users. Figure 4.3 represents the screen shot of home page.

Figure 4.3 Home Page

The home page has different modules such as

i) Upload Images

ii) View my pics

iii) Update profile

iv) Update friends profile

v) My wall

vi) Log out
• **Upload Images:** - In this module the user will be able to upload images over the application. Figure 4.4 represents the screen shot of uploading a photo.

![Figure 4.4 Upload Images](image)

• **View my pictures:** - When the user clicks on view my pictures tab then all the images uploaded by the user will be displayed. Figure 4.5 represents the screen shot of view my pictures tab.
Figure 4.5 View my Pictures

- Update Profile: - Under this tab the user will be able to set the privacy setting on the images uploaded by the user. Whether the user wants to share images or not. Figure 4.6 represents the screen shot of update profile tab.

Figure 4.6 Update Profile
• Update Friend’s profile: - In this tab, the user will be able to set different privacy setting on the same data for different friends. If a user does not want to share an image with a particular friend then the user will be able to set that privacy setting in this tab. The restricted users will not be able to view that image. Figure 4.7 represents the screen shot of update friend’s profile tab.

![Image of Connectline](image)

**Figure 4.7 Update Friend’s Profile**

• My wall: - When the user clicks on this link all the uploaded images by different users will be displayed after evaluating privacy setting provided by the owner of uploaded images. Each time the privacy settings will be evaluated and the result will be displayed on my wall accordingly. Figure 4.8 represents the screen shot of my wall page.
Log out: To exit from the system, user has to click on ‘log out’ button. It will redirect the user to the log in page.
5. TESTING AND EVALUATION

Testing is the method or way of finding any errors in the developed application. It also ensures that the developed application is working as expected. During the testing different inputs are applied to the system and result or behavior is observed. There are two different types of techniques. They are:-

i) Static testing

ii) Dynamic Testing

Table 5.1 Difference Table

| Static Testing: - It includes performing all the verification activities. It checks all the standards of code and integration are followed. Ex:- Technical reviews and walkthroughs | Dynamic Testing: - In dynamic testing all validation related actions are tested. Ex: - Unit testing, Integration testing, validation testing and system testing. |

5.1 Test Cases:-

Test Case 1:- Uploading Images

In order to upload images over the application the user has to register and then log in to the application by entering the username and password.

Part 1a:- Registration

This is the first step towards using the application. In this section validation for username, email and password are checked. The table 5.2 describes all the conditions being checked.
Table 5.2 Registration

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Input Values</th>
<th>Test case</th>
<th>Conditional being checked (Message displayed)</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Username</td>
<td>Empty</td>
<td>Please enter username</td>
<td>Successful</td>
</tr>
<tr>
<td>2.</td>
<td>Username</td>
<td>Existing Username</td>
<td>Username already exists</td>
<td>Successful</td>
</tr>
<tr>
<td>3.</td>
<td>Email</td>
<td>Empty</td>
<td>Please Enter Email</td>
<td>Successful</td>
</tr>
<tr>
<td>4.</td>
<td>Email</td>
<td>Existing Email</td>
<td>Given Email is already used</td>
<td>Successful</td>
</tr>
<tr>
<td>5.</td>
<td>Password</td>
<td>Empty</td>
<td>Enter Password.</td>
<td>Successful</td>
</tr>
<tr>
<td>6.</td>
<td>Confirm Password</td>
<td>Empty</td>
<td>Password and confirmation password must be same</td>
<td>Successful</td>
</tr>
</tbody>
</table>

Part 1b: - Login

In this test case the validation of username and password are tested. If username field is empty then a message to “enter username” will be displayed. Similarly for password the validations are checked. The table 5.3 describes all the conditions being checked in this test case.
Table 5.3 Login Table

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Input Values</th>
<th>Test case</th>
<th>Conditional being checked</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Username</td>
<td>Empty</td>
<td>This field is required</td>
<td>Successful</td>
</tr>
<tr>
<td>2</td>
<td>Password</td>
<td>Empty</td>
<td>This field is required</td>
<td>Successful</td>
</tr>
<tr>
<td>3</td>
<td>Username/Password</td>
<td>Incorrect</td>
<td>Username or Password is Incorrect</td>
<td>Successful</td>
</tr>
</tbody>
</table>

After successful login the user will be able to upload images by clicking upload image tab on the home page. In this test case, the user is tested for uploading a valid image file. If the user does not select a valid image file then a message “The selected file type is invalid” will be displayed. Moreover, if the user does not select any image then a message “No file Chosen” will be displayed. The table 5.4 describes all the conditions being checked in this test case. Figure 5.1 represents the screen shot of uploading images.

Table 5.4 Validating Image File

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Input Values</th>
<th>Test case</th>
<th>Conditional being checked</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Image</td>
<td>Not a valid file</td>
<td>The selected file type is Invalid. File must be gif, png, jpeg, jpg.</td>
<td>Successful</td>
</tr>
<tr>
<td>2</td>
<td>Add Image</td>
<td>Empty</td>
<td>No File Chosen</td>
<td>Successful</td>
</tr>
</tbody>
</table>
Test Case 2: Update Profile

In this test case the privacy setting of users are tested. The update profile tab has two privacy settings such as “share with all” and “share with friends”. If a user enforces the privacy setting “share with all” to “Yes” then the uploaded image will be displayed on my wall and it will be shared with all the users of application. If a user set the privacy setting “share with all” to “No” then uploaded images will not be displayed on my wall. Moreover it will not be shared with all users and friends of the user. If the user set privacy setting “share with friends” to “Yes” then the images will be displayed on my wall and it will be shared with friends. Here the main setting is “share with all” and if the user enforces this setting as “No” then the other settings will be invalid. The table 5.5 describes all the conditions being checked in this test case.
Table 5.5 Update Profile

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Input Values</th>
<th>Test case</th>
<th>Conditional being checked</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Yes</td>
<td>Share with all</td>
<td>Images will be displayed on my wall.</td>
<td>Successful</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
<td>Share with all</td>
<td>Images will not be displayed on my wall.</td>
<td>Successful</td>
</tr>
<tr>
<td>3</td>
<td>Yes</td>
<td>Share with friends</td>
<td>Images will be shared with friends</td>
<td>Successful</td>
</tr>
</tbody>
</table>

Figure 5.2 and figure 5.3 represents the screen shots of the update profile tab.

Figure 5.2 Privacy Settings
Figure 5.3 Updating Privacy Settings

Test Case 3 : Update Friends Profile

In this test case the privacy setting “share with particular friend” or “Not to share with a particular friend” is tested. If a user does not want to share an image with particular friend then the user can enforce the setting “friend share” to “No” for that particular friend. The table 5.5 describes all the conditions being checked in this test case. Figure 5.4 and figure 5.5 represents the screen shot of update friend’s profile tab.
Table 5.6 Update Friend’s Profile

<table>
<thead>
<tr>
<th>SI No</th>
<th>Input Values</th>
<th>Test case</th>
<th>Conditional being checked</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Yes</td>
<td>Share with Particular Friend</td>
<td>Images will be shared with particular friend</td>
<td>Successful</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
<td>Share with particular friend</td>
<td>Images will not be displayed with particular friend</td>
<td>Successful</td>
</tr>
</tbody>
</table>

Figure 5.4 Friend’s Privacy Settings
Test Case 4: Adding a Friend

In this test case adding a new friend to the friend’s list of the user is tested. When a user wants to add other user as its friend then the user can send a friend request to that particular user by clicking on “add new record button”. The user has to enter the username name and the user can also set the privacy settings for that friend by clicking that button. The other user who is getting added will receive a friend request. If the user accepts the friend request then the friend list of both users will be updated. The table 5.7 describes the condition being checked in this test case. Figure 5.6 represents the screen shot of adding a friend test case.
### Table 5.7 Adding a Friend

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Input Values</th>
<th>Test case</th>
<th>Conditional being checked</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Username</td>
<td>Friend request</td>
<td>The user will get a friend request</td>
<td>Successful</td>
</tr>
</tbody>
</table>

![Figure 5.6 Adding a Friend](image-url)
Test Case 5: View my Pictures

In this test the application is tested for displaying all the uploaded images by a particular user on the application. Figure 5.7 represents the screen shot of view my pics test case.

Figure 5.7 View my Pictures
6. RESULTS AND CONCLUSIONS

The system is a prototype of online social networks which allows the user a virtual space where users can upload the data (e.g. photos), share the data, post message and add friends. The difference between the existing mechanism and developed mechanism is:

In existing policies of social networks user can set two privacy settings. Figure 6.1 and figure 6.2 represents the privacy policies of Facebook and Myspace social networks. The two provided privacy settings are:

- Visible to all
- Visible to (friends, friends of friends)

![Facebook Privacy Policies](image)

Figure 6.1 Facebook Privacy Policies [32]
In current approach of enhancing the privacy policies, the user can set different privacy settings for different users on resources (images). The privacy settings include:

- Share with all
- Share with Nobody
- Share with particular friends

### 6.1 Future Enhancements

The future enhancements can be:-

- The developed system or mechanism can be applied to real time social networks like Facebook, twitter, Myspace, LinkedIn, Renren (a popular Chinese social network) etc to enhance the privacy settings.
• The future work for the application can be allowing users to upload and share different types of data such as videos and adding friends by searching the name, creating groups. Moreover, the system can generate automatic notifications when the data is shared or viewed.

6.2 Conclusion

In conclusion the application is working with all the test cases. It allows the user to enforce privacy settings for different users on the resources (Images). By restricting the sharing of data over the web application can reduce the threats and frauds in social networks. The application restricts the sharing of user data which will be uploaded over the application as it can be personal. The system will enhance the existing privacy policies in online social networks by maintaining security policies of multiple users, controlling unauthorized data access, providing policy and a privacy evaluation mechanism for authorization and defining user control privacy settings.
BIBLIOGRAPHY AND REFERENCES


[9] https://www.google.com/imghp?hl=en&tab=wi&ei=Zp3vVLb8LJK0yAS0iYLQBA&ved=0CBQQQi4oAg, last accessed 21st February 2015.


public class UploadFile extends HttpServlet {
    private static final long serialVersionUID = 1L;
    private String UPLOAD_DIRECTORY = "";

    protected void doPost(HttpServletRequest request, 
        HttpServletResponse response) throws ServletException, IOException {
        HttpSession session = request.getSession(true);

        String user=(String)session.getAttribute("username");
        DConnection db = new DConnection();

        String qry = "select * from userdetails where username='"+user+"'";
        ResultSet rs1 = db.selectQuery(qry);

        boolean isMultipart = ServletFileUpload.isMultipartContent(request);
        System.out.println(""+qry);
        try {
            while(rs1.next()){
                UPLOAD_DIRECTORY = rs1.getString(7);
                System.out.println(qry+user+UPLOAD_DIRECTORY);
            }
        }
        catch (SQLException e) {
            // TODO Auto-generated catch block
            e.printStackTrace();
        }
        System.out.println(qry+user+UPLOAD_DIRECTORY);
        // process only if its multipart content
        if (isMultipart) {
            // Create a factory for disk-based file items
            FileItemFactory factory = new DiskFileItemFactory();

            Figure 8.1 Upload Class for Uploading Image
// Create a factory for disk-based file items
FileItemFactory factory = new DiskFileItemFactory();

// Create a new file upload handler
ServletFileUpload upload = new ServletFileUpload(factory);
try {
// Parse the request
List<FileItem> multipart = upload.parseRequest(request);

for (FileItem item : multipart) {
    if (item.isFormField()) {
        String name = new File(item.getName()).getName();
        item.write(new File(UPLOAD_DIRECTORY + File.separator + name));
        System.out.println(name);
        String sql = "INSERT INTO sharing (username,Filename,dirid,DT,Sharing,Fsharing) VALUES("
                        + user + "," + name + "," + UPLOAD_DIRECTORY + "," + new Date() + "," + name + ")";
        int i = db.updateQuery(sql);
        if (i == 1)
            System.out.println("Success");
    }
}
}

} catch (Exception e) {
    e.printStackTrace();
}
Figure 8.3 Creating Connections to Database
```java
String fname=null;
String sharing=rs.getString(5);
String fsharing=rs.getString(6);

if(sharing.equals("YES")) {
  fname=rs.getString(4)+"/"+rs.getString(3);
  fileurl.add(j, fname);
  filnam.add(j, rs.getString(2));
}
else if(sharing.equals("NO") && fsharing.equals("YES")) {
  ResultSet rs1=dbj.executeQuery("select * from friends where fname="+fname+" and sharing = 'YES' and name= 'user1'");
  if(rs1.isBeforeFirst())
  {
    while(rs1.next())
    {
      fname=rs.getString(4)+"/"+rs.getString(3);
      fileurl.add(j, fname);
      filnam.add(j, rs.getString(2));
    }
  }
}
```

Figure 8.4 Fetching the Privacy Settings
try{
    DConnection obj=new DConnection();
    System.out.println(""+obj.getConnection());
    ResultSet rs=obj.executeQuery("select * from userdetails where username="+session.getAttribute("username")+"");

    while(rs.next())
    {
        String msg=rs.getString(7);
        File f=new File(msg);
        File []f2=f.listFiles();

        for(int ii=0;ii<f2.length;ii++)
        {
            if(f2[ii].isFile())
            {

                String fname=f2[ii].getPath();
                String url[]=fname.split("\WebContent\" );
                fname = "+"+url[1];
                %

                <img border="0" src="\"+fname+" width="450px" height="350px">\n
            }
        }
    }
}

Figure 8.5 Displaying the Uploaded Images