Bilkent University

Department of Computer Engineering

CS 353 - Database Management Systems

Collaborative Hypertext Dictionary

Project Final Report

Group 03

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20.11.2017

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1. Description of Application System

"Dictator" Collaborative Hypertext Dictionary is a web-based dictionary application which lets users create online topics and comment on particular topics. Any person will be able to sign-up to the site using their nickname, email, password. The website will generate an ID for them to be unique and differentiate between users. Users of the "Dictator" dictionary will be able to enter a topic to the system and under each topic title, different users' entry related definitions will be written. "Dictator" Dictionary also will provide the opportunity of adding multiple categories for each topic such as "iPhone X" category and "Samsung Note 8" category under the "Most Recent Smart Phones" topic. Topics will also have dates of creation. Moreover, contents of each topic can be rated and commented by users and users can add them to their favorites.

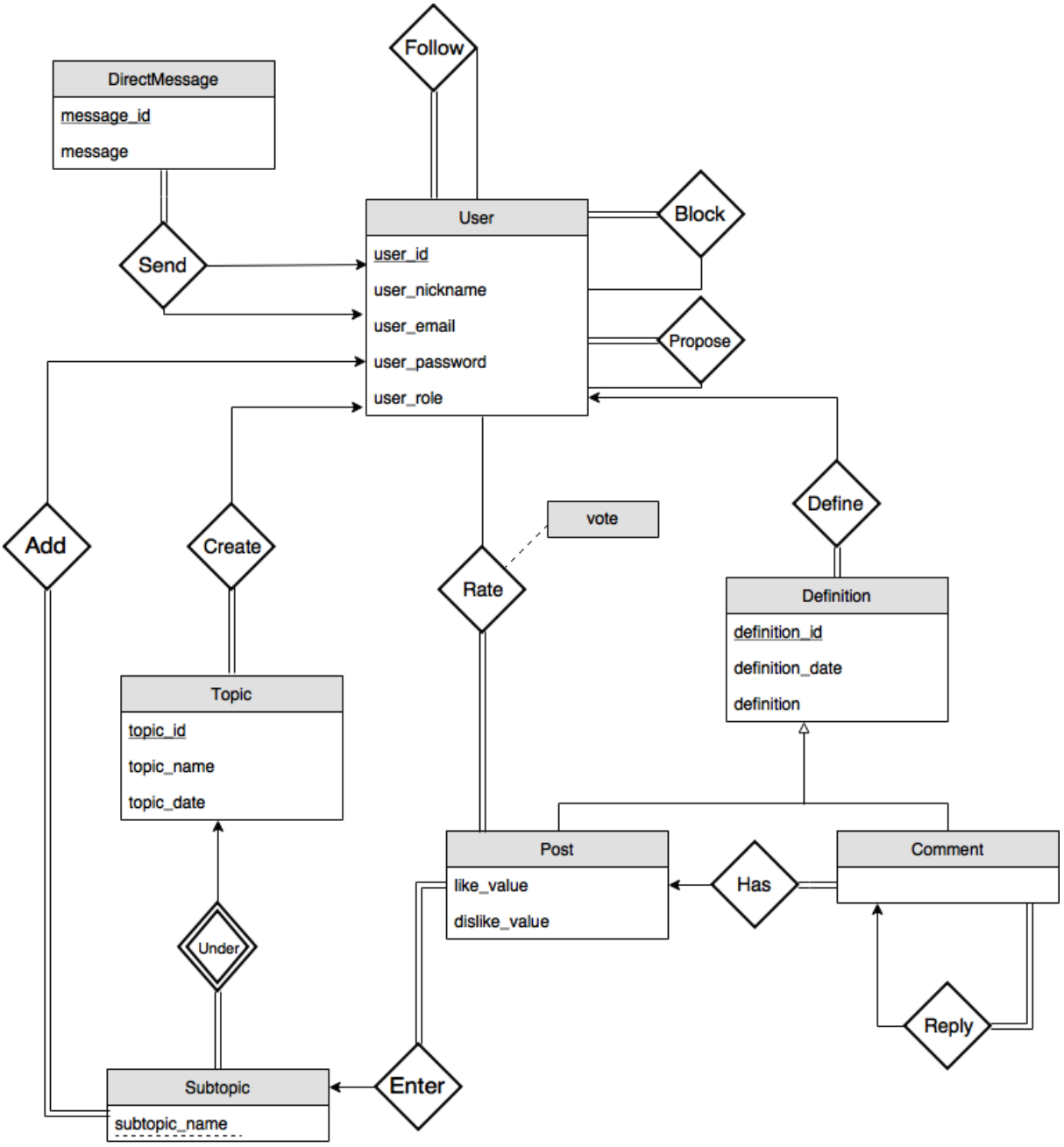
There will be a user ranking system in "Dictator" dictionary. Users will be categorised as **Freshman**, **Sophomore**, **Junior**, **Senior** and they will be promoted according to their activity rate in the dictionary by **Admin**.

- **Freshman:** Users are assigned as **Freshman** when they create their accounts. They can rate and comment on existing contents but can't create definitions.
- **Sophomore**: Promoted version of **Freshman** users. They will be able to comment on definitions in the topics. They will have all the abilities of **Freshman** users.
- **Junior:** Promoted version of **Sophomore** users. They will be able to add definitions in the topics. They will have all the abilities of **Sophomore** users.
- **Senior:** Promoted version of **Junior** users. They will be able to create topics. They will have all the abilities of **Junior** users.

Furthermore users will be in contact with each other with a basic following system. They will be able to follow, unfollow and block each other. Higher rank users will be able to propose promotion on other users. Lastly, users will be able to send direct messages to each other like in the other interactive web applications.

The aim of the "Dictator" Dictionary is providing a virtual brainstorming environment while maintaining trust and respect among the internet users.

2. Final E/R Diagram



3. Final List of the Tables

3.1. User

Relational Schema:

User(user_id, user_nickname, user_email, user_password, user_role)

Candidate Keys:

user_id, user_name or user_nickname

Selected Primary Key:

user_id

3.2. Follow

Relational Schema:

Follow(follower, followed)

Candidate Keys:

{follower, followed}

Selected Primary Key:

follower, followed

Foreign Keys:

(follower, followed) ref. User(user_id)

3.3. Block

Relational Schema:

Block(blocker, blocked)

{blocker, blocked}

Selected Primary Key:

blocker, blocked

Foreign Keys:

(blocker, blocked) ref. User(user_id)

3.4. Propose

Relational Schema:

Propose(proposed, proposer)

Candidate Keys:

{proposed, proposer}

Selected Primary Key:

proposed, proposer

Foreign Keys:

(proposed, proposer) ref. User(user_id)

3.5. DirectMessage

Relational Schema:

DirectMessage(message_id, message, sender_user, receiver_user)

Candidate Keys:

message_id

Selected Primary Key:

message_id

Foreign Keys:

(sender_user, receiver_user) ref. User(user_id)

3.6. Topic

Relational Schema:

Topic(topic_id, topic_name, topic_date, creator_user)

Candidate Keys:

topic_id or topic_name

Selected Primary Key:

topic_id

Foreign Keys:

creator_user ref. User(user_id)

3.7. Subtopic

Relational Schema:

Subtopic(topic_id, subtopic_name, adder_user)

Candidate Keys:

{topic_id, subtopic_name}

Selected Primary Key:

topic_id, subtopic_name

Foreign Keys:

topic_id ref. Topic

adder_user ref. User(user_id)

3.8. Definition

Relational Schema:

Definition(definition_id, definition_date, definition, definer_user)

Candidate Keys:

definition_id

Selected Primary Key:

definition_id

Foreign Keys:

definer_user ref. User(user_id)

3.9. Post

Relational Schema:

Post(post_id, like_value, dislike_value)

Candidate Keys:

post_id

Selected Primary Key:

post_id

Foreign Keys:

post_id ref. Definition(definition_id)

3.10. Enter

Relational Schema:

Enter(subtopic_name, post_id, topic_id)

Candidate Keys:

{topic_id, subtopic_name, post_id}

Selected Primary Key:

subtopic_name, post_id

Foreign Keys:

(topic_id, subtopic_name) ref. Subtopic

post_id ref. Definition(definition_id)

3.11. Rate

Relational Schema:

Rate(user_id, post_id, vote)

Candidate Keys:

{user_id, post_id}

Selected Primary Key:

user_id, post_id

Foreign Keys:

user_id ref. User

post_id ref. Post

3.12. Comment

Relational Schema:

Comment(comment_id, post_id)

Candidate Keys:

comment_id

Selected Primary Key:

comment_id

Foreign Keys:

comment_id ref. Definition(definition_id)

post_id ref. Post

3.13. Reply

Relational Schema:

Reply(comment_id,replied_comment)

Candidate Keys:

comment_id

Selected Primary Key:

comment_id

Foreign Keys:

(comment_id,replied_comment) ref. Comment(comment_id)

4. Implementation Details

“Dictator” system implementation is divided into two parts: database and web site. We implemented the database structure utilizing PostgreSQL. Like in the programing assignment, we created a program that creates and generates testing data. The program is coded in Python using Psycopg driver for database connection. Our Python script is responsible for creating required tables, with specified constraints like primary key, foreign key, not null and unique from Design report. Sample data is generated and inserted into the database to test all features and verify that they are working properly. The script is also responsible for advanced database features like views, triggers and data indices. We are using our own computers as server for the database.

To implement real system operations and backend for the project we used Python with Flask framework. Whenever a user send a HTML request, Flask framework handles the request and send relative SQL queries using Psycopg driver. Then it puts the received datas in to the pages and responses to request.

For the user interface part we also used HTML, CSS, JavaScript for the frontend with Bootstrap framework. Interface is designed using HTML with view elements from the Bootstrap. Each page is created as different HTML files but to create dynamic content each HTML file contains Jinja2 directive for the Python code to put datas inside. There is some common page elements such as navigation bar and the sidebar that are present in many of the pages so they are created as different files and included in different pages using Jinja2 directives. Rather than writing same part several times in different parts.

5. Advanced Database Features

5.1. Secondary Indices

Secondary indices will be used to search users and topics by their names. Also definitions will be searched by their definition id's. We use PostgreSQL. Thus, queries to create secondary indices with btrees will be the followings:

```
CREATE UNIQUE INDEX user_name_index ON user(user_name);
CREATE UNIQUE INDEX topic_name_index ON topic(topic_name);
CREATE UNIQUE INDEX definition_id_index ON definition(definition_id);
```

5.2. Reports

5.2.1. The Most Interactive Topic

The most interactive topic for each day will be calculated based on how many times its posts are rated by users.

```
WITH latest_topics AS(
SELECT *
FROM topic
WHERE topic_date = (SELECT MAX(topic_date)
                    from topic), topic_rates AS(
SELECT topic_id, SUM(like_value+dislike_value) AS sum_rate
FROM latest_topics NATURAL JOIN post
GROUP BY topic_id
)
SELECT *
FROM  topic_rates NATURAL JOIN topic
WHERE sum_rate = (SELECT MAX(sum_rate) FROM topic_rates)
```

5.2.2. The Most Interactive User

The most interactive user will be calculated based on how many times he/she posted so far.

```
WITH topic_count AS(
SELECT user_id, COUNT(*) AS topic_creator_count
FROM user NATURAL JOIN topic
WHERE user_id = creator_user
GROUP BY user_id), definition_count AS(
SELECT user_id, COUNT(*) AS definer_count
FROM user NATURAL JOIN definition
WHERE user_id = definer_user
GROUP BY user_id)
SELECT user_id, MAX(topic_creator_count+definer_count)
FROM topic_count NATURAL JOIN definiton_count
GROUP BY user_id
```

5.3. Views

5.3.1. The Most Liked Posts

Users can see most liked posts.

```
CREATE liked_view(post_id) AS
        SELECT post_id
        FROM  post NATURAL JOIN (SELECT MAX(like_value)
                                 FROM post)
```

5.3.2. Search View

Users can see their search results but they can not see topic_id and definition_id

```
CREATE search_view(topic_name, topic_date, definition, definition_date, definer_user  ) AS

        SELECT topic_name, topic_date, definition, definition_date, definer_user
        FROM topic NATURAL JOIN definition
        WHERE topic_name like '%top_search%' OR  definition like '%def_search% or
        definer_user like '%definer_search%
```

top_search, def_search, definer_search are passed from web server component.

5.4. Triggers

5.4.1. Proposing a User

Users have a role value from 1 to 4: [1 -> Freshman, 2-> Sophomore, 3-> Junior, 4-> Senior]

When 100 users promote another user who has a role value less than themselves, promoted user's "role_value" increases.

5.4.2. Blocking a User

Every time when 1000 users block a user, "role_value" of blocked user decreases "1" point until he/she becomes a freshman.

5.5. Rate Trigger

5.5.1. Rating a Post

After a "Post" entity is rated either +1 or -1 ("vote" attribute) by a "User" entity, "vote" will be added to "Post" entity's sum of like_value(+1) or dislike_value(-1) will be generated.

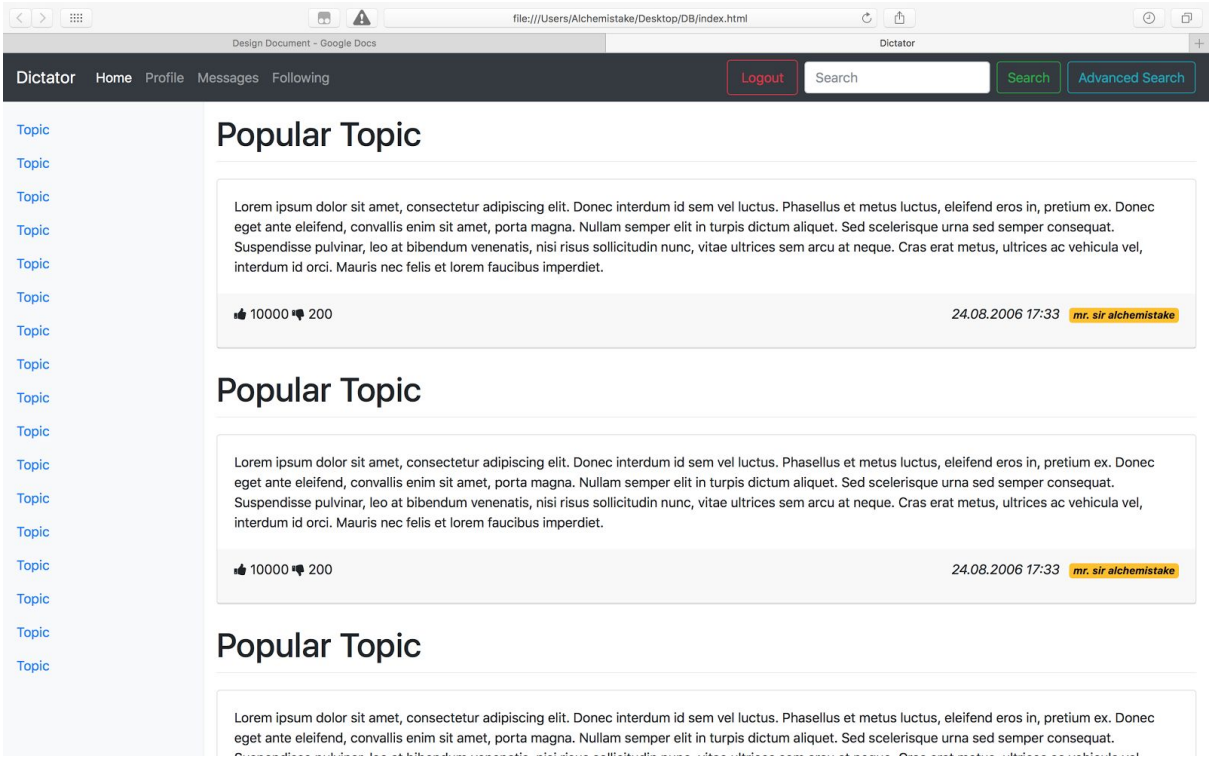
5.5.2. Rating after Deleted User

When a tuple is deleted in the "User" table, the votes that the user had will be deleted and "rate_value" for each post will be re-generated.

6. User's Manual

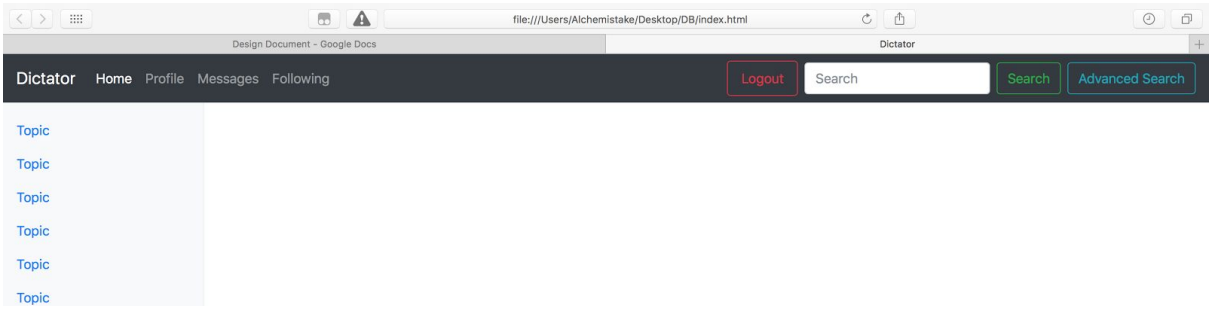
In this section the graphical interface elements and user functionality of the Dictator dictionary is explained in detail.

6.1. Home Page



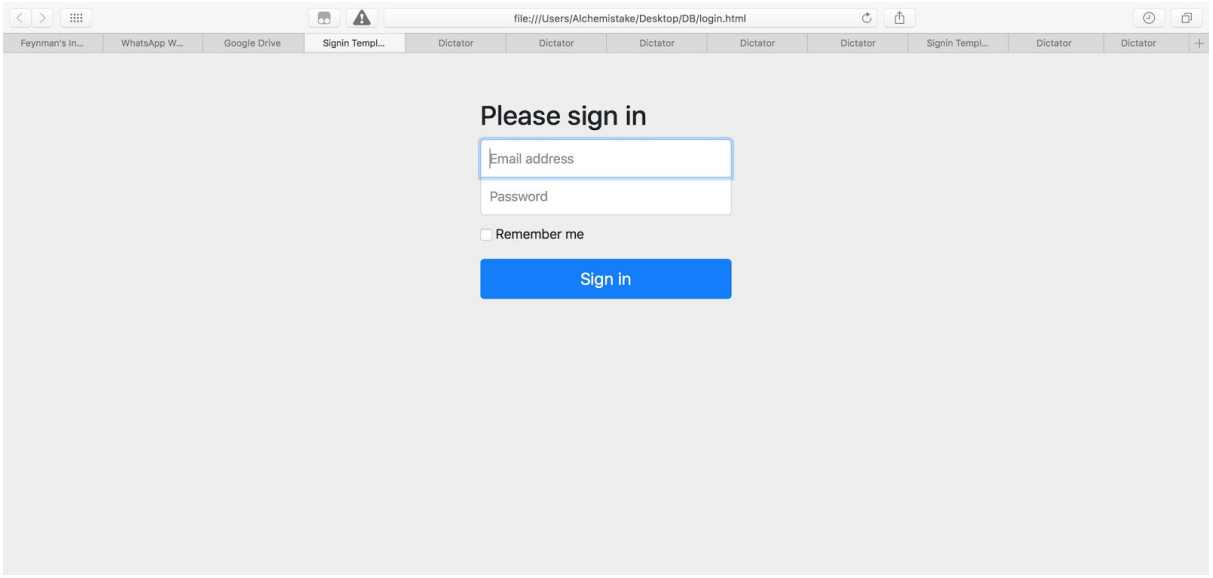
Home page of the Dictator Dictionary is shown in the figure above. In the middle of the page it contains the popular topics of the day listed consecutively based on their ratings. The list can be scrolled down to see more topics and it extends as the end of the list is reached. One can click on the topic box in order to go that topics main page and see the context in detail. On this box it is possible to see the name of the topic on where it writes the “Popular Topic” in the figure and the writer's description of the topic written in the field under the name of the topic. Also, it is possible to see the amount of the likes, dislikes that the topic got. The post date and the name of the topic creator is available to the visitor under the description on the right. A Login button resides in the places of the Logout button when the visitor is not logged in. The button directs visitor to the login page on click to that button.

6.2. Navigation Bar and Left Side List



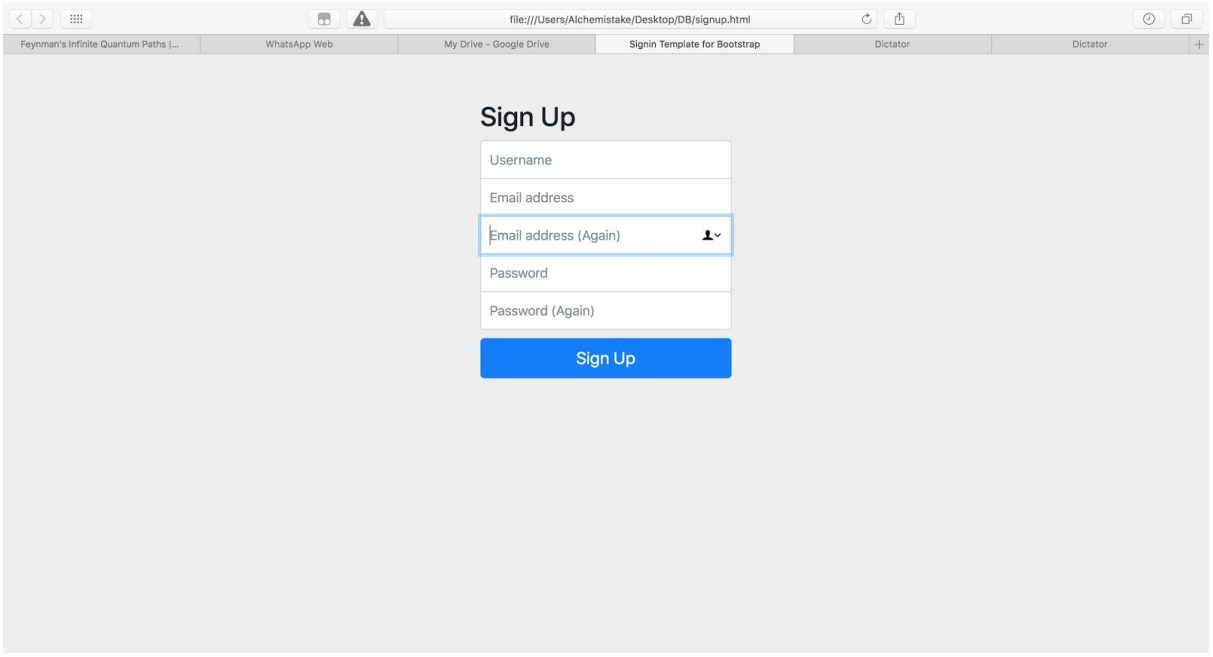
In Dictator dictionary there exists a navigation bar consisting of several links. Home button directs users to the homepage of the website. Profile button show when a user has logged in account and directs the user to his/her profile page. Messages button directs the user to his/her list of chats with other users. Following button opens the page that lists recent posts of the people which the user follows. Logout button closes the user's account. There is a search bar on the right of the logout button where is the possible to search for a content anywhere in the website. There is also an advanced search option is available. When clicked it directs the user to an advanced search page. On the left of the page there recides a list of popular topics that can be reached from any page view of the Dictator dictionary. When a visitor is not logged in there will be a similar navigation bar to indicate to them. This component does not use any SQL queries. It is detected by browser cookies.

6.3. Login Page



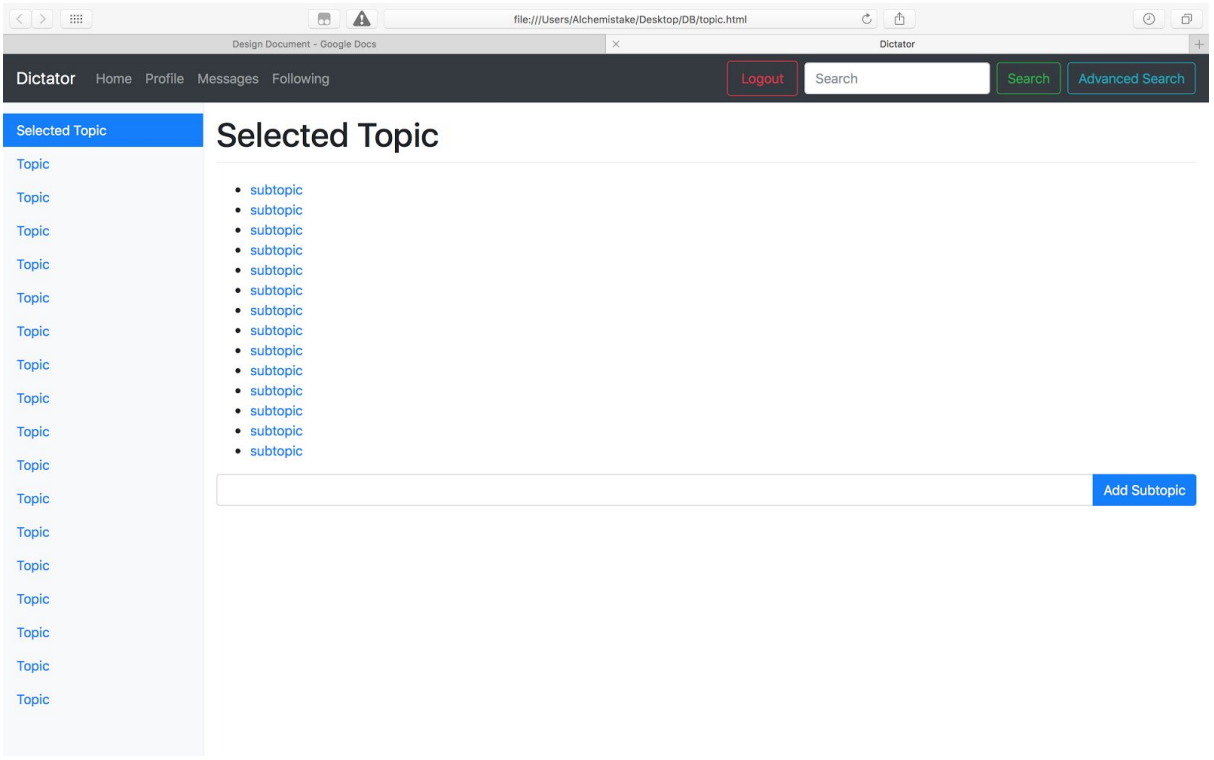
When login button clicked from the navigation bar of the any of the Dictator website's page the page in the figure above is opened. A user has to enter their registered email address to the upper field and password the lower field and click "Sign in" in order to login his/her Dictator account. The user can also select the "Remember me" field in order to be remembered in later logins.

6.4. Signup Page



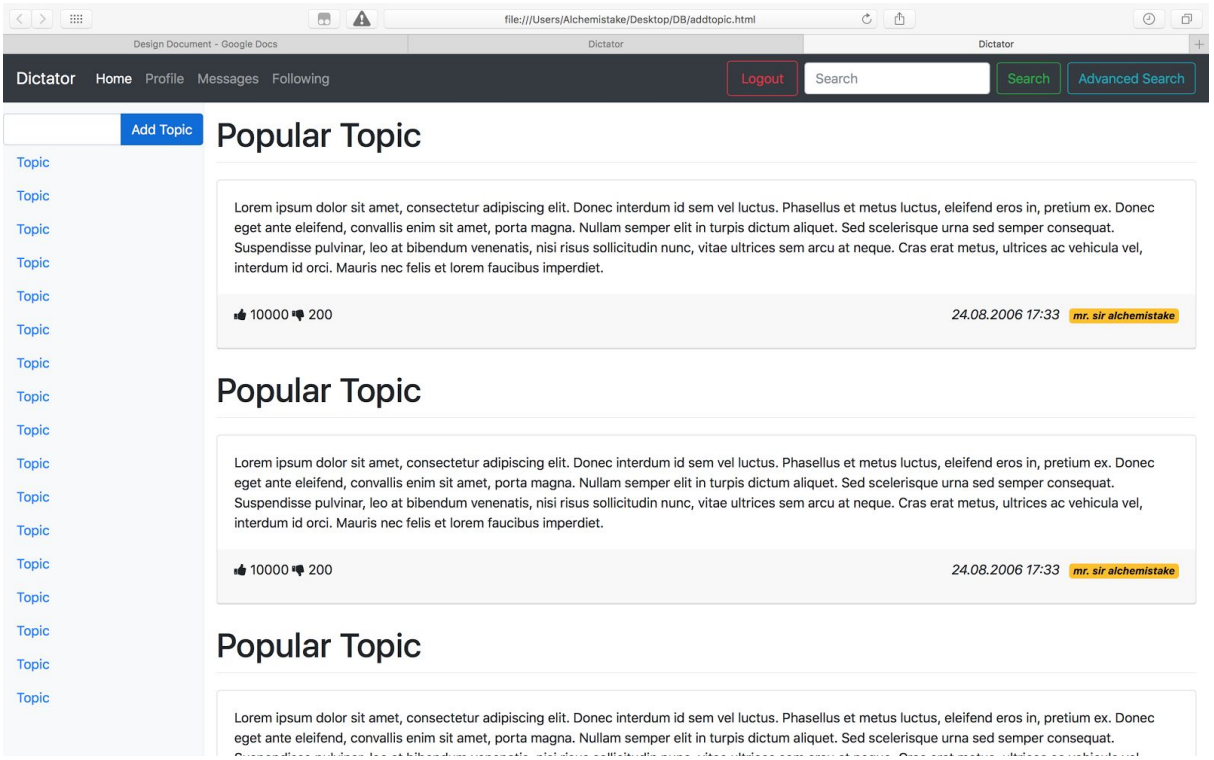
Signup Page is where visitors can register their information to the system in order to become a part of the Dictator dictionary experience. There are no prerequisites for anyone to sign up to the website. For registration a unique username, a valid email address entered twice, a safe password again entered twice and a click on the "Sign Up" button is required. The uniqueness of the username is checked by the system before the account is granted and if not a new username will be requested from the user. Every new user registered to the Dictator dictionary starts with the rank of Freshman. And can go up the ranks Sophomore, Junior and Senior.

6.5. Topic Page



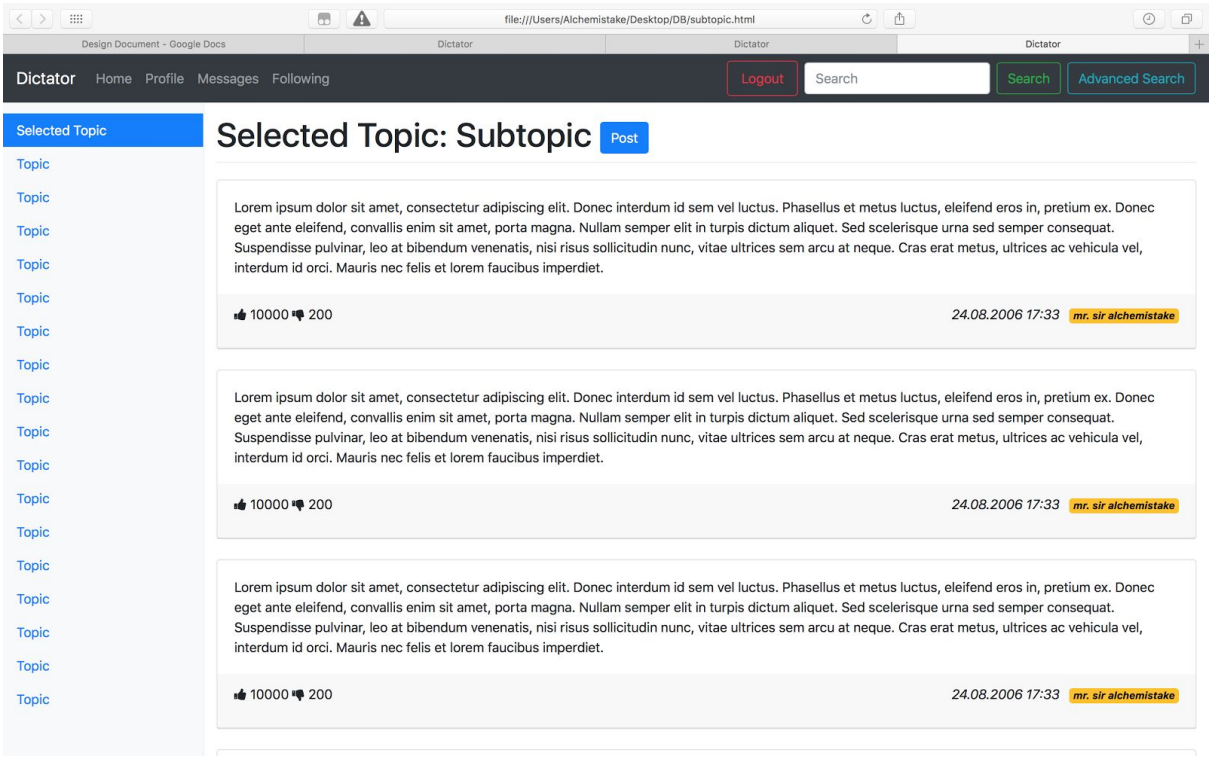
When a topic is selected from the Home Page list of most popular pages or the left sidebar user is directed to the Topic Page. In topic page the subtopics of the topic are displayed. Only users with a Senior rank has visibility to the “Add Subtopic” button. Therefore, they can add new subtopics to a topic and the other rank users or unregistered visitors can only see the subtopics. When a subtopic is clicked it directs user to the respective subtopic pages of the content.

6.6. Adding Topic



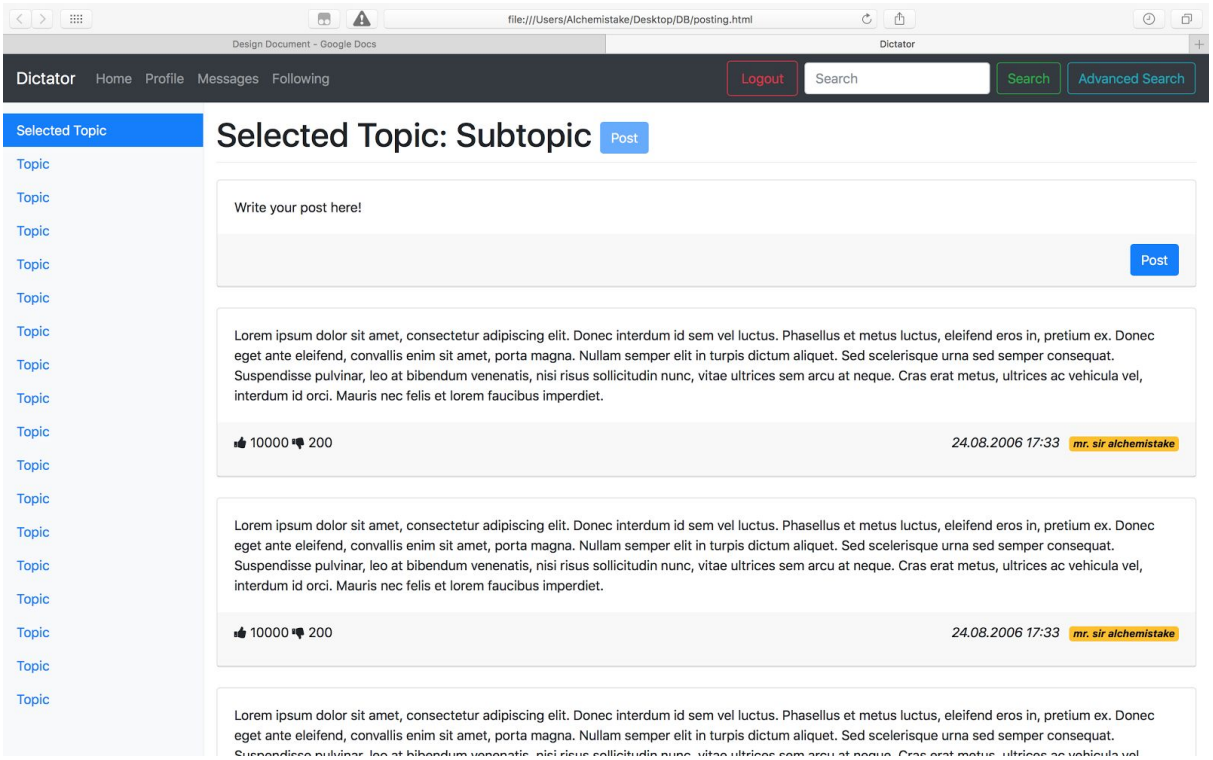
In the homepage of a user with a senior rank there is a “Add Topic” button on top of the popular topics list on the left side of the page shown in the above figure. A senior user can add new topics to the Dictator dictionary system by clicking this button and typing topic name and description to the opening field.

6.7. Subtopic Page



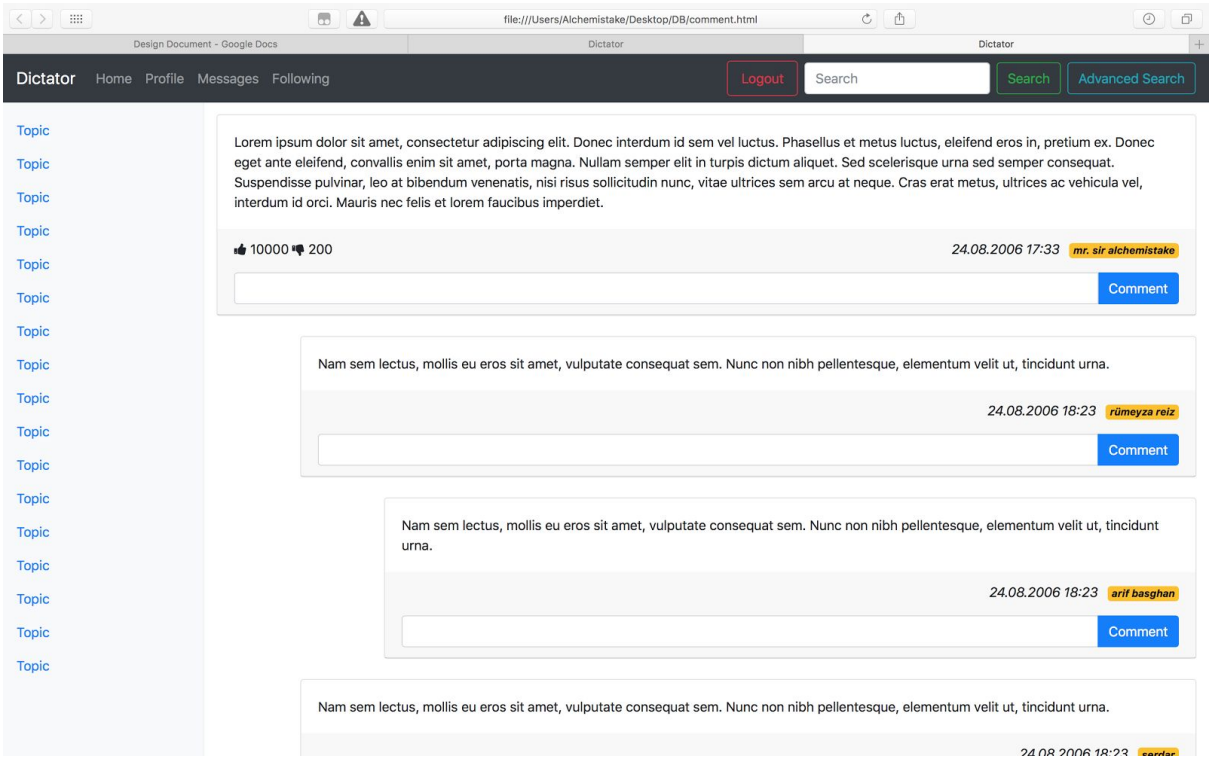
After a subtopic is selected by the user in a topic page user is directed to the subtopic page he/she chosen. In the opening subtopic page it is possible to see the posts of the other users added under that subtopic. The subtopics are listed on top of each other and it is possible to navigate between them by scrolling down in the page. The posts are listed by their post date and it is possible to when a post is made by looking at the bottom left corner of the post box. Next to the date information it is possible to see the writer of that post. In Dictator dictionary it is only possible for a senior, junior or sophomore ranked user to make a post under a subtopic. These users can see a post button near the name of subtopic that allows them to add new posts to the subtopic. A freshman cannot make a posts. All users can like or dislike the post that are made and it is possible to see this data right bottom corner of each post box.

6.8. Posting



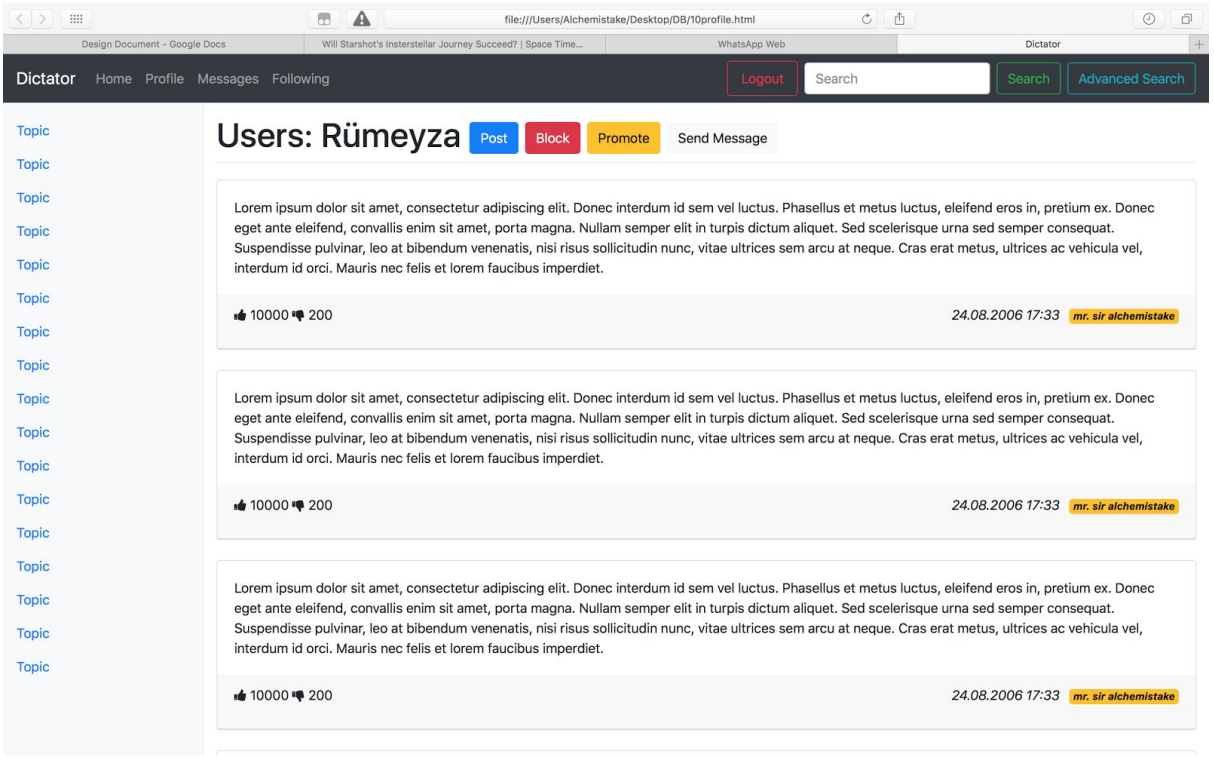
When user desires to post, they can click “Post” button shown in above figure to open a textbox to write. They can write their post and send by clicking the other post button bottom left of the text box. When the text box is opened after the click of the first post button, the button is disabled (both visually and functionally) to prevent any confusion.

6.9. Comments Page



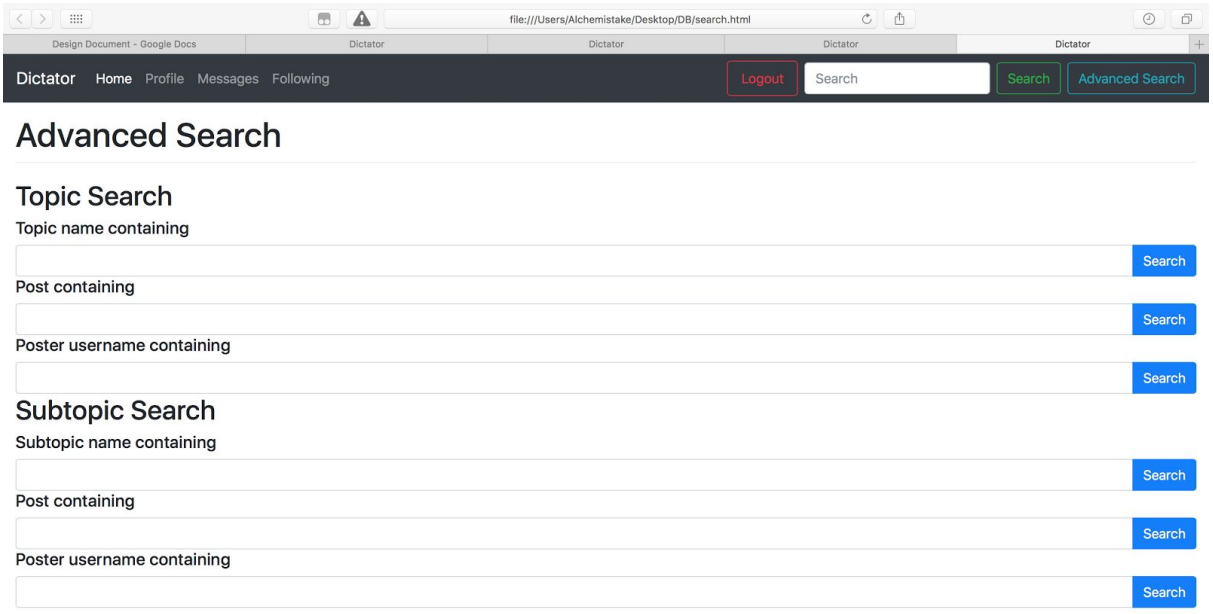
If a user clicks on any of the posts from subtopic page, a page that shows the post and the comments on it will open. All users can comment the post and on any of the comments on the opened page. There will be at most three sublevels of comments will be visible at a time, however, if a user desires to further comments they can click on any comment to make them main focus and show three more sublevels.

6.10. Profile Page



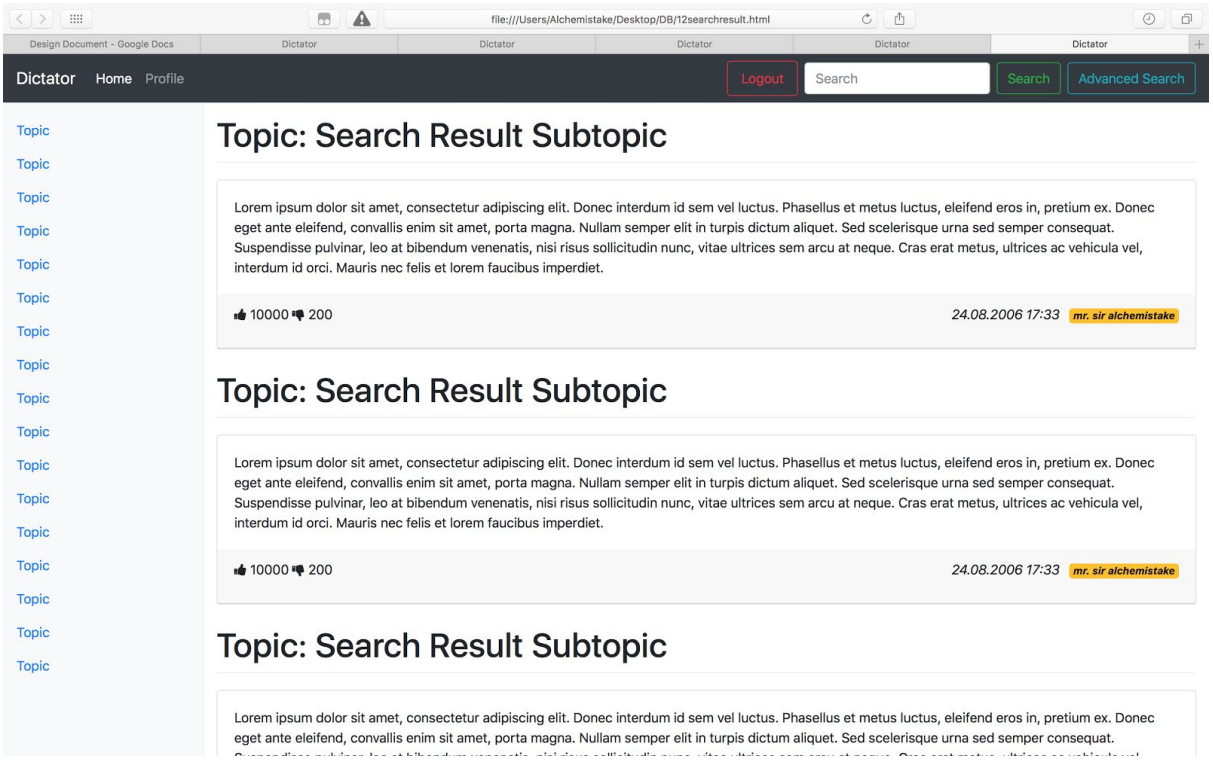
Profile page is a page where users can interact with one and other. In order to open a user's profile page one can simply click on the name of writer of any post or topic. This will open the profile page that user. In order to open self profile one needs to click the “Profile” button on the navigation bar. Profile page is alike to a subtopic page and is specialised with some other options. Users can post about another user here just like adding posts to a subtopic. The posts added are listed in terms of the date and can be liked, disliked or commented like a post. Older posts can be seen by scrolling down to page. Furthermore users can block the other user to avoid further interaction with them by clicking block button appears near the name of the user. Near the block button there is a “Promote” button. Users can click this button in order to propose promotion for the user they are visiting his/her profile. Users can also send messages to other user using “Send Message” button next to promote button. When “Send Message” is pressed it opens user to his/her user message page.

6.11. Advanced Search Page



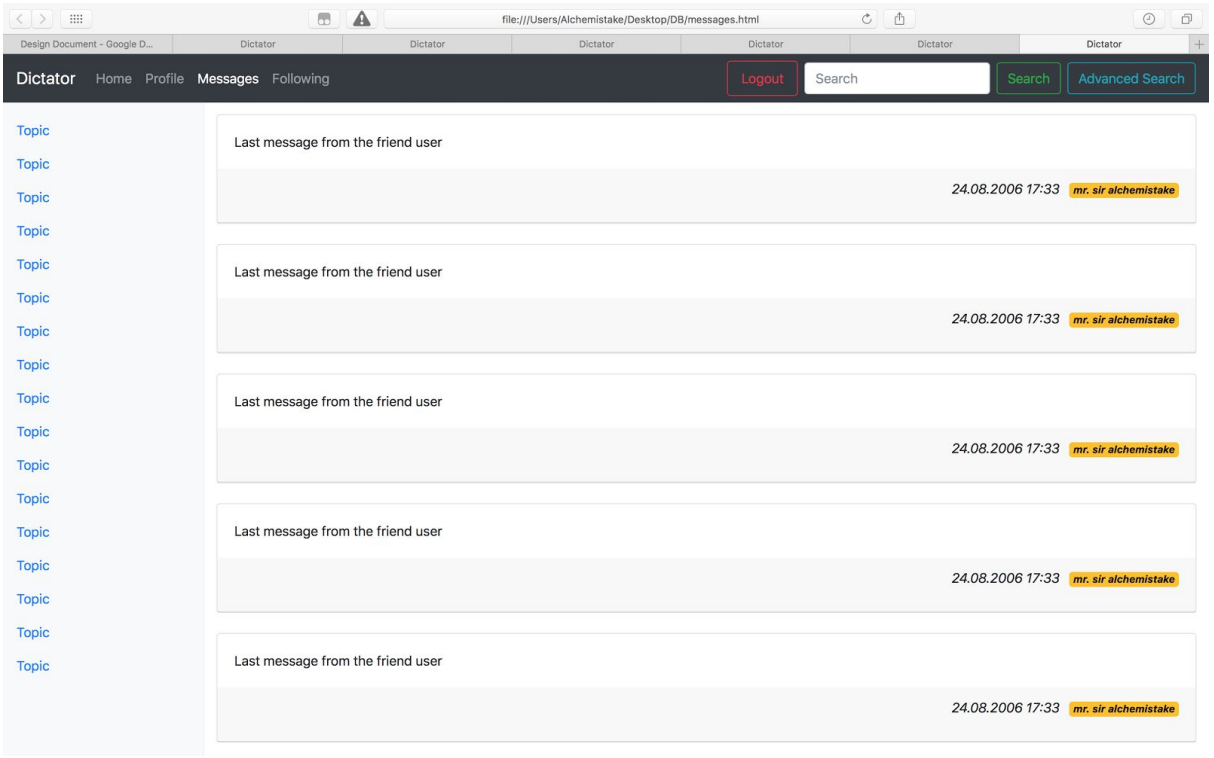
Any visitor or user of any rank can click “Advanced Search” button on the navigation bar in order to see the extended search options placed in this page. They can reach the word or pierce of text in any of the content type all over the Dictator dictionary system. One can search for the name of a topic, description of a topic or a writer of a topic. The search bar on the navigation bar acts as “topic name containing” option here. User can select any given option in the above figure and search according to that.

6.12. Search Result Page



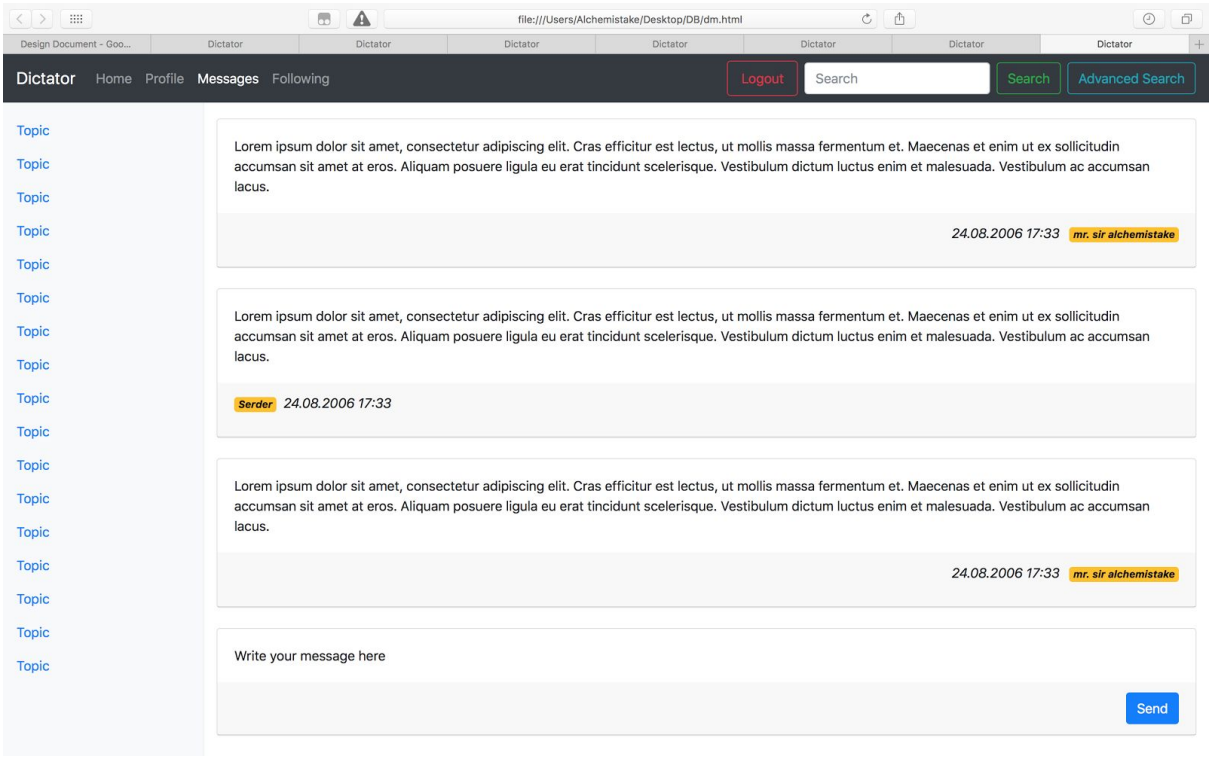
Users can search topics or subtopics by their names from the search bar which is at the upper right of the navigation bar. Result of the requested topic names will be listed in the feed. User can navigate through the searched topic page by clicking the title.

6.13. Messages



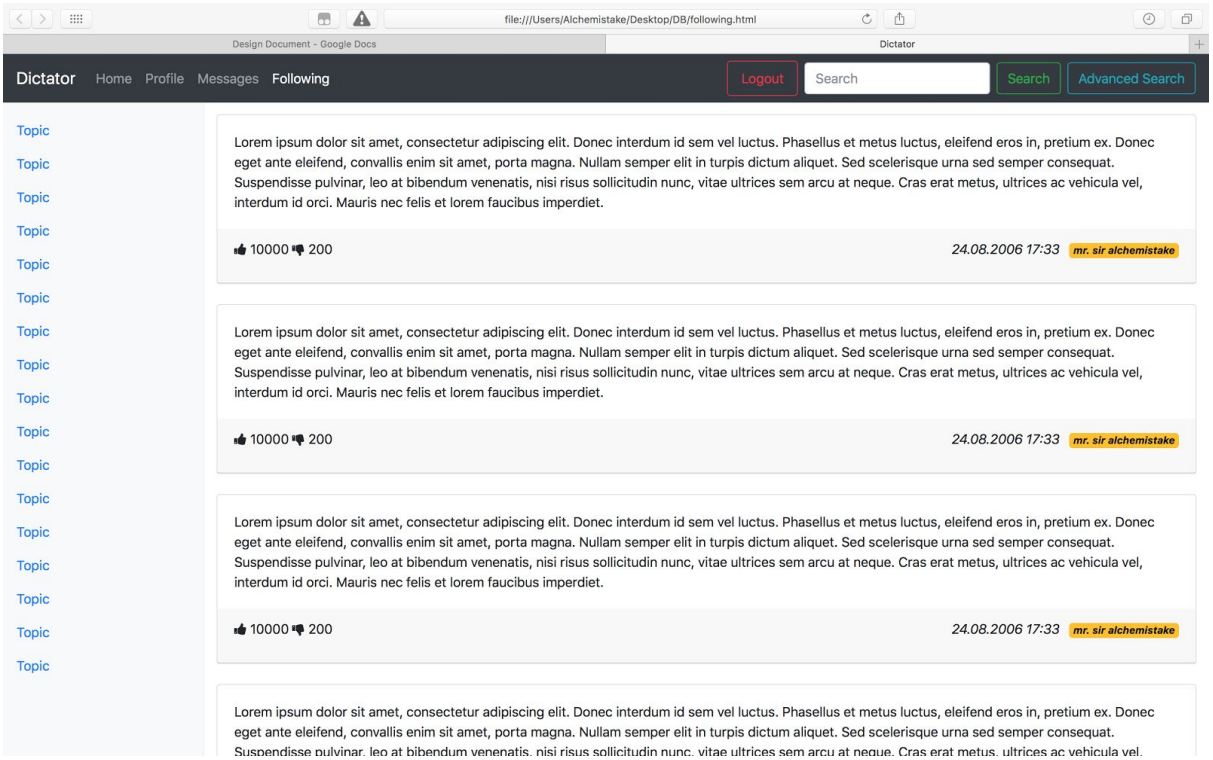
When a user opens his/her message box he/she will see the latest messages from different users. User can click to open the user to user direct message screen to send message to a particular user or read older messages coming from a particular user.

6.14. User to User Message Page



When a user opens user to user message page for a particular user the messages between two will be sorted in chronological order (using message_id). Elder messages will be appear first and in the end of all messages there will be message send prompt. User can type the message to input buffer and send the message by clicking "Send" button.

6.15. Following Page



A user can follow other users of the "Dictator Dictionary". Following page will serve as a home feed page and contain the posts from the followed users. Newest posts will appear on top of the feed page.