Social Media in the Process Automation Industry

Distributed Software Development

Test Report Version 0.1

In co-operation with:

ABB

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MMi	Revision	04.12.2013	0.02
DP	Added new mobile functionalities	11.12.2013	0.03
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DP, MM, MMi	Added Random Testing	08.01.2014	0.07
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1 Scope

1.1 System Overview

This project is about creating a web application and a Windows Phone application that would rely on some common features that characterize a social media approach. These applications are supposed to be used by ABB Company i.e., the customer. ABB is one of the largest engineering companies in the world and it covers several areas like robotics and power and automation technology as well. The corporation is headquartered in Switzerland and it has a branch in Västerås which is cooperating with Mälardalen University. The main goal set by the customer from ABB side i.e., Aneta Vulgarakis and Jonas Bronmark regards the improvement of information flow between factory employees. In fact, they want to investigate if the introduction of a social media application in the daily communication process could be beneficial. The goal of the product is for employees to be able to share knowledge quickly and simple.

1.2 Document Overview

The test report document contains: scope, referenced documents, test specifications and results. This document provides a detailed description of each test specification, the requirement it tests and the results of the tests. The test procedures explain the actions step-by-step, show the expected result and any special condition that is necessary for testing. Each requirement from the Requirement Document includes a unique identification (ID) and specified functionality. The test cases will be used by the team to check if the system meets the requirements.

1.3 Security Test and Evaluation

In our case, the security test includes problems with accessibility. One user cannot access the main web page unless he is logged in. Moreover, mobile user needs also to log in in order to access the application.

2 Referenced Documents

The following documents are either referenced in or were used in preparation of this document:

2.1 Project Specific Document References

Requirements Specification version 0.1 for the project Social Media for the Process Automation Industry November 6, 2013

Design Document version 0.1 for the project Social Media for the Process Automation Industry November 6, 2013

Acceptance Test Plan version 0.1 for the project Social Media for the Process Automation Industry December 31, 2013

3 Test Specifications and Results

3.1 Features to be Tested

The principal features to be tested are categorized into the following areas:

a) Accessibility
b) Security
c) External Interfaces
d) Usability
e) Performance

3.2 Features not to be tested

System Compatibility

3.2.1 Pass/Fail Criteria

Any discrepancies identified are classified as one of three types defined in Table 3-1:

Severity	Description
Critical	Discrepancies that halt further program execution. Example: run-time errors that cause the system to lock up in an unexplained or unexpected way.
Major	Discrepancies that cause the application not to perform as functionally required. Example: inability to view feeds.
Minor	Discrepancies that are not considered critical or major. Examples: misspellings on a screen.

Table 1. *Severity Rankings for Discrepancies*

3.3 Input Specifications

See the Operator Action column for the detailed input specifications in Section 3.6

3.4 Output Specifications

See the Expected Results column for the expected outputs of each operator action in Section 3.6.

3.5 Test Specifications and Procedures

WEB USER

Test Name: Test Case 1: Navigation through the web page (view all feeds).
Description: The web user should be able to navigate into the web page and he should be able to view every section he clicks on.
Prerequisites: N/A

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
1. 1.	Web user logs in with correct credentials.	The system shows the main web page which is used to navigate by the web user and view the posted feeds by both sensor and human users.	The system shows the main web page which is used to navigate by the web user and view the posted feeds by both sensor and human users.	Pass
2. 1.1	The credentials are not correct	The system shows a message telling that the password or username is incorrect	The system shows a message telling that the password or username is incorrect	Pass

Table 2. *Test Case 1*

Test Name: Test Case 2: Logout from the web page.
Description: The web user should be able to logout from the web page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
3. 1.	Web user clicks on the Sign Out item of the navigation menu	System logs out the web user. System redirects the web user to the log in page.	System logs out the web user. System redirects the web user to the log in page.	Pass

Table 3. *Test Case 2*

Test Name: Test Case 3: Feed Categorization.
Description: The web user should be able to categorize the feeds posted in the home page.
Prerequisites: The web user is logged in to the web page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
4. 1.	The web user clicks on the right side of ”Feed Selection” button.	The system gives the web user three alternatives to click (critical, warning, All) that represent feed categories.	The system gives the web user three alternatives to click (critical, warning, All) that represent feed categories.	Pass
5. 2.	The web user selects one of the alternatives.	The system displays the list of latest feeds according to the category option chosen by the user.	The system displays the list of latest feeds according to the category option chosen by the user.	Pass

Table 4. *Test Case 3*

Test Name: Test Case 4: Publish notes.
Description: The web user should be able to publish his own notes to the main page.
Prerequisites: The web user is logged in to the web page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
6. 1.	The web user clicks on the right side of ”Publish” button.	The system gives the web user two alternatives to click (picture, note).	The system gives the web user two alternatives to click (picture, note).	Pass
7. 2.	The web user clicks on the ”Note” alternative.	The system displays a pop-up where the web user can select the note type (StickyNote, WorkPost or VacationPost) and enter the content of the text that he wants to publish as a note.	The system displays a pop-up where the web user can select the note type (StickyNote, WorkPost or VacationPost) and enter the content of the text that he wants to publish as a note.	Pass

8. 3.	The web user chooses the note type (StickyNote, WorkPost or VacationPost) and fills the content of note that he wants to post. The web user clicks on the ”Post new note” button.	The text that the web user entered is posted on the top of list of feeds.	The text that the web user entered is posted on the top of list of feeds.	Pass
9. 3.1	The web user fills in the content but he does not want to publish the note anymore. The web user clicks on the ”Close” button.	No note is posted on the web page.	No note is posted on the web page.	Pass
10. 3.2	The web user does not fill in the content of the text i.e., he leaves it blank. The web user clicks on the ”Post new note” button.	The system displays a message that says that some text must be inserted.	The system displays a message that says that some text must be inserted.	Pass

Table 5. *Test Case 4*

Test Name: Test Case 5: Post comments.
Description: The web user should be able to post comments related to existing feeds in the web page.
Prerequisites: The web user is logged in to the web page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
11. 1.	The web user positions on the comment text field below a post. The web user fills in the content of the comment. The web user clicks on the ”Post” button.	The comment is posted below the post and its existing comments.	The comment is posted below the post and its existing comments.	Pass
12. 1.1.	The web user starts with writing the comment but decides not to publish it. The web user clicks on the ”Cancel” button.	The comment is not posted.	The comment is not posted.	Pass
13. 1.2	The web user does not fill in the the text field for the comment. The web user clicks on the ”Post” button.	No changes are made in the system.	No changes are made in the system.	Pass

Table 6. *Test Case 5*

Test Name: Test Case 6: Load more feeds.
Description: The web user should be able to load more feeds that have been posted earlier in the webpage.
Prerequisites: The web user is logged in to the web page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
14. 1.	The web user goes to the bottom of the web page. The web user clicks on the ”Load more feeds” button.	More feeds are loaded and shown in the web page.	More feeds are loaded and shown in the web page.	Pass

Table 7. *Test Case 6*

Test Name: Test Case 7: Tag users in a post.
Description: The web user should be able to tag users in a post.
Prerequisites: The web user is logged in to the web page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
1.	The web user clicks on the ComboBox to select the note type.	ComboBox lists the note types.	ComboBox lists the note types.	Pass
1.1.	The web user chooses the note type.	The note type appears in the ComboBox as the chosen one.	The note type appears in the ComboBox as the chosen one.	Pass
2.	The web user enters the text of the note.	Entered text appears in the text area.	Entered text appears in the text area.	Pass
3.	The web user clicks on the ComboBox “Tag users”.	ComboBox lists all the users which can be tag.	List of users by it’s username.	Pass
3.1	Web user clicks on the users which he wants to tag.	Tagged users appear in the selected area.	Tagged users appear in the selected area.	Pass
3.2.	Web user clicks on the “Post new note” button.	New note is posted on the web page.	New note is posted on the web page.	Pass

Table 8. *Test Case 7*

Test Name: Test Case 8: View Profile
Description: The web user should be able to see his user profile.
Prerequisites: The web user is logged in to the web page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
15. 1.	Web user clicks on ”Username” in the feed page.	Website redirects to the user profile page.	Website redirects to the user profile page.	Pass

Table 9. *Test Case 8*

MOBILE USER

Test Name: Test Case 9: Login to the application.
Description: The mobile user should be able to login to the application and navigate into the mobile page and he should be able to view every section he clicks on (scrolls).
Prerequisites: N/A

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
16. 1.	Mobile user logs in with correct credentials.	The system shows the main feed page which is used to navigate by the mobile user and view the posted feeds by both sensor and human users.	The system shows the main feed page which is used to navigate by the mobile user and view the posted feeds by both sensor and human users.	Pass
17. 1.1	The credentials are not correct	The system shows a message telling that the password or username is incorrect	The system shows a message telling that the password or username is incorrect	Pass

Table 10. *Test Case 9*

Test Name: Test Case 10: View Feeds
Description: The mobile user should be able to view the feeds displayed in the site.
Prerequisites: 1. The mobile user should access the "ABB Connect" Windows Phone application (The mobile user is logged in).
2. The mobile user should be located in the main page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
18. 1.	Mobile user clicks on "Feeds".	The system displays the latest feeds that have been recently posted based on the chosen filter. By default, all human and sensor feeds are displayed.	The system displays the latest feeds that have been recently posted based on the chosen filter. By default, all human and sensor feeds are displayed.	Pass

Table 11. *Test Case 10*

Test Name: Test Case 11: Publish notes.
Description: The mobile user should be able to publish notes in the site.
Prerequisites: 1. The mobile user should access the "ABB Connect" Windows Phone application (The mobile user is logged in).
2. The mobile user should be located in the main page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
19. 1.	Mobile user clicks on "Post".	The system displays the page where the mobile user have the possibility for inserting the picture or (and) text that will be published.	The system displays of latest feeds that have been recently posted.	Pass
20. 2.	Mobile user enters the note text in the "Content" text field. Mobile User clicks on the "Publish" button.	The note is published and added in the list of published feeds. A pop-up is shown and it says that the note is published.	The note is published and added in the list of published feeds. A pop-up is shown and it says that the note is published.	Pass
21. 2.1	Mobile user starts writing the note but does not want to publish it. Mobile user clicks the "Hardware" button in order to not post the note.	The note is not published on the site. A pop-up is shown and it says that the note is not published.	The note is not published on the site. A pop-up is shown and it says that the note is not published.	Pass

Table 12. *Test Case 11*

Test Name: Test Case 12: View Profile.
Description: The mobile user should be able to view his user profile.
Prerequisites: 1. The mobile user should access the "ABB Connect" Windows Phone application (The mobile user is logged in).
2. The mobile user should be located in the main page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
22. 1.	Mobile user clicks on the "Profile" heading.	The system redirects to the user information that includes his name, email, phone number and location.	The system redirects to the user information that includes his name, email, phone number and location.	Pass
23. 2.	Mobile user clicks on the phone number.	The systems displays a message by asking the user if he wants to call the number.	The systems displays a message by asking the user if he wants to call the number.	Pass
24. 2.1	Mobile user decides to call the number and clicks "Yes".	The system establishes a phone call with the phone number that the mobile user clicked.	The system establishes a phone call with the phone number that the mobile user clicked.	Pass
25. 2.2	Mobile user decides to not call the number and clicks "No".	The system does not establish a phone call with the phone number that the mobile user clicked.	The system does not establish a phone call with the phone number that the mobile user clicked.	Pass
26. 3.	Mobile user clicks on the email.	The system redirects the mobile user to the page where he can send an email to the email address he clicked.	The system redirects the mobile user to the page where he can send an email to the email address he clicked.	Pass

Table 13. *Test Case 12*

Test Name: Test Case 13: Load more feeds.
Description: The mobile user should be able to load and view more feeds that have been posted earlier than the ones that are currently shown.
Prerequisites: 1. The mobile user should access the "ABB Connect" Windows Phone application (The mobile user is logged in).
2. The mobile user is located on the "Feed" page.
3. The mobile user is in the bottom of the feed list.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
27. 1.	Mobile clicks on the "Load more feeds" button which is situated in the bottom of the list of published feeds.	The system loads and displays other feeds that have been published earlier.	The system loads and displays other feeds that have been published earlier.	Pass

Table 14. *Test Case 13*

Test Name: Test Case 14: View Comments.
Description: The mobile user should be able to view comments that are attached to a post.
Prerequisites: 1. The mobile user should access the "ABB Connect" Windows Phone application (The mobile user is logged in).
2. The mobile user is located on the "Feed" page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
28. 1.	Mobile user clicks on the content (text) of a feed.	The system redirects the main feed that was clicked by the mobile user.	The system redirects the main feed that was clicked by the mobile user.	Pass
29. 2.	Mobile user clicks on "Comments".	The system displays the comments that are attached to the feed.	The system displays the comments that are attached to the feed.	Pass

Table 15. *Test Case 14*

Test Name: Test Case 15: View Tags.
Description: The mobile user should be able to view tags that are attached to a post.
Prerequisites: 1. The mobile user should access the "ABB Connect" Windows Phone application (The mobile user is logged in).
2. The mobile user is located on the "Feed" page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
30. 1.	Mobile user clicks on the content (text) of a feed.	The system zooms the main feed that was clicked by the mobile user.	The system zooms the main feed that was clicked by the mobile user.	Pass
31. 2.	Mobile user clicks on "Tags".	The system displays the main tags that are attached to the feed.	The system displays the main tags that are attached to the feed.	Pass
32. 3.	Mobile user clicks on one of the names of the users that are tagged in the post.	The system redirects to the profile page of that user.	The system redirects to the profile page of that user.	Pass

Table 16. *Test Case 15*

Test Name: Test Case 16: View Filters.
Description: The mobile user should be able to view filters that are attached to a post.
Prerequisites: 1. The mobile user should access the "ABB Connect" Windows Phone application (The mobile user is logged in).
2. The mobile user should be on the main feed or on the "Post" page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
33. 1.	Mobile user clicks on "Filters".	The system displays two checkboxes: One for Human feeds and one for Sensor feeds. The system displays also all the saved feeds that the user has in a list format.	The system displays two checkboxes: One for Human feeds and one for Sensor feeds. The system displays also all the saved feeds that the user has in a list format.	Pass

34. 2	Mobile user unticks one checkbox. Mobile user clicks on ”Feeds”.	The system loads and shows the feeds of the type that is not unticked.	The system loads and shows the feeds of the type that is not unticked.	Pass
35. 2.1	Mobile user clicks both checkboxes.	The system loads and shows both human and sensor feeds.	The system loads and shows both human and sensor feeds.	Pass

Table 17. *Test Case 16*

Test Name: Test Case 17: Tag users in a post.
Description: The mobile user should be able to tag users in a post.
Prerequisites: 1. The mobile user should access the “ABB Connect” Windows Phone application (The mobile user is logged in).
2. The mobile user clicks on “Post” and enters the content (text) in the textfield.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
36. 1.	Mobile user clicks on the ”Tag” button.	The system redirects the mobile user to the ”Tag user(s) page.	The system redirects the mobile user to the ”Tag user(s) page.	Pass
37. 2.	Mobile user clicks the names of the users that will be tagged in the post.	The system lists these selected users in the bottomside of the page, under ”Selected users:”. These users disappear from the list of users that can be tagged to the post.	The system lists these selected users in the bottomside of the page, under ”Selected users:”. These users disappear from the list of users that can be tagged to the post.	Pass
38. 3.	Mobile user clicks on the ”Done” button in the bottom of the page.	The system adds the tags to the post.	The system adds the tags to the post.	Pass
39. 3.1	Mobile user clicks on one/some of the names listed under ”Selected users:” in order to untag them.	The system removes the tags from the post. These users appear again in the list of users that can be tagged to the post.	The system removes the tags from the post. These users appear again in the list of users that can be tagged to the post.	Pass

Table 18. *Test Case 17*

Test Name: Test Case 18: View New Feeds.
Description: The mobile user should be able to view new feeds that have been recently published.
Prerequisites: 1. The mobile user should access the "ABB Connect" Windows Phone application (The mobile user is logged in).
2. The mobile user is located on the "Feed" page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
40. 1.	Mobile user clicks on the "Refresh" button in the right bottom side of the page.	The system loads the feeds that have been recently added by the mobile user or other users. They are shown on top of the list. A text that says how many feeds are added is shown.	The system loads the feeds that have been recently added by the mobile user or other users. They are shown on top of the list. A text that says how many feeds are added is shown.	Pass
41. 1.1	No new feeds have been added recently. Mobile user clicks the "Refresh" button, anyway.	The system does not load any new feed i.e., the list of feeds is not updated.	The system does not load any new feed i.e., the list of feeds is not updated.	Pass
42. 1.2	30 seconds have passed since the last update.	The system updates the feed list automatically.	The system updates the feed list automatically.	Pass

Table 19. *Test Case 18*

Test Name: Test Case 19: Add Comment(s) to Feeds.
Description: The mobile user should be able to add comments to feeds that are displayed in the feed list.
Prerequisites: 1. The mobile user should access the "ABB Connect" Windows Phone application (The mobile user is logged in).
2. The mobile user is located on the "Feed" page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
43. 1.	Mobile user clicks on the feed that he wants to comment.	The system zooms the selected feed.	The system zooms the selected feed.	Pass
44. 2.	Mobile user clicks on "Comments".	The system redirects the user to the "Comment" page.	The system redirects the user to the "Comment" page.	Pass
45. 3.	Mobile enters the comment text in the textfield and then clicks on the "Publish" button.	The system adds the comment to the feed and displays a message "Comment published". The comment is also visible on top of the other comments.	The system adds the comment to the feed and displays a message "Comment published". The comment is also visible on top of the other comments.	Pass

Table 20. *Test Case 19*

Test Name: Test Case 20: Search Users.
Description: The mobile user should be able to search for users.
Prerequisites: 1. The mobile user should access the "ABB Connect" Windows Phone application (The mobile user is logged in).
2. The mobile user should be located on the main feed, filter or the post page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
46. 1.	Mobile user clicks on the "Search" application bar.	The system displays the textfield so the mobile user can input the name of the user that he wants to search.	The system displays the textfield so the mobile user can input the name of the user that he wants to search.	Pass
47. 2.	Mobile users starts inputing characters in the texfield for getting the user he wants.	The system lists the name(s) of user(s) that correspond to the characters entered, based on first name, last name and username.	The system lists the name(s) of user(s) that correspond to the characters entered, based on first name, last name and username.	Pass
48. 3.	Mobile user clicks on the name of one user.	The user gets redirected to the user profile page.	The user gets redirected to the user profile page.	Pass

Table 21. *Test Case 20*

Test Name: Test Case 21: View Activity Feed related to a user.
Description: The mobile user should be able to view the feeds related to a user that are listed by the system.
Prerequisites: 1. The mobile user should access the "ABB Connect" Windows Phone application (The mobile user is logged in).
2. The mobile user shall be located on the "Profile" page of the wanted user.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
49. 1.	Mobile user clicks the "Activity".	The systems shows the feeds the user has commented on and the feeds he has been tagged in .	The systems shows the feeds the user has commented on and the feeds he has been tagged in .	Pass

Table 22. *Test Case 21*

Test Name: Test Case 22: Log out from the Windows Phone application.
Description: The mobile user should be able to log out from the Windows Phone application.
Prerequisites: 1. The mobile user should access the "ABB Connect" Windows Phone application (The mobile user is logged in).
2. The mobile user should be located on the main feed, filter or the post page.

Step	Operator Action	Expected Results	Observed Results	Pass/ Fail
50. 1.	Mobile user clicks on the "three dots" at the bottom right of the page	System extends the pop-up at the bottom of the page.	System extends the pop-up at the bottom of the page.	Pass
51. 2.	Mobile user clicks "Logout" at the bottom left side of the pop-up.	The system displays the message "You will logout if you click here" which is associated by an "Ok" button.	The system displays the message "You will logout if you click here" which is associated by an "Ok" button.	Pass
52. 3.	Mobile user clicks the "Ok" button.	Mobile user is logged out from the application. The system redirects the mobile user to the login page.	Mobile user is logged out from the application. The system redirects the mobile user to the login page.	Pass
53. 3.1	Mobile user does not click the "Ok" button. Instead, he clicks the "Cancel" button.	Mobile user is not logged out from the application.	Mobile user is not logged out from the application.	Pass

Table 23. *Test Case 22*

3.6 User Testing

Random testing was performed with different users in order to test as much as possible both web and Windows Phone applications. While performing these tests, features such as usability and Graphical User Interface (non-functional aspects of the system) were taken into consideration.
Different users had the opportunity to check and test both applications. In the end, they filled in a questionnaire in order to rank usability and GUI aspects of the applications from 1 to 10 (10 is the highest rank). They also provided feedback and comments in order to help on improving further the applications.

Web application feedback

The questionnaire for the web part contained the following questions:
1. From scale 1-10, what do you think of the GUI?
If you graded below 5, what was the reason?
2. From scale 1-10, how easy was it to do your task?
If you graded below 5, what was the reason?
3. If you had the opportunity to change the web application, what would that change be?
4. If you would work in a factory, would you use this application?

The results from different random users are as following:

1. Regarding the first question i.e., "From scale 1-10, what do you think of the GUI?", the results are as following:

- Highest grade given: 9
- Lowest grade given: 8
- Average grade given: 8.25

The users were pretty much satisfied with the GUI design. However, some feedback was provided for further improvement. For example, it was suggested that double shortcuts should not be so close to each other.

2. Regarding the second question i.e., "From scale 1-10, how easy was it to do your task?", the results are as following:

- Highest grade given: 9
- Lowest grade given: 8
- Average grade given: 8.5

The users were very satisfied with the usability, as well. They found it very easy to use although there was a suggestion for inserting more features.

3. Regarding the third question i.e., "If you had the opportunity to change the web application, what would that change be?", the suggestions include:

- Shift page should load a little bit faster.
- Response time must be reduced a bit.
- Charts should be in the profile page.

4. Regarding the fourth question i.e., "If you would work in a factory, would you use this application?", the answers were mostly positive. There was only one negative answer. However, that user provided generally positive feedback by saying for example that he found sensor monitoring quite useful.

The feedback given by the different users is taken into consideration. The comments were generally very positive, regarding both usability and GUI. Some critics are present but they may come since different random users may have different expectations regarding usability and GUI design.

Windows phone application feedback

The questionnaire for the mobile part contained the following questions:

1. From scale 1-10, how easy was the mobile application to use?
If you graded below 5, what was the reason?
2. From scale 1-10, how do you feel about the design?
If you graded below 5, what was the reason?

3. If you had the opportunity to change the mobile application, what would that change be?

4. From scale 1-10, do you believe that this application will make your work more interesting?

The results from different random users are as following:

1. Regarding the first question i.e., "From scale 1-10, how easy was the mobile application to use?", the results are as following:

- Highest grade given: 10
- Lowest grade given: 6
- Average grade given: 7.8

The users were pretty much satisfied with the application usability and found the app quite easy to use. This is a very good indicator since the users were of different professional backgrounds and not all of them were familiar with using Windows Phone applications. One helpful comment was about including a "help" button or an "info" button in order to help everyone to perform the user actions.

2. Regarding the second question i.e., "From scale 1-10, how do you feel about the design?", the results are as following:

- Highest grade given: 10
- Lowest grade given: 6

- Average grade given: 7.5

The users were very satisfied with the GUI, as well. However, there were some comments regarding the colors and the fact that it is a too dark design. Moreover, more content and description should be provided by clicking the responsible buttons ("Info" button).

3. Regarding the third question i.e., "If you had the opportunity to change the mobile application, what would that change be?", the suggestions include:

- The possibility of having more colors rather than black and white.
- The possibility of inserting more pop-up tips and easy instructions upon first time of use.
- Headlines should be more visible in order to find them easier.
- There is a problem with the text message when the user wants to post. The text disappears while the user clicks inside the text field.

4. Regarding the fourth question i.e., "From scale 1-10, do you believe that this application will make your work more interesting?", the results are as following:

- Highest grade given: 10
- Lowest grade given: 6
- Average grade given: 8.1

The feedback given by the different users is taken into consideration. The comments were generally very positive, especially regarding usability. However, some critics may come because of the different backgrounds of the users involved in this testing approach. Moreover, different users were familiar with different mobile platforms. For example, a user that was familiar with iOS was influenced by that while judging the Graphical User Interface of our application.

3.7 Middle Layer Unit Testing

NUnit tests were carried out for the Business Logic Layer in order to test the classes and methods implemented for the Middle Layer. Basically, a setup was used for some fixtures so testing input was controlled and avoided to being subject to hardcoding to database results. This way, an object is created in the database before the tests are run.

NUnit testing is performed in order to check for bugs that may exist not only in the Middle Layer but also in the layer that interacts with the database.

3.8 Test Allocation of Requirements

FR ID	BR ID	Requirement Description	Test Case where verified
FR.01	BR.04	Every user shall be able to post notes to the system.	4 and 9
FR.02	BR.04	As a human user, you shall be able to upload media files to the system.	4 and 11
FR.03		The system should characterize every post/action with the time and date it was published.	4 and 9
FR.04	BR.07 BR.14	The system shall provide static and dynamic ways of filtering feeds.	3 and 14
FR.05	BR.05 BR.07	A human user shall be able observe the AF of a sensor/human.	19
FR.06	BR.12	The system shall include user information in every post/action.	4 and 9
FR.07		Every human user shall be able to log in to both applications by providing username and password.	1 and 7
FR.08		Each user shall have his own AF.	19
FR.10		The system shall provide a way of connecting a human user with a post.	15
FR.11	BR.05	A human user shall be able to view the general information about another user or a sensor.	10
FR.12	BR.17	A human user should be able to comment to a note.	5 and 17
FR.13	BR.18	A human user should be able to save a filter for the feeds.	3 and 14
FR.14	BR.12	The system shall include location information in every post.	4 and 9
FR.16		Posts published outside of working hours of a user shall be distinguished with less importance.	3 and 14

Table 24. *Allocating the most important requirements*

The table above allocates the most important requirements stated in the "Requirements Definition" document to the test cases presented in the previous section. FR implies functional requirements while BR goes for business requirements.

3.9 Integration Testing

Based on the unit tests, integration tests were conducted to ensure the operation of features and the operation of subsequent linked business layer procedures. Not all functions were eligible for automated testing, which was done by using the Selenium toolset. Those functions include posting pictures, commenting, tagging and filtering, due to the way they were implemented.
In the case of tagging and filtering, it's related to using specific libraries from which the elements are not selectable using Selenium, and in the case of commenting, specific feed IDs cannot be selected because of inability to predict their ID during automation. In the case of posting pictures, Selenium is not able to upload pictures from the local folder in an automated manner. The tests which were conducted are listed in the following table:

Test ID	Automated	Name	Related test cases / Description	Pass/Fail
IT1	Yes	LogIn	Precursor to all testing, obtaining an active user ID.	Pass
IT2	Yes	PostFeed	Test Case 1, Test Case 4, Test Case 6	Pass
IT2.5	No	TagUser	Test Case 4, Test Case 7	Pass
IT3	No	PostPictureFeed	Adding picture to the feed and successfully posting.	Pass
IT4	Yes	SensorSubscribeAndUnsubscribe	Subscribing and unsubscribing to a sensor from different pages.	Pass
IT5	Yes	ShiftFeedView	Transition from one page to another.	Pass
IT6	Yes	ViewUserPage	Test Case 3, Test Case 6, Test Case 8	Pass
IT7	No	SearchUser	Searching of users and redirecting to other pages.	Pass
IT8	No	PostFiltering	Adding desired filters to feed view and changing its state and display.	Pass
IT9	No	SaveAndLoadFilter	Saving and loading the last user defined filter.	Pass
IT10	Yes	SignOut	Test Case 2	Pass

Table 25. *Conducted tests*

3.10 Responsiveness

To ensure timeliness of loading the model data to the presentation layer, a responsiveness measurement was undertaken. However, these times are influenced by a multitude of factors, such as the upload speed of servers the database and applications are on (in this case, they are on the same server), the download speed of the client and the type of data being fetched (picture feeds are much larger than textual ones).
The following table displays the response times measured in 3 separate measurements, and the average of those measurements:

Action	Measurement 1 [ms]	Measurement 2 [ms]	Measurement 3 [ms]	Average [ms]
Load feeds	3418	3282	2711	3137
Post a feed	1412	1425	1418	1418
Post a picture feed	1892	1609	2095	1865
Load more feeds (5)	621	942	520	694
Profile page loading	942	904	844	896

Table 26. *Response times*

3.11 Summary of Test Results

In this document, we showed that we have tested both functional and non-functional aspects of our system.

Functional testing has been performed by carrying out the test specifications listed in section 3.6. These test specifications have been linked to the main requirements in section 3.9. This shows that these requirements have been fulfilled since the respective test cases have passed. Moreover, NUnit testing has been used to verify and check if there are issues and bugs related to the logic of the system.

Non-functional testing was performed with different random users in order to test non-functional properties such as usability and GUI. Despite of the fact that the users belonged to different backgrounds, most of them evaluated both applications (mobile and web) to be user-friendly. This way, it was tested that both GUI and usability are in a good level.

4 List of Tables