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# 1. Preliminary Study

## 1.1. Introduction

This document summarizes the collaboration of Group 2 for the system development exam of the 3rd Semester. The group consists of 4 members of 4 different nationalities. Despite the major differences in our opinions, we agreed on certain rules and guidelines to follow, thoroughly elaborated in the accompanying document called group contract; we managed to harness the

benefits of diverse ideas and identify multiple possible approaches to certain problems.

### Project Idea

The idea of the project is to create a service that handles multiple chatrooms with limited people count capacity, where people can discuss topics they are passionate about; which the users may access either via the web client or the windows application. Listening to music through the application using YouTube Data API, joining as groups of people or simply playing a game of rock-paper-scissors, are other major user stories of our program.

### Problem Statement

Some of the problems we had to find the answer to include, but are not limited to: When a greater number of users, than the number of available places, wishes to enter a chat, at the same time, or a premade group, whose number of people is greater than the available slots in a given chatroom, tries to join

(for example, a group of 4 attempts to join when there are only 3 or less slots left), preventing SQL Injection, learning how to use Callbacks and bindings.

After formulating the problem statement and having it approved by the supervisors we were assigned the task of solving the problem by selecting the most suitable agile system development method based on the situation, through well-planned and well-synchronized teamwork.

## 1.2. Plan driven Vs. Agile Development (elaborated through methods)

When it comes to software development, the best way of working as a team, is to select one of the many frameworks that exist, that best fit both the team’s composition and the project’s needs. The following few frameworks are some of development methods we have taken into consideration.

### Plan Driven

#### Waterfall

Waterfall method follows very simple pattern. At first all the requirements are gathered. Then final product is designed, and the product development process may begin. After product is finished, it is tested. Finally, product is released and only jobs left to do are maintenance jobs.

#### Unified Process

Unified Process is an iterative and incremental, use-case driven and architecture centric software development method. At first, all the requirements are gathered. After gathering requirements, use-cases are created along with other diagrams like domain model, sequence diagrams, communication diagrams and design class diagram. Work is done in iterations, iterations have 4 phases- Inception, elaboration, construction and transition. Tests are usually done at the end of each iteration.

#### Pros of Plan Driven Development Methods

* Clear overview of project
* Documentation is easy to write
* Perfect for small or critical projects, or when requirements change little if at all
* Good for beginner programmers since most of the decisions are taken by the designers.
* Easy to manage and control

#### Cons of Plan Driven Development Methods

* Changes are hard to implement and can be extremely expensive
* Little communication between customer and development team
* Little time for fixing errors and can lead to delays

### 1.1.2. Agile

#### Extreme Programming

Extreme Programming(XP) is an agile planning and development method. It is based on 4 values (communication, simplicity, feedback and courage) and 12 principles (Planning Game, Small releases, Metaphor, Simple design, Define test

first, Refactoring, Pair programming, Collective ownership, Continuous integration, 37-hour week, On-site customer, Coding standards).

XP methodology starts with planning game. User stories are created to describe functions in the program. Then they must go through acceptance test. Next up is estimations for user stories. Team estimates time it takes to finish a certain user story, block of user stories or even the whole project. A good idea is to create burndown chart as well to visualize progress in project’s development. XP implements many coding practices, a couple of which are pair programming and test-driven development (TDD).

Pair programming is a clever way to solve problems about complex parts of project. Not only because it quickens the idea generation for solutions in different problems, but also because it reduces the chance of imperfections appearing during the coding.

TDD is smart way to prevent code from stopping to do what it is supposed to do. For example, when implementing modifications to existing code, one or more functions might get lost or simply stop working. TDD helps keep track of all the functions in the project by forcing one to create test before writing actual method.

#### SCRUM

SCRUM is an agile planning and controlling method. It has 3 roles (product owner, scrum master and scrum team), 3 ceremonies (sprint planning, daily meeting and sprint retrospective) and 3 artifacts (product backlog, sprint backlog and burndown chart).

At first the scrum master and product owner set up product backlog. Items are then prioritized, and time estimations are added. After time estimations are added, it is possible to create burndown chart. Items are then moved from product backlog into sprint backlog and sprint can begin. Daily meeting is also part of scrum, they are conducted by Scrum master. Meetings are used to get an overview of the state in which the project currently is. People discuss what they achieved since last meeting, what do they plan on doing and if there are any problems. Since scrum is based on incremental development, divided in iterations, called Sprints, the product’s evolution can be easily seen by both the development team and the customer.

If any changes in the requirements occur, then new tasks can be added to product backlog at any time and from there they can be put into sprint backlog for development.

#### c. Kanban

Kanban is another agile development method which uses the “Kanban board” for dividing workflow. Kanban has 3 rules: visualize workflow, put limit to number of items in work in progress area, and estimate time it would take to finish the task.

Since there are fewer rules than the other previously mentioned development methods, it can be seen as a double-edged sword, by the developer, because although the developer has the freedom to take decisions, it also means the developer has the responsibility to ensure the quality of the product.

Kanban uses user stories, they are put up on a board into backlog section. Then items are taken from backlog area and put into selected area, which can be compared to the sprint backlog from scrum. From there the developer takes a task and puts it into the development section, which means that this user story is now in development. After finishing with this user story, it is put into testing area. If all tests give expected results, then the user story is moved into final, live area, meaning that it is finished and ready to be released.

A limit on “work in progress area” (development area) is important, because as soon as development of new part of the project stops or slows down, it is visible on the board. Kanban has the best solution for dealing with changes in program, since new user stories can be put into backlog area on the board at any time.

#### d. Pros of Agile Development Methods

* Changes are easy to implement
* Incremental delivery
* Continuous testing, as opposed to some plan driven methods
* Improved relationship between customer and development team
* More freedom for the developer
* Increased customer satisfaction

#### e. Cons of Plan Driven Development Methods

* Big fixed price projects are difficult to manage
* Prioritizing user stories can be a challenge with multiple customers
* Refactoring is expensive
* Can be overwhelming for inexperienced developers

## 1.3. Quality Assurance

Quality assurance is part of project which is making sure that in the end, a high quality product, that satisfies the customer’s requirements, will emerge. Just as the old English proverb says: “better safe than sorry”, assuring the quality of a product, before and during the development process, is usually a cheaper and faster process of preventing errors than fixing them in a sloppy way, at the last moment.

Some external quality attributes include maintainability, reusability, reliability and usability. External quality can be ensured with pair programming, test driven development, continuous delivery and unit testing.

There are several ways to ensure the quality of a product. Following chosen development method’s instructions is first step towards developing high quality product. Final step is to have quality control. Quality control deals with testing already

existing product. People in quality control make sure that the end product came out exactly as planned and the product fulfils all the requirements.

# 2. Development Process

The following portion represent the practical part of the report and is meant to show how exactly did we apply the theory, in our work.

## 2.1. Development Method of Choice

Although we have learned about the existence of many development methods, each with its own unique characteristics, we decided that the best way of choosing a development method is by evaluating the team and creating a Boehm and Turner Model.

The following image shows the model we have ended up with and according to which, we have chosen a development method.



### a. Final Choice

From the diagram above, resulted that we needed some kind of agile method, due to the high amount of expected changes and Critical level of the product, that is structured enough in order to accommodate for the high number of low level developers and Culture. We have decided to use a combination of the SCRUM and the XP methods of development taking daily meetings (usually at 10 a.m. at school) and sprint structure of the project work from SCRUM while ensuring the robustness of our program through XP and/or pair programming if necessary.

In the end we have observed that the selected criteria, came with the following perks:

### b. Pros

* The daily meetings allow to very well understand the stage at which the project is as well as identify any possibly issues and setbacks as soon as possible before they become a major problem.
* Splitting the work into sprints provides the opportunity to evaluate how well-planned was each iteration and make changes if necessary (learn from our mistakes). For example, if we assign too many tasks and fail to accomplish them by the end of the sprint, for the next sprint we will be able to adjust and plan correctly.
* Quickly identify and solve any problems that were lurking and appeared not to be there.
* Pair programming can make different developers more familiar with the code overall rather than just their own part.
* Optimizing and testing the code all the time greatly reduces the chance of having major bugs or missing functionality.

### c. Cons

* Planning meetings and travelling daily takes some time, which could’ve been used on work instead.
* Pair programming can sometimes take more time than wanted since 2 people are focusing on the same task.

## 2.2. Sprints Summary

Sprint work was mainly organized by scrum master and decided by product owner. Each working day started with a short meeting, in the class room or other location previously decided by group, but it usually happened at 10:00 unless majority of group agreed for different time, according to the group contract. Meeting in which the group members, with help of the scrum master, discussed the following things- which goals have been achieved since last meeting, what goals are set by the next meeting and if any problems were encountered so far.

After the meeting, work was started on the project, if there were any problems, the scrum master or any other person with experience would help in finding a solution to it. On the last sprint day there was sprint review where group members discussed the good and bad about this sprint and how can we improve in these fields, followed by goal setting for next sprint and work distribution. This process resulted in our estimations getting progressively better, thus allowing us to set more realistic goals.

In the following portion we are going to give you a detailed diary of what we have done each sprint.

### Sprint 0

#### a. Sprint summary and MoSCoW model

This sprint’s roles were distributed as follows:

* Product owner- Hannes Heiskonen
* Scrum master- Ralf Zangis

One of the first things we needed to establish were the user stories, and once they were established we needed a way to organize them depending on their importance. And the best way to do so, is with the help of a MoSCoW Model, so the following, colorful, table, shows our final version of it.

|  |  |  |  |
| --- | --- | --- | --- |
| Must | Should | Could | Wont |
| ------------- | ------------- | ------------- | ------------- |
| Register | Forgot password | Show if someone is writing | Follow/subscribe |
| Login/Logout | Multiple chats for user | Multiple chats for person | Friends |
| Manage profile | Invite to chat | Manage YouTube playlist | News area |
| Manage public chat | Show online users | Multiplayer game |  |
| Manage private chat | YouTube video player | Join with group |  |
| Manage messages | User can’t log in if he is online |  |  |
| Dedicated client | Manage group |  |  |
|  | Web client |  |  |
|  |  |  |  |

The first version of the model looked quite differently, having a lot of text in the first two columns and little to nothing in the last two columns. But as time passed and after we pivoted from the original idea, a few times, the final version of the model slowly started to be appear, resulting in its concluding form sometime in the middle of Sprint 1.

#### b. Sprint Backlog and burndown chart

| **Priority** | **Work** | **time-est.** | **25.10.2017** | **26.10.2017** | **27.10.2017** | **31.10.2017** | **3.11.2017** | **6.11.2017** | **Person** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2 | Mock up | 4 | 4 | 4 | 4 | 5 | 2 | 0 | Ralfs |
| 2 | MoSCoW | 3 | 3 | 3 | 3 | 4 | 0 | 0 | Ralfs |
| 1 | Use cases | 2 | 2 | 2 | 2 | 1 | 0 | 0 | Ralfs |
| 2 | Distribute use cases | 1 | 1 | 1 | 1 | 1 | 2 | 0 | Ralfs |
| 3 | Read about chats | 3 | 3 | 3 | 2 | 1 | 0 | 0 | Ralfs |
| 1 | Group Contract | 9 | 3 | 0 | 0 | 0 | 0 | 0 | Andrei |
| 3 | Database table creation scripts | 2 | 2 | 2 | 2 | 2 | 2 | 0 | Andrei |
| 3 | Drop database script | 1 | 1 | 1 | 1 | 1 | 1 | 0 | Andrei |
| 3 | Database trigger tests | 2 | 2 | 2 | 2 | 2 | 2 | 0 | Andrei |
| 3 | Database insert row scripts scripts | 3 | 3 | 3 | 3 | 3 | 3 | 0 | Andrei |
| 1 | User stories | 10 | 12 | 4 | 1 | 0 | 0 | 0 | Hannes |
| 3 | Create report structure | 3 | 3 | 3 | 3 | 3 | 2 | 0 | Hannes |
| 3 | Domain model explanation | 2 | 2 | 2 | 2 | 2 | 3 | 0 | Stoycho |
| 1 | Backlog | 7 | 7 | 7 | 9 | 4 | 1 | 0 | All of us |
| 2 | Database model | 12 | 12 | 12 | 12 | 7 | 2 | 0 | All of us |
| 1 | Generate product idea | 10 | 6 | 2 | 0 | 0 | 0 | 0 | All of us |
| 2 | Domain model | 7 | 7 | 7 | 7 | 8 | 5 | 0 | All of us |
| 1 | Decide on development method | 2 | 1 | 0 | 0 | 0 | 0 | 0 | All of us |
| 2 | Establish coding standards | 3 | 3 | 3 | 3 | 3 | 3 | 0 | All of us |
| 2 | Agree on working conditions | 2 | 2 | 2 | 2 | 0 | 0 | 0 | All of us |

#### 

#### c. Sprint retrospective

Although the sprint was 14 days, we have considered only the 5 days that, represented by the bottom set of numbers in the chart, in which we have spent the most time working on the project.

### 2.2.2. Sprint 1

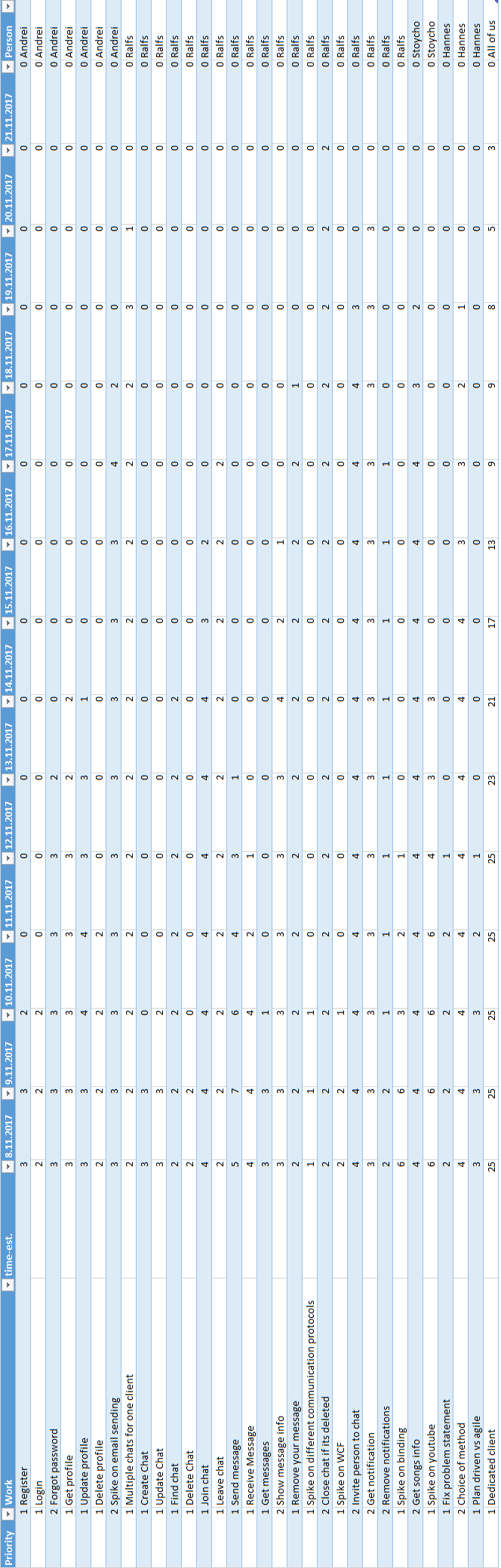
#### a. Sprint summary

This sprint the assigned roles have been changed to the following:

* Product owner- Ralf Zangis
* Scrum master- Stoycho Anastasov Nenov

Sprint 1 was possibly the most important regarding the program, as in this sprint we made multiple spikes on new technologies like binding, WCF, YouTube API, different communication protocols and email sending. It resulted in the main features of the project being finished, besides that sprint also tested the team, as there we had conflicting arguments regarding future of project. Conflicts which were solved by the product owner and the scrum master, agreeing on middle ground, resulting in project main idea changing drastically while keeping main user stories.

#### b. Sprint Backlog and burndown chart



#### 

#### c. Sprint retrospective

Although the sprint tested our group’s work limits, it was still a great success because we could agree on common project path and it resulted in all necessary features being successfully implemented.

### 2.2.3. Sprint 2

#### a. Sprint summary

This sprint the assigned roles have been changed to the following:

* Product owner- Andrei-Eugen Birta
* Scrum master- Hannes Heiskonen

This sprint’s main purpose was finishing touches for the existing features, such as optimizing, refactoring, fixing some of the most obvious “features” and just adding a little sprinkle on top, to make it shine from a crowd of other projects. As a result of our great efforts, during this sprint, we had a completely working dedicated client with all the intended features.

#### b. Sprint Backlog and burndown chart

| **Priority** | **Work** | **time-est.** | **22.11.2017** | **23.11.2017** | **24.11.2017** | **25.11.2017** | **26.11.2017** | **27.11.2017** | **Person** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | Play song | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Stoycho |
| 1 | Save song | 1 | 1 | 1 | 0 | 0 | 0 | 0 | Stoycho |
| 1 | Create playlist | 3 | 2 | 0 | 0 | 0 | 0 | 0 | Stoycho |
| 1 | Get playlist | 1 | 1 | 1 | 0 | 0 | 0 | 0 | Stoycho |
| 2 | Update playlist | 2 | 2 | 2 | 0 | 0 | 0 | 0 | Stoycho |
| 2 | Delete playlist | 1 | 1 | 1 | 0 | 0 | 0 | 0 | Stoycho |
| 2 | Exception handling | 4 | 4 | 0 | 2 | 2 | 0 | 0 | Stoycho |
| 2 | Multiplayer game | 6 | 6 | 3 | 1 | 0 | 0 | 0 | Andrei |
| 2 | Game debug/release mode execution error | 3 | 3 | 7 | 10 | 6 | 0 | 0 | Andrei |
| 1 | One person can be logged in at once | 2 | 2 | 2 | 2 | 2 | 0 | 0 | Andrei |
| 1 | Logout | 2 | 2 | 0 | 0 | 0 | 0 | 0 | Andrei |
| 1 | Refactor database | 4 | 4 | 0 | 0 | 0 | 0 | 0 | Andrei |
| 2 | Exception handling | 5 | 5 | 5 | 5 | 3 | 0 | 0 | Andrei |
| 2 | Exception handling | 2 | 2 | 1 | 0 | 0 | 0 | 0 | Hannes |
| 1 | Join group | 1 | 1 | 1 | 0 | 0 | 0 | 0 | Hannes |
| 1 | Leave group | 1 | 1 | 1 | 0 | 0 | 0 | 0 | Hannes |
| 1 | Create group | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Hannes |
| 1 | Read group | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Hannes |
| 1 | Update group | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Hannes |
| 1 | Delete group | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Hannes |
| 2 | Chat users updated if user info changed | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Ralfs |
| 2 | Show if someone is writing | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Ralfs |
| 2 | Show online persons | 2 | 2 | 1 | 0 | 0 | 0 | 0 | Ralfs |
| 2 | Show newest chat info | 3 | 3 | 2 | 0 | 0 | 0 | 0 | Ralfs |
| 1 | Join as group | 9 | 9 | 9 | 8 | 0 | 0 | 0 | Ralfs |
| 2 | burn down chart | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Ralfs |
| 2 | Updating end expanding existing UI | 1 | 1 | 2 | 0 | 0 | 0 | 0 | Ralfs |
| 2 | Exception handling | 4 | 4 | 4 | 3 | 0 | 0 | 0 | Ralfs |
| 2 | Report planning | 18 | 18 | 18 | 18 | 18 | 24 | 0 | All of us together |
| 2 | Spreading tasks | 8 | 8 | 0 | 0 | 0 | 0 | 0 | All of us together |

#### c. Sprint retrospective

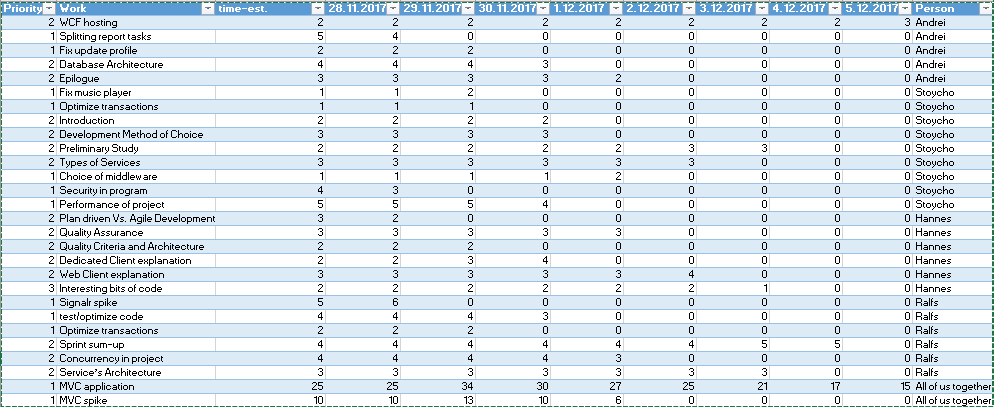
This sprint was possibly the most “exciting” of them all, simply because of the problems we have encountered, such as both the Video Player and Rock-Paper-Scissors game, working only in Debug Mode.

### 2.2.4. Sprint 3

#### a. Sprint summary

This sprint the assigned roles have been changed to the following:

* Product owner- Stoycho Anastasov Nenov
* Scrum master- Andrei-Eugen Birta

We like to call this Sprint as “The beginning of the end”, simply because this is the sprint in which we intended to wrap up the project, at least start doing so. The main goals for this sprint were finishing the web client, finishing touches for the service itself and started writing the reports. And as usual, all this sprint’s tasks can be seen in the following table, sprint backlog and the accompanying image, burndown chart.

#### c. Sprint retrospective

But of course, since we have never previously worked with MVC, fell right into Mr. Brian’s “prediction”. Just as you can see from the burndown chart, this sprint’s estimations were just as close to reality as we would ever get to winning the lottery. We had to do a spike on MVC, SignalR and several other web client related technologies.

Although at the begging of the sprint we were slightly ahead of schedule, at the end of it, time became an enemy and the race to handing in a “finished” product, began. Only benefit we got from this sprint was increased knowledge regarding web clients and web servers.

### 2.2.5. Sprint 4

#### a. Sprint summary

#### b. Sprint Backlog and burndown chart

#### c. Sprint retrospective

# 3. Conclusion

## 3.1. Denouement

In conclusion, during this semester we have managed to achieve not only knowledge about different frameworks of developing software, such as Extreme Programming, SCRUM and Kanban, and seeing how actual developers work, through the company visits; but also, how to communicate and reach out to companies of the profile.

As an ending note, we would like to thank all the readers, who invested their time in reading this paper and also to the guiding teachers that helped and guided us through the entire process.

## 3.2. References

## 3.3. Appendices