Process Report

Indoor Air Quality

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ICT Engineering

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Bring ideas to life
VIA University College

Table of content

1 Introduction

The current document is meant to inform both the team and the reader about how the planned activities worked out and how the collaboration and workflow went in our group. For this project, there was no mandatory given topic, but instead, we had the possibility of choosing the methodology, we want to use. The chosen working methodology for this project was SCRUM since it was the ideal way of managing the team in an agile way. The group's activities for this assignment were organized in sprints. There was a total of 14 sprints for the given project and each of them was held weekly one for each sprint. Our group scheduled the weekly sprints to take part every Thursday at 8:20 AM. The meetings were scheduled to last around 8 hours per meeting. Each sprint had its own sets of requirements all having a grade

of importance and a workload estimate. Some tasks took more time to complete than originally estimated and at some point, we fell behind of schedule because of this. A time schedule in the form of a Gantt chart was made for this project and this helped in keeping track of the given tasks and helped in organizing our group work. At a certain point in the project, we stumbled with certain tasks and had difficulties in advancing further. As a result, we seemed help from our supervisors during the scheduled meetings, which were held each week on Thursday. The meetings went well and the problems that we encountered were solved, allowing us to advance further with our project. The workflow went smoothly in most cases since we had a well-organized team prior to starting the work. Each member did his tasks and did not hesitate to ask for help when problems started appearing.

2 Group Description

1. Fadi Atia Dasus

I am from Syria where I studied to become a dental assistant. In my free time I learned to take care of majestic Arabian horses my uncle owned. Thanks to the time spent taking care of horses I learned patience and to look for hidden talents in anyone I saw. And thanks to the dental practice I gained skills to slowly and surely finish a job with the highest quality possible. During nearly two years in VIA UC I learned to code with multiple languages and to manage different systems.

2. Oskars Arajs

I come from Latvia and have experience working with wires and electronics. I spent multiple internships as an electrician, working for the Latvian main energy supplier. During that time, I learned how to work in a team, communicating with other people to achieve a common goal or to plan something project related.

During time in the university in Denmark I have learned a bit of programing in Java, SQL, android and other programing languages, some database design and other important stuff. Of which, teamwork, patience and understanding where the most valuable ones due to the perks you may gain from these skills.

3. Roza Hasso

I am from Syria, I was studying electrical and electronic engineering before coming to Denmark and changing my education to ICT engineering, I have some experience in working with groups form my previous education.

I am organized, motivated and I tend to keep track of the work.

4. Vladimir Rotaru

I am coming from Republic of Moldova. I am 21 years old enthusiastic person that is very self-determined and motivated towards completing IT-related tasks. I am a committed person towards everything I am doing, and I am ready to work hard in order to achieve what I want. My current goals are self-development, improvement in both communication and field-related skills.

5. Balkis Khaled Ibrahim

I am 21 years old, from Syria. I have been in Denmark for about three years. I have never imagined that one day I would be here in Denmark studying ICT, but I am very happy with that and looking for a brighter future. I am always optimistic and tries to motivate all other members. During the time that I spent at VIA, I got a lot of experience in programming and learnt many new things.

6. Ainis Skominas

I am Ainis, 21 years old from Lithuania. I discovered programming when I got interested to understand how computers work inside. This was when I was 14. Later I was interested in game development and started writing simple games in C++ and thought I want to do this for a living, but during my studies in VIA I discovered that I like to design and develop such software that helps people make their life easier by promoting good habits which helps to develop as a person. My role in the team was to always raise a discussion about different topics which can slow our progress down, but in the end, we as a group can get to the point and draw a conclusion. As a perfectionist, I did not manage to fully fulfill my own personal requirements from the project, but after each semester project I can feel I have less and less personal tasks for the projects to be fully completed.

7. Aleksandr Zorin

I am a cheerful 24-year-old guy from Lithuania that came to Denmark 5 years ago. Before I was studying Mechanical Engineering, but it wasn't my cup of tea, so I took some time off from studying to search for a purpose. I found that purpose in ICT quite recently by pursuing the Data Warehousing/BI career. Thanks to VIA I am given lots of opportunities to prove my worth to the industry.

8. Robert Misura

I am 23 years old, I am from Slovakia and currently at this moment I am also a student of ICT in Via University Horsens. After two years of study in Czech Republic my decisions and a little bit of luck brought me to Denmark, where I got the chance to start again. Thanks to this opportunity I have found my passion in programming once again. I am glad being in such a great community of people and being part of this interesting project.

9. Muhammad Nadeem

I came from Pakistan and living in Aarhus from 12 years. I am doing a student job as a IT field engineer at SPX Flow. At first, I feel shy and doesn't want to bother the rest of the team if I don't know something. But it turns out that I am a smart and talented guy that knows a lot of programming and also knows how to document the work. My technical skills and theoretical knowledge comes in handy when the project period starts, and the deadlines are approaching.

10. Yasin Issa

I am a 22 years hard working team player, who will be able to work seriously and structured to achieve his goals. I am very cooperative and positive and would rather avoid friction for smoother teamwork. In addition, I would be able to contribute with sparring and programming within Java, SQL, .net / C # as core competencies. On my projects, I have worked with SCRUM and Agile Unified Process, as well as documentation of code through GitHub. In connection with my study, I have also gained knowledge of a large number of IT systems.

3   Project Initiation

The topic of choice was decided upon after studying the requirements for the project. Since the project required the use of different sensors, the project group decided on "indoor Air Quality" as the project topic, since sensors like CO2, and temperature/ humidity where available.

The group was chosen more or less at random. There were no special criteria in mind as long as every group member did their part and respected the majority vote. But since the group members knew each other prior the project, that made the choice a bit easier. The bases for the Project was Since every group member has experience working with other people on different projects, everyone had some input as to what tools we could use to better manage our task regarding the project. We used tools like Slack and Trello. Since these where the favorite tools of the majority of the group we decided to use them. With Slack everyone had worked with, but Trello, prior this project, was only

used on a surface level and not really utilized. This semester we used Trello much more since it provided us with clear task that needed to be done and helped us see the people working on each respective task.

4   Project Description

The first thing we did after the project was approved was to write a project description. We tried to explain as clear as possible the problem our team wanted to solve. It helped us to understand better our project, the problem we wanted to solve and the requirements it would need. Problem statements and delimitation made us think about the key points and the obstacles that can occur. Risk assessment were created to evaluate our risks and to avoid them in the future. That is all helped us in building a better project. After finishing the project description, we got a better understanding of the project, and we were able to proceed to the other parts in our project.

5 Project Execution

This phase of the project is based on good time management and well communication. As we were 10 people in the group now it was completely different. From the second meeting, we decided to structure all the workload we have. This helped us and facilitated our work on the project.

In order to find out what you need to do for the project is to write down the requirements. Considering the fact that we were 10 people in a classroom, many ideas were generated by everyone and we tried to consider every point of view. Multiple of them have been debated and members had to defend them by providing reasonable arguments. Continuing with the use case diagram which during the first version seemed to fit perfectly our system, has been changed from sprint to sprint according to our system. An activity diagram has been made for each use case to get a better overview of how the interactions are made in the system. After this step, our group has separated into 3 different groups: android, data and embedded. Ainis, Alexander and Vladimir were taking part in the android group. Nadeem, Fadi, Yasin, and Balkis were taking part in the data group and Robert, Roza, and Oskars were a part of the embedded group. Each of the group has created a class diagram representing their implementation. Later these class diagrams were adapted in order to match the needs of all sides.

Overall, we managed to cover everything we had in our minds. Communication played a big role during the creation of REST web service API. We followed the structure we have made during the early sprints throughout the project.
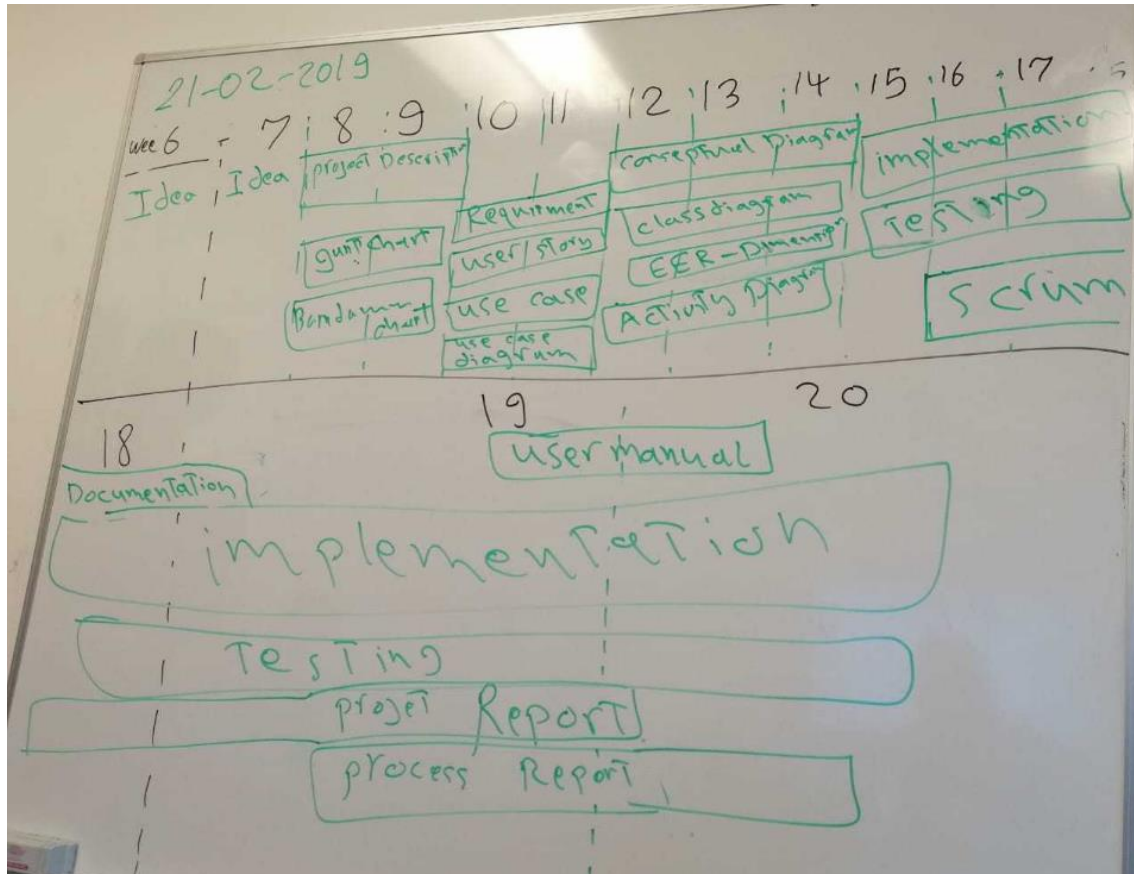
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Figure 1 - Semester Project Schedule

Using correctly a methodology during the project implementation of such scale is very important. We decided to use Scrum and Unified Process in our project.

Scrum

During this semester project, Scrum methodology was used in order to split the workload into smaller parts called sprints. Moreover, it was done completely different this time, first sprint started directly after the presentation. When we had a well-structured idea of what we are going to implement we decided to move on with the user stories.

We organized regular Scrum meetings each Thursday where we have been generating tasks according to our structure presented in the figure above. From the seventh sprint we divided our group into 3 small teams, android, data and embedded. From that moment each team was responsible for the workload they are handling. Each team has

managed to implement their own sprint backlogs with all the tasks. We assigned Scrum roles to some of our members.

Our roles were:

Product owner:

We have decided that every member of our team will be the product owner. Every member has the right to create a vision and collaborate with his teammates in order to decide whether we should implement it or not.

Scrum master: Fadi Dasus

Fadi was the Scrum master in our group. His purpose was to maintain a good and calm environment. Usually, he was taking the initiative to write down what we will make during the Scrum meetings. Also, he was the one who planned out the Scrum meetings.

Development team:

The development team was split into 3 different groups which were: android, data and embedded. The main goal of the development team was to implement the diagrams which built up a plan for further implementations. Moreover, each team had its own sprints for managing the workload. During this project, our development team worked hard in order to achieve the set-up goals.

Sprint groups	User Story	Priority	Status
data	As a user I want to check CO2 levels in the classroom so that I ensure the best IAQ (Indoor Air Quality).	High	Done
data	As a user I want to check the temperature in the classroom so that I ensure the best IAQ.	High	Done
data	As a user I want to check the humidity in the classroom so that I ensure the best IAQ.	High	Done
data	As a user I want to see a diagram about CO2, temperature and humidity levels in the classroom so that I ensure the best IAQ.	High	Done
data	As a user, I want to be able to see live data from one particular room. so that I keep an eye on IAQ	High	Done
data	As an admin, I want to add a new device so that I can track CO2, temperature, and humidity.	High	Done
android	As an admin I want to add rooms to the system so that I can track the measurements from that room.	Medium	Done
android	As an admin I want to add users to the system so that all the users will have access to the app.	Medium	Done
android	As a user I want to read a report about CO2, temperature and humidity levels in the classroom so that I ensure the best IAQ.	Medium	Done
android	As a user I want to check warnings history so that I can see where that happened and when.	Medium	Done
android	As an admin I want to delete rooms to the system so that I remove non existing rooms.	Low	Done
android	As an admin I want to delete users from the system so to block users access to the app.	Low	Done
android	As an admin I want to edit users from the system so users change their credentials.	Low	Done
data	As an admin I want to edit room to the system so that I can edit the information about the rooms	Low	Done
data	As an admin, I want to delete a device so that I can remove unused device.	Low	Done
data	As an admin, I want to edit a device so that I can change the room of the device.	Low	Done

Figure 2 - Product Backlog

Note: There is no embedded group in the product backlog because they do not have any direct relation to the user stories. They are supporting the data and android group in the backend which indirectly contributes to the user stories.

In the figure above Product backlog can be visualized. Each user story has been categorized according to a priority. Moreover, a story point estimation has been made for each item in the backlog.
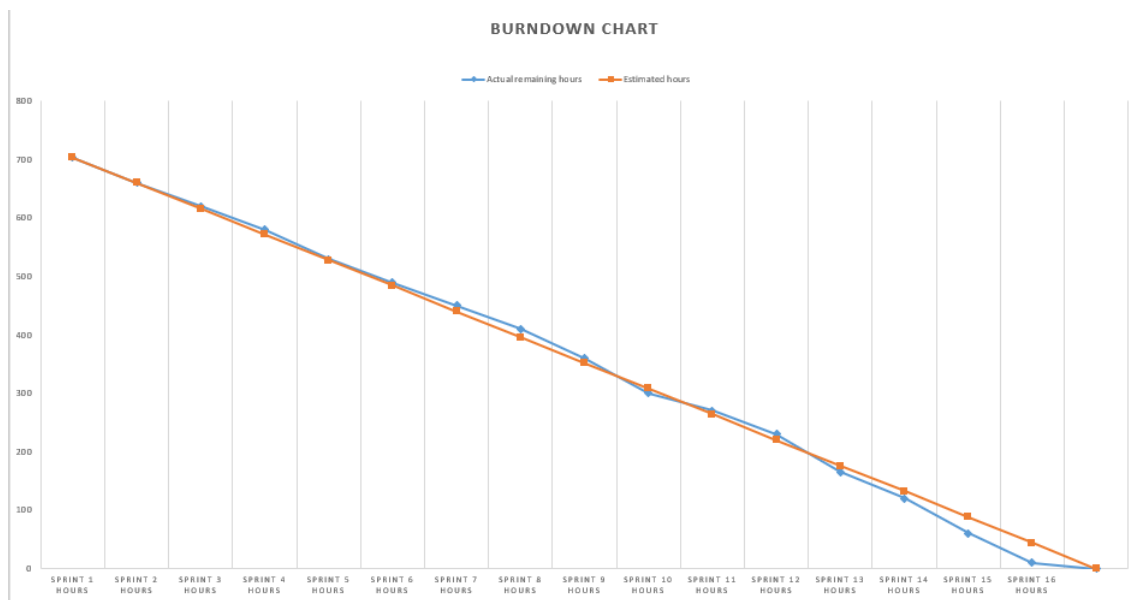

Figure 3 - Burndown Chart

All of the sprint backlogs and sprint burndown chart can be seen in Appendix.

Unified Process

Inception

During the inception phase, we have formed our group, and everyone had a chance to introduce themselves. From the first presentation, we knew what we have to prepare for. Creation of the group contract was the next thing we have done in order to settle some rules during the group communication. We were having some ideas already what we could have in the project description but that was just on a discussion level.

Elaboration

The main objective of elaboration was to review the requirements and build all the necessary diagrams for implementation. As we have split into 3 different groups, every

group had to implement their own class diagram which represented what they are going to implement. At the end of the elaboration phase small amount of implementation was done but not enough for testing the whole system.

Construction

During the construction phase, all of the groups were putting the effort into implementation. Communication about the accepted model and the web API endpoints were inconsistent. Throughout the development, after the first week of project period, a common agreement about the endpoints was accepted between android and data teams. Overall this phase led to a nearly to deliver product.

Transition

This phase is very important because here the final product is prepared for delivery. With small polishing made to the code and diagrams, the application is ready for deployment for the customer.

6 Personal Reflections

6.1 Ainis Skominas

One of the most enriching SEP4 projects I have worked on. For me it felt that we were accomplishing some things exactly like companies would do in real environment. The most fun part for me was communicating with Data tier and working on mutual agreement for web service endpoints. There was a lot of discussion around this and it was very fun to draw diagrams on the blackboard and discuss the ideas. Also sitting in one room where three teams are sitting independently and working on their own project looked very nice. Hearing some of the guys talking about their success and what they did motivated me to work more on the Android part. Apart from this I learned a lot about Android development. This semester I realized I really like mobile application development and as of now I will strive further into this industry to see where I will go. As a team of 10 I believe we all communicated well, especially because it was our first time working in such a big group where everyone has a different work ethic and a way of doing things. I would like to thank Fadi for taking up most of the responsibility of the group, organizing meetings and leading all of us to success. Without him, we would have been disconnected from each other in the team. This project gave me even deeper understanding of design phase and how essential it is for project success. Having properly designed android application in Astah diagrams helped Android team to have one place which indicated what was done and what is left to do. Throughout implementation phase updating class diagram was essential for understanding the structure of the code and whenever new feature was to be implemented in Android, first class diagram was updated and only then coding started.

I am really glad I had an experience to work with a group of 10 people as this gave me astounding experience how to work on a scalable project with 2 different teams included. It was very interesting to get to know what other teams were doing and talk about coding with them. I hope this type of semester project will continue to run for other 4th semester projects.

6.2 Aleksandr Zorin

This was my first time doing a project of such a scale. Working with 9 other people truly is a difficult task, especially when you have no prior experience how to do it properly. At the first couple of meetings things seemed okay, but when things started to get difficult, the miscommunication started, but since all of the group members were reasonable and responsible people, talking it out and just discussing some points of the project helped clear up the problems we had as a group. When the project period started, the group already knew what needs to be done and when we it is needed to be done. Everything ran quite smoothly comparing to previous semesters. Everyone kept it professional and by doing so, strengthened the trust of each other that they will deliver. Personally, I would have loved to do this project being in the data group instead of android. After quite some time, I realized I like working with data and handling it and that I found my passion in ICT. Nevertheless, it was quite the experience and I would love to do similar projects.

The negative parts of the project were my problem mostly because of constant work. Quite a lot of the days I couldn't contribute as much, because I would be too tired. This is the battle I keep having every single semester, studies colliding with work. Hopefully one day I can just quit my job and commit fully to my studies.

6.3 Balkis Ibrahim

It is interesting working in a SEP group where you are one of the two girls out of ten people. But these guys are really friendly and helpful. If anyone has difficulty understanding the task at hand, they explain everything as best as they can. And I feel that I also give a contribution to the team effort. It was easy to get overwhelmed at some points because the deadline was approaching quickly. But following our sprints helped us keep track and gave us head-up for the upcoming tasks.

We would sometimes sit after hours to discuss the next meetings so we would have extra time on our hands.

I was a little concerned about the meeting times and if all of the group members would be able to come to our meeting and spend time productively. Since it was my first time working with these people, I wasn't quite sure about their work ethic or their sense of

responsibility. But turns out my concerns were unneeded since our group members only missed a meeting or two due to illness.

I enjoyed the time we spent doing this project.

6.4   Fadi Atia Dasus

This project was by far the most technically advanced project because we had to incorporate multiple programming languages and hardware to achieve our goal. The embedded part of our system faced some long-term issues, but we managed to solve them towards the end of the project.

As a scrum master for this project, I have learned so many new skills regarding teamwork, and I have learned how to avoid conflicts with other group members.

It is impossible to have 10 people with different experience background contributing equally in the project, but after all I believe every single one has done his/her best in order to achieve the best outcome.

I have literally learned at least one thing from each one of my colleagues in this group, and I hope that somebody has learned something from me too.

The group contract, in my opinion, is just a piece of paper if people do not enforce it. Fortunately for my group, most of us were meeting up on the scheduled days, but as for the people that could not make it to the meeting, they followed up with their work from home.

I especially enjoyed working with the nice people in the data group and I might go for another project with them.

Dividing the team into three groups gave us the privilege to communicate very well from the beginning. In general, it was a good experience for me working in this group, and I feel satisfied with the final result.

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6.5 Muhammad Nadeem

In my opinion the project is quite interesting because I like to work with database for internet of things. Project has a really good infrastructure and interfaces are very well explained. We have studied quite many different programming techniques and interestingly android studio.

I was the part of the data group and our meetings went as expected. Each meeting we discussed our progress and things we need to do for the upcoming meetings. I would have liked it more if we could have made our meetings after class since I have a long way to drive to get to VIA. But at the end of the day I am willing to commit to the team effort.

I don't really enjoy spending a lot of time looking for information. I prefer to be coding. It takes a lot of time but at least something is happening. Of course, it doesn't mean that if I have to research something, I won't do it. It's just that I don't enjoy it that much. But coding took a lot out of us regarding energy to code. A lot of things to consider and even more things to implement so that everything works smoothly. There are always more things to improve on even with this project but as it stands now, I am very happy with our accomplishment.

6.6 Oskars Arajs

This project has been quite frustrating at times, since this was our first time working with "Internet of Things". Some things could have gone better but the collective effort triumphed over every problem that we faced. For me this project seemed quite challenging and gave a bit of anxiety due to the fact that we couldn't get our system to communicate. More specifically we couldn't get the embedded part of the system working and the teachers were updating the sensor and LoRa drivers every so often. But the idea of the project was really interesting and seems to have real perspectives in future industry. Pluss this was a real team project, with different systems communicating together to perform certain tasks. It was interesting to

see different sub-teams working together to achieve a common goal. Everyone needed not to think of only their part of the project, but also how it would impact other parts of the system. Since we are collecting data from different sensors and saving them in a database so that a user can access the analyzed data and us it as he/she will.

As per how the meeting went, they were beneficial to an extent. Since the embedded group faced a lot of trouble getting the system to communicate with the LoRa network and to send gathered data to the database, most of the meetings were between the Android group and Data group. Embedded just gave some partial information on how the system should work from their end.

6.7   Robert Misura

My flashbacks about this project are mostly positive. I finally feel like we were given meaningful idea of project and also, we were able to create interesting system that can be used in real life. Since the beginning I was a little bit skeptical about having such big group, but I have to admit that this project was worth of having so many people working on it. The initial phase showed us, that before we start with this project, we need to talk about many things like proper scheduling of things, looking for compromises or even making final decisions.

Moreover, I am glad that I got the chance to test new technologies such as LoRaWan or different type of sensors running on microcontroller.

As last, I want to say thank you to everyone involved in this project. It is really unbelievable that something that is coming from such a small board is actually possible to display to something meaningful for user through so many different layers. I feel satisfied with the final result and hope that everything will result in the best outcome.

6.8   Roza Ibrahim Hasso

That project was the most challenging project because for me it was the first time dealing with IoT and coding in C language. But also, it was the most interesting project since it combines the three different dimensions together: IoT, data engineering and cross media.

I also had the chance to work with a bigger team than the last three semesters which gave me an idea of how working on big projects could be in the future after graduation.

I chose to work with the Embedded group because I tend to challenge myself and I wanted to learn more about IoT and C language.

Our team also signed a group contract. Although we did not make use of it, perhaps it acted like a subconscious motivation, which was helpful.

Each one in our group was caring about the project work and really doing his best to achieve what he can achieve and to gain some new knowledge and experience.

All in all, I am satisfied about the whole working process, since we managed to finish the project on time and deliver a very nice working system.

6.9 Vladimir Rotaru

First of all, I would like to say that this project was a pleasant experience. Even if we have worked in a group of numerous people everyone knew what he/she should take care about. However, it felt that some of the group members were not motivated enough to push themselves more in order to achieve higher results.

While working on the project I have gained a lot of experience regarding of how I should approach certain problems and analyzing it from different perspectives.

When we had to split ourselves into 3 different groups, I had the opportunity to join the Android team. In my opinion, communication went much better like this. Each team had its own leader which would communicate with the ones from other teams regarding problem-solving.

Scrum went completely different during this project. I like how the workload has been split. We agreed on to splitting the sprints into 3 different paths each corresponding a team.

In conclusion, the workflow and the communication of the team were on a pretty high level. I got a better understanding of how to be a member of the Scrum team and how important it is to communicate efficiently. Overall, I am satisfied with the outcome.

6.10 Yasin Issa Aden

Working on the project has taught me a lot both personally and professionally. Having a big group of different individuals working together to create such an extensive project is not a simple task and require a serious commitment from most of us to succeed. However, I do believe we managed to reach a satisfactory result. Everyone in the group seemed committed and willing to cooperate. Conflicts are of course on avoidable, but there were no major problems. For me this SEP has given me a new perspective to effective group work. Usually I like to keep things casual and just focus the task often ending up neglecting to follow SCRUM and keep my work structured. Here I luckily had some group members that would keep me focused and clear on the bigger picture while I was focusing on my task at hand. Despite everyone was given different task people were always willing to help out if needed. The communication is where I believe we were most successful. Tools like slack and Trello were used to both document our sprints and communicate. Right now, I am guessing that our slack probably has several hundred messages, in addition to the fact that we met regularly every Thursday unless we got hindered. All in all, this project went well and has been a great learning experience.

7 Supervision

Embedded

Supervision was needed more near the end of the project period. Since there were problems implementing and creating the drivers needed for the LoRa network and the supervisors themselves had issues finalizing the drivers, so it was natural to seek their guidance and it helped immensely.

Data

Supervision was done mostly in the design phase for structuring and creating a EER Diagram and Data Warehouse.

Android

The only supervision occurred before the implementation phase for designing a strong and structured codebase for the Android application using MVVM + Repository design patterns.

8 Conclusions

This project was different compared to the previous semester projects, because instead of working with 3 or 4 people, we worked with 10. The biggest challenge was to work as one coherent unit, and these are the problems we came across trying to achieve that.

- Miscommunication
- GitHub merging issues
- Mutual agreement regarding generated ideas
- It was hard to satisfy everyone's attendance

In order to avoid these problems in the future, follow these recommendations:

- More communication from the branch leaders.
- Always update your fellow group members about the new changes.
- Help struggling members even if they do not take part in your subgroup.
- Always pull before you make a new commit to the repository.
- Always push the changes after you have finished your work.
- Instead of debating on an idea, vote for it.
- Warn members that do not notify about not attending the meeting.

9 Appendices

Appendix A: Group Contract.

Appendix B: Scrum sprint tables.

Appendix A: Group Contract

Located in the root folder of the hand-in…

Group Name (optional):   Date: **2019-02-07**

These are the terms of group conduct and cooperation that we agree on as a team.

Participation: We agree to....
Fulfill each of our individual responsibilities

Communication: We agree to...
Give feedback on each task we finish and discuss about it

Use Slack for group communication and Trello for task tracking

Consider all of our opinions coming from the group members

Meetings: We agree to....
Follow the Agile methodologies (SCRUM)

Meet a minimum of every Thursday

Conduct: We agree to....
Report whenever attendance is not possible

Conflict: We agree to....

Give a warning for the member who does not contribute or attend. Three warnings and
the person is kicked out or considered to be kicked out.

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Deadlines: We agree to....

Meet the deadlines

Other Issues:

Group member's name	Student number	Signature
Ainis Skominas	266756	A.S
Aleksandr Zorin	224493	A.Z
Vladimir Rotaru	266914	V.R
Robert Misura	269381	R.M
Oskars Arajs	266534	O.A
Roza Ibrahim Hasso	266235	R.I.H
Balkis Ibrahim	260092	B.I
Yasin Issa Aden	267276	Y.I.A
Muhammad Nadeem	266704	M.N
Fadi Atia Dasus	266265	F.A.D

Appendix B: SCRUM Sprint Tables

Located in the root folder of the hand-in…