

# PROCESS REPORT

## Zuper - Library Climate Control IoT System

### Students

Amahdya Delkescamp - 256523

Andrei Cioanca - 266105

Claudiu Rediu - 266129

Dominika Kubicz - 266148

Flemming Vindelev - 251398

Michal Ciebien - 266908

Mihail Kanchev - 266106

Nikita Roskovs - 266900

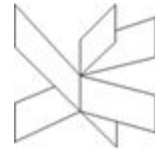
Stefan Harabagiu - 266116

### Supervisors

Kasper Knop Rasmussen

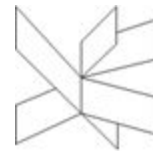
Knud Erik Rasmussen

Erland Ketil Larsen



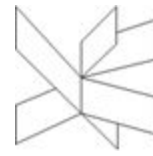
## Acknowledgements

The team wishes to formally acknowledge VIA University College's active implication in the evolution and completion of this project work. All documents contained or referred to from this project are based on VIA University College's templates and designs. All information present in this document, while original, could not have been made possible without VIA's resources.



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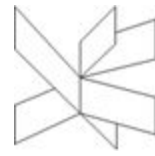
## Introduction

For this semester project we formed a group of nine people. By the end of the project the number of members was reduced to eight. The team was working in three smaller “sub-groups” which were working on certain parts of the project. In the beginning all three teams had three members, but one of the groups lost a member and only two was left.

The idea for the project did not give us much room to be creative, however we did manage to find a suitable theme to fit with our system. We received the requirements for each of the parts of the system that we had to meet. Because one of the members worked in a library and saw the need of our system in the VIA Library, the whole team agreed to work for that cause. Even though we were working half of the time in smaller group we still had to learn how to cooperate within a bigger group. It took some time to get used to, but in the end the team work was successful.

To properly organize the group work we used AUP and the SCRUM framework. Claudiu Reditu was the SCRUM Master while Andrei Cioanca the Product Owner. We organized at the start of every sprint a planning meeting and at the end of every sprint review and retrospective meetings. Most of the semester the meetings were held once or twice a week, during the project period we met on daily basis. In order to keep track of the tasks, services provided by <https://www.jetbrains.com> were used. Since only three members could have access to the board, only the team managers had access to it so they had to make their team aware of the current tasks. The three managers were Stefan Harabagiu, Dominika Kubicz and Andrei Cioanca. When a member from a team fulfilled the groups responsibility, his manager updated the information on the board, so the other managers were aware of the completed tasks. That website made it much easier to keep track of the progress. Because we sometimes lacked the knowledge to fulfill the requirements, we had a number of meetings with our supervisors. During that time, they helped us with our problems, so that we could continue with the work.

In conclusion, we spend during the past four months the total of 1237,5 hours on implementing and documenting the project. The group worked together in peace, united by the common goal of creating the possible best system for libraries. After all the effort put in building the software and documenting the process, the whole operation turned out to be a success.



## Group Description

### Belbin Roles

According to Belbin team roles each member of a group shows a certain “tendency to behave” while cooperating with others.

#### **Andrei Cioanca** (Romania)

**Shaper** – is good at challenging other members, thrives under pressure. On the other hand, he can be prone to provocation.

**Plant** – has unique ways of solving problems, is known for his creativity. Can be forgetful, and absent-minded.

#### **Claudiu Rediu** (Romania)

**Shaper** – keeps the team focused on the work and helps them stay motivated. The risk is that he might by accident offend someone’s feelings.

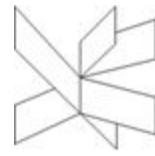
**Co-ordinator** – divides work between all group members and stays focused of the team’s goal. On the other hand, some people might see him as manipulative.

#### **Dominika Kubicz** (Poland)

**Complete finisher** – scrutinizes the teams work for errors and fixes them. Is known for being conscientious and anxious.

**Specialist** – brings knowledge and skills in a one specialized area. Has tendency to concentrate only on the one chosen area.

#### **Michal Ciebien** (Poland)



**Monitor Evaluator** – makes sure the ideas and doubts can be solved through discussion and analysis

**Plant** – brings ideas for solving problems, can improve the process of developing the product by a highly analytical mindset

#### **Nikita Roskovs (Latvia)**

**Implementer** – feels most comfortable when his work is planned, and he can follow his strategy. It might be hard for him to adapt to new possibilities, or to change his plan.

**Complete finisher** – is the best at giving work a “final touch” and return it in the possible best condition. On the other hand, can get unduly careful with the details.

#### **Mihail Kanchev (Bulgaria)**

**Co-ordinator** - I am a visual learner and although I come from a mainly high-context culture, my character had developed into a low-context communicator.

**Plant** - Creativity is my main trait, that is why I tend to focus more on the technical roles in order to gain more experience overall.

#### **Stefan Harabagiu (Romania)**

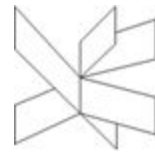
**Monitor Evaluator** – has a logical eye on things, being able to make impartial judgment. Might be overly critical and lacks ability to inspire others.

**Plant** – has a tendency to solve upcoming problems in a creative way, comes up with a lot of different ideas for the project. May pay too much attention to communicate in the most effective way.

#### **Amahdya Delkescamp (United States)**

**Implementer** – Practical, reliable, efficient. Turns ideas into actions and organises work that needs to be done

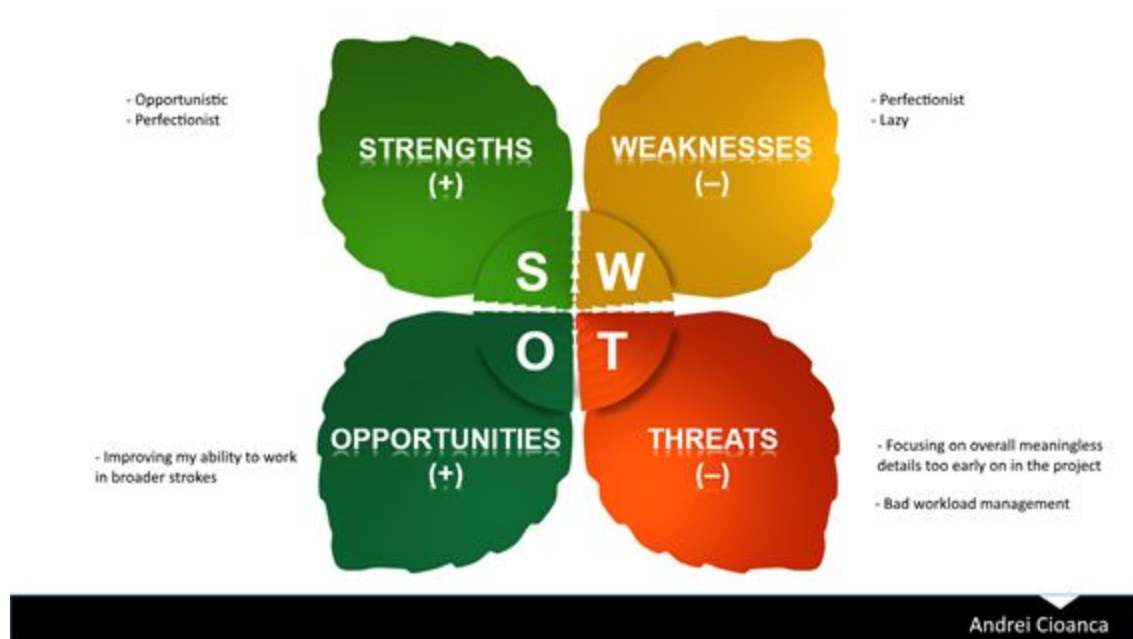
**Complete Finisher** – Painstaking, conscientious, anxious. Searches out errors. Polishes and perfects

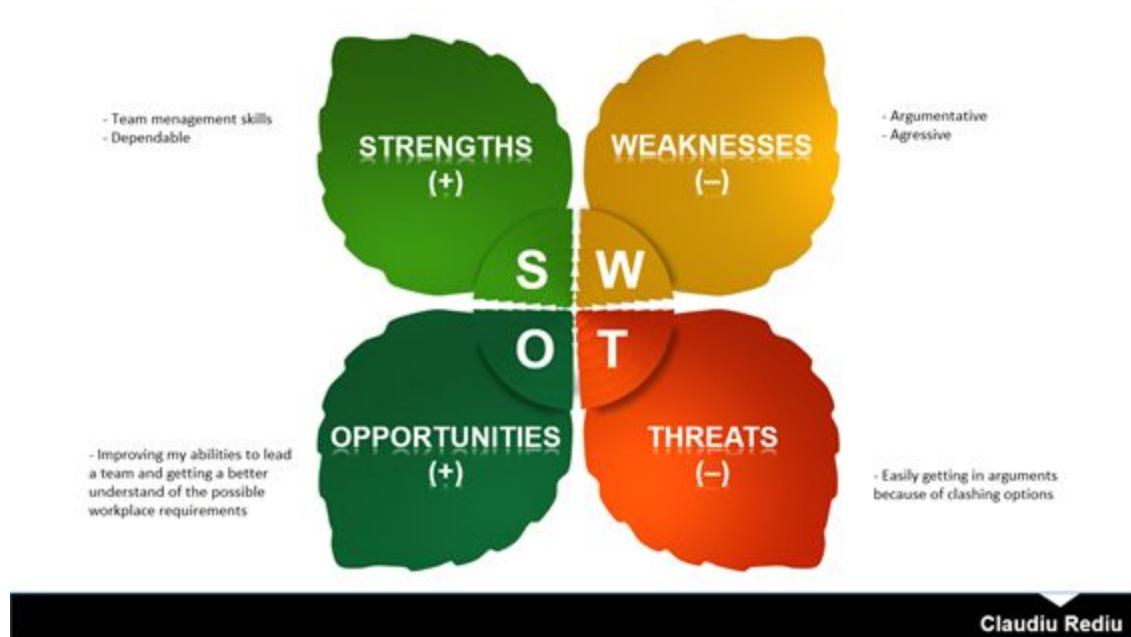
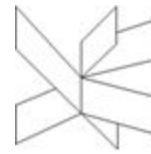


**Specialist** – Single-minded, self-starting and dedicated. They provide specialist knowledge and skills.

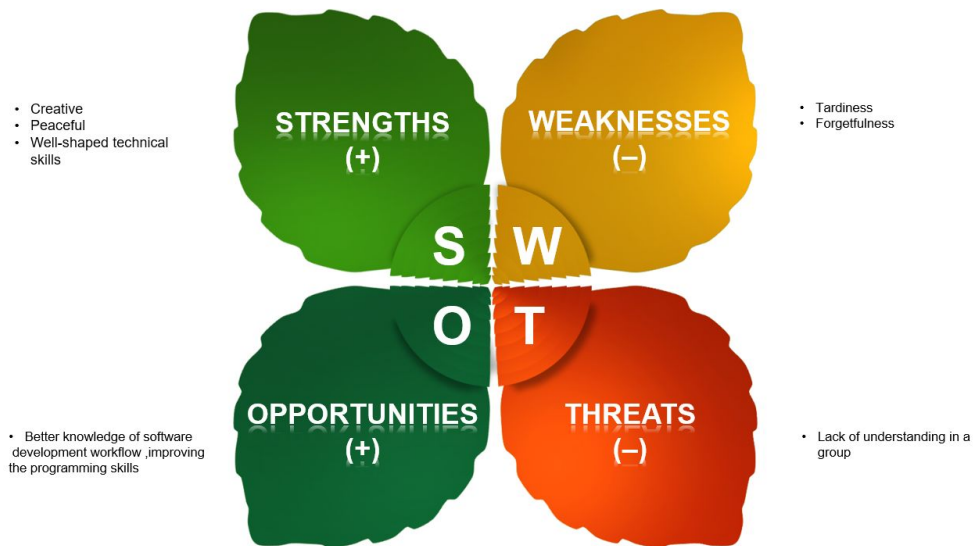
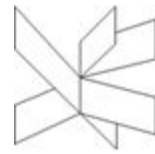
### SWOT Analysis

Each team member made a SWOT analysis of himself, so we could know each other better. Bellow we attached a diagram for each team member and also one for the whole team.

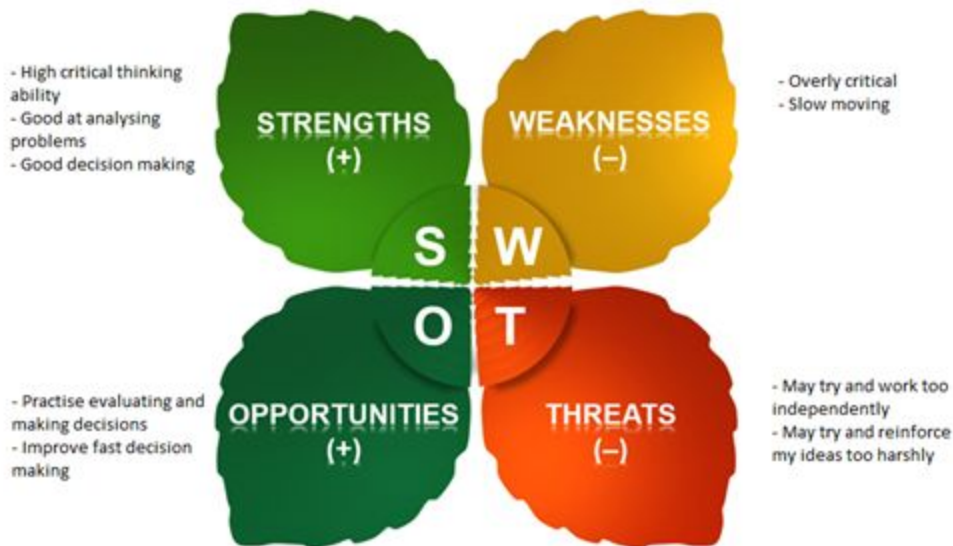




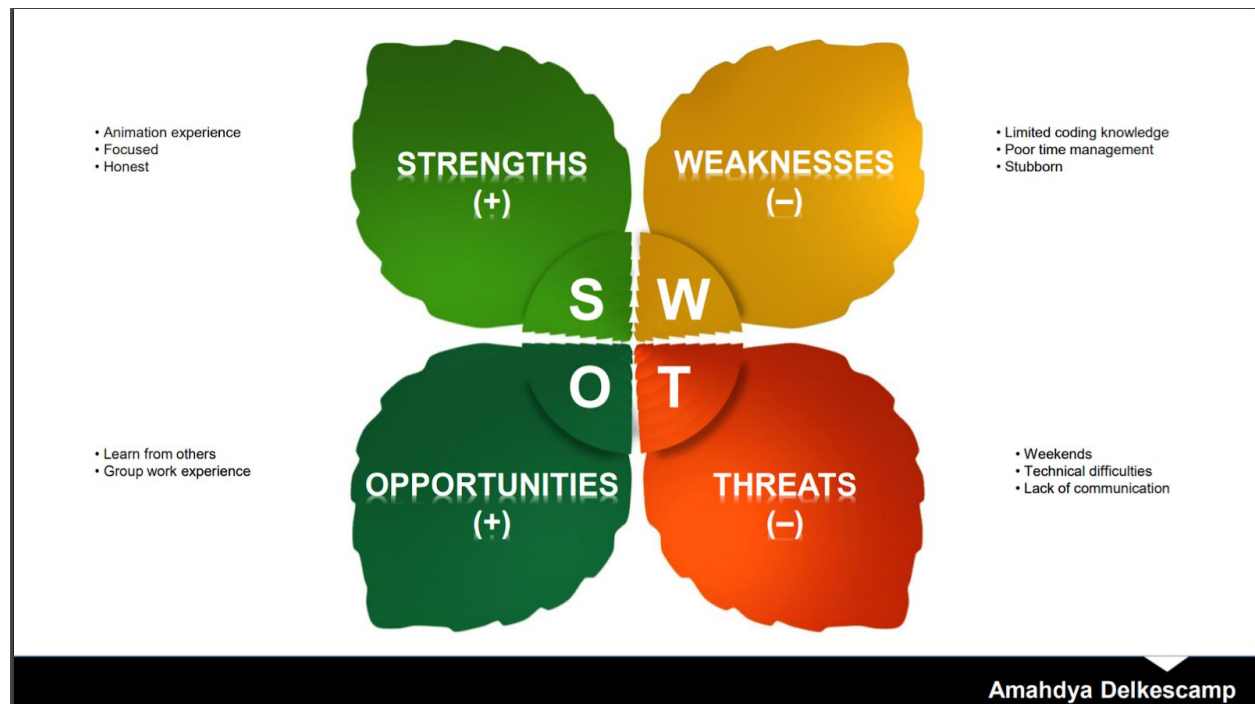
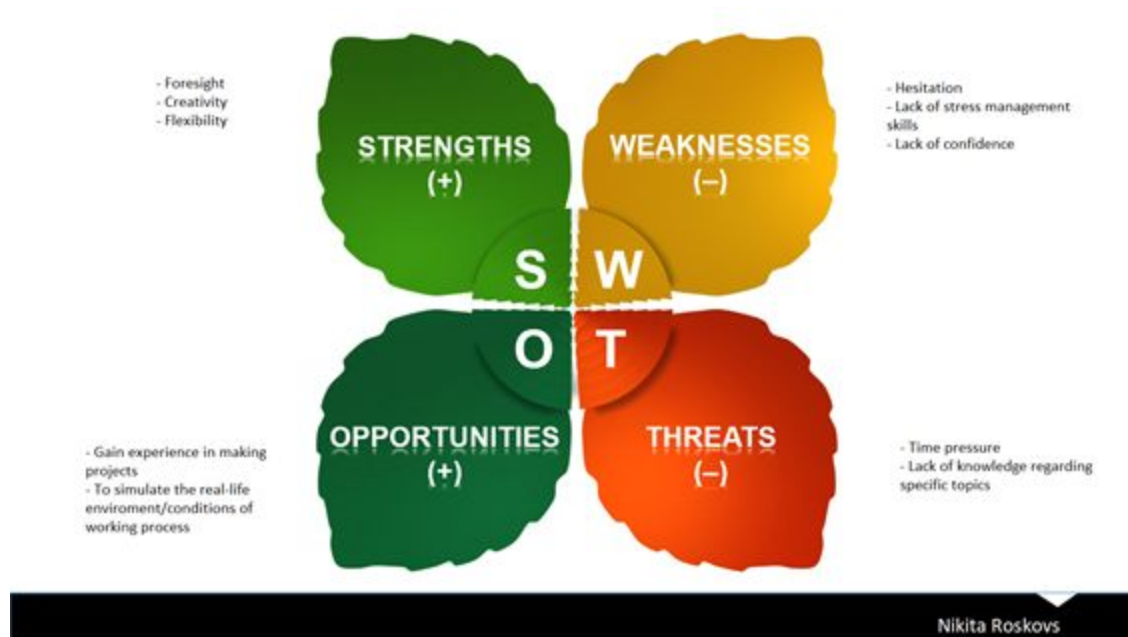
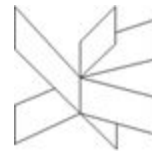


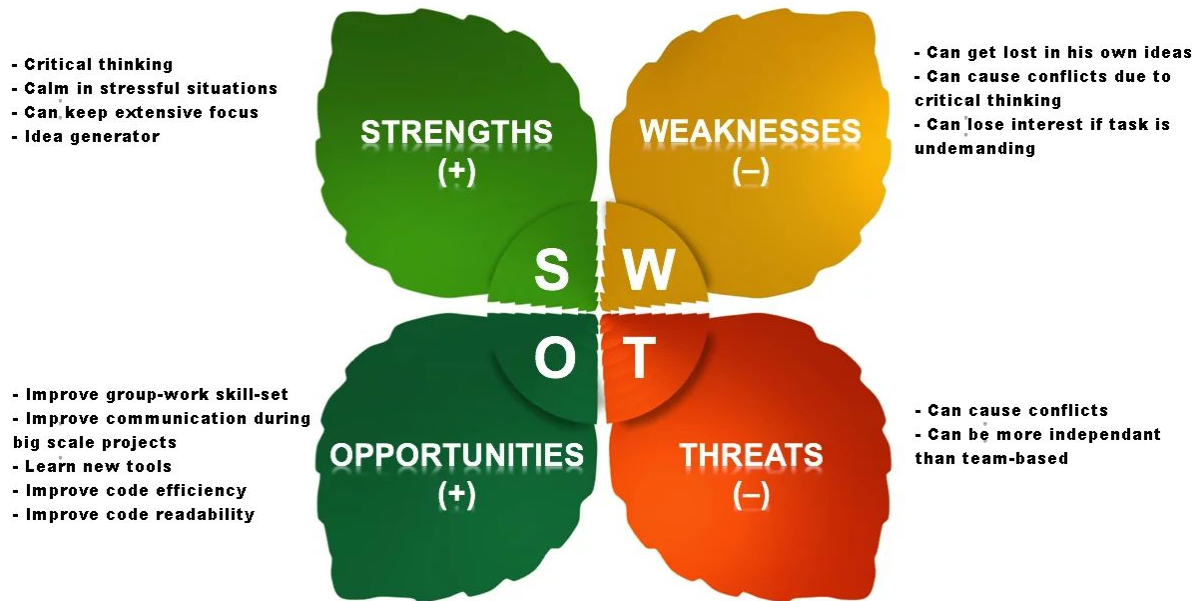
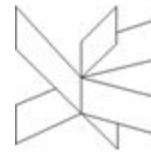


Michal Ciebien



Stefan Harabagiu

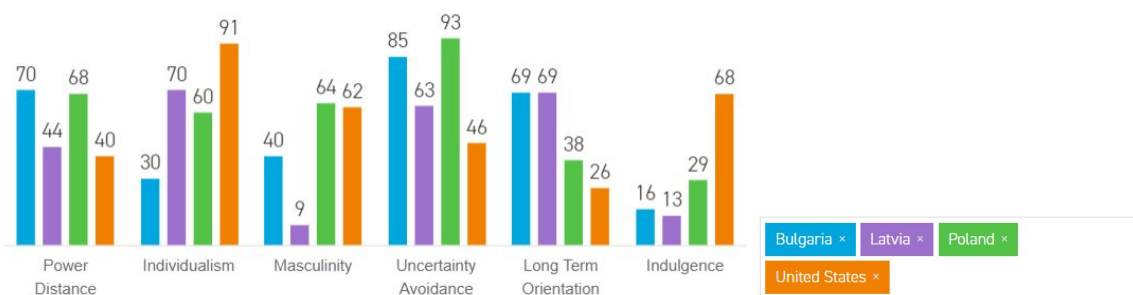


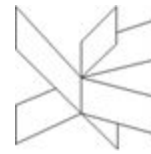


**Mihail Kanchev**

### Cultural Differences

Between all nine team members we share the total of five different nationalities, such as Romania, Latvia, Poland, Bulgaria and the United States. All countries scored a certain amount of points for different dimensions. The received scores are shown on the figures below:





## Romania

Because Romania scored very high in the power distance dimension, that means that the people are used to a hierarchy and accept their place. They are used to others telling them what to do.

The score of individualism shows that in Romania there is a collectivistic society. That means that they take group responsibility very seriously, and they also take very serious relationships between group members.

Romania has a Feminine society, which means that people “work in order live”. They value equality and solidarity. The conflicts between them are solved very easily.

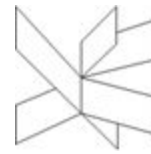
## Poland

Just like Romanian society Poland also is a hierarchical society, because of its high power distance score. People agree to their place in the hierarchical order and are used to being told what to do.

In the Individualism dimension Poland scored quite high, meaning that they care about themselves and the closest family. In such society offence causes a loss in self-esteem and guilt. The promotions and hiring are based not on the relationship but on merit.

Poland is considered a Masculine society. That means that people “live in order to work”. The conflicts are settled by fighting them out.

## Latvia



Latvia is an Individualist country with a high score of 70, and it is important to remember that Latvia remained Individualist during the soviet occupation. The ideal of a nuclear family has always been strong and close family members are usually regularly in touch, while respecting each other's space.

As a Feminine country with a score of 9, Latvians have a tendency to feel awkward about giving and receiving praise, arguing that they could have done better, or really have not achieved anything worthy of note. As such they are modest and keep a low profile, and usually communicate with a soft and diplomatic voice in order not to offend anyone. Conflicts for Latvians are usually threatening, because they endanger the wellbeing of everyone, which is also indicative of a Feminine culture.

With a very low score of 13 in Indulgence; it can be seen that Latvian culture is one clearly marked by Restraint. Societies with a low score in this dimension have a tendency to cynicism and pessimism. Also, in contrast to Indulgent societies, Restrained societies do not put much emphasis on leisure time and control the gratification of their desires.

## **Bulgaria**

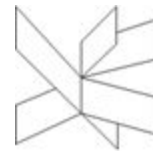
Bulgaria, with a score of 30 in Individualism is considered a collectivistic society. This is manifest in a close long-term commitment to the member 'group', be that a family, extended family, or extended relationships. Loyalty in a collectivist culture is paramount, and overrides most other societal rules and regulations. The society fosters strong relationships where everyone takes responsibility for fellow members of their group.

Bulgaria scores 40 on Masculinity and is thus considered a relatively Feminine society. In Feminine countries the focus is on "working in order to live", managers strive for consensus, people value equality, solidarity and quality in their working lives. Conflicts are resolved by compromise and negotiation. Incentives such as free time and flexibility are favoured. Focus is on well-being, status is not shown.

## **United States**

The fairly low score on Power Distance(40) in combination with one of the the most Individualist (91) cultures in the world reflects itself in the following:

The American premise of "liberty and justice for all." This is evidenced by an explicit emphasis on equal rights in all aspects of American society and government. Within American organisations, hierarchy is established for convenience, superiors are accessible and managers



rely on individual employees and teams for their expertise. Both managers and employees expect to be consulted and information is shared frequently. At the same time, communication is informal, direct and participative to a degree.

The score of the US on Masculinity is high at 62, and this can be seen in the typical American behavioral patterns. This can be explained by the combination of a high Masculinity drive together with the most Individualist drive in the world. In other words, Americans, so to speak, all show their Masculine drive individually. The British, however, have the same culture in this respect. The question, therefore, should be: is the same drive not normally to be seen on the surface? This difference is a reflection of the higher score of the US on Uncertainty Avoidance than of the UK. In other words, in both societies we find the same drive, but Americans show it up-front whereas the British will take you by surprise.

### **The Group**

All team members have experienced group work in previous semesters. Nikita, Claudiu, Dominika, Stefan and Andrei worked together on a project last semester. All five of them accepted the new team members, which brought to the group new approach towards the project.

However, working in a large group of 8 people is something that no one had experience in and it presented its own set of challenges. Coordination and organization has certainly been more difficult, along with communication but the group managed to pull through, as everyone was aware of the state of the project and group work was well structured as well.

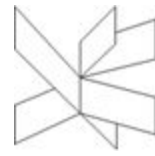
In the group we had members with Belbin roles from the following dimensions:

Action oriented: (Nikita – implementer, Andrei Cioanca - shaper, Amahdya - complete finisher)

People Oriented Roles (Claudiu – Coordinator, Mihail - Coordinator)

Thought Oriented Roles (Dominika – specialist, Stefan – monitor evaluator, Michal - plant)

As our group benefited from a diversity of action, social and thinking roles we were able to organize ourselves into 3 different subgroups, each focused on a different part of the project but with a common goal in mind. The decisions and plans of action were taken together as a result of discussions and, what is more, we managed to ensure that each subgroup would have freedom to make their own decisions while working together. This way the group managed to work in a way that would not require every minor decision to be taken collectively. However,



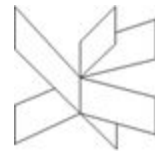
major aspects of the project such as overall design and most of the analysis was done together, in order to benefit from the ideas of every member.

## Project Initiation

As stated before, the team that was formed this semester was significantly larger than the ones before so everyone was well aware from the beginning that a nuclear organisational structure, similar to the ones before (e.g: a group coordinator), was not going to cut it. It was made known to us that the members will divide into subgroups that would specialize in one of the three different aspects of the project (embedded, data and android) and, moreover, all members from the team knew from the beginning what subgroup they would like to be a part of. However, the division into subgroups was not something we focused a lot during the initiation as it was something for later on in the process, but it did help relieve some of the tension from the beginning.

We continued with drafting a group contract and setting up some ground rules. It was clear to us that trying to match everyone's schedule was going to be near impossible so we decided that a group meeting was going to be held as long as at least one member from each subgroup could attend. Those members would then relay the information to the others. We also decided that for major changes or decisions a meeting with most, if not all, of the members is required, in order to avoid major decisions being taken as a result of a 3 people meeting. Three of the members stated that they could attend every meeting consistently so we decided to have a team manager for every subgroup. They were tasked with relaying information from the other subgroups, keeping their members updated on the overall state of the project and also managing the task tracking system we decided to use (JetBrains YouTrack).

The last thing decided during the project initiation was the length of the sprints and when to start the sprints. Everyone agreed on week-long sprints starting from the 25th of February and ending on the day of the hand in, 15th of May.



## **Project Description**

Following the initiation of the project the group had to decide on a theme about our project. We knew from the requirements that we were supposed to use a number of sensors and actuators to collect data and then send them to be displayed on an android application. With this information, we had to brainstorm and find a suitable environment for our system to be used in.

After the brainstorming session it was decided that our project will deal with libraries, more specifically measuring the conditions that make a library a comfortable place for study and research (Temperature, CO2 concentration, humidity). We managed to book a meeting with librarians from VIA and get their insights on the issue, it was very helpful as it gave us a good perspective on the domain we were dealing with. We set a realistic goal for the end product, that being an intuitive and simple mobile application that could be used by both students and librarians, to monitor the conditions in the library.

## **Project Execution**

### **SCRUM**

#### **SCRUM Roles**

SCRUM Master: Claudiu Rediu  
Product Owner: Andrei Cioanca

#### **Sprint Planning**

1<sup>st</sup> Sprint:  
25<sup>th</sup> of February – 3<sup>rd</sup> of March

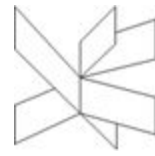
2<sup>nd</sup> Sprint:  
4<sup>th</sup> of March – 10<sup>th</sup> of March

3<sup>rd</sup> Sprint:  
11<sup>th</sup> of March – 17<sup>nd</sup> of March

4<sup>th</sup> Sprint:  
18<sup>th</sup> of March – 24<sup>th</sup> of March

5<sup>th</sup> Sprint:





25<sup>th</sup> of March– 31<sup>th</sup> of March

6<sup>th</sup> Sprint:

1<sup>st</sup> of April – 6<sup>th</sup> of April

7<sup>th</sup> Sprint:

7<sup>th</sup> of April – 13<sup>th</sup> of April

8<sup>th</sup> Sprint:

14<sup>th</sup> of April – 20<sup>th</sup> of April

9<sup>th</sup> Sprint:

21<sup>th</sup> of April – 28<sup>th</sup> of April

10<sup>th</sup> Sprint:

29<sup>th</sup> of April - 5<sup>th</sup> of May

11<sup>th</sup> Sprint:

6<sup>th</sup> of May - 12<sup>th</sup> of May

12<sup>th</sup> Sprint:

13<sup>th</sup> of May - 17<sup>th</sup> of May

### **Group Meetings**

Group meetings will be on Mondays. They will consist of SCRUM Review and Retrospective. They will all be held at the university. There will be approximately 112.5 hours of work each sprint.

### **Sprint Backlogs**

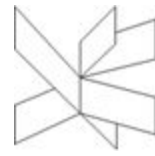
1<sup>st</sup> Sprint

Sprint Review:

The first part of the upcoming project has been tackled. After having everything set up, the group could focus on formulating the Project Description. The main focus was making sure to capture the background description from the customers.

Sprint Retrospective:

Being the first sprint, most aspects have yet to fall into place. Aspects like everyone communicating on the same platform of choice or making sure how they need to make



themselves clear to others. Teamwork went well even if the members were not yet used to working with each other.

#### TASKS:

Background Description: 3 days (major, done)

Project Description: 4 days (major, done)

Project Description fix: 1 day (major, done)

### 2<sup>nd</sup> Sprint

#### Sprint Review:

The focus of this sprint was getting the user stories right. Relevant intel has been gathered about what the customers would want from the librarians at VIA. This would enable the team to create a system to benefit the university environment.

#### Sprint Retrospective:

Communication has seen improvements and the way tasks were split satisfied every member. Members got accommodated with the tools we agreed on.

#### TASKS:

User Stories: 2 days(major, done)

Use Case Diagram: 1 day(major, done)

Use Case Descriptions: 3 days(major, done)

### 3<sup>rd</sup> Sprint

#### Sprint Review:

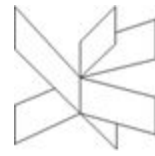
There was little information to go with during this sprint. After discussing with the teachers, the team got a better idea on how to approach the analysis of the system.

#### Sprint Retrospective:

In comparison with the previous sprint, there was a lot more work to do, but the team managed to pull it off. There were no internal issues that could hinder the work process.

#### TASKS:

Activity Diagram: 1 day(major, done)



Update YouTrack: 3 days(normal, done)

Requirements: 2 days(major, done)

Analysis: 2 days(major, done)

#### 4<sup>th</sup> Sprint

##### Sprint Review:

The design part left the team even more clueless because of its seeming complexity. After asking the teachers more details about how the the system should be designed, the first steps towards creating a design were took.

##### Sprint Retrospective:

The team now has split into 3 subgroups with 3 different focuses(Embedded, Data and Android Development) Communication is going even better than before as the team first make it clear between themselves and then communicate it to everyone else.

##### TASKS:

Overall Design: 2 days(major, done)

Create Dimensional database in MSSQL: 2 days(normal, done)

Diagram for dimensional database: 2 days(normal, done)

Embedded Data Model: 2 days(normal, done)

Skeleton for Web Service: 2 days(normal, done)

Data design: 11 days(normal, not done)

IoT design: 11 days(normal, not done)

Cross Media design: 11 days(normal, not done)

#### 5<sup>th</sup> Sprint

##### Sprint Review:

The design part has been completed after meeting and discussing with the teachers. There have been a few difficulties that have been solved with the help of fellow students after a feedback session.

##### Sprint Retrospective:

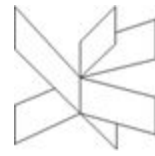
The split into 3 teams have been benefic for the whole team. Communication goes very well and every team member can focus more easily on what needs to be done.

##### TASKS:

Data design: 11 days(normal, started in a previous sprint)

IoT design: 11 days(normal, started in a previous sprint)

Cross Media design: 11 days(normal, started in a previous sprint)



Bridge App design: 5 days(major)  
Android diagrams(Activity + class): 5 days(normal)  
Android Application(Activities, Intents, Layouts): 5 days(normal)  
Android Documentation: 5 days  
Android Application(Resources, Communication with API): 5 days(normal)  
Design for Web Service: 6 days(normal)  
Get requests: 6 days(normal)  
Source transactional: 6 days(normal)  
Documentation SQL Server: 6 days(normal)

#### 6<sup>th</sup> Sprint

##### Sprint Review:

This sprint has been about acting on the feedback and finalizing every detail. The team is ready to start implementing based on what has been designed and accepted.

##### Sprint Retrospective:

This sprint has been similar to the previous one. The focus has still been on the documentation and getting ready to implement the system. Communication went well and tasks were split according to each member's wish.

##### TASKS:

Android Final Diagrams: 5 days (normal)  
In-Depth Documentation Data: 2 days (normal)  
In-Depth Documentation CrossMedia: 2 days (normal)  
In-Depth Documentation IoT: 2 days(normal)

#### 7<sup>th</sup> Sprint

##### Sprint Review:

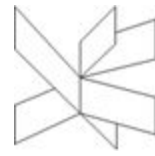
This sprint has been mostly unproductive. It was mostly about setting up the field for the proof of concept. The Data team managed to get ahead with the implementation.

##### Sprint Retrospective:

The focus hasn't really been on the project. Communication went ok, but there haven't been too many things done. Only minor tasks have been done in comparison with other sprints.

##### TASKS:

Start proof of concept: 3 days (major, not finished)  
Source Database on Common Server: 2 days(minor)  
Java App for Transferring Data: 6 days(minor)



Cloud MongoDB: 3 days (minor)

Java Pipeline: 3 days(minor)

#### 8<sup>th</sup> Sprint

##### Sprint Review:

This sprint was during the Easter Break. A member had left the team during the break. This created a gap in the embedded team. The other members will aid the two member team.

##### Sprint Retrospective:

Taking place during the break, nothing has been done except planning the period ahead. We are now down one member. Members from other team will aid the embedded team in which ways they can.

##### TASKS:

#### 9<sup>th</sup> Sprint

##### Sprint Review:

The proof of concept hasn't been completed due to issues on the embedded side. It has been difficult to manage without a member.

##### Sprint Retrospective:

Organization took a hit because there are more tasks on fewer members. Communication goes well. There is some recuperating to do.

##### TASKS:

Start Proof of Concept: 3 days(normal)

Data Proof of Concept: 13 days (major)

#### 10<sup>th</sup> Sprint

##### Sprint Review:

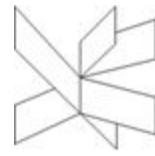
The proof of concept hasn't been completed due to issues on the embedded side. It has been difficult to manage without a member.

##### Sprint Retrospective:

Organization took a hit because there are more tasks on fewer members. Communication goes well. There is some recuperating to do.

##### TASKS:

Android Application(Activities,Intents, Layouts): 5 days (minor)



Android Application(Resources, Communication with API): 5 days (minor)

Add sound to Dimensional Model: 3 days(minor)

Sound in Source db: 1 day(minor)

Humidity in Dimensional Model: 3 days(minor)

CO2 fact to Dimensional Model: 3 days(minor)

Finish the basic sensors: 10 days(critical)

## 11<sup>th</sup> Sprint

### Sprint Review:

Being near the end, the focus was implementation and making sure the analysis and design is updated to match the current system.

### Sprint Retrospective:

In comparison with previous sprints, most of the work has been done during this sprint. Being only 8 members, the deficit could be felt in managing the workload. A bit too much work remained towards the end.

### TASKS:

Dimensional Incremental Changes (11 days, normal)

Modify D\_Device for handling validity and add Device name (2 days, normal)

Time Table Dimensional (6 days, normal)

Fill D\_Date and D\_Time (1 day, normal)

Creating Staging area (2 days, normal)

Change sourceDb to have Device Table (1 day, normal)

Merge Facts into F\_Reading (1 day, normal)

Initial Load (1 day, normal)

Gather Data for process report (4 days, major)

Update outdated information in project report (2 days, major)

Update UseCase Diagram + Domain Model (1 day, major)

Project Report - Implementation - Incremental + Initial Load(1 day, major)

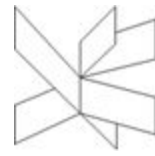
Add the sound sensor (3 days, major)

Actuator (3 days, major)

Implement the queue (3 days, major)

Do the bridge (3 days, major)

Android Open Window API Communication ( 7 days, normal, not finished)



### 12<sup>th</sup> Sprint:

#### Sprint Review:

The final hand in took place on the 15<sup>th</sup> of May. There were two days left in the sprint to discuss and consider the following period in which the examination will take place.

#### Sprint Retrospective:

Being the last sprint, everyone was motivated to end everything the best way possible. People meet and worked to finish the product on time, this being the main focus of everyone.

#### TASKS:

Document the Arduino Design (4 days, major)

Set the right timers ( 1 day, major)

Document Bridge App Design ( 5 days, major)

Test Cases (2 days, major)

Android Architecture Revised (2 days, critical)

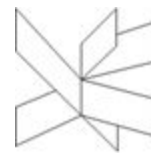
Finish Project Report (2 days, critical)

Finish Process Report (2 days, major)

Update UseCase Descriptions (2 days, major)

PowerBI Documentation (4 days, normal)

Android Open Window API Communication ( 7 days, normal)



## Burndown Chart

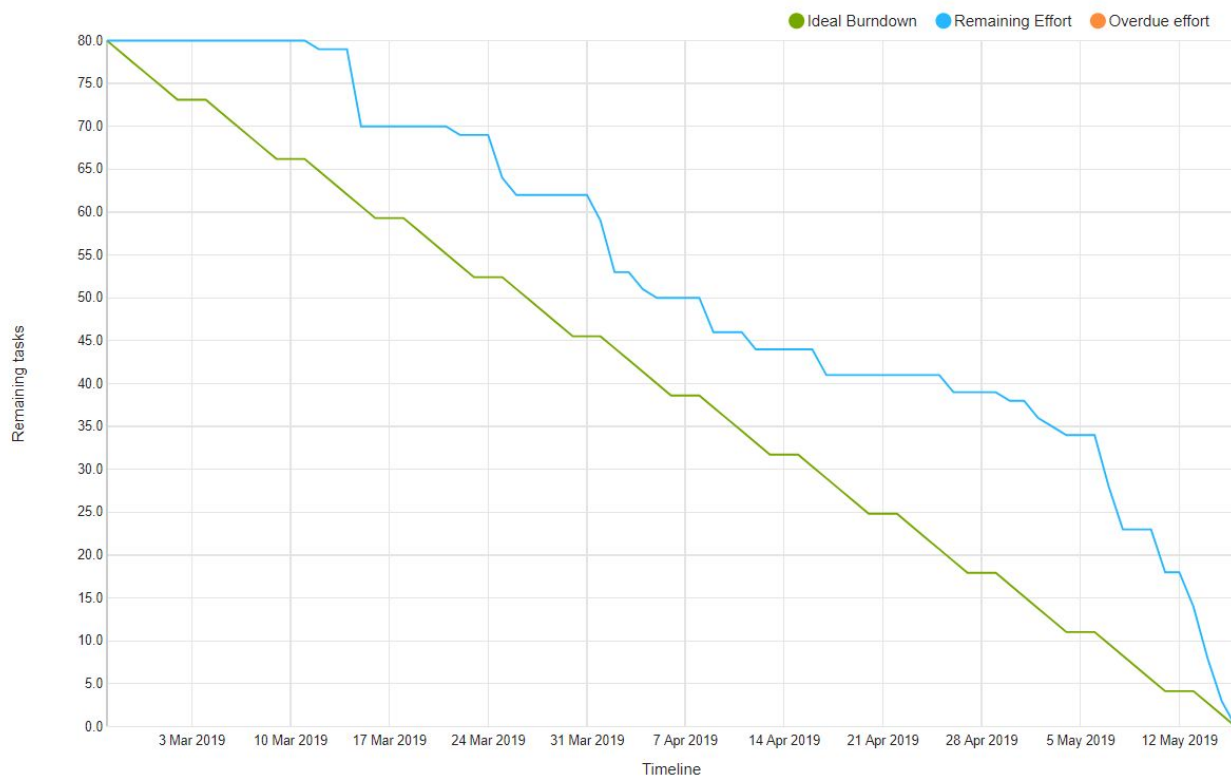


Figure 1 in SCRUM - Burndown Chart

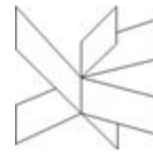
Being a new kind of project for everyone, there were a lot of new things to consider, that hindered the progress. One of the members left during the holiday, aiding in the departure of the actual line from the ideal line. Even though all these issues were present, all tasks were done at the end. Most of the implementation has been done during the final sprints.

## Unified Process

### Inception

During the Inception phase, focus was placed on preparing the working environment and formulating a scope of the project. Working together with SCRUM, this phase was mostly in the first sprints. It consisted of creating the project description, sprint planning and creating the product backlog. Project description was created to formulate a scope, introduce boundaries, a vision for the system and gain acceptance and estimate what the product should end up like. The requirements and the first use cases are created to guide the development of the system. SCRUM was used in this phase to estimate a schedule and delimit what the system should and should not do using the product backlog.





### Elaboration

During the Elaboration phase, the main activities were defining and refining the vision and understanding the problem domain of the system, making sure that the risks are mitigated, ensuring the project is worth further advancement and planning for the construction phase. Possible risks are that the system is not maintainable, understandable or not respecting the requirements. The use cases were created to demonstrate that the system will support the requirements. It was ensured that they would reflect the system that will be developed. Elaboration phase is mostly characterized by the analysis and design of the system.

### Construction

During the Construction phase, the priority is constructing the system as rapidly and efficient as possible while having the analysis, design, implementation and testing complete. As each component is implemented, the system is proofed against the requirements and specifications then updated accordingly. Emphasis is put on the working process and its efficiency. The approach was that after each component was implemented, the system could be on its own a product that would work. In this way, the focus was to create it in a way that makes it maintainable and open to the adding of components with new features.

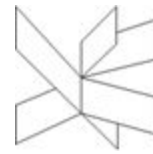
### Transition

During the Transition phase, the main goal was that documentation and have it ready to present to the customer. By the end of this phase, bug fixing, and enhancements made to the system must be complete. User feedback should be considered for fine tuning the product. The system must be presented to the customer.

#### Distribution Between Effort and Schedule

	Inception	Elaboration	Construction	Transition
Effort	10%	20%	50%	20%
Schedule	16.6	25	41.6	16.6

This table was filled with values that resulted from the time spent in a sprint and all over the course of all sprints.



## Tools

### Git & GitHub

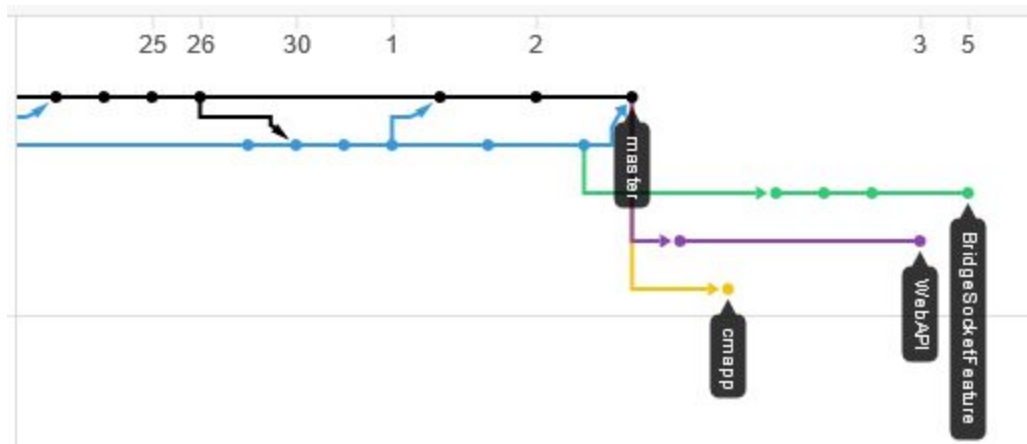


Figure 1 in Tools - Github Network During Sprints

Members branched out to develop the specific features in the system to better achieve version control.

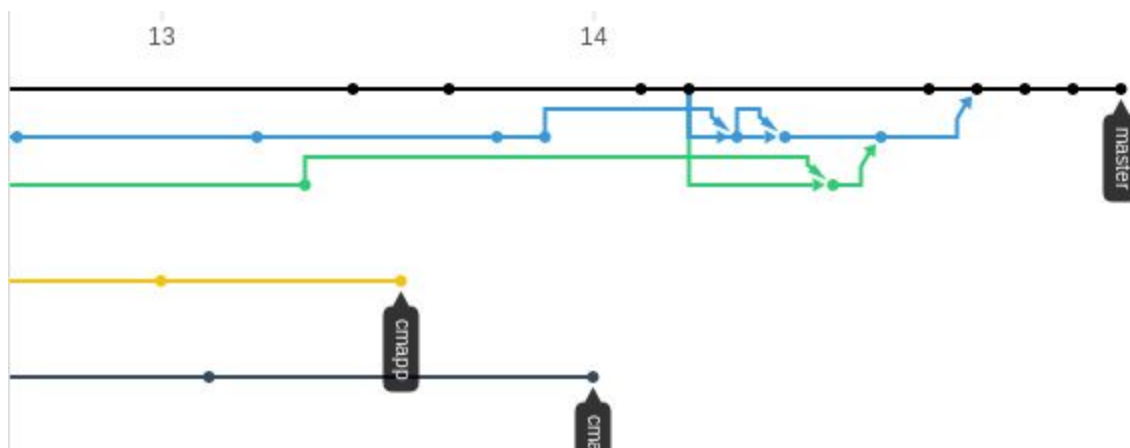
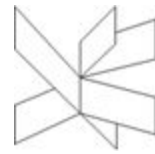


Figure 2 in Tools - Github Network Towards the end

Towards the end, everything started merging down in the master branch. It helped in avoiding conflicts and managing bugs in the system.












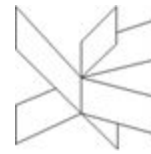
<input type="checkbox"/>	 <b>Web api</b> #12 by vidwalk was merged an hour ago
<input type="checkbox"/>	 <b>Bridge socket feature</b> #11 by vidwalk was merged an hour ago
<input type="checkbox"/>	 <b>Web API</b> #10 by vidwalk was merged 3 days ago
<input type="checkbox"/>	 <b>Bridge socket feature</b> #9 by Dominika98 was merged 4 days ago
<input type="checkbox"/>	 <b>Bridge socket feature</b> #8 by skorején was merged 4 days ago
<input type="checkbox"/>	 <b>ETL process without SQL Server Jobs</b> #7 by vidwalk was merged 7 days ago
<input type="checkbox"/>	 <b>Bridge socket feature</b> #6 by skorején was merged 7 days ago
<input type="checkbox"/>	 <b>Bridge socket feature</b> #5 by skorején was merged 12 days ago
<input type="checkbox"/>	 <b>Bridge socket feature</b> #4 by skorején was merged 13 days ago

Figure 3 in Tools - Github Pull Requests

To merge features, most of the time pull requests were used to make sure that the members agreed on what was put on the master branch



## Swagger

# Data warehouse Web API

1.0.0

[ Base URL: `virtserver.swaggerhub.com/MihailKanchev/Climatizer/WebAPI/1.0.0` ]

This is the Web API of SEP4-Z group1 IoT system  
find more at '<https://github.com/vidwalk/SEP4IoT>'

[Terms of service](#)

[Contact the developer](#)

[Apache 2.0](#)

[Find out more about Swagger](#)

### Schemes

HTTP

default



GET

**/readings** returns the latest reading



GET

**/readings**  
**/date** returns all the readings of a day with an average for every hour



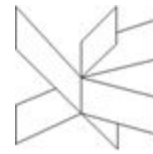
PUT

**/window** operates the actuator of a remote arduino



Figure 4 in Tools - Swagger Page for the API

- *Swagger is used for a simplistic visualization of all CRUD operations.*



## Slack

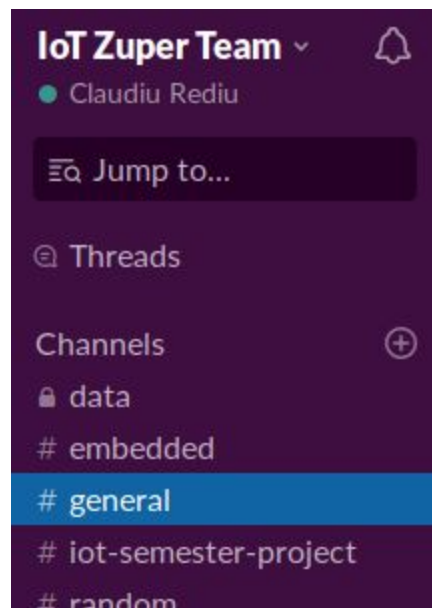
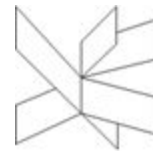


Figure 5 in Tools - Slack Channels

Having 9 members(at the time), it was decided that the best option for communication was slack because it is specialized in setting up collaboration environments to communicate online.



## Personal Reflections

### Andrei Cioanca

Right from the start I loved the idea that was presented to us by our supervisors, a proper IoT system from start to finish with a team large enough to rival even some real-life examples of IT companies.

I appreciated the fact that this time we had to split ourselves between three different parts of the project: data, cross-media and embedded. I was part of the cross-media team and things went smoothly on this side of the project. The smaller “teams” within the project communicated with each other using a spokesperson (me, for cross-media) and this proved to be quite effective. One issue I had throughout the project period was how the ESW’s course objectives did not align so well with our actual objective in SeP. This led to our embedded team having to develop pretty much everything in the final weeks of the project instead of having a steady and smooth growth.

The same can be said about the cross-media part, more specifically on the AND course. In my opinion the system architecture part of the course should’ve been taught and presented a lot earlier since it is a requirement for SeP. So just like the embedded part, the architecture wasn’t implemented until the later stages of SeP and this messed up the documentation as well.

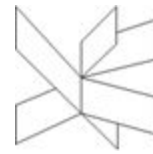
Even though there were two big issues we still pulled through and completed the project.

I have to commend our supervisor’s dedication to helping us finish the project, most notably Ib and Kasper. They understood our issues with the courses associated with SeP and helped us with a lot of issues that arose from not having well structured courses in line with what we had to do in SeP.

### Michal Ciebien

I really liked this team from the beginning. This feeling only grew further as we dived into solving the problem that we have set up for ourselves.

We made a group that consists of people that most importantly liked to work with each other. The great atmosphere accompanied us throughout the whole process of development and improved the communication in our team as well as the overall productivity. I also very much liked the idea of splitting into smaller groups and dividing the final product into smaller chunks. That really helped us focus on one thing at a time and not really have to worry about other parts of the system. My team, responsible for the embedded part - at the beginning consisted



of 3 people. Unfortunately we were left by one student who has decided to drop out of the school. It wasn't easy for us to squeeze into the schedule having only two people but we managed to find a good work pace and stick to it. We used SCRUM internally, having the retrospective meetings and dividing tasks respectively.

One of the main issues we had was that not all the drivers were ready and working in the beginning, so that made us wait until this issues will be fixed and then spend most of the implementation time in last few weeks of the development process.

Overall I really enjoyed working on this project. I felt that even though we had a lot of issues in the beginning we have learned a lot about how to structure C-written programs and how is it to work in often tedious, but in the end rewarding world of IoT.

### **Claudiu Rediu**

The team for this semester held a lot of promise. Most of the members have worked at least once at a semester project in the past, so we had a good idea of what we were getting into.

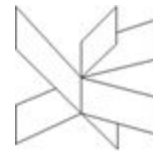
The project had a slow start because we were 9 people that needed to communicate. After the split into 3 smaller teams, the workflow improved. People could communicate more easily and manage themselves. In comparison with other semesters, there were fewer conflicts. Everyone had the patience to listen to each other and debate their ideas. The atmosphere was very calm.

I appreciated that I could work with the data side of the project. It was a good decision to make it this way, as everyone could apply their skills in something they like. Unfortunately, we had one member drop out of university, leaving us without a colleague in the embedded team. I helped them in whatever way I could, but they managed very well without most of my aid. There weren't any issues in the data part of the IoT System.

In conclusion, working on the project was enjoyable and it helped me work with the concepts I would apply in work environments.

### **Dominika Kubicz**

During this project I really enjoyed the team work. All members were engaged, motivated and friendly. From the very beginning we managed to cooperate perfectly with each other. There was no problem with separating into smaller groups and sharing the tasks. I also liked the project itself. The idea of making an IoT system was very interesting for me and I was very



happy to complete it. The best thing was that I could choose in which specialization I can work, and enjoy doing my part.

One of the challenges was that the curriculum didn't cover much of the embedded part of the project. A lot of the implementation was not connected to the classes we had. What made it harder was that one of the students from my team dropped out and in my team there was only one more member which meant a lot of work. Another problem was that the teachers were changing the requirements during the project, which was very confusing.

Overall this project was very pleasant and I learned a lot from it. The atmosphere in our team was very enjoyable, just the project organization and supervision was a little messy.

### **Amahdya Delkescamp**

I believe that the group worked well together. At first I had my doubts about how well a group of 9 was going to do after previous experiences with groups that only consisted of 4 members. However, it all turned out better than expected. The tasks were broken up enough that there was enough work to go around without anyone getting too bogged down. Everyone was able to contribute and work according to their strengths or at least close enough to their strengths. It was motivating to see the project coming together and slowly becoming what we had planned on in the beginning. I would say that the only blow to morale was having a member leave early, but the team was still able to pull together and complete the IoT system.

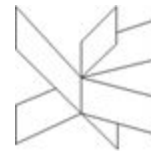
I really enjoyed being a part of the Cross Media team and working on the Android application. It was mostly because I was able to use some of my design experience along with what I had generally learned as a software engineer. I think the Cross Media group worked well together. It was a bit tough to allot tasks at first due to how quick it can be to make an Android app, but we ultimately made it work and everyone was able to participate. Personally, I can't think of anything that needs improvement.

### **Mihail Kanchev**

Watching a project of such scale unfold as the entirety of your team contributes to it is an incredible experience.

Initially the idea seemed preposterous knowing the size of the teams and the scale of the project. Team building was crucial in order for a decent outcome to be achieved. Contrary to my concerns a team of hardworking individuals was ultimately formed.





Having roughly the same vision for the solution contributed towards a stable time schedule with room for error. The tasks were evenly split in sprints and the SCRUM framework was utilized efficiently. The analysis and part of the design were done on SCRUM meetings while the group specific work was left for its respective sub-groups.

Being part of the data sub-group helped me to solidify everything learned throughout the CDI course and put it effectively into practice. Querying the data warehouse while simultaneously receiving and sending requests had put me into the very critical position of data pipeline which greatly builded upon my communication and cooperation abilities..

Working on a project of such scale proved to me further on that communication and forward-planning come hand in hand and that you need both in order for a solution of good quality to be produced.

#### **Nikita Roskovs**

I enjoyed team work during this project. It was a good experience of working on the project of such scale together in a big team.

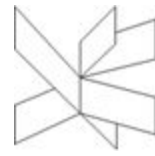
I did not expect any problems to be arisen inside the team as majority of us has already worked with each other before. It went very well indeed. Communication become easier when we were split into sub teams working on different parts of the project.

For me as a member of cross-media team, one of the issues was the flow of the AND course. Particularly architecture part was presented in the end of the course which was not really aligned with the flow of SEP project, as we did not know how to build the architecture of android application, so we made it based on our assumptions, which eventually made us redo both coding and documentation part.

All in all, my experience of the semester project group work is satisfying. I indeed gained a lot of knowledge as it always happens when delving into code and trying to make everything to be done smoothly.

#### **Stefan Harabagiu**

I really enjoyed working on this project and being part of this team, I was able to join the data subgroup which is something I am very interested in. I loved that we managed to communicate and organize ourselves in such a good way, everyone had enough freedom to take decisions

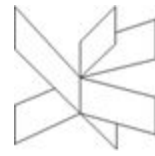


and think for themselves, while also conducting group meetings and discussions. We did, however, come up mostly behind schedule with the tasks during every sprint; we managed to finish and wrap up everything by the end but I guess it was unavoidable seeing as how the project was significantly bigger than the others and each of the 8 members had such different schedules as well.

## **Supervision**

Kasper the supervisor for the cross-media team was always available and helpful through the communication platform Discord. He helped the team with questions regarding the overall architecture of the android app as well as how to effectively use certain components of it.

Ib, Lars and Erland were available multiple times to aid in the development of the embedded component of the whole IoT System. They presented us how to debug the arduino and different issues that could appear if enough attention wasn't paid to how the code is structured in C. Being a bit behind, the embedded side managed to get back on track with their help.



## Conclusion

All in all, the group managed to organize themselves in an efficient manner, such that we avoided creating a chaotic work environment and managed to keep everyone satisfied with the way the project was conducted. The project was larger than any of the others, as well as the group itself; we had people from five different nationalities, everyone with different personalities and different work habits, but in the end we managed to pull through and resolve all our disagreements in order to develop a system we were overall satisfied with.