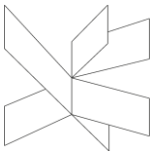

Process Report

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Nikola Vasilev - 260099

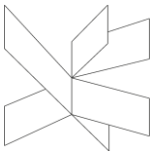
Supervisor: Knud Erik Rasmussen

Number of characters 20250

Software Engineering

7th Semester

December 2020



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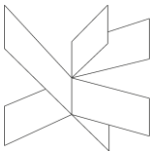


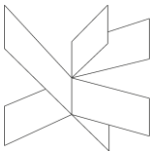
1 Introduction (Balkis)

This document outlines the process used for developing the system. The document will identify the methodologies and the techniques implemented throughout the development process.

The group initiated the work on the project on the 3rd of September. The goal was to develop a product as well as document, plan and reflect the work to be done. The developed product was about a case from the industry. In collaboration with Trifork Smart Device, a project case was made. From the project case, the requirements were identified and prioritized, thereby setting a frame of work for the prototype. An overall plan for implementation was set, to plan ahead and be sure that the most important features of the product would be made first

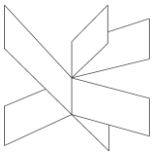
In order to manage the challenging nature of this project, an agile software development process, called Kanban was adopted alongside a software development process known as the Unified Process (UP). We will take in more details about the implementation of the combination between Kanban and the Unified process during developing the system.

To always be able to control our version of the software, we used GitHub for version control.



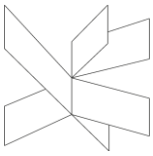
2 Group Description (Nikola)

This group was formed during BPR-1 class April 2020. The group consists of three members: Balkis Ibrahim, Alexandru Mircea Dima and Nikola Petkov Vasilev. During the beginning of BPR-1 classes 6th semester students represent their bachelor project ideas in front of the class. Alex Dima presented his idea to make a system which can read inputs from a production line and visualise them to the user. This idea caught the eye of the other two members Nikola and Balkis. They have skills which can contribute to this project. Each group member studies a different specialisation at VIA University College. Balqies has knowledge for making backend applications. Alex specialization gives him enough knowledge to deal with the embedded software development and Nikola can visualise output to the users. Evaluating their weak and strong sides, the three students decided that they can form a functional group. First step after group formation is agreement on group policy and signing a group contract. Then the group outlines the first version of the project idea description.



3 Project Initiation (Alex)

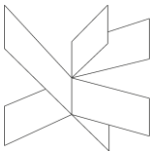
In February 2020 Nikola Petkov Vasilev and Alexandru Mircea Dima met and discussed an idea, that came from Mads Mikkelsen – the founder of a small start-up company MM Technology, about producing a user interface that will display on a web page/application information based on data retrieved from an industrial programmable logic controller. The company MM Technology was incorporated in 2020 as a business unit in Trifork A/S under the name Trifork Smart Devices A/S, but the idea remained valid even if at that time there were no customers with a similar interest. The idea originates from discussions that Mads Mikkelsen had with staff from small production factories, that don't have access to relatively inexpensive systems that will access and make available certain production data needed for the monitor of overall equipment effectiveness. Since the basis for this data comes from the memory banks on the automation equipment installed in the plants, the mentioned system will have to interact with said equipment. In March 2020 by the joining of Balkis Ibrahim, the idea was enhanced with the addition of a cloud database storage layer for the data and business intelligence tool. After initial meetings, the group decided to pursue this idea and that such a system will make for a good bachelor thesis. The following meetings were focused on how to integrate this idea in a real case scenario, and due to the fact that the company was not able to produce an interested client, the team decided to go for a 'persona' case scenario.



4 Project Description (Nikola)

The purpose of this project is to visually represent data from a production line in a factory. This data represents production performance and quality of production. In this case the produced items are mobile cases. Data is retrieved from a production line and sent to a cloud database, where it is stored. This data then is represented via web interface. Users can view data from the production line and can modify data in Azure cloud database. This project follows three layer architecture principles.

Each layer uses different technologies to accomplish its goal. Firstly data is retrieved from a production equipment using PLC. PLC stands for programmable logic controller. This is an industrial computer which regularly monitors the state of input devices. It is programmed to make decisions which control the state of an output device. Data Acquisition layer uses SIA platform which is a decentralized cloud storage platform used to create robust data storage. Back end logic of the system lies on a Azure cloud server. Power BI serves to visualize historical data form a data warehouse. Users can view data in a web browser with the help of Angular cross-platform framework. Requirements are shaped at the project inception phase. Main functional requirements include the ability of the system to store data into the cloud, fetch data from the cloud and visualize the fetched data. This data must be visualized in a responsive user interface. In order to work with the newest data as possible the PLC must retrieve the data in less than five seconds. The system must also be able to send data from the PLC to the database every ten minutes.

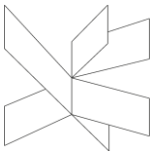


5 Project Execution: (Balkis)

The methodology that we used to organise the workflow during the project period is Kanban as you already read in the introduction.
The group went through a long decision to decide on the methodology we use. With the two options we had, it was challenging to choose one of them. we fluctuated between using Scrum or Kanban. We know scrum very well and we have been using it during our entire study semesters even during our internships. It is the methodology we have been taught by VIA University College.
On the other hand, Kanban was not hard to learn and it is so comfortable to go with.
Kanban is a visual system for managing work as it progresses through a process. It visualizes both the process (the workflow) and the actual work passing through that process. The goal behind using Kanban is to identify potential bottlenecks in the process and fix them so work can flow cost-effectively at an optimal speed or throughput.

To decide on one we agreed to define the pros and the cons for this project. as a result, we found out that Kanban would be the best option for the following reasons.

- Kanban does not require any roles in the team such as (Scrum Master and Product Owner in Scrum), which we have been struggling with, during our semesters' projects, since those roles did not exist in our projects so we had to assign it to one of the group members, to make it work.
- We can easily combine kanban with Agile unified process framework.
- A key aspect of Kanban is to reduce the amount of multitasking that most teams and knowledge workers are prone to do and instead encourage the team to “Stop Starting! And Start Finishing!.
- Kanban is a better methodology for small teams.
- The tasks are organized in three columns: “To do”, “doing”, “done” which will give the team members a better vision of the workflow.



Working with the Agile unified process framework was really important for us, therefore, we decided to use a combination of Kanban and the Agile unified process.

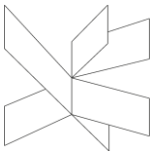
The following activities define the advantage of the Agile workflow:

- Weekly meetings: Each member of the group has to inform the rest of the group about what he has done since the last meeting, the next task that he will work on and about the hitches he faced or facing.
- Live Demonstration: Deliver live presentations of each iteration final product to show progress.
- Share Feedback: Receive feedback from the supervisor and share it with the entire group before the next phase begins.
- Remain Agile: Make changes to the process based on feedback to ensure each phase improves the last.

Kanban and the Agile Unified process:

It turns out that the combination of Kanban and the unified process worked as perfect as expected in this project. It made the work move forwards smoothly by organising it in a better way and making the team fixing the problem in more subordinate time.

The work breakdown structure of this project contains 4 phases that make up the unified process, which are the Inception phase, the Elaboration phase, The Construction phase and the Transition phase.

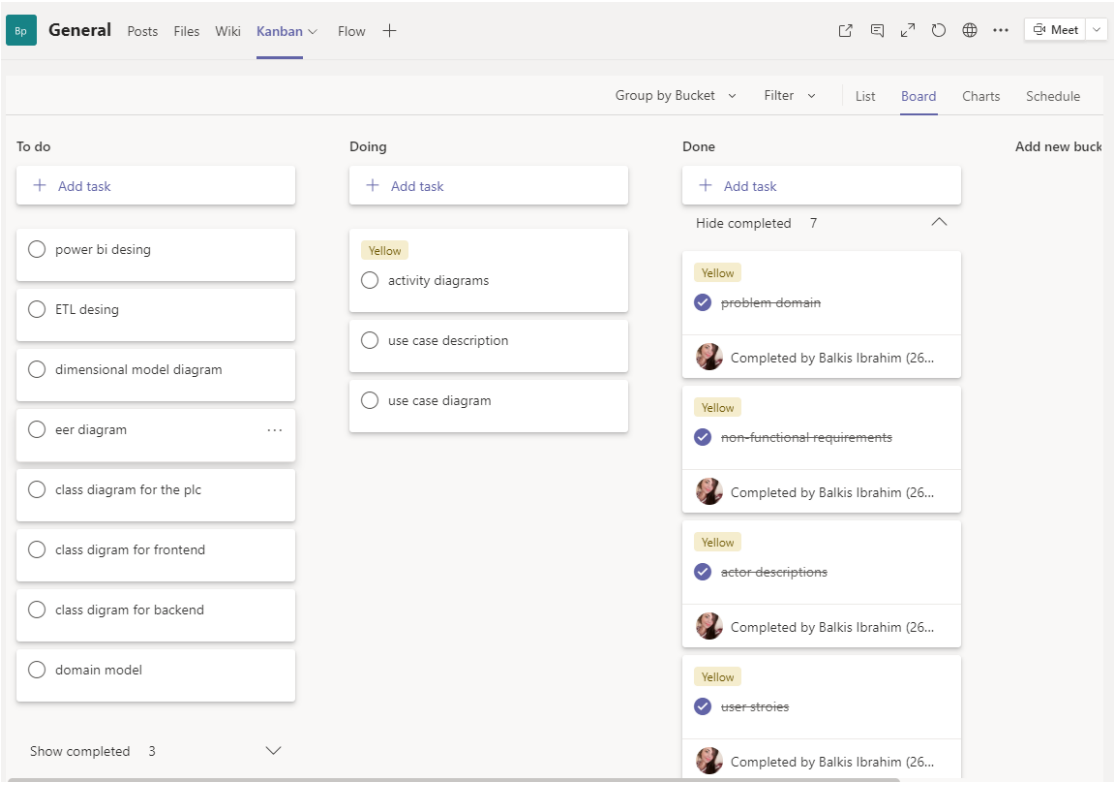


The following section explains how the group adopted the Kanban methodology within the four unified process phases.

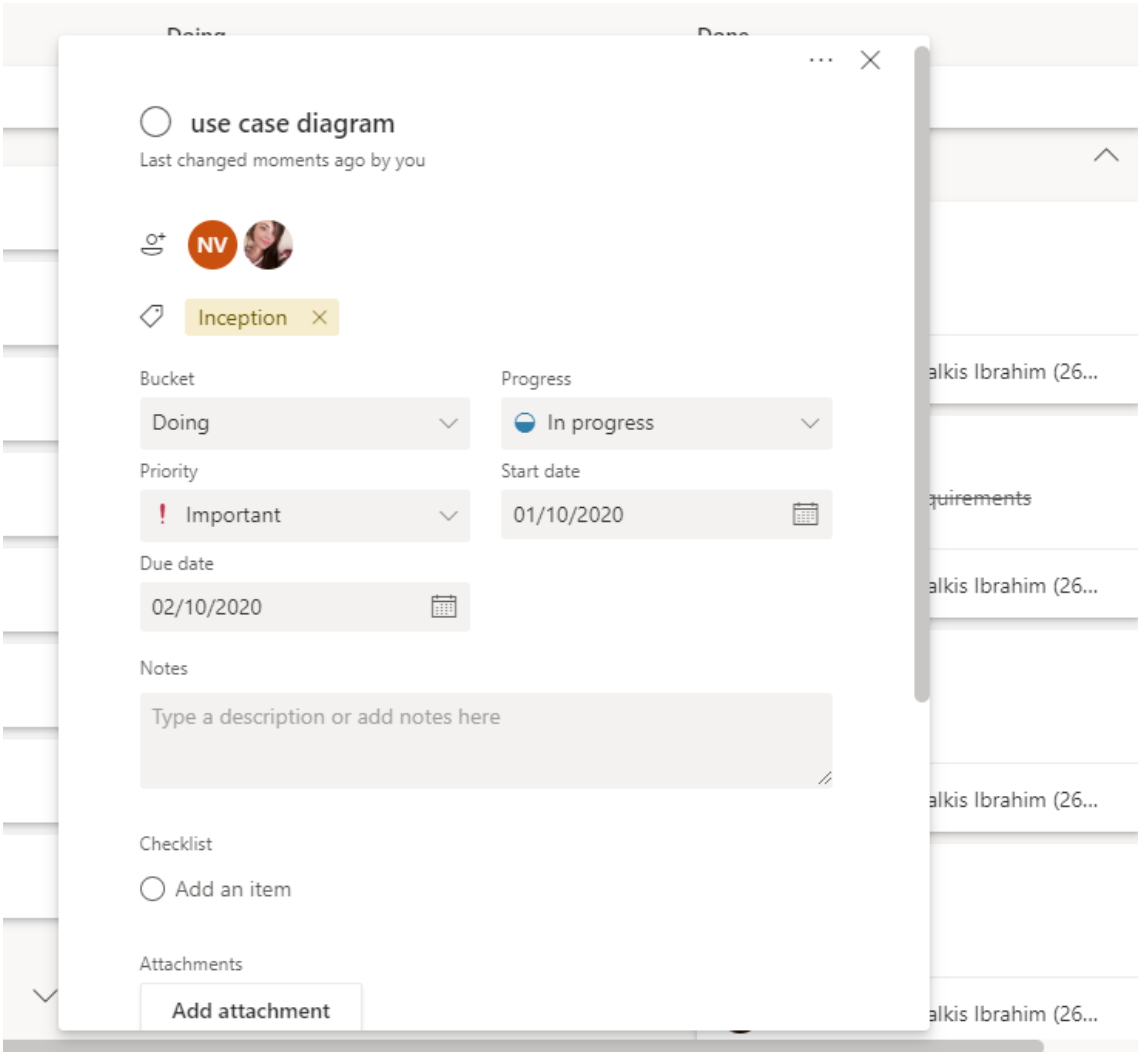
Inception:

The primary goal of the Inception phase is to establish the plans needed for developing the proposed system. This phase will produce around 10% of the significant requirements defined in details including the high-level objectives, defining the scope of the system and prototyping, identifying the critical risks, starting to make the business case based on the estimated cost, effort, schedule and product quality. The Inception phase in this project started on the 3rd of September and ended on the 9th of October having a total of 5 weeks. In this period, the total amount of hours for the entire project were decided, the meeting hours, the project description, the estimated product backlog, what methodologies to use, splitting the tasks among the team members and so on. Furthermore, in this phase, the group started working on the diagrams that will give a detailed description for the user stories such as the use case diagram and the activity diagram.

Below is a figure for the Kanban board that we made in Microsoft Teams, it represents the tasks within the inception phase.



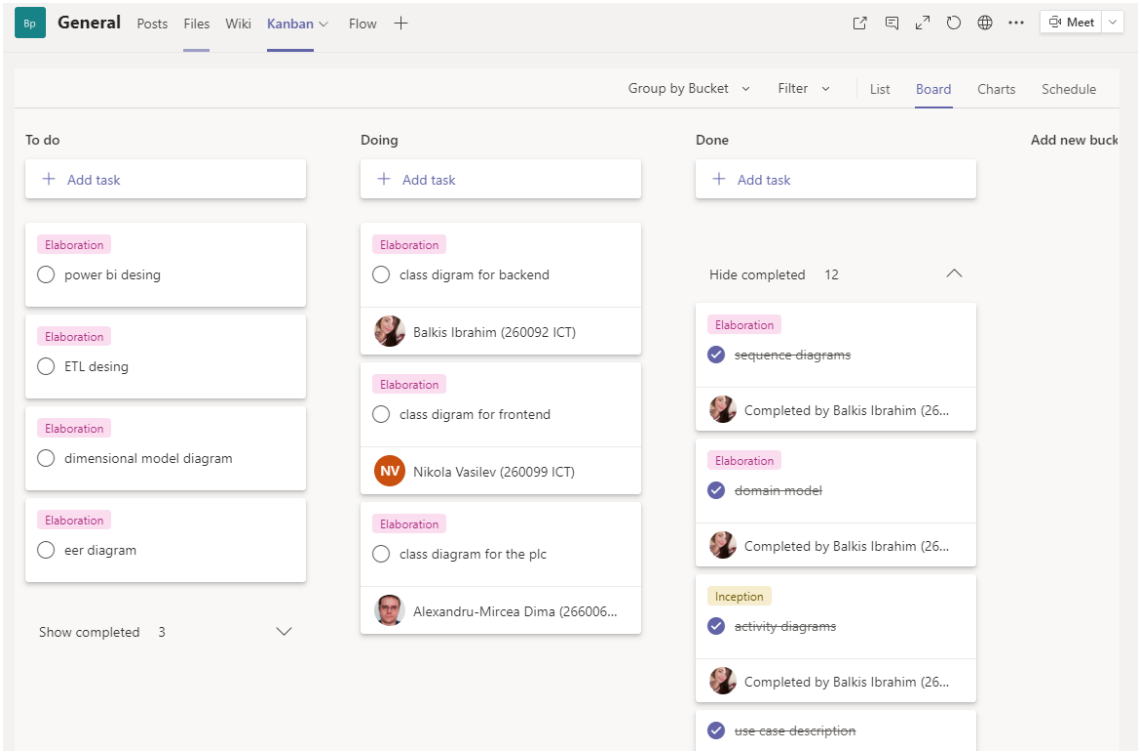
each one of the tasks is assigned to one or more member, a start and due date are set for each of them, the priority of the task during the week, there is also a section for comments from the other group member, a small description of the task when needed and most importantly the label to specify to what phase it belongs. The following snip shows an overview of the use case diagram task.



Elaboration:

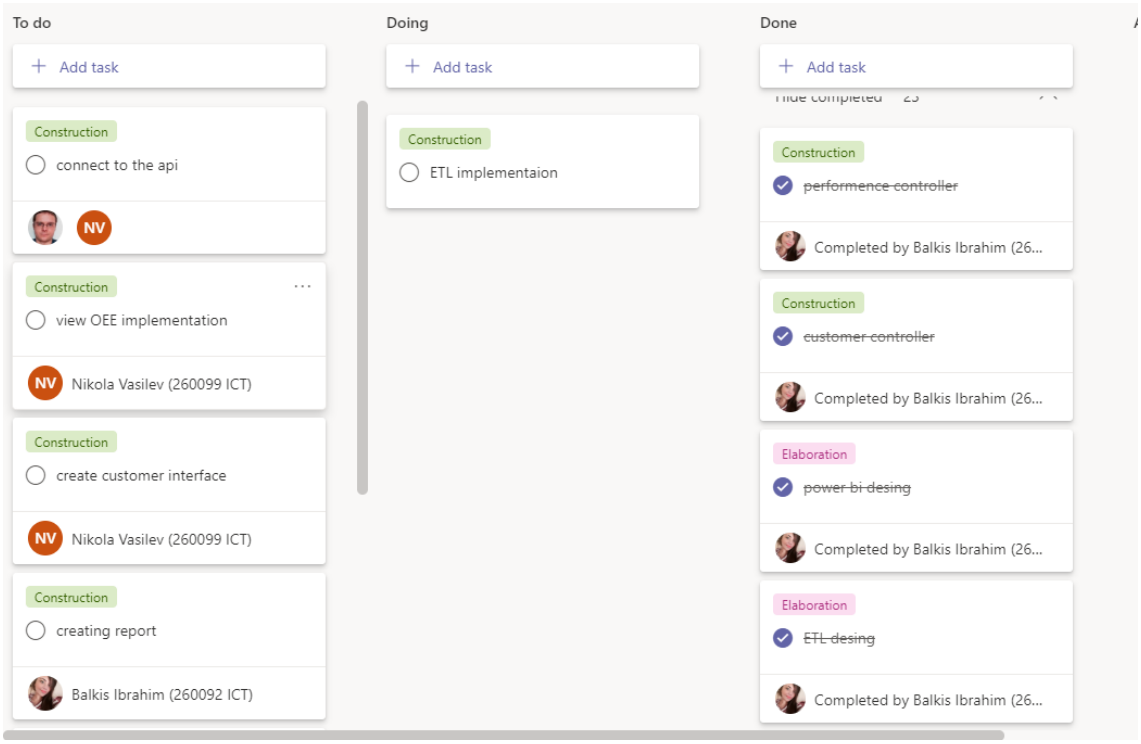
The main goal of this phase is to establish and build the architecture of the system and to expand the risk factors were assessed in the inception phase. By the end of the Elaboration phase, the business case and the plan for the project contained enough details in order to move on to the third phase, Construction

The elaboration phase for this project started on the 12th of October and ended on the 23rd of October with a total of 18 days. In this phase, the domain model for the system was produced along with updating and completing the use case and the sequence diagram, class diagram, the design pattern, we also chose the technologies for implementing the system and, most of the research was done.



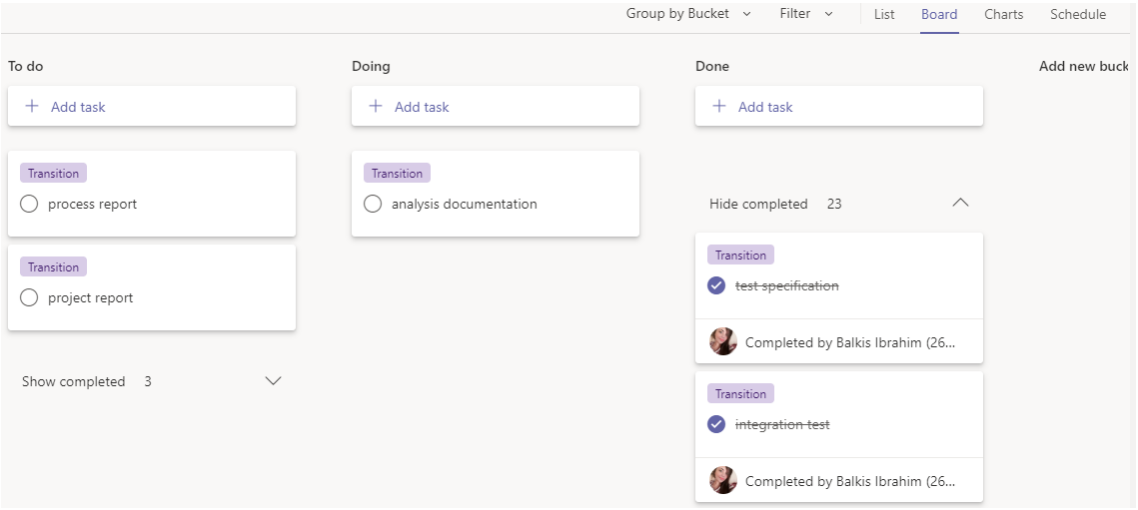
Construction:

The construction phase is the biggest phase in the unified process it is where the coding and the implementation of the project plan occurred. By the end of this phase, the equivalent of the beta version, in the business world perspective, of the project was produced. In the construction phase in this project, the group implemented the front end of the system that represents the user interface. The backend that represents the APIs. The implementation of the data warehouse including the ETL process. Creating the report on Power BI.



Transition:

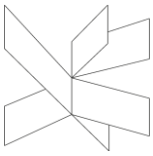
The transition phase is when the project is deployed and released after all the functionalities and the different parts are wrapped up together to make the first version of the project. In this phase, the group connected all the different parts that the group members were working on individually. After the parts were connected the whole system was tested. The team faced a few errors but managed before the end of this phase to solve them. In this phase as well, the documentation was completed and the whole bachelor project along with the reports was ready to be handed in.



Teamwork:

The group members come from different nationalities and this is the first time we work together. That made the relationship between the members more professional and productive. From the beginning, each member took his part of the responsibility for this project and did his best to achieve his tasks as best as possible.

The project structure required us to take independent responsibility for the different parts of the system. So we decided to divide the parts between us. There is the embedded software development part which is assigned to Alex, and then the backend part which includes the API, the database, the data warehouse with the Power BI which are assigned to Balkis, and finally the frontend part which includes the single web application and it is assigned to Nikola.



Group Contract:

The group contract can be found in Appendix 4.

Definition of group and objectives

The goal of this project was that the team should successfully manage to complete the bachelor project with the maximum performance possible and be able to have the prototype ready by the end of the project period.

As we worked on different parts of the project, we had a different plan for each of us but were still dependent upon each other as both parts would combine the full project.

Meetings:

The approach we followed during this project required us to only meet once a week. which worked perfectly with the pandemic since we could not meet daily and visually.

Instated we had our meeting online and we used different technologies for that, like zoom and Microsoft teams and Facebook.

The meeting took place every Wednesday after lunchtime. During the meeting, we discuss the issues we had during the last week. Each member gives an update on what she/he has been doing and what will he be doing for the next meeting.

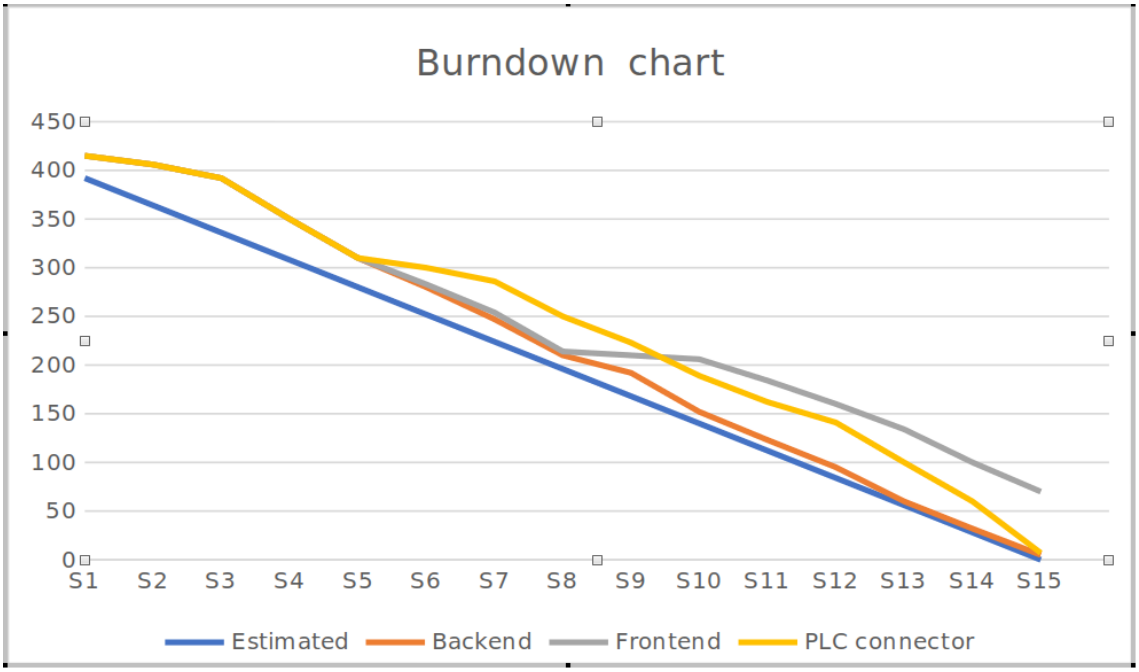
When something urgent happened, we did not wait until the next meeting to communicate about it. instead, we did call each other and write to each other between the meetings.

At the end of each Unified process phase, we had a review meeting where we updated the Kanban board and documented what was done during this phase.

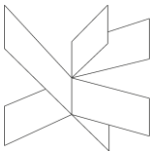
During the Inception phase, as mentioned before, the group created the work schedule, which included allocating the time required for the entire project, the days and the meeting hours.

The project has a total of 416 hours per member, starting on the 3rd of September and ending on the 18th of December, with a total of 15 weeks and 2 days.

We had flexible working days on this project which give the group member more motivation that led to a better working environment and made the work gets done smoothly.



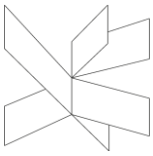
This vertical dimension of this chart represents the total work hours while the horizontal dimension represents the sprint timeline from the beginning of the project till the end.



6 Personal Reflections

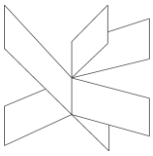
Nikola Vasilev:

This is the final project for my studies in VIA University College. The reason why I chose this project is because I wanted to work and improve my skills with technologies which allow you to create professional looking and executing web solutions. The project aims to visualize data from a production line. As a group we outlined and shaped the idea together what the application is going to do and what potential problems it can solve in the real world. Due to external factors, planning of the application took longer than anticipated. Once we got information we needed the workflow start running smoother. We elaborate, analyse and design the application together for the most part. The way we design architecture leaves a lot of work to be done independently from the other team members. Web interfacing does not achieve its goals which were described at the start of the project. Web page exists but it is barely functioning. The general structure and containers are created with additions to some services to fetch unstiled data. My way of work was not effective. Such a big project needs more thoughtful planning of the available time and tasks. Multitasking may prove useful in specific cases but this one is not of them. I had implementation problems which were connected with incompatibility between some of the external packages I was using. I spent too much time trying to fix this issue, so I had to push contemporary tasks for future sprints, which limited my time even more. Looking back at time It would be more useful to skip this issue and continue with other implementations which may prove to be more successful. From a professional learning point of view I increase my knowledge in TypeScript and Angular framework. Because of the huge number of external packages I had to import I assume I got better with organizing my hierarchy. Working remotely happens to be harder and so successful and enjoyable than I expected.



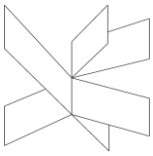
Alexandru-Mircea Dima

The idea of system-to-system communication protocols and Linux development software have fascinated me for awhile now and these are the main reasons for which I have chosen this project. It was also a great opportunity to get a good insight into how teams of developers that work on almost completely separated parts of the same larger project come together to deliver one single product. I am thankful for this experience since I believe that it will be useful in the management of future production projects. I found it instructive to be part of a team that can take one rather informal request from a client, or a persona in our case, and through the processes of requirements analysis and system design break it down to formal system requirements and diagrams. It was also an edifying experience to have the freedom and the responsibilities that come with it, to take charge of the design and development of an entire sub-system, and even if this put to a test my knowledge about C/C++ programming and Linux running environment, I gained invaluable new wisdom regarding these topics. In retrospective, there is always room for improvements especially on the extension of the test documentation. All in all, this was a good experience with important insights about what one might expect in life after the university benches.



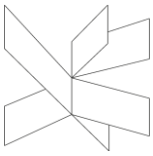
Balkis Ibrahim:

Looking back to my education journey at VIA University College. I see that working on this project is definitely the best decision I ever made, for many reasons actually. This project has challenged me the most on all levels. The workload put in my shoulder was very huge, and I never experienced doing that much work. Usually, I have fewer responsibilities in semester projects, but I felt responsible for each little details in this project. I wanted to do the perfect project and get a high score, and for that, I did my best. To be honest, I was worried at the beginning, and I doubted my ability ever to reach the perfect. We struggled a lot at the initiation phase; the company could not help define exact problem Domain the even did not allow to talk to one of their customers. All they asked is having a web page to visualise real-time data coming from the PLC about OEE and a business intelligence tool. Therefore we spent a lot of time trying to find real production data and people who work in this domain to interview and make our persona based on their needs. I recall that I did a lot of researches, we tried to talk to the production engineering teachers. I also interviewed my friends who previously worked at a factory. All of that failed, and more than one month passed without any progress. At that point in time, we had to changes our strategies. With our supervisor's suggestion (thank him) we decided to make imaginary personas and start there. I knew that we already lost a lot of time, but I wanted to make this works at all costs. So I put aside all my fears and focused on my goal. I worked extra days even during weekends. In the end, I succeeded, and I am so proud of what I did. Being able to go through this with a good result, it just feels fantastic, and because of that, I have now more confident in my skills and ready to work on any complex project. I gained a lot of knowledge from both the project and the group work. However, I know there is still room for improvements, but giving the time and the resources we had, I would say I made something that I am proud of.



7 Supervision (Nikola)

Supervisor for this group project is Knud Erik Rasmussen. After agreeing with him the group settled supervision meetings to be conducted every Monday at 12:45. Meeting duration was approximately 30 minutes. First two meetings during the inception phase were conducted physically at VIA University College, campus Horsens. Meetings during next phases were rescheduled to happen in ZOOM. During these meetings group members would report about their progress or impediments they met during the current phase and questions about future development. Supervisor provided useful information, help and directions whenever it was needed.



8 Conclusions (Nikola)

After the project is finished not all team members are satisfied with the end result. Most parts of the system are complete. Given more time on the visualization part a properly working system can be delivered. Based on conducted testing the current application could possibly get data from a production line. This data can be pushed to a cloud database. Data can not be visualised in a meaningful manner to the web interface. IOT and server side are finished besides having minor flaws , whereas the client side is not ready for deployment. The project has a lot of room for improvements. User interface can be made more responsive and with better design which suits the need of this particular system. Current system retrieves data only from PLC and would be useful if more PLC are connected. Free web application hosting could be changed with a paid one with better security and more functions. Overall better design could decrease the response time of the system.