GROEP T
INTERNATIONALE HOGESCHOOL LEUVEN

Process Report

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This report is written for the EE4 project 'building a small solar verhicle'.
This report includes all the final results after finishing the build of our SSV. The build includes the planning, writing of all the reports, calculating every little detail and of course building the actual SSV.

All of the reports written for the calculations and the build can be found on our Wikipage. These reports are named 'Case SSV I', 'Case Simulink' and 'Case SSV II'. Also our Gantt Chart by which we planned everything can be found on the same wikipage as well as our plan of approach.

The resources used throughout this report can be found at the bottom of each report. For this report no external resources were used so there is no paragraph with the different resources. For case I, II and Simulink there were resources used.

1. Introduction

Every project should have a good plan otherwise it fails. Before we started this assignment we also made a planning in the form of a Gantt Chart. In this process report we will discuss the progress of our project. We will also compare the estimated time with the time we actually spend. You will also find a review of the difficulties and an overview of the activities of each team member, at the end some pictures of the final version of the SSV can be found with explanation.

The goal of this report is to state the final result and compare them to the initial ideas and thoughts.

2. Planning

If you create a Gantt Chart in the beginning of a project it's very difficult to determine how much hours each member will spend on the different parts of the project. So there are always aspects that take more time than expected. We are almost at the end of the project and we can conclude that the division of the hours was pretty good. In the Gantt chart, you can see that the big parts in this project were the 2 cases and FabLab.

When we started working on a case, we divided the tasks, so every member of our team knew precisely what he needed to do. Because each team member has his own qualities, we didn't lose much time. Someone did the calculations, drawings and someone wrote the report. This was also the strength of our team and made that we were always on time for a deadline.

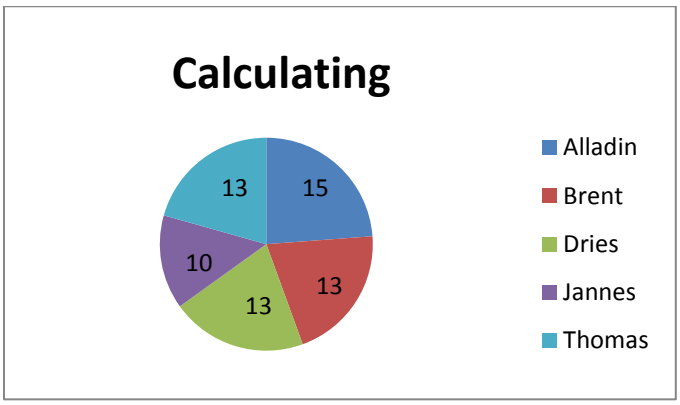
But like in every project there were always some things that not went how we thought it would go. This was the FabLab part in our project. In the vacation we arranged a meeting in FabLab to build our car. We thought that we could build the car in just one day, but this was a bit disappointing. We printed a few wrong things and so time passed by with the result that we didn't finish the car that day. A lesson for the future could be that we need to be sure that all our drawings are correct before going to FabLab. We lost there a lot of time by changing things.

When we compare all the tree cases (Case I , Case II and Simulink), we can conclude that Case one and Simulink took the most time. In case Simulink, it took some time to become familiar with the software. Because no one was an expert in programming, it wasn't easy in the beginning. After we found out how everything worked it was quiet easy. Case one was a big case, so it's not surprising that this took some time. We made also some mistakes in this case so correcting this took some extra time.

3. Corporation

3.1. Calculating:

In this pie chart you get an overview on how many hours each team member spend on the aspect of calculating. This is the calculating aspect of all the cases. So this includes Matlab, Sankey, efficiency, bisection,...



3.2. Report:

After we did all the calculations and the measurements we need to put everything in a report. Writing all the reports took also a lot of time as you can see in the pie chart.

3.3. Remarks:

Jannes was the one who assembled all the pieces of our SSV, it took him blood sweat and tears. But the result is insane.

Alex was the one who draw our SSV, only he worked on the drawings so it isn't representable to make a pie chart of this aspect.

Jannes worked more on the report, therefore he had to do less calculations than the rest of the team.

Not only calculating, writing and drawing were aspects of the report but there were also some other activities. To divide the tasks and to plan we had every week a seminar. In the vacation we went with the entire team to FabLab to design the car. During these activities each member showed their own set of skills.

4. Skills

In our team every member had his own skills and qualities, this made that everything went very smooth during our project. Each team member will list the skills he learned during the project.

4.1. Alaâ-Eddine:

Adapting to new software

The EE-projects have every time new programs to work with. At a certain point you learn how to adapt. It's like writing a program in two different programing languages (C++ and Java). Most of the time the logic is the same; only the way you want to express what you want to do changes.

Autodidact

There were subjects were the teachers didn't give us any information about a possible solution. Learning those subjects by yourself and look for information in the courses we have, was the only solution .This is good for the EE5-project because we will have practically no help.

Ask relevant questions

This is a consequence of being autodidact. When we had a meeting with the coach we couldn't come and ask irrelevant questions. Good questions will result in good answers of the teacher. I wrote each time down what I had to ask with a list of arguments.

4.2. Brent:

Before the start of the project I didn't know anything about Matlab, with the help of Allaâ-Eddine and some videos I now know something about it. The project was also very interesting for me because this was the first time I came in tough with gears and things from real life. I know now also something more about solar panels and the working of a DC-motor. After solving some equations myself, I got an idea of the parameters.

In each project you also learn to work with a team and that's something you definitely will need later. You learn to communicate and work with each other. For me it was also the first time that I had an English coach so my English writing skills proved also a bit.

4.3. Thomas:

During this project my skills as an engineer improved a lot. I have learned to work in team, it was very important that there was a good communication between all the team members. I learned to respect deadlines and work to these deadlines, I can control the stress better now. The team and I never missed a deadline. The SSV cases improved my writing skills, and it was a good exercise to apply all the rules we learned during the class "Scientific writing".

Also my technical skills are better now, I know a lot more about the solar panel and the motor. I have an idea of all parameters you have to take into account if you want to simulate the speed or acceleration of the car. We have now also extra math physic knowledge for example the bissectionmethod.

A thing that I will remember is that a project never ends, there is always a possibility to improve. The first day our car could ride I thought we were done, but we worked after that moment another 3 weeks to have the optimal SSV. I can better estimate the time for a certain project.

4.4. Dries:

Before I started with this project I already had a lot of skills. The work I did was mostly some refreshment of my knowledge.

I did learn how to work in Matlab and Simulink. It took some time to understand the interface and operations of those programs but after a while I mastered this skill.

I finally visited fablab and assisted during the creation of our solar car. I had to select the different parts and was responsible for managing the logistics involved. I learned to be flexible, they told me the delivery would take place on Monday and surprisingly they delivered one day later on Tuesday. I learned to be creative with using formulas in calculations.

4.5. Jannes:

During the first part of this project I especially focussed on the writing of the report 'Case SSV I'. This report had to be written in English so this improved my writing skills in English. During the second part I focused more on the building part of the SSV. I assembled everything and adjusted some things when needed. I wrote the report in word so my word skills improved.

Our car has been supplied with bearings on every axle that spins so almost no power would be lost due to friction. The car has been a lot of trial and error because when something didn't work I had to start over and over till it was perfect. So my patient has been tested a lot but I didn't get angry at all so this was a good training. But also the fitting of the bearings, axles, gears and aligning everything was new to me. I have worked a lot on motorcycles but this required even more finesse. I really enjoyed doing this.

I also learned to work a bit with Matlab and Simulink but only the basics.

During this project there were a lot of deadlines so I had to be ready in time for everything. We managed to meet every deadline so that's a positive point.

4.6. Alex

During this project my expertise changed a lot. I learned drawing with sollidworks and working with the lasercutter. We have also had a nice group with good workers. Everyone worked hard. I also noticed that it isn't only building a car, but also the calculation before are very important and it ask allot of work and expertise. We are very happy with the results.

4.7. Conclusion

Each team member had his own set of skills and during this project we all learned a lot of new skills. During the project we hadn't a problem of dividing the work according to each of their skills. This way we all completed each other and had no problem finishing the tasks.

5. The final version of the SSV

In this part the final model of the SSV will be discussed together with all its components and the important decisions that were made.

5.1. Top of the SSV

This is a picture of the SSV at this moment. But in this section only the choice of materials and the construction will be discussed.

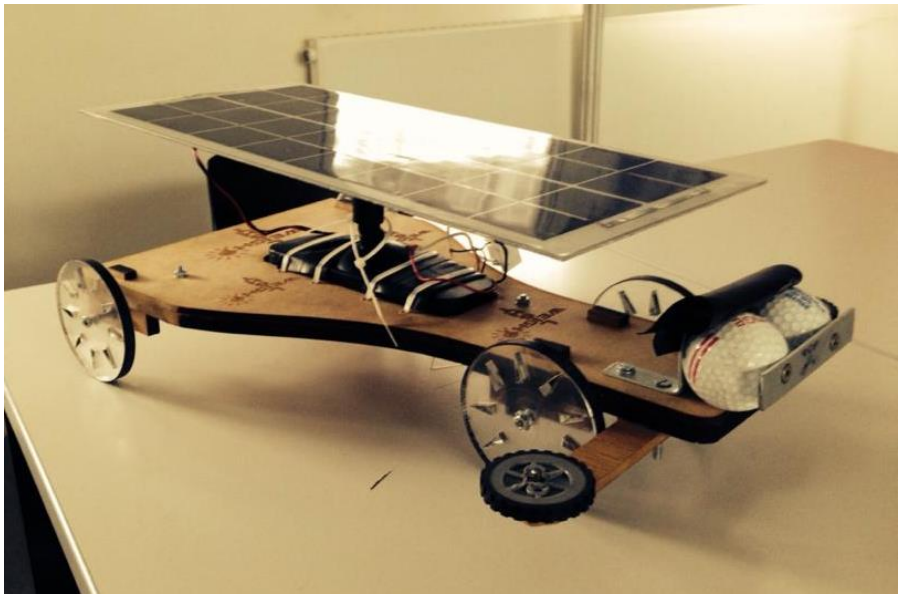
In the beginning there were some important choices that had to be made, the material of the frame, wheels,… all these decisions can be read in the report case SSV I. But they will be discussed here shortly. As frame material, mdf was used, this is because it is light, strong, easy to adjust and not very expensive. This has been bought and made at FabLab.

As collision material, a golf ball seemed a good solution. This is because golf ball are hard and have a high restitution coefficient, this will result in a good punch to the ball. In the first case, it was intended to use only one golf ball, this is in fact better for the punch but this makes it harder to hit the steel ball. That's why two golf balls were implemented. Also the two steel L-shaped forms are not chosen randomly. When colliding with the ball they will act as a spring and a spring doesn't lose energy. Also the plate in the front makes it easier to hit the ball but contributes to an effective collision with the ball.

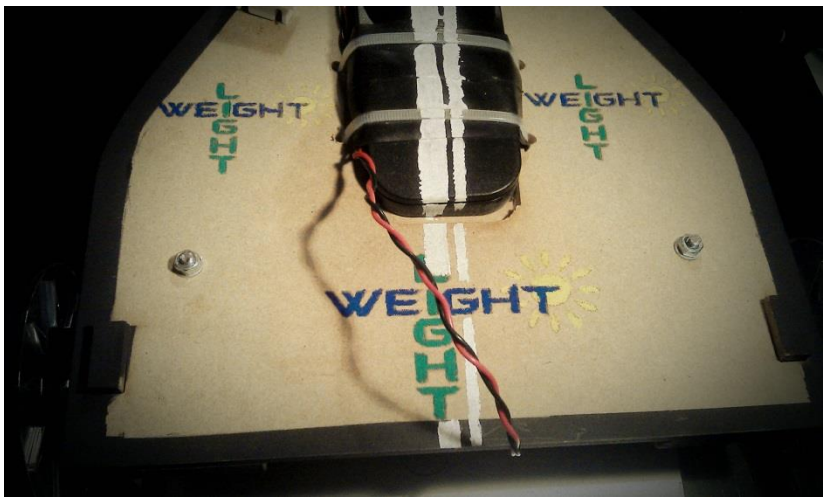
The solar panel is kept in place with a mirror from a car. This mirror has a suction cup at one end en the mirror at the other end connected to each other with a flexible arm. This flexible arm will make sure the solar panel can be directed to sun.

The wheels are made of Plexiglas but this hasn't a specific goal. They are 8 mm thick which is pretty thick but this way they won't break. They also look better than wooden wheels.

The SSV has been provided with some support wheels which will make sure the SSV keeps driving on a straight line. The wheels are from Knexx and are provided with a bearing inside to reduce friction losses.

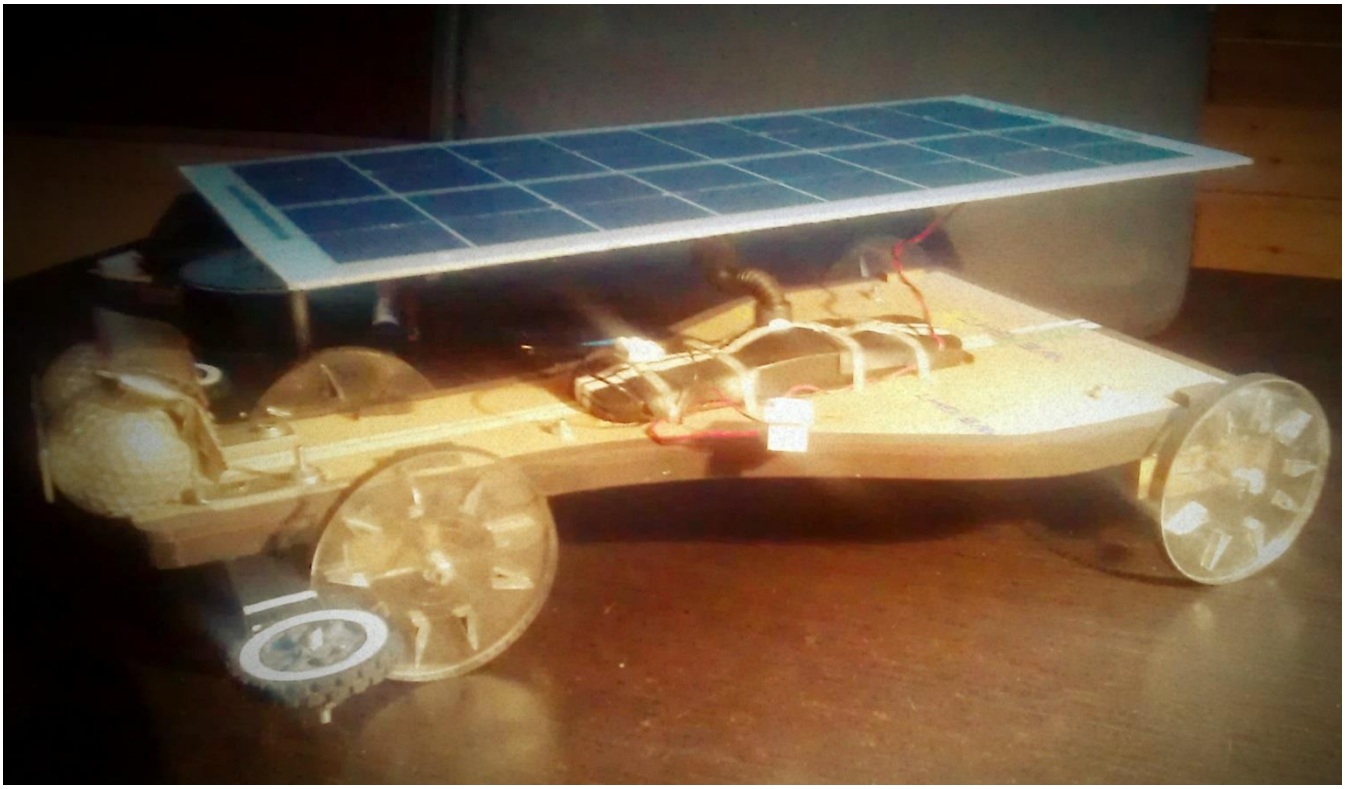


After paint the SSV looked like this.



The SSV got during paint a race-stripe, the golf balls were painted in gold and the engraved logo was given the right colors.

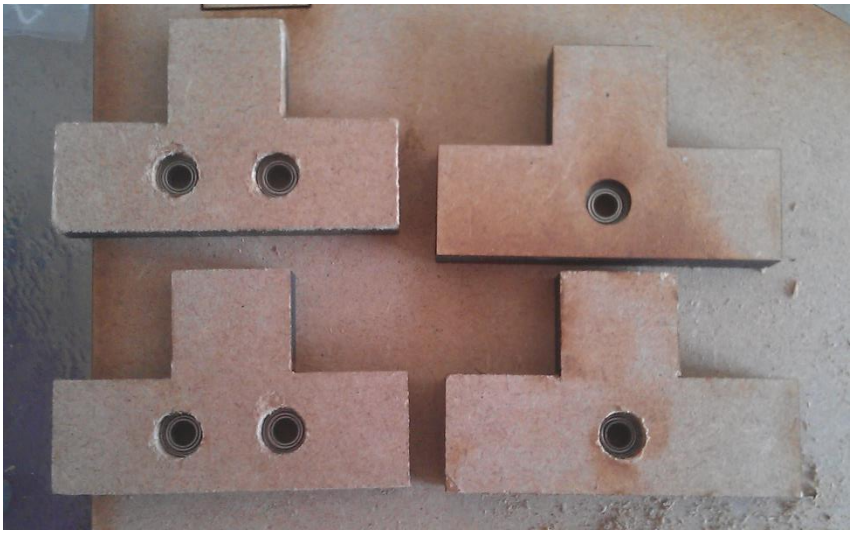
In the picture below the final version of the SSV can be seen. This picture shows that also the side wheels were given color, they were painted in the white-wall look. On this picture the cables from the solar panel are visible and you can see that they are wound up with each other. This is to reduce the induction currents induced in a conductor.



5.2. Bottom of the SSV

On this picture it's easy to see the how the different gears and axles are implemented.

Every axle (3) visible on the picture is provided with 2 bearing located in the wooden parts. This was actually a tricky part to produce because the bearings can't fall out and they had to stand straight. In the picture below the different parts provided with a bearing can be seen.



That hardest part was to align the gears perfectly, this is a crucial part for the SSV because this might cause a lot of losses. The motor is kept in place with a metal strip covered with some kind of rubber so the motor can't vibrate or slide out of its place. We chose to use metal gears and ordered them at Conrad, an online store where you can buy parts for RC-cars. This way we were ensured the gear

were perfect and wouldn't cause a lot of friction. The only thing that may seem stupid is the use of the gears. We used four gears, but the two small ones are the same and the two big ones are the same. This wasn't chosen for no reason, we know more gears cause more friction but if we wanted to use this type of gear we had to use more than two. Otherwise the motor wouldn't reach the axle of the wheels. We also considered using three gears but this way we couldn't get our ideal gear ratio (the store only had limited sets of gears). The gear themselves are fixed on the axle with small bolts, this way the gear won't slide along the axle.

On the final picture one of the ends of an axle can be seen. To keep the wheel in its place and to prevent them from spinning round the axle they had to be bolted to the axle (if the wheels spin round the axle this will cause more friction than when they spin together with the axle in the bearing). That's why screw-thread was provided to the axles to bolt the wheels with the axles.

6. Conclusion:

After seeing the result, we can conclude that this was a successful project. In the beginning we never thought that we could achieve this. But we really worked as a team, before the project we didn't know each other but afterwards we became a group of friends with new skills. The entire projects went as hoped but there are of course some things that could've gone smoother but these things were especially minor things so no big deal. The project has come to a good end.

To finish this last part of the last report we can mention that we were declared winner of the SSV race with a height of 30.4. This gave a really good feeling and makes all the hard work worth doing.