KTH Management of Projects

EH2760, HT 2018

FINAL REPORT

ESS-NW/ESS-CAR

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1 General Summary

A prototype for an autonomous car has been built. As requested, the car is able to do some basic self-monitoring and uses ethernet with a network controller for on-board communication. Unfortunately, it is not able to consistently track a flag, which was another requirement.

Due to integration issues, a lot more time than planned had to be spent during the last weeks of the project. The budget was exceeded by roughly 74%.

The integration issues consisted mostly of problems with the interprocess communication between different software tasks. During integration, it was also found that ordering PCBs via KTH was not possible and that the PCB machines available to the group were broken. The interprocess communication and the PCB issues were the main causes of delay in the project.

2 Follow-up of objectives

2.1 Goals

1. The computer vision system of the car does not have the required performance to properly follow a green circle held in front of the car.
2. The hardware has been extended to include one unique processor for each sensor or actuator node and the car has all the functionality it needs to keep a distance of 30 cm to an object in front.
3. The car has been made failsafe to the extent that it can detect if any of the major nodes are missing. Most importantly, the node that controls the motor can by itself stop the car within the required time, even if it gets isolated from the other nodes. No battery level reading has been implemented.
4. The software running on the controller node checks the availability of all subsystem and does not start if any of them are missing.
5. The physical layer has been set in a topology that allows the SDN-system to route packets to and from all nodes.
6. The SDN system consists of a SDN-controller that runs on a Raspberry Pi and Zodiac FX OpenFlow switches.
7. There is only one route between any two given nodes that are connected as hosts to the SDN system. As long as the SDN system is activated, packets are always take this route.
8. The SDN controller does not reassign network resources during runtime.

2.2 Action Plan

Goals 1, 3 and 8 cannot be considered completed. No action will be taken for goal 3 since the current situation was deemed acceptable by the stakeholders. The cause of failure for goal 1 and 8 have been identified and the shareholders have been notified. The action taken for these failures is to hand over a well-documented repository to the stakeholders so that they can have another group of students solve these issues in a future course round.

3 Lessons learned and suggestions for improvement

The experience with the project has, in general, been good. Most members felt that they got to work with relevant topics and try out new ideas. Furthermore, all members got to try out professional engineering tools and methods that will be useful in the future. Some examples include cmake, Doxygen, Slack, Fusion 360, Eagle and PyChar.

However, the group had quite a few experiences with inefficient meetings and throughout most of the project there was a consensus that more people were required. Although, an effort was made to implement a Scrum system using the Trello platform as well as a physical whiteboard, it did not work out in the end. Also, the integration of all the software subsystems got delayed, partly due to difficulties with both making and ordering a PCB.

Despite the difficulties with ordering a PCB and the inefficient meetings, most of the communication with suppliers and stakeholders worked smoothly. Lastly, even though not all goals were fulfilled, the project members felt that they made the right choices in prioritizing what would be the final deliverables.

3.1 Lessons learned

- To improve the time utilization, it would have been good to have a project manager who does little or no development.
- To improve the Scrum system, only one board should have been employed instead of using both a whiteboard and a digital Scrum board.
- To improve the meeting efficiency, a more formal meeting structure should have been employed.
- More flexibility when it comes to restating the goals. For instance, the goals should have been restated when it at one point was discovered that previous work would have to be redone.
- Write more detailed technical requirements that can help facilitate the task breakdown.

4 Summary of time and resource plans

The final versions of the time and resource plans can be seen in Figure 3 and 2. All tasks up until mid-november were dealt with in time. After that, a lot of tasks hade to be postponed and the order of some of the tasks had to be changed as well. This was mostly due to integration problems with the different software subsystems that had been developed. Something that was missing in the time plan that could have mitigated this issue was to set aside a few days for implementing the interprocess communication between software tasks, as this was the main reason for the integration problems.

Another reason for the delay was issues with ordering PCBs and broken PCB prototype machines. Unfortunately there was nothing in the risk analysis that reflected this specific issue, which could probably have been mitigated with some simple proactive measures like hand soldering prototype cards early on in the project.

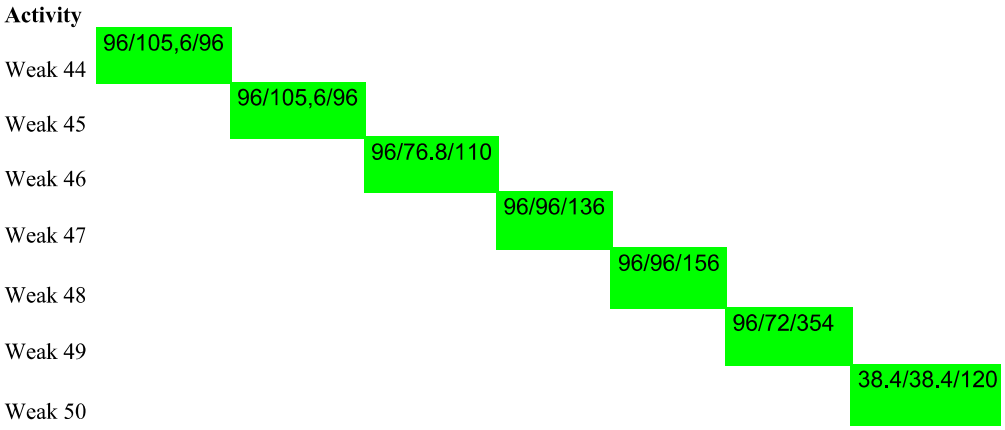
Note: Milestones that were never met are denoted by a red semicircle in Figure 2.

5 Final comments

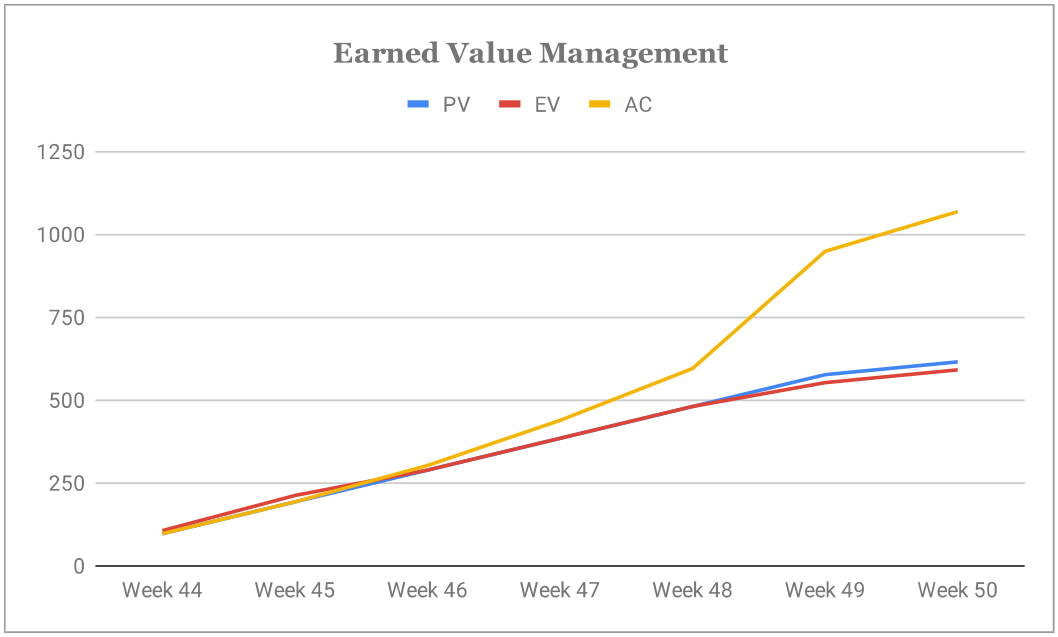
We in the group felt that we really made an effort to conduct the project in a professional and structured way. However, we also felt that with a project manager who also was a developer, this was very difficult. The project would really have benefitted from having one person with an overview of the status of all subsystems, so that resources can be delegated accordingly. Despite the shortcomings

of the project, we still feel that we have gained some valuable knowledge and experience, both in pure technical skills and within project management.

A EVM



	Week 44	Week 45	Week 46	Week 47	Week 48	Week 49	Week 50
Planned Value (PV)	96	96	96	96	96	96	38.4
Accumulated PV	96	192	288	384	480	576	614.4
Earned Value (EV)	105.6	105.6	76.8	96	96	72	38.4
Accumulated EV	105.6	211.2	288	384	480	552	590.4
Actual Cost (AC)	96	96	110	136	156	354	120
Accumulated AC	96	192	302	438	594	948	1068



B Time Plan

C Resource Plan

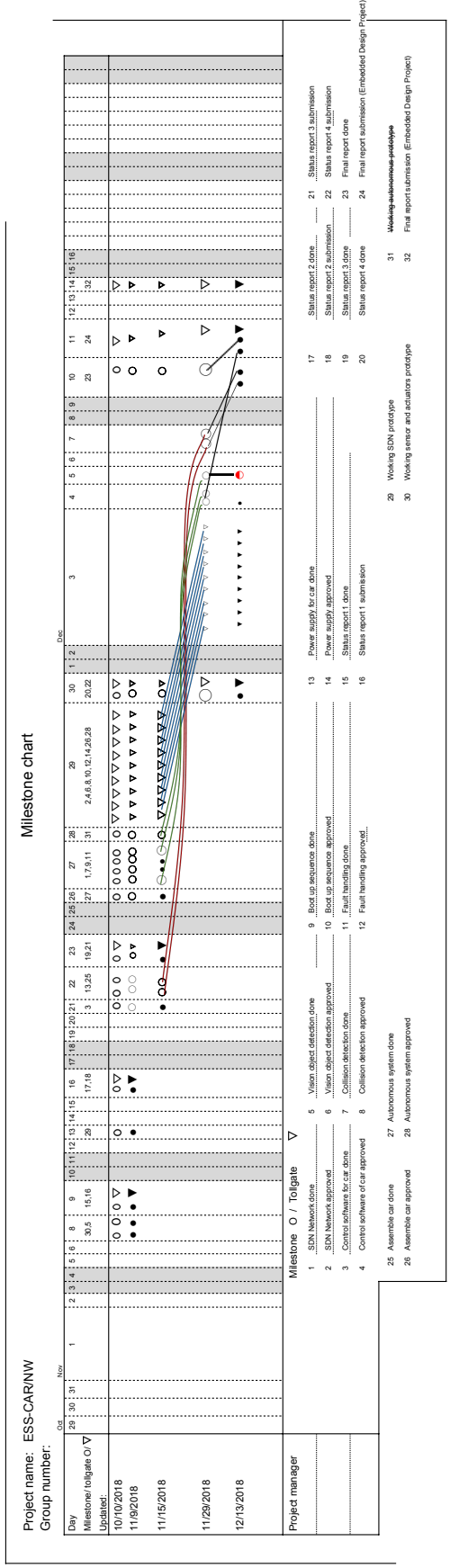


Figure 2: Time plan for the project.

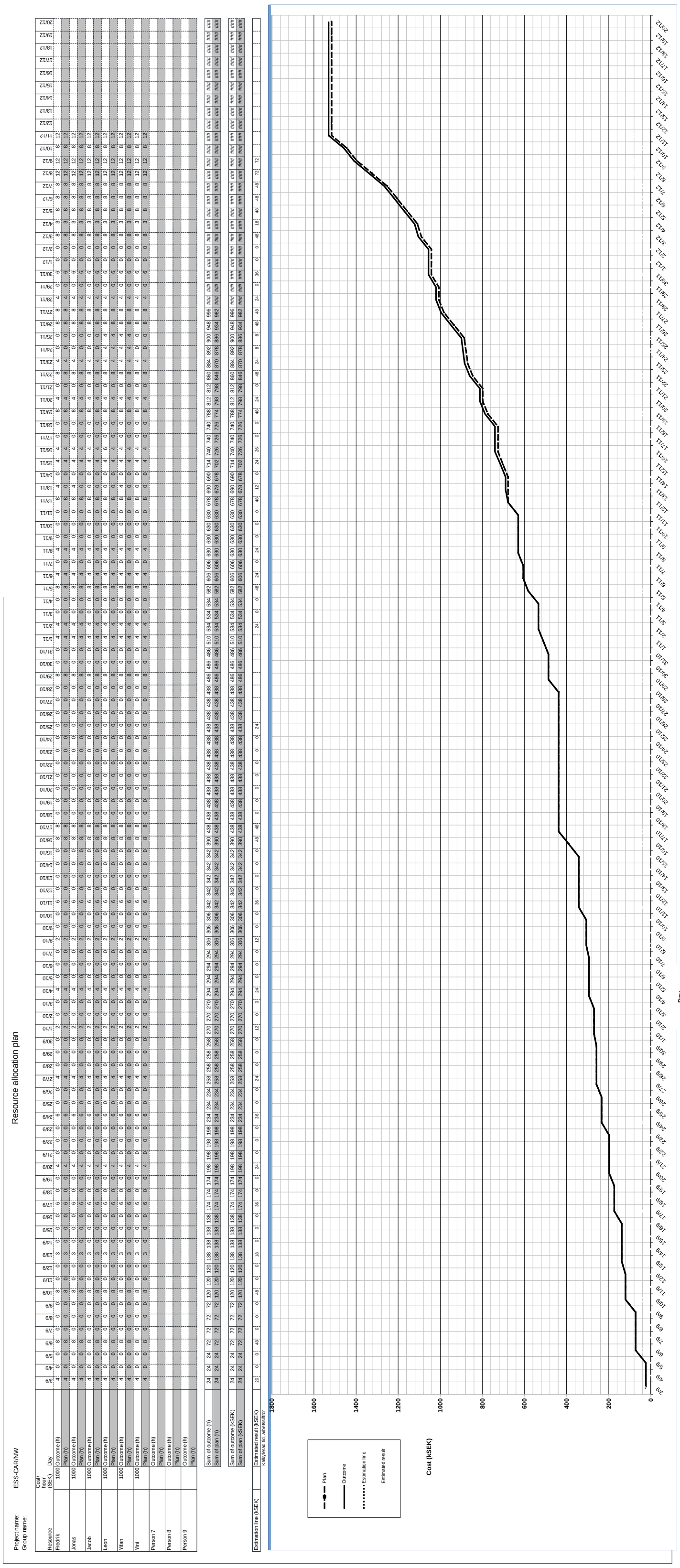


Figure 3: Resource plan for the project.