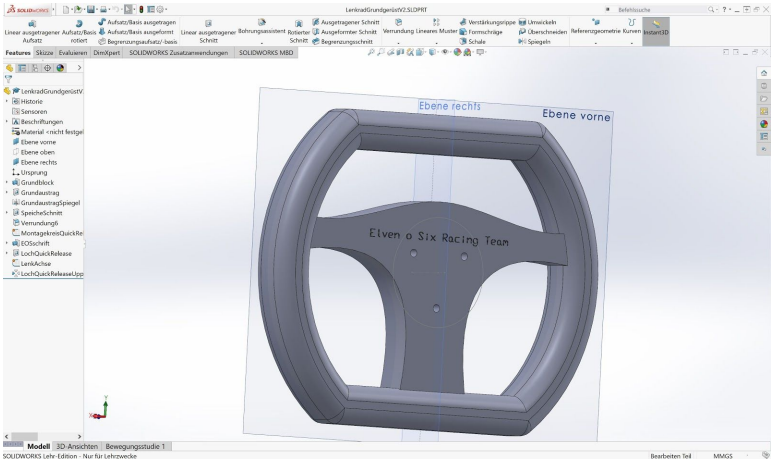
RUSH 18 Steering Wheel

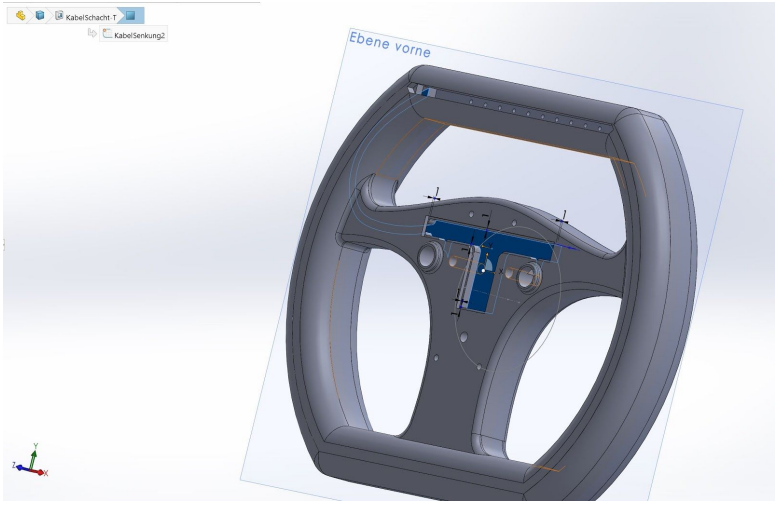
Intro

The steering wheel of the vehicle destined for usage in 2018 offered the potential to explore new technologies in a relatively small but nethertheless complex project and to be able to gather first hand experience and data regarding mechanical properties, handling and usability.
As my first CAD product I went through several stages of prototyping and constructing until the final product was finished and further expertise in programming and electronics could be gained.

CAD - Prototyping Phase

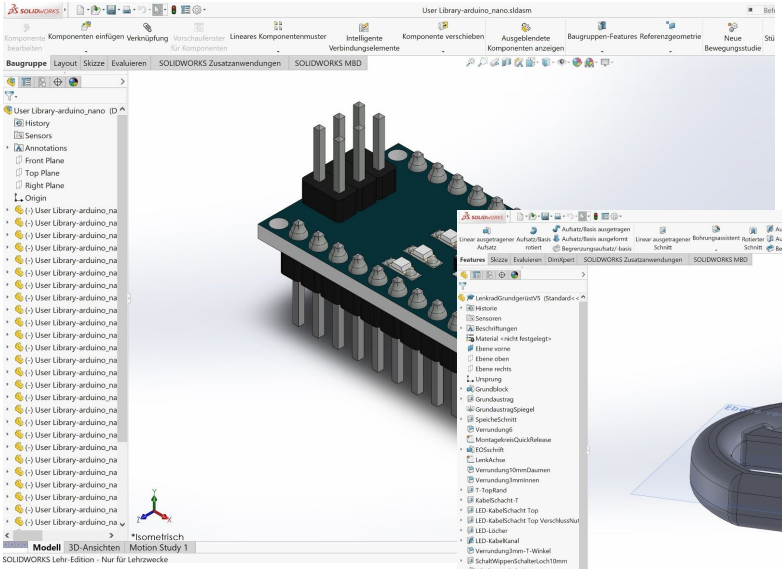
During construction a lot of problems were found and solved as well as mistakes that could have been avoided if there had been more experience previously.
The old carbon fiber steering wheel was used for general measures but had to be drastically redesigned due to bad ergonomics and a completely different approach for the production process. Since 3D - printing was the process of choice, due to its possibility to craft relatively fast and complex, the CAD model was designed for this as of the very beginning.



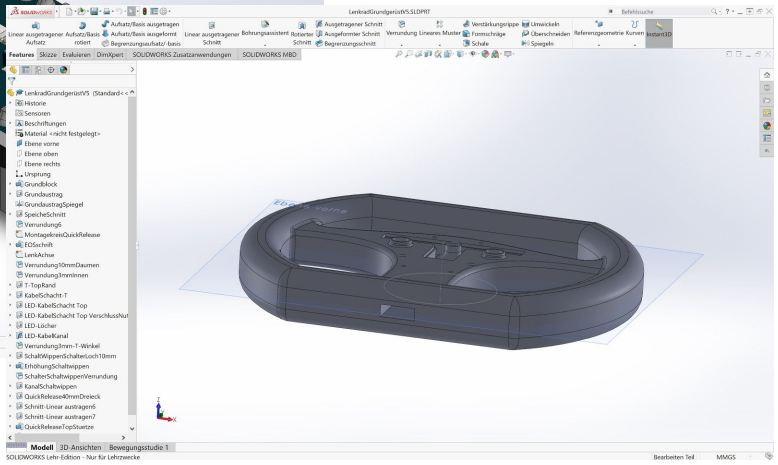


With the desire to have a rev-counter made of LEDs on the top facing the driver, electronics needed to find the necessary space, resulting in an otherwise impossible cable canal through the inside of the steering wheel, although the steering is a single piece. The picture clearly illustrates the space which was freed up for the LEDs and their cables.
An error occurred when adapting the mounting holes from the old Catia model to the new one seen to the left because the measurements were not the same as they were in reality, making it impossible to mount the

steering wheel onto the old car for test purposes. Although this was a setback within the project, the resulting print showed that the filling structure created in the printing process was more than enough to take the expected loads. This was adapted to the second print which is a lot lighter than the previous one while not showing any difference when taking the same load. Further the cable canal proved to be realizable and working thanks to the printer being able to print a water solvable support structure where needed.



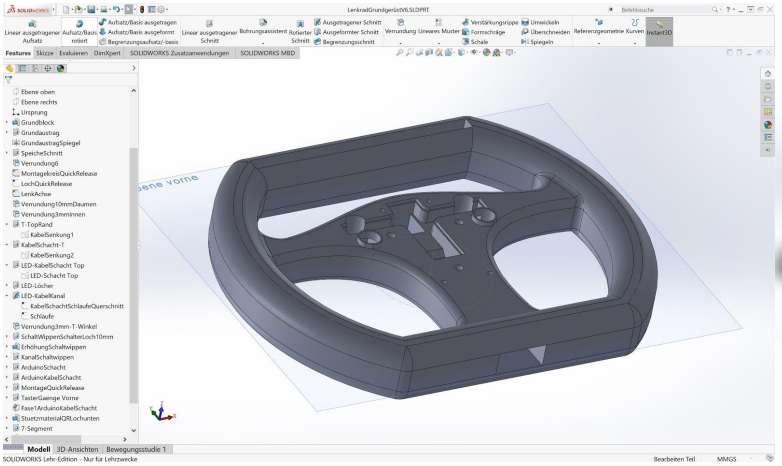
This ability came useful and was further implemented to make space for electronic chips such as the arduino nano.

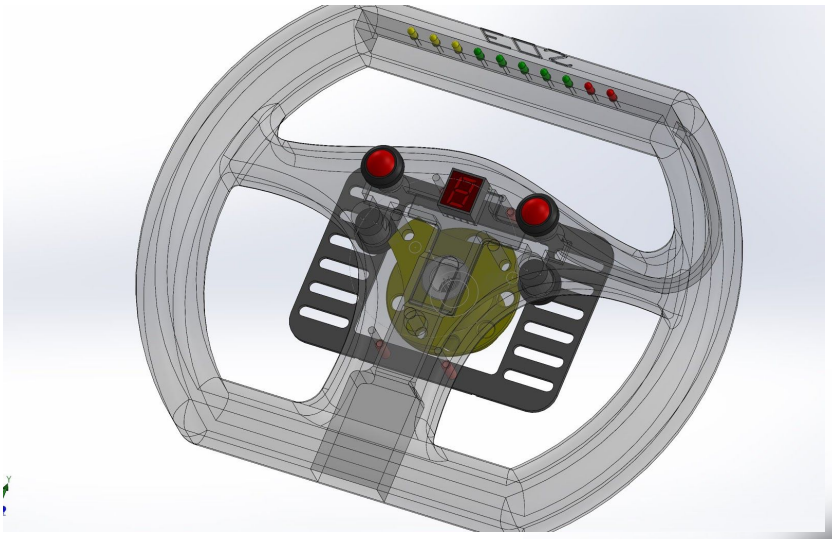


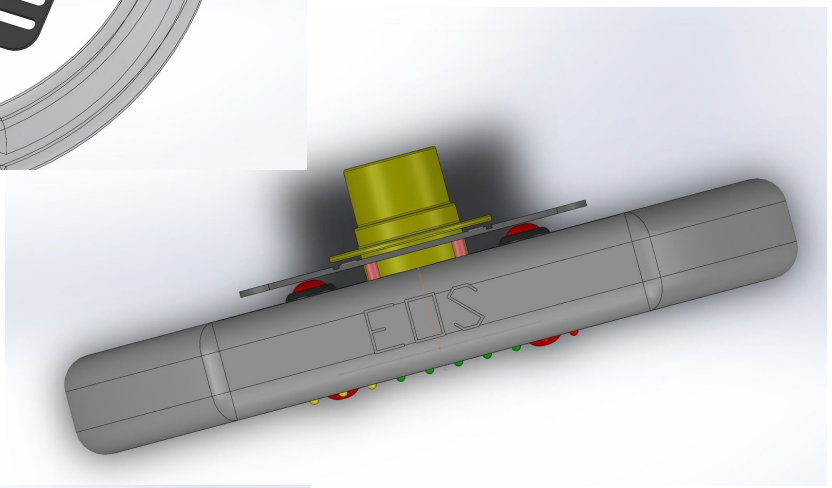
This storage space for the arduino can be found in the lower link making for the best possible placement for it and its cables.

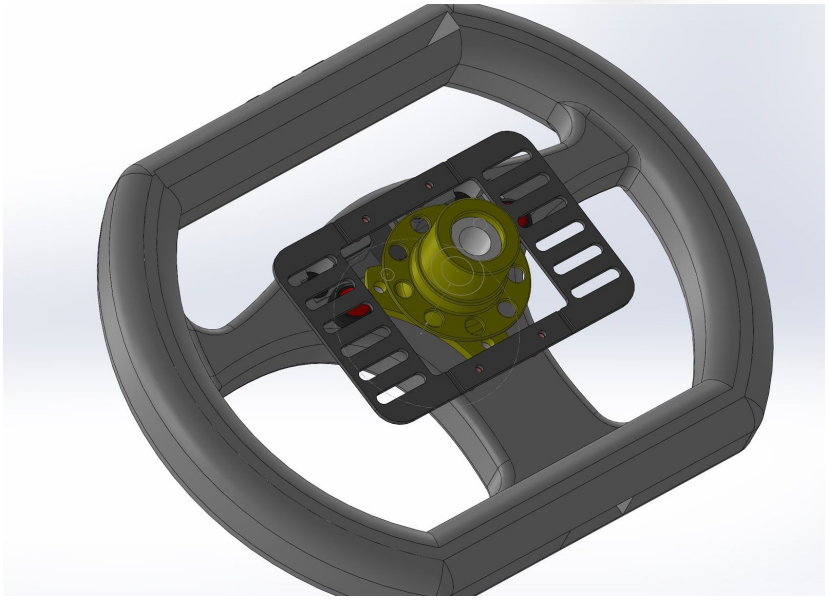
Version six is the closest to being production ready and finished. All electrical components are known or bought and therefore making precise fitments possible such as 12mm holes for the buttons for gear change. In addition a 7-segment display for displaying the current gear has been implemented. Also buttons for gear changes have been added on the front for ground usage or personal preference.

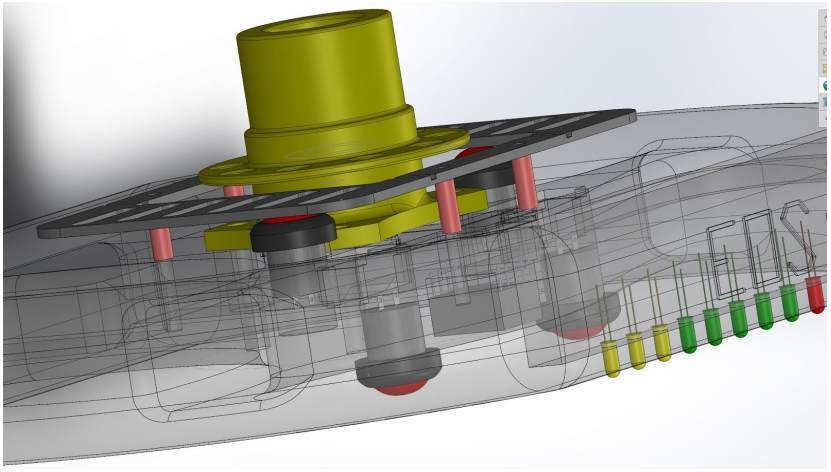
At last CAD enables construction prior to the actual assembly. Here spacings between several components could have been adjusted preventing that parts do not fit as originally thought.











Electronics

From the beginning several goals were established: The steering wheel was to have the possibility to change gears and show the engine speed. Later on wishes came that the current gear shall also be displayed.
The first arduino was soldered onto a board with a few LEDs and a two way button to demonstrate the gear change operation and simulate the whole electronic setup that was going to go into the steering wheel prior to the assembly. A simple program allows for storage of shift information such as up/down and a timestamp for further analysis as well as the control of each individual LED.
The engine management (Motec m800) is expected to output the engine speed through an amplitude varied signal which is easily interpreted by the arduino.