Description of the adopted solution
The adaptive racer includes two different parts, iterative learning control (ILC) and traction control. The base for both parts is to have a controller that follows the track. We have implemented a PID-controller since it’s a very good and widely used regulator in automatic control. For the racer to be able to follow the line we need a light sensor. When it comes to implementing the ILC solution, a choice of method and algorithm has to be considered. Properties that are important to take in consideration are for example that the system needs to be robust enough, early ILC iterations can introduce errors which the system needs to be able to handle. The ILC solution will handle any minor repetitive errors in the system identification over time. Another light sensor is needed to know when a new lap starts.
For the friction estimation our approach is to estimate the speed of the chassis and compare that with the speed on the wheels. If the speeds measured at the wheels are higher compared to the chassis speed we know that we got slip. Measuring when slip occurs will let us tweak the input to the system depending on traction. Two light sensors may be needed to be able to read all the lines on the inside of the track. An accelerometer is also considered for the speed estimation.

Completed and intended work
We have modelled the system and designed a PID-regulator. A first implementation of the ILC is also done. The chosen solution for the ILC is a parallel PD-type implementation. So far have we approximated each lap to be the same when using the ILC. The new printed track with dashed lines on the inside have shown promising results where we can see that we get more slip when driving without rubber on the tires. We think that it will be possible to set up a system where we can get a more precise result and be able to tell the racer how to change the input.
After our talk with Alexander today, we will make some changes. We have to find out what’s wrong in our PID-regulator, rebuild our racer since we have had the support wheel in the front.
Deadlines for intended work

- Localize problem with our PID-regulator: 6/12
- Rebuild our racer, so it has the support wheel at the back: 6/12
- Set up a simulation environment for the PID and ILC in Matlab: 6/12
- Get the new design of the system and racer to converge with our ILC implementation: 13/12
- Get more reliable results from the slip ratio by tuning our model to the track: 13/12
- Most part of the programming and tuning done: 20/12
- Some sort of results from both the ILC and traction control problem: 20/12
- Report and final result finished: 10/1
- Final presentation: 15/1
Work distribution

- **Mikael**: Traction control strategy and simulation
- **Lars-Gunnar**: Traction control strategy
- **Linus**: Programming, testing and tuning
- **Erik**: ILC implementation and tuning.