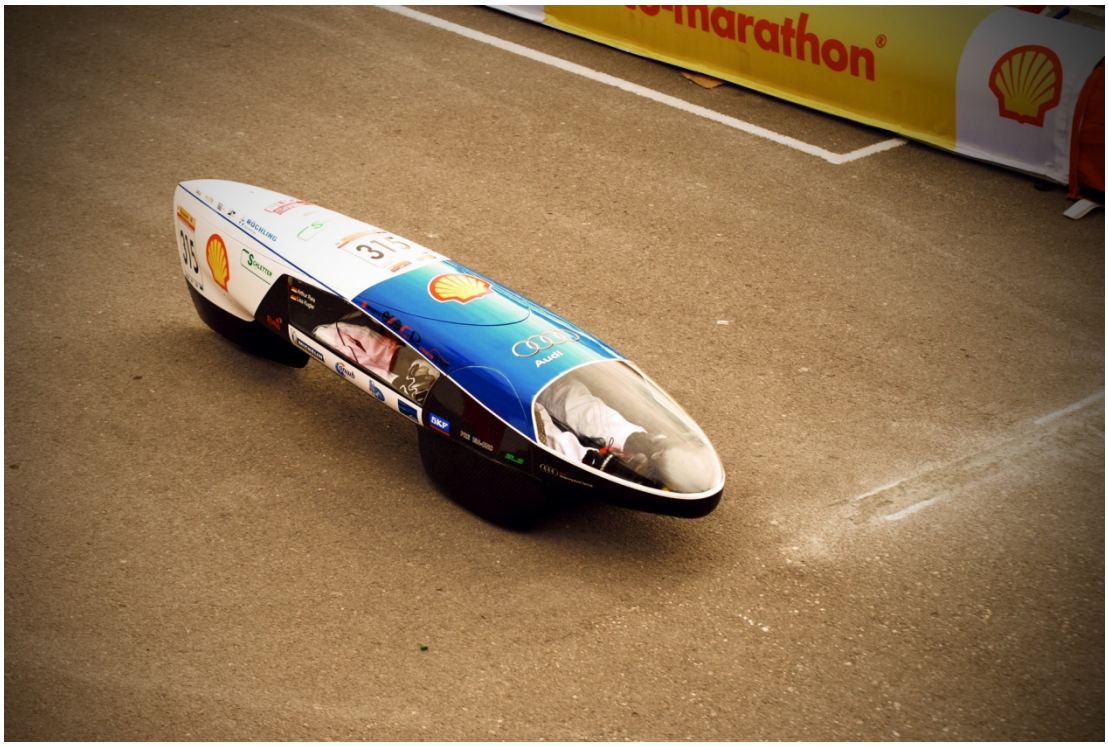
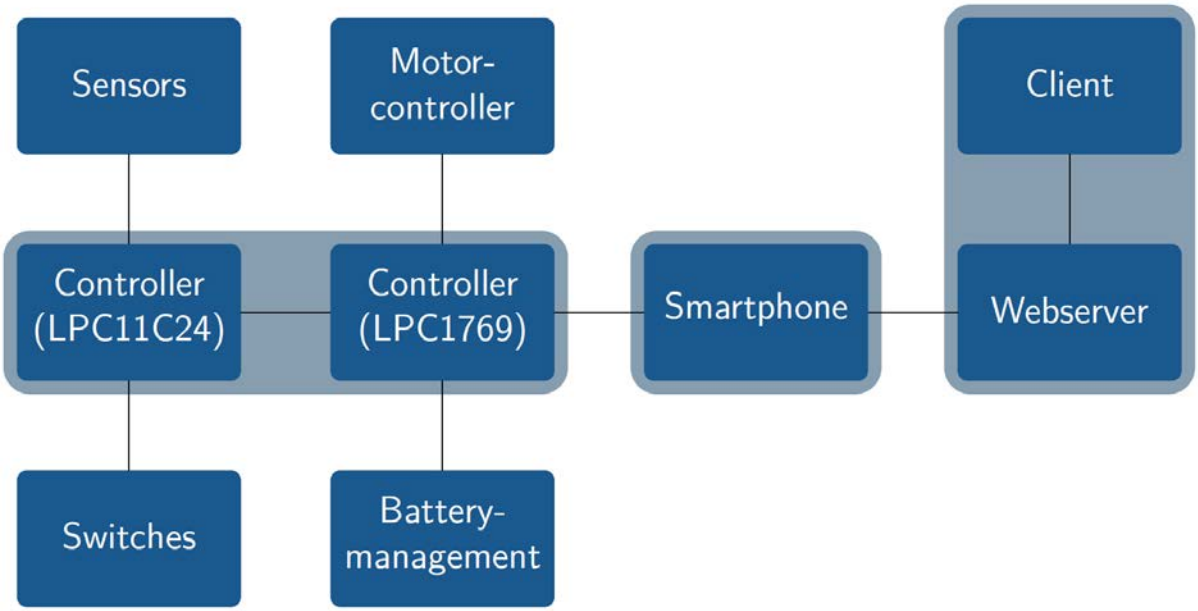
eLi12 V2.0

We are the TUfast Eco team, a team of students from the Technical University of Munich in Germany, and we are designing and developing a highly efficient car for the Shell Eco-marathon Europe. The eLi12 (figure below this text) is a highly efficient battery powered car. In the latest iteration of the Shell Eco-marathon we reached an energy consumption of only 570 km/kWh or a fuel-equivalent of 5100 km/l regular gas. More information about our team and our car can be found here (http://www.greatenergychallengeblog.com/2012/04/26/tufast-eco-with-innovation-to-victory/).



For next year's season we want to improve our car amongst other things with a new system for the power train.

The power train for Season 2013



This figure shows our car's main systems of the power train.

On the left side there are the two boards of the AOAA. The **LPC11C24** is connected to switches which start/stop/accelerate/decelerate the car and control the app on the smartphone. There are also some sensors attached to this device e.g. a current sensor measuring the current usage of the engine.

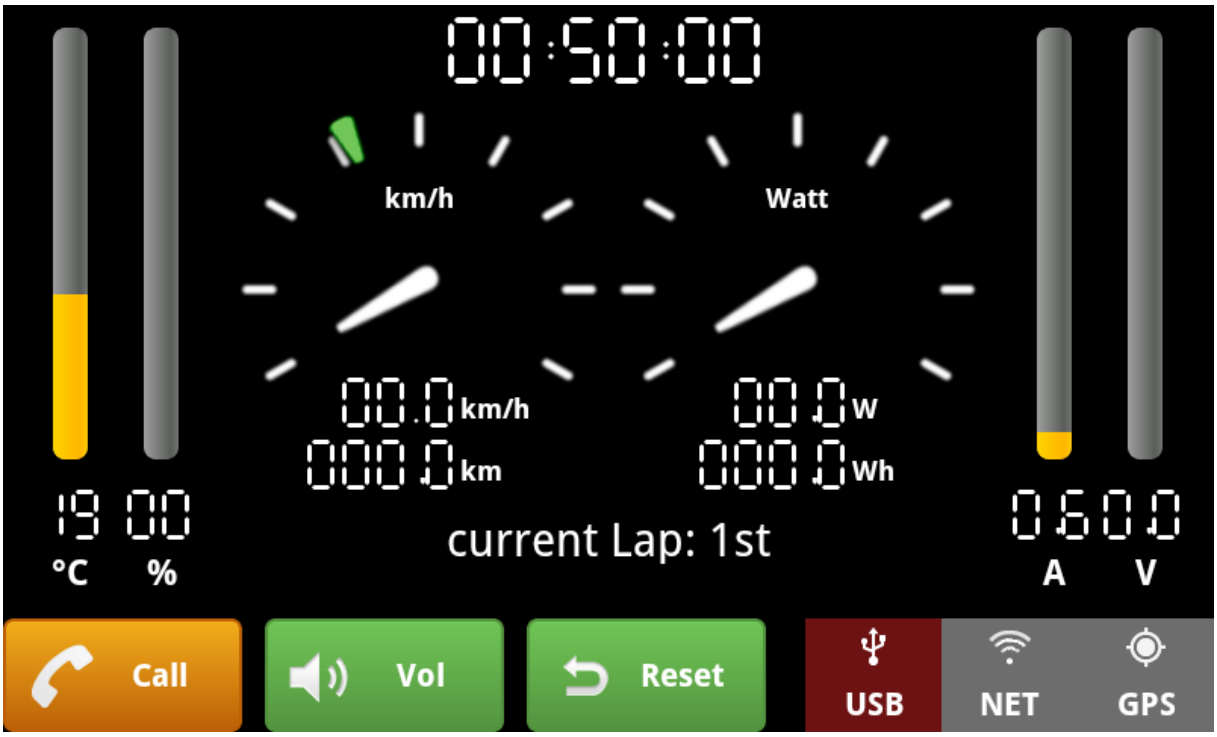
The **LPC1769** board is connected to the battery management system, the motor controller and the LPC11C24 controller via CAN bus. And it is also connected to a smartphone through USB.

The **smartphone** has several functions:

- The app is the instrument panel of the car showing data like speed, current usage of engine etc.
- The app logs the data it gets from the controller, collects gps data from its own sensor and sends them to a webserver.
- The smartphone enables the driver to call a mechanic during the race.

The **webserver** collects the data and can be accessed via **client** (a browser) showing its data.

The Android App



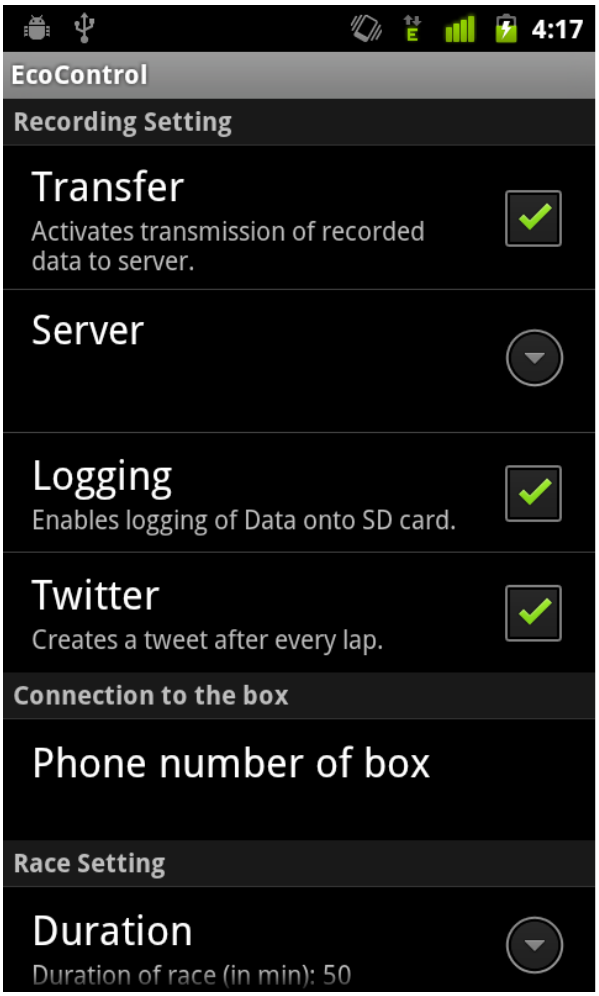
This figure shows the instrument panel view of the app.

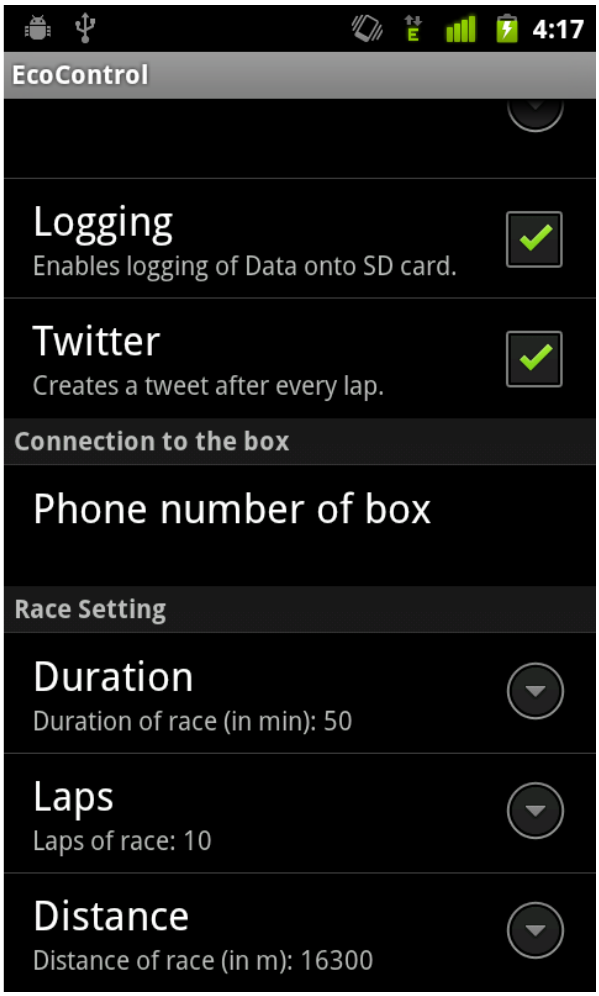
On the left side there are bars showing motor temperature and charging level of the battery. The bars on the right side show current and voltage.

Above of the two instruments in the middle there is a countdown for the race. And the instruments show speed and energy consumption.

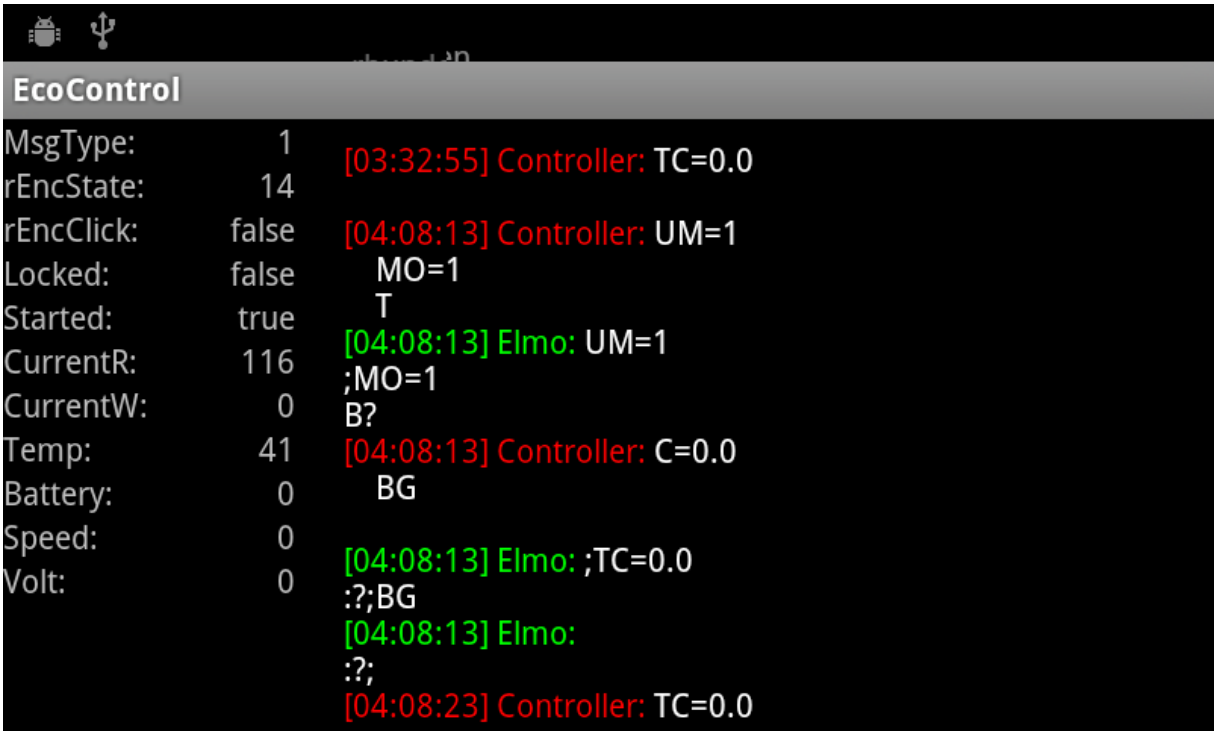
Below these instruments there are three buttons on the left, which can be accessed by the driver via the buttons connected to the LPC11C24. The three buttons on the right show the current connection status of the smartphone.

There are also some other views of the app the settings view:





And the debug view showing the communication between the controller and the motor controller:



Improvments to current system with Arduino ADK

Our current system has an Arduino Mega ADK as controller. The switches are attached directly to the board and due to long cables (1.5m) the signal quality can be poor in some cases. The battery management system is not attached to the controller so no information from the battery management (e. g. voltages of the cells cannot be read) is currently used. The motor controller is currently attached via RS232 interface.

We want to realize the following improvements with the AOAA:

- Improved signal quality from switches to the controller due to CAN bus
- Only a single reliable bus system for switches, battery management system and motor controller
- Higher sample rate from sensors and better filter options thanks to the higher compute power of the LPC1769 (compared to the ATMega2560)
- Reduction of weight (smaller battery) as the AOAA needs less energy