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AAUDI

As part of the project, a concept car was developed which worked as a platform for testing Electric Vehicle (EV) related components and technologies. A Audi A8 Quattro with a 4.2 litre gasoline engine was chosen for conversion (Fig. 1-3) due to its in-class characteristics: good aerodynamics, lightweight, overall compartment size, simple Vehicle Control Unit (VCU), comfort and styling.

Fig. 1: AAUDI Prototype

Research Goals

The primary research focus was on component level instead of vehicle level, aiming at the highest efficiency of the drive train, leaving aside other aspects of the vehicle performance, like aerodynamics and mass.

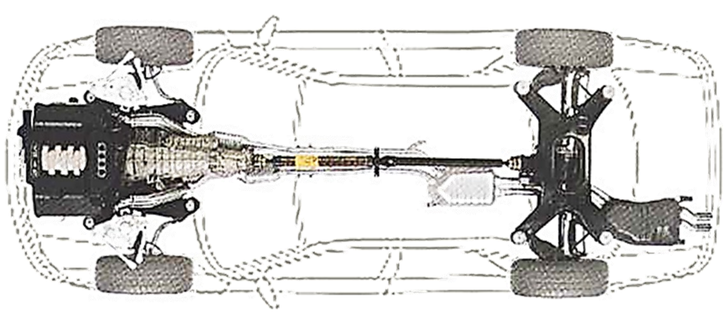


Fig. 2: Drive train before conversion

AAUDI layout

Two independent magnetic geared electric drives were built and mounted at the rear shaft, while a 38 kWh Li-Ion modular battery was built and installed in the former engine compartment. The associated power electronics and the 12V battery were placed in the trunk maximizing the space available for the battery pack in the front part (Fig. 2-3).

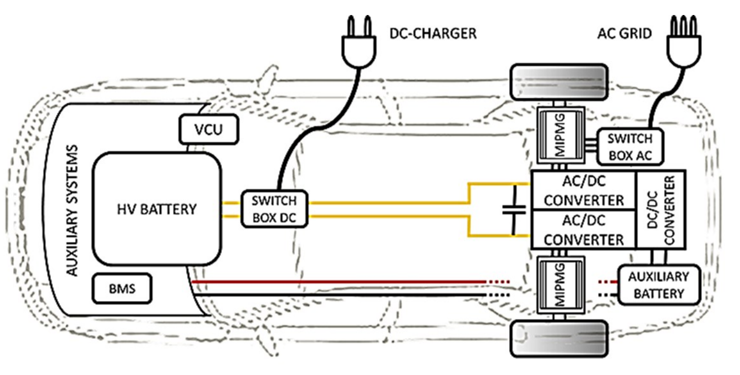


Fig. 3 Drive train after conversion

By placing the traction motors at the rear wheels, the mechanical complexity related with transmitting power to the steering wheels is avoided. Also a more uniform weight distribution and better weight transfer during acceleration are obtained. A gearbox and differential were not needed since each motor drives each wheel through an intermediate integrated magnetic gear assembly. Avoiding in-wheel motor configuration erased unsprung weight concerns and minimized changes in suspension and brakes.

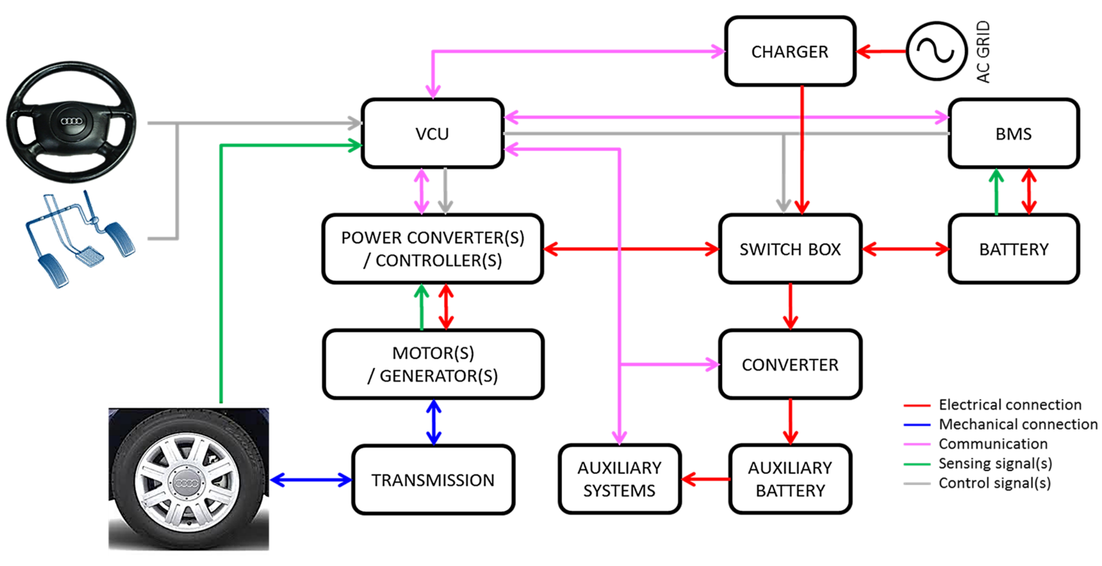


Fig. 4: Block diagram of the AAUDI

Results

A new high-efficiency drive system was developed and installed on-board, including the Li-Ion modular battery system, the electric machines plus magnetic gears and all the associated electronics: Motor Control Unit (MCU), Battery Management System (BMS), Vehicle Control Unit (VCU) and auxiliary DC/DC converter (Fig. 3-4). Uniform weight distribution (56%F/44%R) and slight increase of curb weight (1820kg→1840kg) were achieved after conversion. Field tests and rolling road tests were conducted proving a good performance of the test platform in terms of efficiency, reliability and handling.

Profile of kilometre per energy consumption vs. steady state speeds for a level road are shown in Fig. 5.

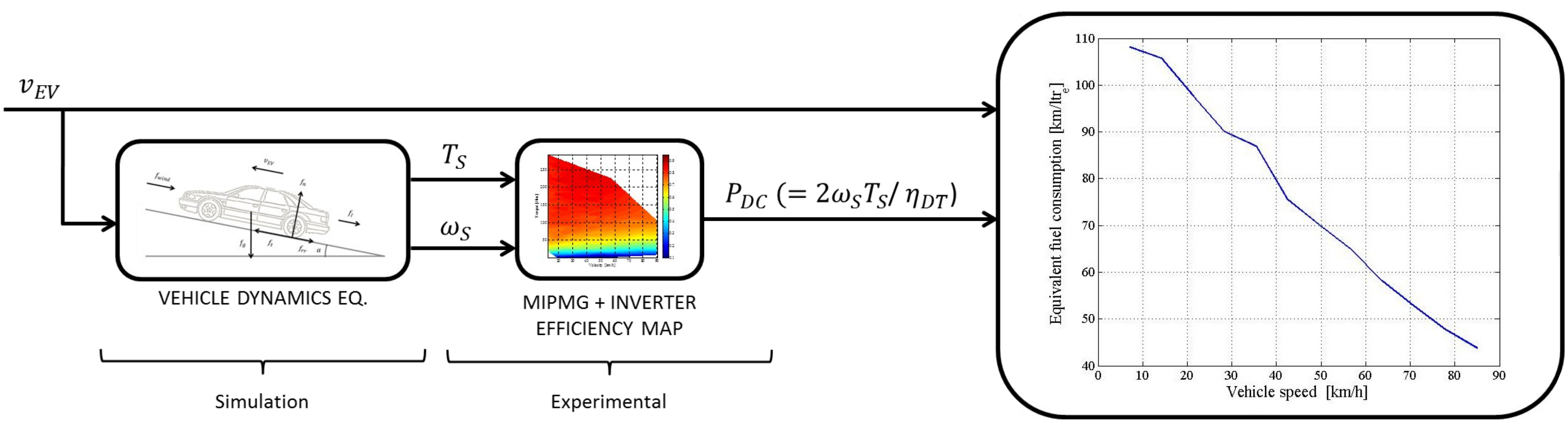
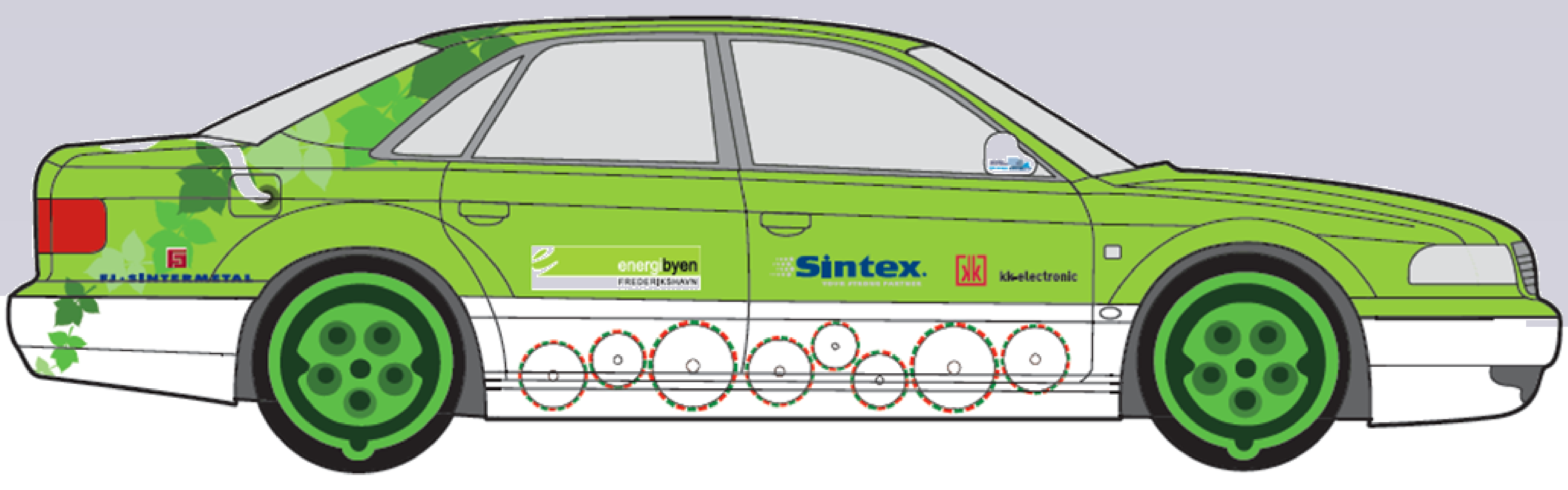


Fig. 5: Estimation of range per litter equivalent petrol consumption, based on a combination of simulations and experimental. re-

Outlook

Development of drive trains with higher efficiency will result in future electric vehicles with higher well-to-wheel efficiency and driving range, as well as lower heat generation, shorter charging times and lower emission of green house gasses.



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