HOW TO REACH US

Use the link **www.ivi.fraunhofer.de** to find a detailed description of how to get there.

For further information feel free to contact us.

Public Relations
Elke Sähn
Phone +49 351 4640-612 | presse@ivi.fraunhofer.de

Fraunhofer IVI

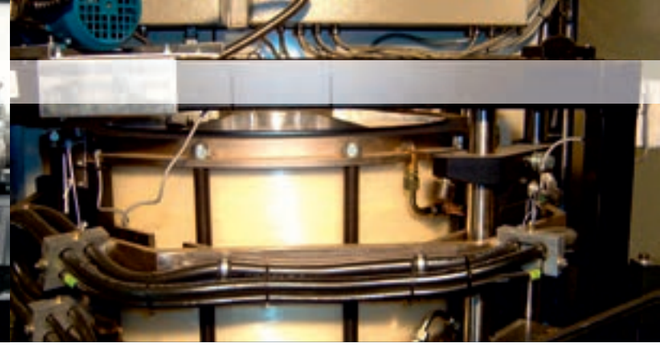
FRAUNHOFER INSTITUTE FOR TRANSPORTATION AND INFRASTRUCTURE SYSTEMS IVI

Fraunhofer Institute
for Transportation and Infrastructure Systems IVI
Director: Prof. Dr. Matthias Klingner
Zeunerstraße 38 | 01069 Dresden
Phone +49 351 4640-800 | www.ivi.fraunhofer.de

»AutoTram®« HIGHTECH DEMONSTRATOR

IDEA

COMPONENTS



The AutoTram® concept, developed by the Fraunhofer Institute for Transportation and Infrastructure Systems IVI in Dresden, demonstrates a future-oriented technology for public transport. As an intermediate public transport vehicle concept, it combines features of conventional buses (e.g. high flexibility, low infrastructure costs and moderate life cycle costs) with the advantages of trams like high transport capacity, driving comfort and the possibility of partial emission-free operation.

The first version of the AutoTram® was constructed in 2005 as a universal experimental platform for different technology developments. The fundamental structure features a series-hybrid vehicle, i.e. a serial connection of a combustion engine and a generator, power electronics and electric traction motors. This serial hybrid concept provides the possibility to integrate alternative energy storages in a simple manner via the intermediate electric circuit as backbone and is therefore an intermediate step towards a full electric drive train.

The development of a precise and flexible multi axle steering system, which is also used for utility vehicles, allows a high maneuverability: three independent steerable axles predestinate the AutoTram® for developing and testing new steering concepts. This includes tracking of a vehicle chain, i.e. with minimal tractrix, as well as fully automated driving based on differential-GPS and lane pattern recognition.

Due to its design, the AutoTram® is used as demonstrator for the electric mobility systems research project of the Fraunhofer society. Essential components of the hybrid drive, e.g. different traction-, energy storage- and energy converter systems, are developed in cooperation with the Fraunhofer institutes IISB, IML, IPK, ISC, IWM, IWS, LBF et al. and integrated into the vehicle afterwards.

The electric energy is generated by a fuel cell cluster or a diesel electric power pack. The modular energy storage concept is based on a Lithium-ion battery system, an electric double-layer capacitor module and a flywheel. Furthermore, fast charging at wayside charging stations can be demonstrated. This configuration of the energy storage devices in combination with an intelligent and predictive energy management system permits a full electric operation mode. Thus, an emission-free operation of up to 2 km is possible.

As a demonstrator in the field of utility vehicles, the AutoTram® can be used to evaluate different energy strategies. Exploiting the a-priori known information like repeating routes and elevation profiles usually given in local public transport in an optimizing energy management regime allows significant energy savings. Current research and development activities at the Fraunhofer IVI render clues and recommendations for designing and constructing future vehicle concepts.

Energy management
- Coordination and optimization of energy storage resources
- Low-loss control of power flux
- GPS based, route dependent usage of traction energy storage

Battery storage
- 300 Lithium-ion battery cells
- Observer based in-situ diagnostics of state of charge and state of health

Electric double-layer capacitor storage
- 55 electrical double-layer capacitor modules with high power density and high cycle stability
- Low-loss recuperation of regenerative braking energy
- Highly dynamic recharge ability

Fast charging device
- Contact system for galvanic high current transfer up to 1000 A
- Vehicle-sided collector and way-sided charging stations
- Large electric conductivity, low abrasion and minor tendency to form electric arcs

Fuel cells (2 x 80 kW)
- Hydrogen oxygen fuel cell system
- Hybrid cluster configuration to expand the life span

Flywheel mass storage (200 kW and 25000 rpm)
- Combination of generator and electric motor, capable for fast charging
- Storage of rotational energy, gimbal-mounted

Diesel electric generator unit (180 kW)
- Vehicle-sided primary source for energy
- Electrically controllable force coupling by means of magnetorheologic clutch

Compact power electronics
- DC/DC and DC/AC converters for adjusting different voltage levels

Lane tracking and multi axle steering
- Fail-proof GPS supported optical track detection
- Three independent steerable axles
- High precision multiple axles steer control