CALL 2010

Project profile

MotorBrain

Nanoelectronics for electric vehicle intelligent failsafe powertrain

The design and manufacture of a truly viable electric vehicle has represented a major challenge for the past several decades. Obtaining a reasonable distance per charge combined with performance to match that of a vehicle with an internal combustion engine has continued to elude the best brains in the automotive industry. The ENIAC JU project MotorBrain brings together the skills and experience of European leaders in the automotive component chain with the aim of making a breakthrough in this field. The consortium is made up of specialists in every facet of electric vehicle technology.

Sub Programme

- Nanoelectronics for automotive and transport

Road transportation accounts for 21% of fossil fuel consumption and 60% of all oil use. A move to hybrid and fully electric cars is crucial for energy saving and emissions reduction but demands the implementation of a full set of new technologies. Research into electric vehicles has already made significant progress in terms of marketable models and technical properties such as range and component efficiency. Nevertheless, the market share is far from satisfactory.

The ENIAC JU project MotorBrain addresses power and high voltage electronics systems beyond the current state of the art. Smart miniaturised systems including subsystems, systems layers and vehicle demonstrators will be derived and their interaction will embody the full supply chain of electric drives for electric vehicles.

MotorBrain will deal with the many well known issues concerning fully electric vehicles in high-volume automotive developments. Significant efforts will be put into safe, reliable and efficient power trains with lightweight motors and their optimal control. Moreover, new solutions are becoming attractive to overcome the shortage of resources such as the rare earth compounds required for permanent-magnet motors.

The safety factor

Conventional three-phase electric motors result in the loss of driving energy in the case of failure of a single phase or a component in the converter or the control units. Even systems with multiple drives can lead to steering and traction problems that affect the safety of the vehicle dramatically. To eliminate the potential for accidents that might endanger confidence in electrical mobility, fault-tolerant drive systems and control architectures need to be explored.

Significant progress has been made with the individual components of electric vehicles. To introduce this new technology to production vehicles, research needs to focus on the realistic integration of the subsystems. The necessary holistic approach for effi-

cient, secure and reliable systems will eventually allow for market penetration in high-volume manufacturing.

The variability in vehicle weight and range requirements makes the need for scalable drive-train concepts obvious. MotorBrain will enhance the energy efficiency of the drive-train through an integrated approach. Future electric cars need to remain functional and allow at least a safe exit from traffic even in the event of failure. Using cost-efficient, powerful multi-core processors, MotorBrain will pave the way for future scalable, configurable integrated drive-trains for electric vehicles.

Market breakthrough

MotorBrain expects to achieve three advantages over the state of the art in electric vehicle drive-trains:

1. Cost reduction by as much as 25%;
2. Increasing operating range by 15 to 20% through improved efficiency and weight reduction; and
3. Increased security due to a distributed drive-train and improved integration.

By increasing the energy efficiency, reliability and safety of electric vehicles, combined with significant cost reductions – such as through new integrated packaging approaches for the joint use of the motor cooling system for power electronics and new manufacturing processes for motors – and opening up of the standardisation potentials for different levels of control, MotorBrain will facilitate a market breakthrough for electromobility.

Individual areas to be addressed include:

- Improvements in efficiency and security by implementing a distributed power train enabling new functions based on a detailed understanding of the driving forces and the resulting requirements for the energy converter;
- Integration of energy storage for the drive unit to provide significant advantages over the current solution;
- New conversion topologies, such as direct power conversion or adaptation of the battery to the motor, reducing the number of active switching elements required and leading to a simplified design with increased robustness;
- Development of a practical solution for temperature control, in particular taking into account the limited temperature range of lithium-ion batteries; and
- Development of a 'smart' control system as well as of an intelligent drive-train communication network to improve further the operation of the drive and the effectiveness of the energy management.

Powerful consortium

This ENIAC JU project brings together some of the most powerful European companies and research institutes operating in the field of electric vehicles and components. The consortium provides an outstanding mix of expertise to rise to the challenge of the next generation of EV powertrains. With MotorBrain, a safe and efficient European electric vehicle seems to be one step closer.

Automotive and transport

Partners:

- All Green Vehicles
- Arcotronics Industries
- AVL LIST
- Brno University of Technology
- Centro Richerche Fiat
- Dresden University of Technology
- E3/DC
- Egston System electronics Eggenburg
- FH Joanneum University of Applied Sciences
- Green Power
- Höganäs
- IMT-Bucharest
- Infineon Technologies
- Infineon Technologies Austria
- Infineon Technologies Romania
- Institut mikroelektronickych aplikaci.
- Istituto P.M.
- NXP Semiconductors
- OFFIS Institute for Information Technology
- Österreichisches Forschungs und Prüfzentrum Arsenal
- Politecnico di Torino
- QinetiQ
- Robert SEUFFER
- Robox
- Siemens
- STMicroelectronics Italy
- University of Applied Sciences Amberg-Weiden
- University of Seville
- University of Sheffield
- Volkswagen
- ZF Friedrichshafen

Project co-ordinator:

- Reiner John, Infineon Technologies

Key project dates:

- Start: April 2011
- Finish: March 2014

Countries involved:

- Austria
- Czech Republic
- Germany
- Italy
- The Netherlands
- Romania
- Spain
- Sweden
- United Kingdom

Total budget:

- €36.6 million

Details correct at time of print but subject to possible change. Updates will be included in the project summary at the end of the project.

The ENIAC Joint Undertaking, set up in February 2008, co-ordinates European nanoelectronics research activities through competitive calls for proposals. It takes public-private partnerships to the next level, bringing together the ENIAC member states, the European Commission and AENEAS, the association of R&D actors in this field, to foster growth and reinforce sustainable European competitiveness.

ENIAC Joint Undertaking • Brussels • Belgium
Tel : +32 2 221 81 02 • email: eniac@eniac.europa.eu • website: www.eniac.eu