PROJECT

SUPERLIB

Smart Battery Control System based on a Charge-equalization Circuit for an advanced Dual-Cell Battery for Electric Vehicles

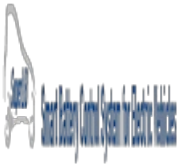
Funding: European (7th RTD Framework Programme)

Duration: May 2011 - Oct 2014

Status: Complete with results

Total project cost: €6,548,215

EU contribution: €4,005,872



Call for proposal: FP7-2011-ICT-GC

CORDIS RCN : 99492

Background & policy context:

The STREP project Smart Battery Control System based on a Charge-equalization Circuit for an advanced Dual-Cell Battery for Electric Vehicles (SuperLIB) addresses the objectives of the call ICT for fully electric vehicles, targeting the energy storage system. SuperLIB focuses on smart control system solutions for batteries. To enhance the overall performance, the battery consists of high-power and high-energy cells. This combination of two different types of cells together with a smart control strategy and a highly integrated package significantly improves the lifetime, the reliability and the cost/performance ratio of the battery system, by also adding the possibility of fast charging without degrading its lifetime. The control strategy is based on accurate model-based estimators, which are mandatory for precise monitoring of the battery state.

Objectives:

Development of a control system for a highly integrated battery with HP and HE cells inside a joint package which share cooling and charge-equalization circuit.

Extending the useable SOC range of the battery and thus increasing the driving range of the vehicle or reducing the size of the battery.

Smart control of the energy distribution within the battery by an advanced battery control system.

Extending the lifetime of the battery pack thanks to reduction of high-current pulses in the high-energy cell.

Cell integrated temperature sensors for precise battery state monitoring.

Reusability of the package in both passenger EVs and light duty HEVs.

Reduction of the complexity of control systems in order to improve reliability and reduce cost.

Methodology:

The electronic architecture required for the connection of the high-power and high-energy cells enables an efficient management of the current and charge distribution inside the package. The architecture will include electronic circuits for charge equalization and DC-DC converters utilizing advanced techniques of zero-current and zero-voltage switching for higher efficiencies and lower electromagnetic interferences. Safety and control system relevant temperature sensors will be developed for an improved thermal management of the package, thus a potential thermal runaway of a single battery cell can be avoided through early detection of local overheating. In addition this will increase the accuracy of the battery state estimation, which allows the utilization of a wide range of the battery

state-of-charge. Thus, the battery can be sized smaller and kept cheaper with still providing the required usable energy content and power performance.

Parent Programmes:

FP7-ICT - Information and Communication Technologies

Institute type: Public institution

Institute name: European Commission

Funding type: Public (EU)

Lead Organisation:

Avl List Gmbh

Address:
Hans-List-Platz
8020 Graz
Austria

Organisation Website:
http://www.avl.com

EU Contribution: €499,110

Partner Organisations:

Volvo Bus Corporation

Address:
Fästningsvägen 1
40508 Gothenburg
Sweden

Organisation Website:
http://www.volvo.com/bus/global/en-gb/home_new.htm

EU Contribution: €379,850

European Batteries Oy

Address:
Karapellontie 11
2610 Espoo
Finland

EU Contribution: €78,885

Robert Bosch Gmbh

Address:
Robert-Bosch Platz
70839 Gerlingen-Schillerhoehe
Germany

Organisation Website:
http://www.bosch.com

EU Contribution: €383,275

Centro Ricerche Fiat - Societa Consortile Per Azioni

Address:
Strada Torino, 50

10043 ORBASSANO (TO)
Italy

Organisation Website:
http://www.crf.it

EU Contribution: €377,700

Frauenhofer Geselschaft Zur Foerderung Der Angewandten Forschung E.v.

Address:
Hansastrasse 27C
80686 MUNCHEN
Germany

Organisation Website:
http://www.fhg.de

EU Contribution: €663,079

Vrije Universiteit Brussel

Address:
Pleinlaan
1050 Brussel
Belgium

Organisation Website:
http://www.vub.ac.be

EU Contribution: €499,000

K & S Gmbh Projektmanagement

Address:
Purweider Winkel 52
52070 Aachen
Germany

EU Contribution: €146,800

Ifp Energies Nouvelles

Address:
1et 4 avenue de Bois-Préau
92500 RUEIL MALMAISON
France

Organisation Website:
http://www.ifp.fr

EU Contribution: €648,023

Valeo Equipements Electriques Moteur Sas

Address:
2 Rue Andre Boulle
94000 Creteil
France

EU Contribution: €330,150

Technologies:

Electric vehicle batteries (and energy management)
Battery management system module

Development phase: Research/Invention

Key Results:

SuperLIB contributes to the expected impacts as listed in the ICT work program of the European Commission concerning Fully Electric Vehicles (FEV) by delivering the following results: The usable SoC range of the battery will be increased from less than 70% to more than 90%. Thus the cost, weight and size of the battery will be significantly reduced or the driving range can drastically be increased. By both measure the consumer’s confidence in the new technology will be improved. In parallel the life time of the battery will be increased by up to 30% since the different cells are used just at its best points. The HE cell will not be affected by high currents, the HP cell will have only small SoC swings. As a consequence the battery replace intervals become longer, warranty costs are reduced (lower cost and risk for car manufacturers) electric cars become cheaper and total-cost-of-ownership over lifetime is being reduced. Thus also the value for 2nd hand cars will be increased. Due to very accurate SoC and SoH calculation and the reduced number of parts the reliability of the battery systems will be significantly improved and will enable a wide use of these batteries for the mentioned applications. The cost for car manufacturers will be decreased and due to lower prices the acceptance by consumers will be increased. This will accelerate the market penetration of electric vehicles dramatically. Compared to conventional systems (e.g. combining a HP and HE device on pack level) the efficiency of the suggested solution is much higher since the losses are minimised by the charge equalization board. Also the overall weight is smaller. The high efficiency will also improve the environmental performance: less energy will be wasted and thus the CO2 emissions will be reduced. Even more, less raw materials will be required especially less expensive metals like Co, Cu and Ni. The global competitiveness is increased in all field of the value chain that is represented by the involved partners from components level to the vehicle. Particularly the involvement of European Batteries as a European cell/battery manufacturer has to be mentioned. Europe will play a significant and leading role in battery development. It will maintain its leadership position in automotive and all secondary industries that depend on automotive. With leading European industries in this field the production of parts and vehicles can be kept in Europe and the number of employees in all those industries will not only be secured but ideally increased

Documents:
M. Daowd

STRIA Roadmaps: Transport electrification

Transport mode: Road transport

Transport sectors: Passenger transport

Geo-spatial type: Other