E-VOLVE
EV for Life, Value, Efficiency

E-VOLVE Cluster Newsletter

May 2020

A full year of success!

The virtual E-VOLVE (Electric Vehicle Optimized for Life, Value and Efficiency) Cluster is realizing and monitoring synergies between six projects from the GV-01 Horizon 2020 call to execute joint dissemination, exploitation and standardization activities.

The Project Members

ACHILES, SELFIE, FITGEN, CEVOLVER, SYS2WHEEL and EVC1000 are the Founding members of the E-VOLVE Cluster.

They form the Executive Board, which plans and implements all the Cluster activity.

A new addition

2020 brought the first Cluster expansion: H2020 TELL Project

was welcomed in the Cluster and is now a proud member.

Interested in learning more about our Cluster members? Visit our website!

E-VOLVE NEWS

E-VOLVE PRESENTED AT EARPA Spring Meeting & GoMobility Exhibition

The new year started with E-VOLVE participating in two major events: EARPA Spring Meeting and GoMobility Poster session. The Cluster and Project members were presented, and fruitful discussions and networking was initiated.

PROJECT NEWS

EVC1000: Electric Vehicle Components for 1000km daily trips

The EVC1000 project (www.evc1000.eu) is a three years EU funded innovation action with the objective to increase electric vehicle efficiency, range and user acceptance by providing innovative and mass-production vehicle components resulting from the efficient integration of electric corner solutions. At the end of 2021, the EVC1000's resulting electric vehicle (EV) shall allow trips of up to 1000 km with no more than 90 minutes additional travel time, due to charging and with enhanced customer experience.

To this end EVC1000 will leverage on the in-wheel electric motor technology, because of its advantages in terms of active safety and drivability and because of its unique benefits of packaging and modularity that will significantly enhance flexibility and adaptability of future EV architectures.

The electric axle (e-axle) concept has been already delivered and details are available on the EVC1000 website. The e-axle integrates the latest ELAPHE in-wheel motor technology and the electric wheel dual drive (eWD²) provided by I&M. The eWD2 is based on wide band gap switches, perfectly matching the requirements of the proposed in-wheel motors. EVC1000 will

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develop new chassis components, namely innovative Brake by Wire and active suspension systems; integrated controllers designed to improve efficiency on long journeys, while ensuring relaxed, comfortable and safer driving.

EVC1000 will showcase the effectiveness of the integrated wheel-centric propulsion architecture and EV management in two second generations of Electric Vehicles – the Audi e-tron and JAC iEV6S.

The EVC1000 project, led by the Austrian company AVL List GmbH, receives a total funding of €5,15 million over 3 years. The consortium includes partners from six European countries: Audi Gesellschaft (DE), Jac Italy Design Center Srl (IT), Brembo S.p.A (IT), Elaphe Pogonske Technologije Doo - Elaphe Propulsion Technologies (SI), Ideas & Motion Srl (IT), Tenneco Automotive Europe Bvba (BE), Fraunhofer Institute for Electronic Nano Systems ENAS (DE), Technische Universitaet Ilmenau (DE), University of Surrey (UK).

Figure 1. e-axle concept

SELFIE: First Year Results

Throughout the 1st year (December 2018 – November 2019) the SELFIE partners focused on the requirements and specifications of the battery thermal management system, as well as on a first preliminary concept design on components and system level. The requirements and specifications at vehicle level have been identified in terms of vehicle performances (max power, max speed, etc.) and driving range, considering the target to remain inside an interval of 60min – 90min more concerning the driving time of an equivalent vehicle with an internal combustion engine for long duration trips of 700-1000 km. Starting from such vehicle requirements, detailed specifications for the battery system have been defined in terms of volume, weight, energy, charging rate, charging power (140 kW) and the lifetime of the pack. After this important milestone, the work could focus on the concept for the design at components and system level, for example, a multi-functional sandwich battery housing (Fig.1). An important part of the SELFIE project is the design and engineering of a battery housing which besides of mechanically supporting the battery cells provides heat storage, heating and cooling capability. It will mainly be made of a sandwich structure consisting of glass-fibre reinforced polymer face sheets and a polymer foam core. The battery cells will be arranged on PCM loaded aluminium foam plates to buffer the heat generated during fast charge cycles to avoid an energy-consuming high-power cooling system. Furthermore, cooling plates between the battery rows and in thermal contact with the aluminium foam/PCM plates will remove the heat from the battery pack.

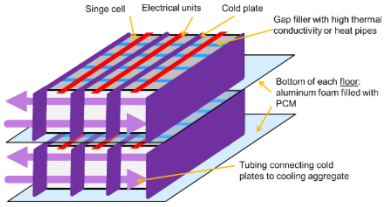

Figure 2 Battery housing structure

An ultra-compact cooling module and a cold storage device to optimize cabin comfort while fast charging was also designed.

Outlook on future activities:

The final design of the components of the battery system will be validated by simulation models in terms of functional performance, weight and volume. Furthermore, manufacturability and costs will be taken into account. Once the design is approved and the manufacturing technologies are selected, the manufacturing of prototypes and testing will start. In the meantime, the SELFIE partners are working on the development of an optimal thermal management system control strategy for the battery system. Once the models have been validated, an optimal control strategy for the thermal system will be identified and take into account a compromise between the thermal performance and the energy consumption for different use-cases.

TELL Project: Optimisation and large-scale manufacturing of low and medium voltage electric powertrain solutions

The TELL project addresses the optimisation and large-scale manufacturing of low and medium voltage electric powertrain solutions, with focus on high efficiency, compact packaging and low cost. Three main applications

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are targeted: i) Small-to-medium segment electric cars; ii) Hybrid electric cars with a low voltage add-on electric propulsion system; iii) The lightweight urban mobility sector, e.g., electric quadricycles.

The TELL powertrains will be demonstrated on two electric vehicle platforms: i) a four-wheel-drive (4WD) vehicle operated at a nominal voltage of 100 V by a Si MOSFET based inverter; and ii) a two-wheel-drive (2WD) vehicle operated at a nominal voltage of 48 V by an inverter based on GaN semiconductor technology.

Figure 3 First TELL vehicle prototype (4WD)

In the past months the TELL participants have achieved important goals together, assembling their first vehicle prototype. The 4WD vehicle, first of the two envisaged in the project, was tested successfully on the rolling road at the I-FEVS facilities and it even moved the first "steps" outside the workshop, for some preliminary performance tests as well for assessing the various sensors and a newly integrated vehicle control system architecture. The second (2WD) vehicle is already on its way.

The choice of a small consortium has revealed very manageable and effective to achieve TELL ambitious targets, with excellent results in the first project period. Some of the impressive technologies, such as part of the electric/electronic architecture were presented early this year at the renowned MOVE 2020 exhibition in London (UK).

For more information:

Visit our project web page: https://horizon2020-tell.eu/

Follow us on our LinkedIn page: www.linkedin.com/company/eu-project-tell

FITGEN at the technology development stage

During the last General Assembly held @BRUSA, the Fitgen consortium discussed the progress in the design of the e-axle complex. The targets and specifications of the final e-axle were completely defined in Autumn 2019, and the project is now at the technology development stage.

The design of the motor geometry and winding is in a good shape, together with the development of the six phases inverter based on the latest SiC power MOSFET technology.

The development of the transmission gear is also proceeding well, and different options for the advanced cooling system are under evaluation, as well as control strategy solutions. The project also includes the study of innovative on-board charger solutions, which are demonstrating promising results. Also, the activity for the D&C is ongoing and the Dissemination manager is working for organizing in October the first foreseen workshop, in cooperation with E-VOLVE Cluster and other H2020 projects in the same field of application. Several publications have been presented in scientific conferences worldwide and others are currently under review. Even if the project is facing the Covid-19 pandemic, the consortium has quickly learned how to cope with the new restrictions and pushing hard to make FITGEN a European success.

Figure 4 FITGEN GA in Senwald, @Brusa

One Year SYS2WHEEL: sustainable city logistics

In the first year of the project, one major achievement was the development of requirements covering the wide range of different electric powertrains. It's the basis for the next steps, especially the

basic simulation and tool development in Work Package 2, where development of controls and virtual validation of solutions is carried out.

A major challenge for the upcoming months is the development of the different powertrains and its components, thermal management, NVH investigations and advanced control fulfilling the different requirements for our 2 main approaches for electric driving in a fleet application (e-axle and in-wheel motor).

NEW TORQUE-VECTORING CONTROLLER: The University of Surrey will implement new torque-vectoring controller for the prototype SYS2WHEEL Fiat Tofas Doblo with front inwheel motors.

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State-of-the-art implicit nonlinear model predictive control technology is being developed and compared with conventional stability controllers from equivalent production vehicles, based on the actuation of the friction brakes.

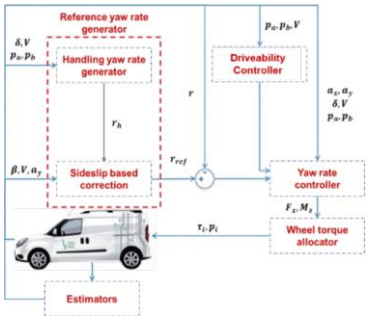

Figure 5 Simplified block diagram of the torque-vectoring control structure

CEVOLVER: Connectivity interface for simulation

Within the CEVOLVER project an important role is played by advanced strategies that operate testing the prototype demonstrators using connectivity as sources of real time information.

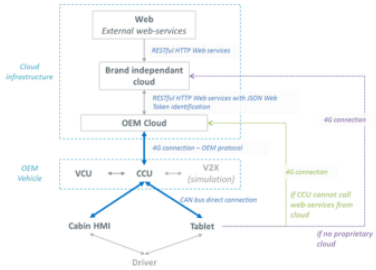

Figure 6 Connectivity architecture

The results of the discussions between the partners are available. In short we can say that the advanced features such as optimal thermal management, eco-routing with assured charging functionality, and eco-driving will rely on connectivity to improve, on one hand, the energy consumption (that will impact the vehicle range), and on the other hand, increase user confidence in electric vehicles.

The complete report can be found here. A simplified version of the connectivity architecture agreed on is sketched in the figure.

Setting the scene for a connected energy and thermal management concept

The CEVOLVER scene for a connected energy and thermal management has been set! The connected management functionalities make use of several connectivity features to optimise the route selection, driving behavior, charging stops and charging process. This is made possible due to the cloud-based data and the cloud computing capabilities to perform resource intensive calculations that cannot be otherwise implemented on a Vehicle Control Unit (VCU). The main activities on this part of the project included specifying brand-independent interfaces for Electric Vehicle (EV) components, system and cloud. Including specifying connectivity requirements for simulation supported testing, read more

ACHILES: Halfway there!

After one year and a half since the ACHILES project started (December 2018), the full requirements and specifications for the Battery Electric Vehicle (BEV) have been defined; focus has been given to the powertrain and chassis with support of the brake system by the powertrain. The requirements are based on the Audi Q2 BEV, which will be used as a baseline to be improved through the project.

The overall architecture for this next generation EV has been optimized to include various subsystems, mainly the brake, powertrain and chassis. Subsystems are being finalized to allow higher reliability, safety, security and energy efficiency with proper signal interfaces. The models and control strategies adaptations to integrate the innovative technological concepts – for a new wheel concept design, a centralized computer platform, an out of phase control and a new torque vectoring algorithm – have been thoroughly discussed within the consortium and have been delivered.

Figure 7 AUDI Q2 BEV demo vehicle on which the ACHILES concept will be tested and verified

Finally, important design and development steps have been taken towards the implementation of the new wheel concept and brake system within the chassis and powertrain. The integration phase will then follow with the Audi Q2 BEV being dispatched to the project partners.

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Exciting News!

E-VOLVE Cluster has more exciting news coming up!

Great efforts will now bear fruit: 2020 will be a year of surprises, networking and exploitation! Connect with us and stay tuned!

Email: evolvecluster.h2020@gmail.com

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