

Real time Autonomy Calculation and Route Optimization for Electric Vehicle Fleets.

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INTRODUCTION

Transport and Logistics Research Group (GITEL) collaborates in the investigation with the Spanish electric car company Zytel Automotive S.L. (ZYTEL). Their main objective is, through the use of advanced design and analysis tools, to carry out simulations of different configurations integrated within a vehicle design, to analyze its behavior in different real scenarios, and to make proposals about final prototype designs.

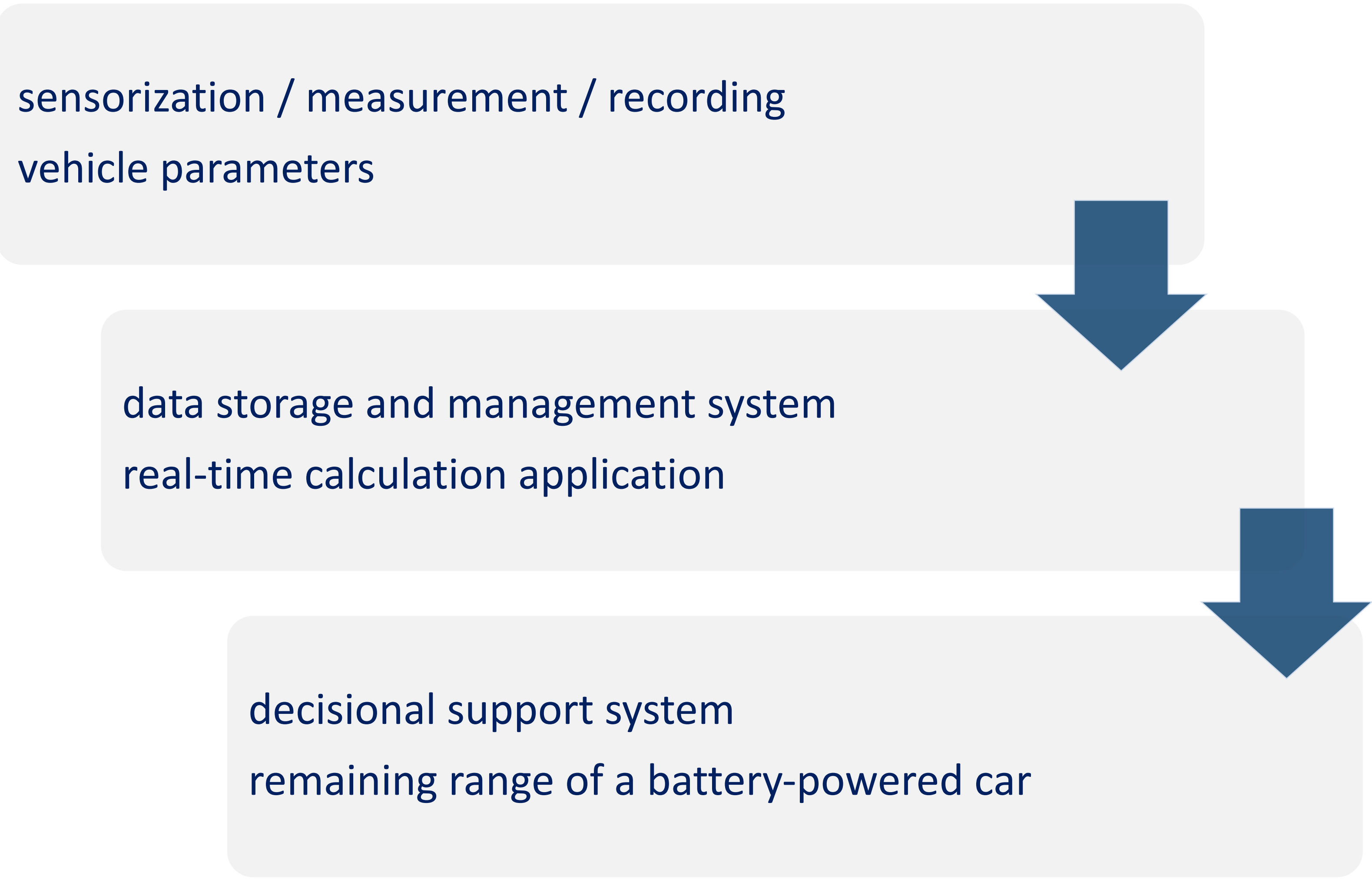
ZYTEL, as part of the development and production process of its electric vehicle models, decides to collaborate with GITEL to investigate different configurations that allow optimizing the behavior and performance of the vehicle's systems, as well as to discuss possible improvements or changes in its architecture. The use of advanced vehicle software allows a vehicle analysis to be carried out more quickly and effectively in obtaining results and reducing the costs incurred in tests with real prototypes.

SYSTEM DESIGN

This system allows, based on the measurement and recording of different parameters, the calculation by means of a computer application of estimated autonomy foreseen for a determined route, at real time.

The system allows have sufficient information to help decision-making when forecasting the remaining range of an electric vehicle powered by batteries.

STAGES OF OPERATION



app FUNCTIONALITY

Computer application to help decision-making, calculates the autonomy of an electric vehicle for urban freight distribution based on real time data.

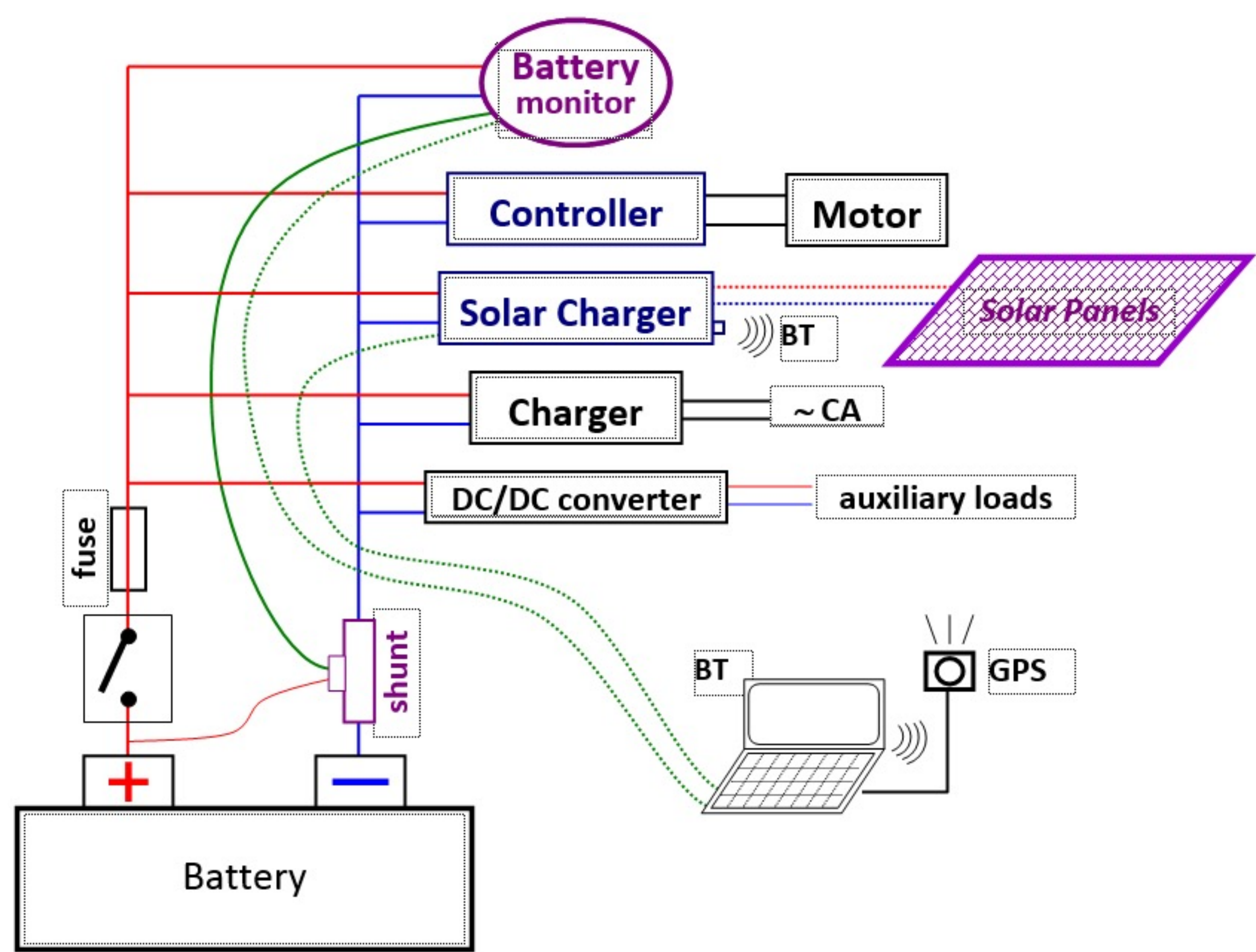
Calculates the expected energy consumption for each delivery route and determines feasible alternatives that do not put delivery operations at risk due to lack of autonomy.

app feeds on:

- data from battery management system (BMS)
- data from geo-location system (GIS)
- energy contribution from photovoltaic solar panel (PV)
- data from current values of vehicle parameters (EBS)

app integrate recorded data in real time
app calculates energy consumption for all the viable alternatives
app inform about viable alternatives based on the stored energy, and the expected consumption on the remaining routes.

DATA ACQUISITION SCHEME



TEAMWORK with ZYTEL

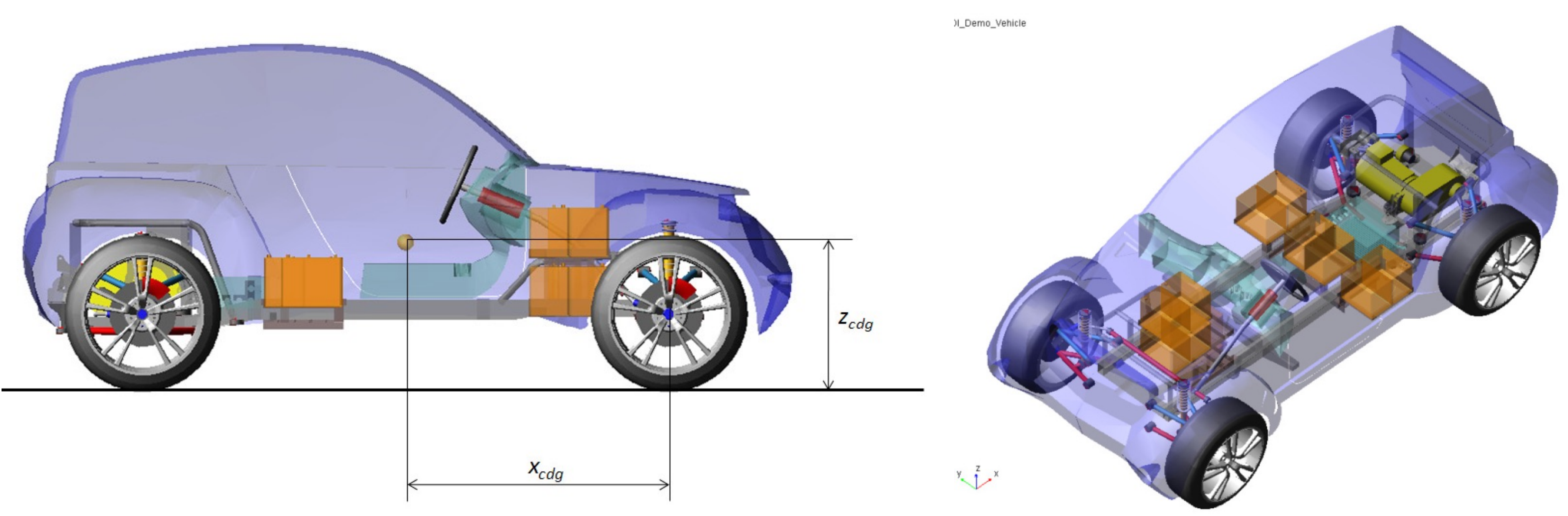
By collaborating with the company ZYTEL, it has been possible to work directly with prototypes of electric vehicles, which has allowed validating the computationally analyzed models that are subsequently tested.



OBJETIVES

1. Modeling and simulation of electric vehicles, which allows the optimization of the component systems through close-to-reality analysis.
2. Analysis of virtual test scenarios of road and urban routes, which contain all the real conditions, and which serves as a platform for the simulation of the vehicle models created, and which allows preparing the real tests of the prototype.
3. Study the behavior of the vehicle on each route and extract some simulation results about the most influential design parameters.
4. Suggest modifications and possible changes in the model that improve the vehicle's performance and validate the result in the simulation for its possible implementation and testing in real conditions.
5. Propose design modifications to the vehicles, use the vehicle, and carry out the actual tests to collect the test results.

MODEL OPTIMIZATION

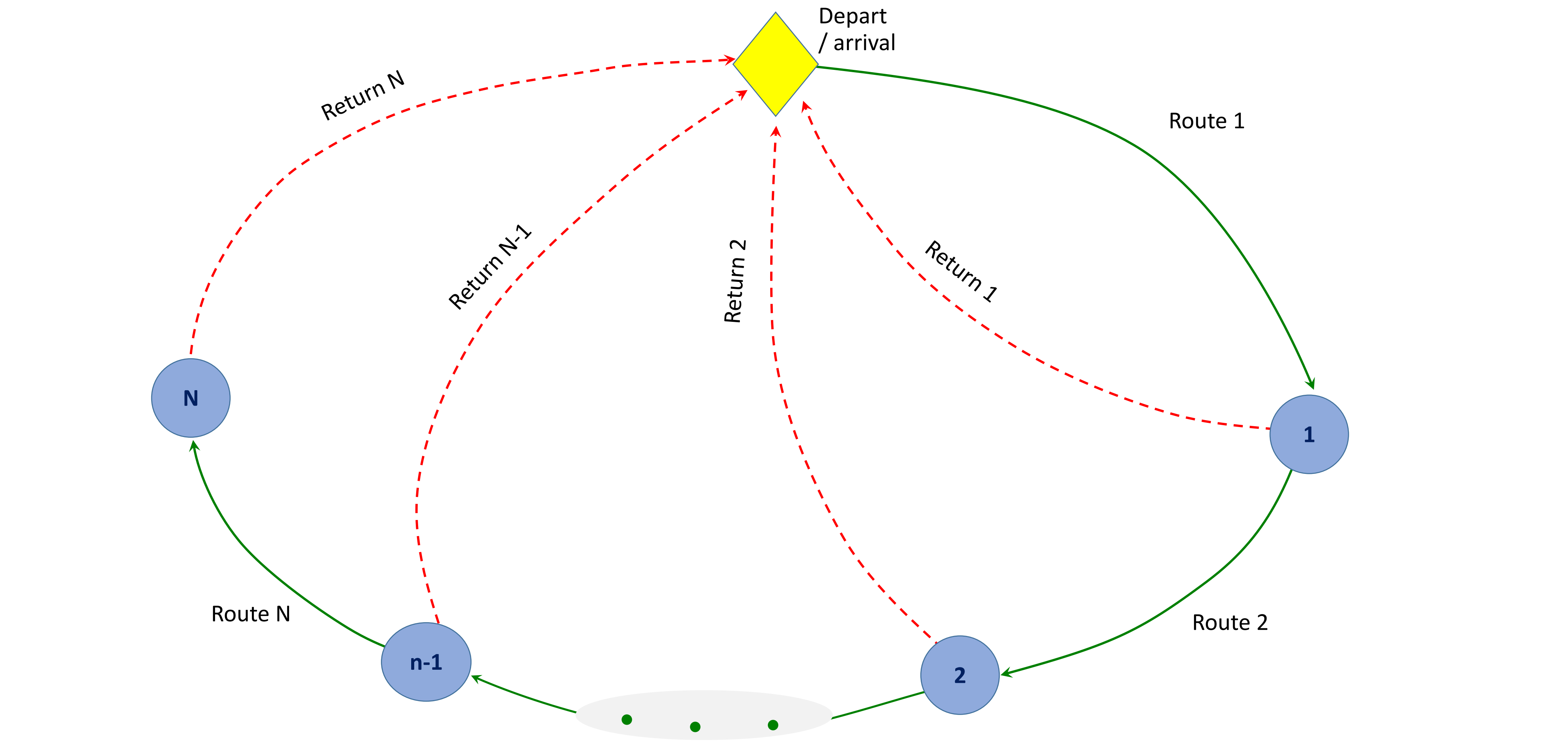


TEST SCENARIOS. ROUTE MODELING

In the research, road and urban driving are considered, where the energy consumption of the vehicle is affected by the characteristics of the vehicle regarding the load transported, the path followed in terms of the distance traveled and the slope to be overcome, the conditions of the rolling, velocity during the operation, road signs and the presence of other vehicles.

The conditions for carrying out the distribution operation have a great impact on the planning of the distribution routes. An adequate organization of the routes together with a correct selection of the type of vehicle, also requires a very precise knowledge of the amount of energy available, and a tool that allows to calculate precisely the viability of the successful completion of a delivery operation. , avoiding being stopped due to battery depletion.

ROUTE PLANNING



ROUTE DECISION

CONCLUSIONS

- app was fully programmed, results obtained allow us to reach positive conclusions.
- experimental tests were carried out with a prototype of urban goods delivery vehicle on a real route.
- after calibration of the sensors, the application was tested for a real case.
- measurements were taken in real time to evaluate app reliability in terms of autonomy estimation.

The implemented system calculates and estimates the autonomy of an electric vehicle for urban freight distribution operations in an efficient manner, by means an autonomy control in real time, avoiding to conclude a distribution operation inefficiently by interrupting the service due to battery depletion.