

E – DRIVETOUR

Beyond the Border of Electric Vehicles: an Advanced Interactive Course

D4.3 e-Learning Platform Deployment

Version number: 1.0
Dissemination Level: CO
Lead Partner: UTHR
Due date: 30/09/2022
Type of deliverable: RE
STATUS: FINAL

Copyright © 2022 EDRIVETOUR Project



Co-funded by the
Erasmus+ Programme
of the European Union

This project has received funding from the European Union's Erasmus+ Programme: Knowledge Alliances call under grant agreement No 612522



Published in the framework of:

EDRIVETOUR – beyond the border of Electric Vehicles: an Advanced Interactive Course

EDRIVETOUR website: www.edrivetour.eu

Authors:

Krzysztof Górski (UTHR), Iwona Komorska (UTHR)

Revision and history chart:

VERSION	DATE	EDITORS	COMMENT
V 0.1	01/09/21	UTHR	1st version
V 0.2	31/03/22	UTHR	2nd version
V 1.0	30/09/22	UTHR	Final version of deliverable

Disclaimer:

The information and views set out in this document are those of the authors and do not necessarily reflect the official opinion of the European Union. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.



Table of content

1	Introduction.....	4
2	The general structure of the deployed platform.....	4



1 Introduction

The e-Learning platform that was developed according to the DoW contains several critical functions that made feasible the successful execution of the course. The results of its deployment are summarized here.

All 24 courses, including the intermediate projects functional categories to be exploited using the e-Learning Platform and its functionalities, have their own space in the platform. Courses, projects and data collected are categorized according to functionality type and given elements. Also, specific space is devoted to the Mobility Periods, thus providing useful information for the participants.

2 The general structure of the deployed platform

The EDRIVETOUR platform (<https://edrivetour.ea.consulting>) can be seen as an ensample of 22 courses and 2 special projects (intermediate project 1 and 2) that are visualized and accessed through the "Site home". Each of the special project entries are organized into two parts to directly associate the activities and data according to the teaching period (1st Teaching period, TS1 and 2nd Teaching period, TS2). In addition to the above, the student mobility periods were supported by including an extra element. Detailed presentations of the overall collection of course elements is presented in the following figures.

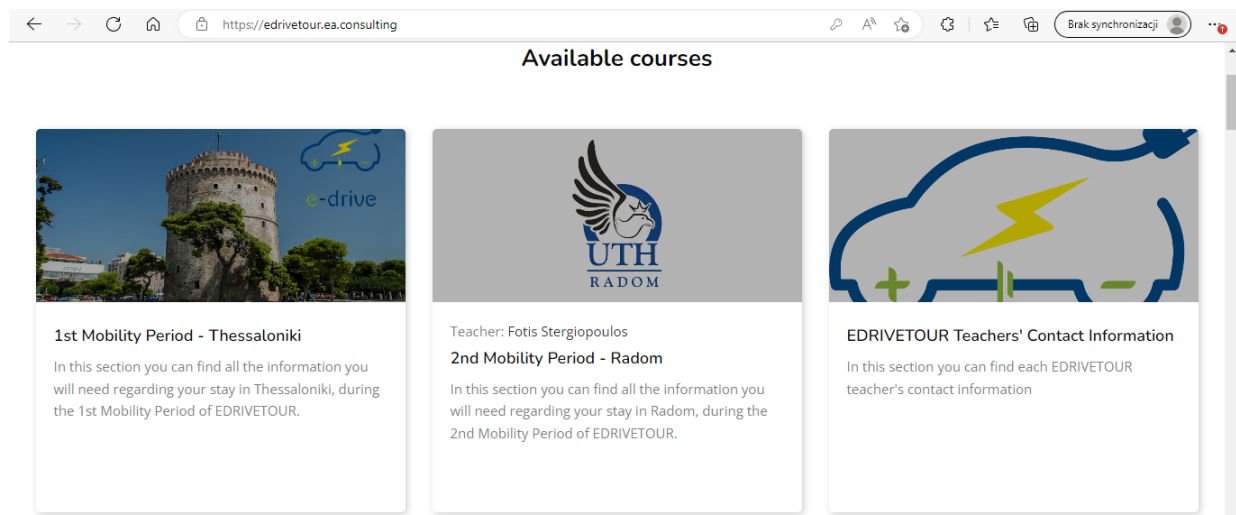


Figure 1. List of items presented as "courses" at the "Site home" – Teaching mobility periods and teacher's contact information.



D4.3 e-Learning Platform Deployment



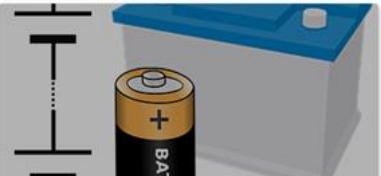
 <p>Teacher: Theodoros Kosmanis</p> <p>TS1.1 Introduction to Vehicle Electrification</p> <p>Teaching hours: 3 (Lectures: 3h, Lab: -)</p> <p>Working effort: 0.2 ECTS</p> <p>This course is an introduction to Vehicle Electrification, covering general information about architectures of all possible vehicles with electric powertrain such as the Battery Electric Vehicles (BEVs), Hybrid Electric Vehicles (HEVs), Fuel Cell Electric Vehicles (FCEVs), Solar Cell Electric Vehicles etc. The course explains the functionality of EVs, including the basics on energy storage as well as the technologies applied for charging them, the various cases of propulsion system and basic accessories.</p> <p>Read more</p>	 <p>Teacher: George Katranas Teacher: Panagiotis Maroulas Teacher: Dimitrios Tziourtzioumis</p> <p>TS1.2 NI LabVIEW Training</p> <p>Teaching hours: 22 (Lectures: 6h, Lab: 16h)</p> <p>Working effort: 1.04 ECTS</p> <p>The LabVIEW Training course is an introduction to National Instruments' LabVIEW graphical programming language for data acquisition and control. Topics covered include creating, editing, and executing programs using the LabVIEW interface. The course will set for the participants the bases for programming and utilizing practical data acquisition structures as well as sensor control circuits. The practical idea of real time processing, essential for many applications, will be introduced and the</p> <p>Read more</p>	 <p>Teacher: Theodoros Kosmanis Teacher: Dimitris Triantafyllidis</p> <p>TS1.3 Automotive Energy Sources</p> <p>Teaching hours: 16 (Lectures: 12h, Lab: 4h)</p> <p>Working effort: 0.96 ECTS</p> <p>The fundamentals of energy sources for vehicles in general and electric vehicles specifically are presented. The course covers battery technology as the basic energy source of electric vehicles from its constructional point of view. Battery chemistry fundamentals of most common types of batteries for electric vehicles (Li-Ion, LiFePO₄, LiFeYPO₄, NiMH, even Lead Acid ones) including their main characteristics are analyzed. Energy sources</p> <p>Read more</p>
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Figure 2. List of items presented as “courses” at the “Site home” – Topics TS1.1, TS1.2, TS1.3.

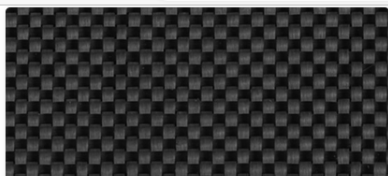


 <p>Teacher: Ioannis Bazios Teacher: Panagiotis Maroulas Teacher: Dimitrios Tziourtzioumis</p> <p>TS1.4 Lightweight Materials</p> <p>Teaching hours: 10 (Lectures: 6h, Lab: 4h)</p> <p>Working effort: 0.56 ECTS</p> <p>The course will touch the industrial trend of using lightweight materials, emphasizing in the weight reduction of vehicle mass. Carbon-fiber reinforced polymers (CFRP) for the electric vehicle frame, panels and pressurized gas tanks are technologies that will be presented in the course. Topics on the specific materials used for vehicle mass reduction, their properties, manufacturing techniques and handling, as well as comparison with corresponding conventional materials will be</p> <p>Read more</p>	 <p>Teacher: Krzysztof Gorski</p> <p>TS1.5 Introduction to Vehicle Dynamics</p> <p>Teaching hours: 6 (Lectures: 6h, Lab: -)</p> <p>Working effort: 0.4 ECTS</p> <p>The basics of vehicle dynamics will be taught in the course. In particular below presented topics will be discussed as an essential knowledge for determining the traction power of a vehicle:</p> <p>Fundamentals of vehicle movement.</p> <p>Vehicle resistances including rolling, aerodynamic and grading.</p> <p>Pneumatic tyre identification.</p> <p>Dynamics of linear motion. Vehicles performance, maximum speed, gradeability, acceleration and</p> <p>Read more</p>	 <p>Teacher: Michail Kizioglou Teacher: Theodoros Kosmanis</p> <p>TS1.6 Data Acquisition and EV Sensors</p> <p>Teaching hours: 10 (Lectures: 6h, Lab: 4h)</p> <p>Working effort: 0.56 ECTS</p> <p>This topic focuses on data acquisition circuits and systems, an essential part of control networks. Electric Vehicle sensors, such as current sensors, encoders and resolvers, and modern sensing systems are analyzed together with their connectivity with electronic control units (ECUs) that support the control network. An appropriately designed laboratory session by means of NI control systems and NI LabVIEW graphical interface will complete the course. Moreover this course provides</p> <p>Read more</p>
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Figure 3. List of items presented as “courses” at the “Site home” – Topics TS1.4, TS1.5, TS1.6.



D4.3 e-Learning Platform Deployment




 <p>Teacher: Christos Ioakeimidis Teacher: Dimitrios Margaritis TS1.7 EV Production Management Teaching hours: 9 (Lectures: 9h, Lab: -) Working effort: 0.6 ECTS MARKET ANALYSIS. Concept of market segmentation. Customer segments and niches marketing. Analysis of an EV market segmentation – who is the most likely to buy EVs. Peculiarity of an automotive market. Micromobility and other new market concepts that EVs are fitting in. Statistics concerning global and European EVs market. Sample marketing strategies and activities taken by EV manufacturers. EVs infrastructure and</p> Read more	 <p>Teacher: Fotis Stergiopoulos TS1.8 Electric Motors & Motor Drives for Evs Teaching hours: 16 (Lectures: 12h, Lab: 4h) Working effort: 0.96 ECTS The course aims to introduce to students the basics of motor types and their drive systems for EVs. Basic construction and operation characteristics will be elaborated. The course will first introduce the students to the principles of electromechanical energy conversion (electromagnetism, calculation of torque and power). The most common motor types will be presented starting from DC and AC induction motors, followed by brushless and permanent magnet machines. Motor operation characteristics will be presented and discussed with laboratory and</p> Read more	 <p>Teacher: Dimitrios Bechtsis TS1.9 Autonomous Vehicles Teaching hours: 15 (Lectures: 9h, Lab: 6h) Working effort: 1.0 ECTS The first part of the lecture covers an Introduction to (i) the use autonomous vehicles in indoor and outdoor environments along with state-of-the-art hardware and software technologies, (ii) the basic concepts of autonomous driving (perception, localization, mapping, navigation, local and global path planning), and (iii) real world applications. The second part analyzes the basic mechanisms of path planning algorithms namely Grassfire, Dijkstra, A Star, D Lite in order to accomplish a point-to-point</p> Read more
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Figure 4. List of items presented as “courses” at the “Site home” – Topics TS1.7, TS1.8, TS1.9.





 <p>Teacher: Malgorzata Lotko TS1.10 EV Business Administration and Automotive Marketing Teaching hours: 15 (Lectures: 15h, Lab: -) Working effort: 1.0 ECTS FUNDAMENTALS OF MANAGEMENT AND ITS FUNCTIONS Concept of management. Management functions: planning, organizing, motivating, controlling. Levels of management (operational, tactical, strategic). Setting organizational goals. Techniques of organizing assets. Theories of motivating staff. Role and types of control. Functions of the executive. Managerial skills.</p> Read more	 <p>Teacher: Paschalia Nathanail TS1.11 Language Lessons - Greek Teaching hours: 6 (Lectures: 6h, Lab: -) Working effort: 0.4 ECTS According to the Common Framework of Reference for Languages, adult participants in this course will acquire the basic skills of Greek (understanding and using oral and written discourse) as well as its socio-linguistic features so as to be able to respond in simple communication situations. In particular, they will focus on issues related to their personal and everyday life (identity, accommodation, simple communication in their social relationships, nutrition, education, transportation and travel). In addition, concepts (identity, culture, education, the economy</p> Read more	 <p>Teacher: Theodoros Kosmanis Teacher: Thanasis Kravaris Teacher: Dimitrios Tziourtzoumis TS1.12 Intermediate Project 1 Working effort: 1.44 ECTS Intermediate Project 1 is mentioned in time slot 1 of the overall educational procedure; however it will concern the participating students right after the end of the courses of time slot 1. Particularly, the students will be divided in international groups and will have the obligation to deal with a subject related to the courses of time slot 1, appropriately selected by all teachers. A tutor will be assigned to each group of students in order to assist them complete their project. The project will require the utilization of the NI products in order to produce a scaled</p> Read more
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------


Figure 5. List of items presented as “courses” at the “Site home” – Topics TS1.10, TS1.11 and Intermediate Project 1 (TS1.12).




D4.3 e-Learning Platform Deployment



Teacher: Iwona Komorska
TS2.1 EV System Modelling and Simulation
Teaching hours: 15 (Lectures: 6h, Lab: 9h)
Working effort: 0.76 ECTS
The first part of the course covers preliminary issues such as dynamic modeling in engineering applications, the use of differential equations in dynamic models, mathematical description of models in the field of time and frequency, non-linear models and their linearization. The second part will discuss the example of a dynamic model, its implementation in a computer program, simulation and discussion of simulation results.
Systems that have been studied in previous courses
[Read more](#)




Teacher: Theodoros Kosmanis Teacher: Thanasis Kravaris Teacher: Dimitris Triantafyllidis
TS2.2 EV Energy Storage Systems
Teaching hours: 12 (Lectures: 6h, Lab: 6h)
Working effort: 0.64 ECTS
Complete electric vehicle energy storage system comprised of sources accordingly mentioned in course TS1.3 "Automotive Energy Sources", like accumulators, ultracapacitors and fuel cells form the subject of the course. The fundamental characteristics of accumulators and ultracapacitors as well as their basic parameters like voltage, capacity, state of charge, state of health, specific power etc are analyzed and case studies are mentioned. Essential diagrams to make a battery.
[Read more](#)




TS2.3 EV Charging Systems
Teaching hours: 30 (Lectures: 24h, Lab: 6h)
Working effort: 1.84 ECTS
The course is closely connected with the energy storage system one. It deals with the characteristics of the most popular electric vehicle charging systems. Technologies found in private and public charging stations, normal and fast chargers are analyzed. Charging time, charging capacity and of course charging cost are among the addressed subjects of the course. Installation demands and policies are further discussed. The course will also involve experiments performed on real world charging infrastructures.
[Read more](#)


Figure 6. List of items presented as "courses" at the "Site home" – Topics TS2.1, TS2.1, TS2.3.



Teacher: Krzysztof Gorski
TS2.4 Mechanical Drivetrains for EVs
Teaching hours: 13 (Lectures: 9h, Lab: 4h)
Working effort: 0.76 ECTS
The course on mechanical drivetrain for electric vehicles (EVs) is focused on the below listed topics: Introduction to drivetrains&powertrains to electric (EV) and hybrid vehicles (HEV). The mechanical drivetrain structure elements and architectures of HEV and EV. Drivetrains of electric bikes. Gear boxes used in selected EVs. Fundamental calculations of drivetrains used in EVs. Internal Combustion Engines for Hybrid Electric
[Read more](#)



Teacher: Fotis Stergiopoulos
TS2.5 Control System Development
Teaching hours: 15 (Lectures: 9h, Lab: 6h)
Working effort: 0.84 ECTS
The course aims to introduce to students the basics of control systems used for EVs operation. It will mainly cover motor control schemes (speed and torque) for basic electric machines used in EVs. First the students will be introduced to the fundamentals of motor control also presenting relevant models. Then various control strategies (e.g. FOC, DTC etc) will be elaborated. Students will also be introduced to principles of sensorless techniques. Non linear control concepts (e.g. fuzzy logic) will also be presented.
[Read more](#)




Teacher: Konstantinos Genikomsakis Teacher: Christos Ioakeimidis
TS2.6 EV Public Policies
Teaching hours: 6 (Lectures: 6h, Lab: -)
Working effort: 0.4 ECTS
The course focuses on the specific reasons that prevent electric vehicles from wide spreading and the policies implemented worldwide in order to overcome this problem. A significant part of the course is the legislation around the EU regarding the purchase, use, charging and disposal of EVs. In this frame, innovation policies, implemented by either the state or private domain in order to promote EV production, EV research and development, ...
[Read more](#)


Figure 7. List of items presented as "courses" at the "Site home" – Topics TS2.4, TS2.5, TS2.6.




D4.3 e-Learning Platform Deployment



Teacher: Konstantinos Genikomsakis Teacher: Christos Ioakeimidis
TS2.7 EVs and Smart Griding
Teaching hours: 6 (Lectures: 6h, Lab: -)
Working effort: 0.4 ECTS
The course will provide the students with knowledge regarding the current trends in power supply and charging of electric vehicles. EVs will no longer be encountered as standalone equipment requiring charging but as entities of an entire charging network that must cooperate with other entities in order to serve their own power supply requirements but also respect and serve the characteristics of the entire network. Theoretical techniques and algorithms are presented and their application is discussed.
[Read more](#)




Teacher: Krzysztof Gorski Teacher: Iwona Komorska
TS2.8 EV On Board Diagnostics, Troubleshooting & Maintenance
Teaching hours: 9 (Lectures: 6h, Lab: 3h)
Working effort: 0.52 ECTS
The course will be a mixture of theoretical knowledge and practical implementation, as it will provide the students insight to the world of on board diagnostics (OBD) for EVs and HEVs and troubleshooting. OBD is a universally implemented methodology by all automotive manufacturers to find, locate and repair a fault in a vehicle. The students will meet the most important diagnostic techniques and their application.
[Read more](#)




Teacher: Konstantinos Genikomsakis Teacher: Christos Ioakeimidis Teacher: Dimitrios Margaritis Teacher: Fotis Stergiopoulos
TS2.9 Life Cycle Assessment of EVs
Teaching hours: 5 (Lectures: 3h, Lab: 2h)
Working effort: 0.28 ECTS
The course is an introduction to the theory of life-cycle assessment (LCA) of electric vehicles. The students will get acquainted with the environmental impact of electric vehicles taking into account the manufacturing, use and end-of-life phases of the vehicles, as well as the energy used. Special software packages will be used in order to calculate the LCA of electric vehicles, having as main tool the well-to-wheel (WtW) methodology.
[Read more](#)


Figure 8. List of items presented as “courses” at the “Site home” – Topics TS2.7, TS2.8, TS2.9.



Teacher: Iwona Komorska Teacher: Andrzej Puchalski
TS2.10 Sustainable Transportation
Teaching hours: 3 (Lectures: 3h, Lab: -)
Working effort: 0.2 ECTS
The assumptions of sustainable transport are discussed during the lecture:
Control of emissions of harmful compounds present in exhaust gases and -in the long term- transition from means of the transport based on fossil fuels to vehicles using renewable energy.
Reducing the scale of destruction of urban space as a result of the dominance of individual road transport.
[Read more](#)



Teacher: Małgorzata Tatar
TS2.11 Language Lessons - Polish
Teaching hours: 6 (Lectures: 6h, Lab: -)
Working effort: 0.4 ECTS
The course on language lessons (Polish) is focused on the below listed topics:
Basic knowledge concerning the Polish alphabet. Greetings and farewells.
Transportation in Poland. Phrases needed at the bus or train station.
Introducing oneself – name, nationality and hobby. Numbers, days of the week, months, telling the time. Giving and asking about contact details such as emails, address and telephone number.
[Read more](#)



Teacher: Paschalia Nathanail
TS2.12 Intermediate Project 2
Working effort: 1.44 ECTS
Intermediate Project 2 will play a similar role in the educational procedure as Intermediate Project 1, link Time Slot 1 courses with Time Slot 2 ones. The students will have to develop simple Augmented Reality (AR) code based on the NI products provided by the partner institutions. The AR code will be used by the *Developing Tool Demonstration* course. The code will be simple enough as developing blank geometrical drawings in the AR space. Similarly with Intermediate Project 1, a tutor will be assigned to each group of students in order to assist them complete their project. A descriptive manuscript the
[Read more](#)

Figure 9. List of items presented as “courses” at the “Site home” – Topics TS2.10, TS2.11 and Intermediate Project 2 (TS2.12).