Car·2·Lab

Telematics module

Learning units and didactic manual

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Learning Unit 1

TITLE: General introduction to telematics

TARGET GROUP 1: technical and vocational school students studying in areas connected to automotive industries – second or third year

THE WAY OF IMPLEMENTATION:

- I option: classes are held as part of theoretical subjects connected with the construction of vehicles (second- year students), whereas practical application of telematics is taught in practical way with the use of telematics box during exercises at car diagnostics laboratories (third-year students);
- II option: classes are held as a module during car diagnostics laboratories (third-year students). Module includes introduction to telematics – theoretical part (2 x 45 min) and practical part with the use of telematics box during practical tasks.

TARGET GROUP 2: vocational subject teachers and practical classes teachers connected to automotive industry or similar branch (professional training and retraining for teachers, complementing their knowledge and skills, adapting to the current needs of the job market)

PRE-REQUIREMENTS

The introductory requirements include the knowledge in the following areas:

- Construction of vehicles (body, chassis, engines),
- Working principles of cat systems, assemblies and mechanisms in vehicles,
- The basics of exploitation, maintenance, diagnostics and repair of mechanical systems and units/assemblies,
- The basics of electrotechnics and electronics ,
- The construction and working principle of electric and electronic systems and appliances in vehicles,
- The exploitation, maintenance, diagnostics and repair of electric and electronic systems and appliances in vehicles.

LEARNING OBJECTIVES

Knowledge: Understanding the notion of telematics and presenting the most important functions of telematic systems connected with using the information. Presenting the current possibilities of practical usage of telematics.

Skills: Analyzing the structure and working principles of different telematic systems in automotive industry. Discussing the development trends in telematics.

Competence: Students can discuss and justify advantages and threats connected with the practical use of telematics.

MAIN CONTENTS

a) General information about telematics,
b) applications of telematics in automotive branch,
c) telematic systems functions,
d) development tendencies and perspectives in telematics,
e) advantages and threats connected with the use of telematics

METHODS

Lecture and presentation, individual or work group (4 -5 people each), discussion (questions and answers), students presentations

ENVIRONMENTS

Classroom equipped with 6 computer stands with access to the Internet

MEDIA & TOOLS

Training material in a form of paper documents, powerpoint presentation, projector or IWB, computers with access to the Internet, worksheets for students, film about the practical application of telematics box in a vehicle.

EVALUATION

Worksheet, knowledge test, evaluation questionnaire

Time schedule of the learning unit 1

STEP	CONTENT	TEACHING AIMS	METHODS	TEACHING PLACE	TOOLS AND RESOURCES	ASSESSMENT	TIME [min]	COMMENTS
1	**General introduction to telematics**	Understanding the expression of telematics and describing the most important functions of telematic systems connected with the use of information. Presenting the possibilities of using telematics practically	Lecture and presentation (Group of 25-28 students)	Classroom equipped in 6 computer stands with the access to the internet	Training material as a paper hand-out PowerPoint presentation Projector or interactive whiteboard	Constant feedback from students: • Questions asked by teacher during the lecture, • Observing the students	10	
2		Analysing the construction and functioning principles of different telematic systems in automotive branch (i.e.: communication telematics, alarm call, teleservice, telediagnostics, thermocall etc.)	Individual work or in groups of (4-5 students)		Training material as a paper hand-out Computers with the access to the internet. Worksheets for students	Observing students' work	20	Allowing students access to the information on-line with the use of mobile phones
3		Checking if the aims have been achieved	Discussion (questions and answers)		PowerPoint presentation Worksheets for students	The assessment of individual statements Self-assessment of the filled-in worksheets by students according to answer key provided by the teacher	15	Summing up the lecture
4		Presenting the development and application tendencies of telematics in the nearest future	Individual work or in groups of (4-5 students)		Training material as a paper hand-out	Observing students' work	15	

5		Presenting the advantages and potential threats for car garages and users of the vehicles resulting from the practical use of telematics.			Computers with the access to the internet. Worksheets for students			
6		Checking if the aims have been achieved	Students' presentations Discussion (questions and answers)		PowerPoint presentation Worksheets for students	The assessment of individual statements Self-assessment of the filled-in worksheets by students according to answer key provided by the teacher	15	The summary of individual work or in groups
7		Checking if the aims have been achieved	Check test		PowerPoint presentation A film showing how to use telematics kid in a vehicle	Checking the knowledge test Evaluation questionnaire	15	The summary of the theoretical part
8		Notifying issues and correlation to the next practical classes	A part of a film showing how to use telematics kid in a vehicle					
						IN TOTAL	90 min	

Learning Unit 2

TITLE: Technical introduction to telematics components in cars

This didactical unit has the purpose to present the telematic kit to the students, especially its hardware components, the menu function and its potentiality.

TARGET GROUP

Considering this didactical unit more theoretical than practical, the whole group/class of trainees/students (maximum 24 – 28) could be involved, and could be developed from the first year of training.

PRE-REQUIREMENTS

There are not specific pre-requirements for this unit, but the didactic could be more effective if students have a basic knowledge of telematic that should be acquired in the first learning unit. Otherwise the two units could be developed simultaneously.

LEARNING OBJECTIVES

This learning unit has three main objectives divided in basic hardware knowledge and software knowledge:

- Recognise the different parts of the telematic kit, in comparison with other systems. Level 3 EQF: The students should be able to recognize the hardware components of the telematic kit, and the common point with the other systems.
- Identify the main function of the software in comparison with other systems. Level 3 EQF: The students know the main function of a telematic software and identify them on the specific instrument.
- Navigate on the platform using software interface: Level 3 EQF: The students should be able to use the platform, giving explanations on the different screens (for example to support customer)

MAIN CONTENTS

a) Hardware: Hardware components, correlations and functioning principles. Comparison with other products on the market.

b) Software: Screens and function of the telematic kit. Comparison with other software.

c) Applications and different uses of the telematic kits: diagnostic, customer support, mobility management and different scenarios.

METHODS

This learning unit is developed mainly by traditional lessons with the whole classroom to provide basic knowledge about hardware and software components of the telematic kit, highlighting the point in common with other system applied on vehicles.

A part of the didactical unit should be developed as a problem solving activity with a small group of students working in team.

ENVIROMENT

The learning activity is realized mainly in classroom.

MEDIA AND TOOLS

The needs for this units are:

- Telematic kit hardware
- Access to the platform
- pc and a projector (or a IWB – interactive whiteboard) to show students screenshot and examples of other system.

EVALUATION

Specific tests or examinations on this specific unit are not planned, considering that this activities are mainly an introduction to more applicative learning units. The main evaluation depends on the feedback provided by teachers during the lessons.

The self evaluation of students is supposed to be realized at the end of all the didactical activities, trough a final questionnaire to collect quality indicators and feedbacks on the whole curricular activities and on the single didactical units.

Time schedule of the learning unit 2

STEP	CONTENT	LEARNING OBJECTIVES	METHODS	LEARNING ENVIRON-MENT	MEDIA & TOOLS	EVALUA-TION	TIME [min]	COMMENTS
1	Hardware compo-nents of the telematic kit	Recognise the different parts of the system and their functions	Traditional lesson	Classroom	Telematic kit compo-nents Pc with a projector or a IWB	Feedback from trai-ners	15	This steps could be reduced if the argu-ments were discussed in learning unit 1
2		Understand the correla-tions between the differ-ent components					20	
3		Identify hardware compo-nents of different systems					15	This part should show the common point of different system with the kit students have at disposal. Costs of the systems should be discussed
4	Software compo-nents: basic knowledge and appli-cations	Recognise the main func-tions and screens of the telematic kit	Traditional lesson	Classroom	Pc with a projector or a IWB	Self evalua-tion	30	
5		Use the software to enter specific sections, explain-ing their contents.	Working group			Collection of feed-backs from the differ-ent groups of students	50	This activity should be realized by 3-4 students. A part of the activity should be dedi-cated to the explanation of the different screens by the students, simulating activ-ities of customer support.

6		Recognize common elements in different software.	Traditional lesson	Classroom	Pc with a projector or a IWB	Self-evaluation	20	During this activity it is important that trainers understand the similarities of systems and the possibility to apply the competences acquired on the specific telematic kit on other software
7	Applications and different uses	Specific software functions and screens related to diagnostic	Traditional lesson	Classroom	Pc with a projector or a IWB	Self Evaluation	15	This part in intended to make only a brief presentation of the instrument potentiality, that will be developed in unit 7 (data analysis) and 8 (diagnostic)
8		Specific software functions and screens to evaluate driving and vehicle performances					15	
9		Specific software functions and screens applied to mobility management					15	
						IN TOTAL	195 min	

Learning Unit 3

TITLE TECHNICAL INTRODUCTION TO TELEMATICS COMPONENTS IN CARS.

TARGET GROUP: Car mechanic/ students advanced level (EQF level 4)

PRE-REQUIREMENTS : Able to read complex wire diagrams. Knowledge to data communication (Can bus) in cars. Able to read workshop manuals. Reading workshop manuals.

LEARNING OBJECTIVES

Knowledge: The student will learn what telematics are, were it can be used. How it works and communicates by a sim card. The student will also see how different brands make makes different systems and what they can do

Skills: The student will be able to use a manual and find telematics components in cars

Competences: The student can evaluate how the telematics system works. The student is able to search for information, which will enable them to identify telematics in all car brands.

MAIN CONTENTS

a) Information on telematics components
b) Group assignments identifying telematics in real cars
c) Document
d) Test

METHODS

Lecture by power point, group work and discussion in class.

Group work in workshop

Documentation in groups using IT (text program and pictures)

Test (online using mobile phone)

ENVIRONMENTS: Classroom teaching and workshop practice

MEDIA & TOOLS Assignment descriptions (handout), Power point.

EVALUATION Simple quiz , Kahoot or socrativ

Time schedule of the learning unit 3

STEP	CONTENT	LEARNING OBJECTIVES	METHODS	LEARNING ENVIRONMENT	MEDIA & TOOLS	EVALUATION	TIME [min]	COMMENTS
1	Technical introduction to telematics components in cars	Understanding the different components	Theory presentation by teacher & small student assignments	Classroom	Instructions on paper / online/PowerPoint	Continuing Feedback of trainers	45	
2		Plan and schedule workshop activities	Instructions for group task		Description of the group task (Hand out)		15	
3		Ability to find the different components in the car Correct use of reading workshop manuals;	Group work (max. 4 students)	Workshop	Real Car (Nissan Leaf) VW Golf VI All tools necessary for dismounting/mounting		90	If possible take the own cars of the students, if they have telematics
4		Documentation by pictures	Group		Computer, Camera or equal.		90	
5		Evaluation	Individually		Socrative test : SOC-33399690	Test	30	
						IN TOTAL	270 min	

Learning Unit 4

TITLE: Implementation of the telematics box

This learning unit has to handle all basic knowledge, which is necessary for a typical installation procedure of telematics hardware (telematics box) into a passenger car or a truck, especially the connection of the components to the onboard power supply and to the car data network or separate sensors.

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TARGET GROUP

This didactical unit contains more practical than theoretical issues, the whole group/class of trainees/students must be divided in small working groups (max. 4 Persons). So it can be guaranteed, that each participant will be really involved in the installation procedure.

PRE-REQUIREMENTS

Following pre-requirements are of great importance for this unit. Students/ apprentices should have basic knowledge of:

a) Power supply in a passenger car or truck (ohm´s law, calculation of cable cross-section, electromagnetic compatibility etc.)

b) Reading and understanding of electric circuit diagrams

c) Measurements of voltage, current, and resistance with a multimeter

d) Structure and function of data networks in a car (Flax ray, CAN, LIN)

e) Different kinds of sensors used in automotive technology and their functionality

f) Connection technologies of copper wires (soldering, crimping, etc.)

g) Diagnostic possibilities of electronic control units and their periphery

Some of the knowledge can be taught and practiced during the units, for example soldering or crimping, measurements with a multimeter or reading and understanding of electric circuit diagrams.

LEARNING OBJECTIVES

The students should be able to

A) Find possibilities to connect hardware components of the telematic box to the car (permanent plus supply, ground, ignition etc.)) by using the electric circuit diagrams

B) Find onboard sources for data (e. g. can) and signals (e. g. switches) in the network, they are necessary for data collecting.

C) To check selected cables with a multimeter (voltage) or oscilloscope (sensor signals or data protocols)

D) To connect cables of the telematics box with cables coming from the car by soldering, crimping or other connecting technologies

E) To connect the telematics system to an OBD-connector

F) To connect other system components (e. g. GSM- or GPS-Antenna)

G) To check whether the telematics box is connected correctly

H) To set the telematics box in operation, including the first system check

I) To fill out the commissioning protocol

J) To estimate costs of installation of a new telematic system

The learning objectives should correspond to EQF Level 4.

MAIN CONTENTS

a) Preparing the installation of telematics components (searching of connection possibilities, measurements etc.)

b) Installing and connecting hardware components to the car

c) Doing a first commissioning of the telematics system and filling in the commissioning protocol.

d) Preparing a calculation and estimating costs of installation of a new telematic system.

METHODS

The apprentices will be inspired by a customer order: “The new telematic system should be installed and tested in the car.” They get a script with several logically connected tasks and questions. The script should operate like a guide and help students to structure their activity and to deal only with the tasks, which are relevant for the learning unit. The time management will be easier with clear structured tasks and questions about the main topic.

This learning unit is developed mainly by a complex, problem- and action-oriented, practical exercise using a real car. The small working groups (max. 4 students) do the same practical exercise and note their answers and findings on a task sheet.

The students should fill in a commissioning protocol to get used to quality management.

ENVIROMENT

The learning activity is realized mainly in a practice room, because a really car will be needed.

MEDIA AND TOOLS

The material requirements for this unit are:

- Telematics kit hardware
- multimeter, oscilloscope,
- soldering station incl. soldering equipment, crimp pliers incl. cable lug
- a passenger car or a truck
- ECU-diagnosis equipment with access to OEM documentation (electric circuit diagrams etc.)
- Access to the VIOM-platform
- tablets or pc and a projector (to write and present the calculation)

EVALUATION

The evaluation can be divided in different sections.

Firstly, the teacher observes the students during their activities and helps them by answering their questions. He evaluates the practical work and the written information given by the students, the commissioning protocol and the calculation. The quality of all these elements results in a final score for the learning unit.

A little theoretical or practical test can be added, if the evaluation of the working process is not possible or not useful.

The self evaluation of students can be realized at the end of the unit by a final questionnaire to collect the opinion about quality of the didactical unit.

Time schedule of the learning unit 4

STEP	CONTENT	LEARNING OBJECTIVES	METHODS	LEARNING ENVIRON-MENT	MEDIA & TOOLS	EVALUATION	TIME [MIN]	COMMENTS
1	Preparation of the installation the electrical components	find the voltage sources to connect hardware components of the telematic box to power supply in the car (permanent plus supply, ground, ignition etc.)	individually	classroom or workshop	1. OEM Instructions and circuit diagrams on paper / online 2. manual of the telematics box 3. vehicle registration document 4. Documentation sheets (paper or online)	continuing feedback of trainers documented observation of students self evaluation	20	The teacher should control the results of step 1 and 2, before students go to step 3.
2		find onboard sources (interfaces) for data (e. g. can, flax ray) and signals (e. g. switches) in the network					20	
3	Installing a telematics box in a vehicle	Check selected cables (in Step 2) with a multimeter (voltage) or oscilloscope (sensor signals or data protocols)	Group work (max. 4 students)	workshop	1. real Car (VW family) 2. telematics Box 3. all tools necessary for installations and measurements (eg. oscilloscope, soldering station with accessories, manual of the telematics box) 4. Documentation sheets (paper or online)		25	
4		connect cables of the telematics box with cables coming from the car by different connecting technologies					25	The teacher should control **diligently** the work safety in step 4

5	Installing a telematics box in a vehicle	connect the telematics system (OBD-FM-box) to an OBD-connector	Group work (max. 4 students)	workshop	1. real Car (VW family) 2. telematics Box 3. all tools necessary for installations and measurements (e. g. pliers, screwdriver, checklist, manual of the telematics box) 4. extraction system for exhaust gas 5. Documentation sheets (paper or online)	continuing feedback of trainers documented observation of students self evaluation	5	
6		connect and install the remaining system components (e. g. GSM- or GPS-Antenna) to the telematics box					10	The teacher should control the correct position of the components in step 6 for the correct function of gps and gsm signals
7	Quality assurance measures	check at last whether the telematics box is connected correctly (optically)					10	The teacher should control the correct connection of the cables, before going to step 8 (ignition on).
8		set the telematics box in operation, including the first system check using the web application					40	The students need to start the engine and drive around to check the alterations of car parameters and gps.
9		fill out the check list in the commissioning protocol	individually	workshop or classroom	pc or tablet, calculation software or calculator, works value list, Documentation sheets (paper or online)		20	
10	Cost estimate and billing	estimate costs of installation of a new telematic system and write an invoice for the customer					40	The students should use a pre-printed form of an invoice.
11	final knowledge test self-evaluation questionnaire	answer the questions about basics knowledge of installation of telematics systems in (multiply choice test)	individually	workshop or classroom	test sheets on paper or digital questionnaire	Evaluation of the test by the teacher self-evaluation	25	The questions in the test should refer by the majority to the practical learning objectives.
						IN TOTAL:	240 min	

Learning Unit 5

TITLE: Configuration and functional testing of telematics devices

TARGET GROUP 1: technical and vocational school students studying in areas connected to automotive industries – third or fourth year

TARGET GROUP 2: vocational subject teachers and practical classes teachers connected to automotive industry or similar branch (professional training and retraining for teachers, complementing their knowledge and skills, adapting to the current needs of the job market)

PRE-REQUIREMENTS

KNOWLEDGE IN THE FOLLOWING AREAS:

• Construction of vehicles (body, chassis, engines),

• Working principles of cat systems, assemblies and mechanisms in vehicles,

• The basics of exploitation, maintenance, diagnostics and repair of mechanical systems and units/assemblies,

• The basics of electrotechnics and electronics ,

• The construction and working principle of electric and electronic systems and appliances in vehicles,

• The exploitation, maintenance, diagnostics and repair of electric and electronic systems and appliances in vehicles.

• The basics of vehicle diagnostics in accordance with EOBD standards

• General construction and functions of the telematic (teleinformatic) system of a vehicle.

LEARNING OBJECTIVES

Knowledge: General construction and functionality of telematic system TelematicsBox (including DIAMEX module), the ability of using VIOS platform. The knowledge of the functinality of TelematicsBox-VIOS system and pointing out the possibilities of practical application. The knowledge of EOBD standard and the way of carrying out vehicle's diagnostics with the use of diagnostics tester

Skills: pluging in and starting TelematicsBox ,using VIOS platform, configurating its functionality. Steering DIAMEX module from both the level of the module as well as the program DXSimTool_1200 – carrying out diagnostics in accordance with EOBD standards with diagnostic tester

Competence: Students can list practical examples of usage of telematic system of the vehicle, prepare examples of remote steering of executive components of electrical circuits. Students also point out the advantages and disadvantages of remote diagnostics, monitoring and controlling the vehicle.

MAIN CONTENTS

a) General construction and functionality of telematic system TelematicsBox-VIOS

b) Vehicle diagnostics in accordance with EOBD standards

METHODS

It is planned that the classes will be held in a form of practical task in car mechatronics lab (third year in case of vocational school students and fourth year for technical school). The tasks starts with an introduction (revision of basic, theoretical aspects of the subject), presenting the Telematics Box and VIOM platform, carrying out a practical task with the use of the system, preparing the analysis of the obtained results. The final point will be checking the filled in handouts as well as knowledge and skills acquired by students/trainees/ teachers in a form of short sum-up test and individual presentation of the ability of handling the TelematicsBox-VIOM system. It is also planned to carry out an evaluation questionnaire that will allow to modify the lesson scenario, if necessary.

ENVIRONMENTS

Classroom equipped with 8 computer stands with access to the Internet, vehicle diagnostics stand.

MEDIA & TOOLS

Training material in a form of paper documents, powerpoint presentation, projector or IWB, computers with access to the Internet, worksheets for students, film about the practical application of telematics box in a vehicle.

EVALUATION

Worksheet, checkup questions

Time schedule of the learning unit 5

STEP	CONTENT	TEACHING AIMS	METHODS	TEACHING PLACE	TOOLS AND RESOURCES	ASSESSMENT	TIME [min]	COMMENTS
1	**Getting to know with Telematics Box**	Getting to know with the general construction and functions of Telematics Box.	Presentation, (a group of 12-15).	Car mechatronics lab	PowerPoint presentation Projector or interactive whiteboard	Constant feedback from students: • Questions asked by teacher during the lecture, • Observing the students.	25	On-line show (or ex ample print-screens)from each of the VIOS Car2Lab platform folders ; correlation with the settings of TelematicsBox.
		Get to know with VIOM Car2Lab platform – presenting the tabs on platform.						
2		Presenting various configuration possibilities of the systems and thus its functions			Guidelines for practical task. Computers with the access to the internet. (max. 2 students per 1 computer) + separate computer for the teacher Worksheets for students		20	Allowing students access to the information on-line with the use of mobile phones
3	Serial diagnostics of the engine control system with the use of Diamex-Box2 module	Revision of the diagnostics procedure according to EOBD standard	Presentation, practical task (a group of 3-4).	Car mechatronics lab	TelematicsBox; diagnostics tester ; Workshop documents (failure codes chart; algorithms of detecting failures eg. Bosch ESI-tronic)	See above	45	Introductory tasks with a partial revision of previously covered issues in accordance with didactic plan for this subject.
						IN TOTAL	90 min	

Learning Unit 6

TITLE: Re-configuration according to customer requirements

This didactical unit deals with showing the students how the telematics box can be applied to other costumer needs. The costumer might be the car owner, an insurance company, or a garage. The term "Re-Configuration" refers to either applying the box to a vehicle other than one from the VW enterprise, or to define and implement a new functional application to the box.

TARGET GROUP

As this learning unit is very practical a group of four students is recommended.

PRE-REQUIREMENTS

As this learning unit requires a deep understanding of the telematics box interfaces, it is strictly recommended that the students already have knowledge about the telematics box itself and the CAN/OBD/digital/1-wire-interfaces.

LEARNING OBJECTIVES

There are two different main objectives coming along with this learning unit. After having passed this course the students should be able to

- assess the opportunity to access data from an OBD interface from a vehicle different to one from the VW enterprise,
- know the opportunities of the interfaces provided by the break-out box.

MAIN CONTENTS

- Introduction to the OBD interface
- Introduction to the digital in- and outputs of the telematics box
- Introduction to the 1-wire-interface
- Practical analysis of an OBD interface
- Practical application for using digital in- and outputs
- Practical application for using the 1-wire-interface

METHODS

This learning unit is divided into three parts whereas each part consists of both a theoretical introduction (for OBD, digital in/out-, and 1-wire-interfaces) and a practical application (check an OBD interface, using digital in/outs and 1-wire-interface) to deepen the learnt skills.

ENVIRONMENT

This learning unit should be realized for the practical OBD part in a real vehicle and for using the digital and 1-wire-interfaces in a laboratory environment.

MEDIA AND TOOLS

The following items are required to realize this learning unit:

- Telematic Box
- OBD ScanTool
- PC or laptop with internet access to the VIOS GUI
- 5-V- switching unit
- Laboratory power supply
- Oscilloscope
- Digital open connector output interface item (e.g. both a 6, 12, and a 24 V relais)
- Non VW vehicle with OBD interface with registration date later than 2012
- 1-wire-sensor (e.g. digital thermometer DS 18B20)

EVALUATION

Directly after the practical unit the students get a specific task for evaluation to be realized with the telematics box. This can be either checking the OBD interface of an unknown vehicle, determining the signals provided in mode 1, and re-identify the signals on the VIOS interface. Another task could be the control of a specific digital output component (e.g. a lamp) or the application of a 1-wire-component. The goal is to realize the required task within a certain time (e.g. 15 minutes).

Time schedule of the learning unit 6

STEP	CONTENT	LEARNING OBJECTIVES	METHODS	LEARNING ENVIRONMENT	MEDIA & TOOLS	EVALUATION	TIME [min]	COMMENTS
1	**General introduction to interface units**	Introduction to the OBD interface using a Scan Tool	Traditional Lesson and presentation by teacher	Classroom	PC and Beamer ScanTool Telematics Box with simulator box (OBD Simulator)	Questions by teachers	30	Lesson should concentrate on OBD communication over CAN and modes 1 and 3 (data acquisition and DTC)
2		Introduction to the digital in- and output interfaces			PC and Beamer Telematics Box with Breakout-Box	Questions by teachers	30	Lesson should concentrate on digital basics and interface circuits (e.g. open collector, active high, active low) and transistor application as a switch
3		Introduction to the 1-wire-interface			PC and Beamer Telematics Box with simulator box, oscilloscope	Questions by teachers	30	Lesson should deal with electric specification, communication, and application examples
4	**Introduction to laboratory units**	Students get hands-on to the devices with which they realize the following tasks	Introduction by teacher	Laboratory	Experiment devices: OBD-Scanner Telematics Box with simulator and Breakout-Box Interface Relais 1-Wire-Sensor	Observing by teacher	15	Specific introduction to experiment devices
5	**Laboratory work**	The students achieve knowledges in planning taks and usage of the TB interfaces	Individual group work under instruction and supervision of a teacher	Laboratory			45	Students should try to solve the tasks on their own
						IN TOTAL	150 min	

Learning Unit 7

TITLE: Data collection and data analysis

This didactical unit develop competences and skills regarding different data types and sources provided by a vehicle and different methods to analyse data.

TARGET GROUP

This didactical unit could involve the whole group of trainees/students (maximum 24 – 28 students), and could be developed during the second or the third year of training. The only difference is that the knowledge of diagnostic process could simplify some parts of this unit.

For the practical part, the maximum number could be the same, but the optimal number should be 10 -12 students to increase the active participation to the lesson.

PRE-REQUIREMENTS

There are not specific pre-requirements for this unit, except a basic knowledge of car technology and mechanical/electronic working principles that should be acquired during the first year of training. It could be useful, but not necessary, a basic knowledge of data analysis and the use of statistical instruments (mean, modal value, median, range field, graphic analysis). This competences are usually provided during the previous school years. Elsewhere this skills could be developed during mathematical didactical units (if the training activities include them) or be included in this learning unit adding 60 minutes to its duration.

Basic notion of diagnostic could be helpful to deepen the learning unit, but this is non e necessary requirement. If diagnostic skills was not developed previously, the didactics could introduce the type of data necessary to this activity, while simulations and practical diagnostic activities will be realized later.

LEARNING OBJECTIVES

This learning unit has several objectives:

- Understand the different sources of data provided by a vehicle, their formats and the association with the different part and systems.
  Level 3 EQF: The student should be able to recognise different types of data and their sources, in order to evaluate vehicle part or system, recognising a value that could be associated with an anomaly.

- Use of data to support diagnostic process, recognising normal values and outliers.

Level 3 EQF: The trainee should be able to choose the main data to use in diagnostic process, understanding if a value is inside its field of range or could be associated with an anomaly.

- Use historical data to evaluate the vehicle status and identify part decay
  LEV3 EQF: The student should be able to read a series of historical data, recognising the normal values produced by the vehicle and identifying trends.

- Compare data to evaluate the vehicle efficiency
  LEV3 EQF: The student should be able to compare values, both with historical data and with data provided by car manufacturer, understanding if the results suggest a normal functionality or suggest to deepen the inspection of a specific part.

- Compare data to support customer in improving performance and driving skills
  LEV3 EQF: The student should be able to compare values, evaluating car performances and identifying potential improvement opportunities.

MAIN CONTENTS

a) Data sources, types and formats: Most important data provided by OBD, by CAN BUS and by GPS. Mechanic and Electronic part connected with this data and measurement units. Data that provides a constant ((ex: functioning control lights), variable data (ex: fuel consumption). Analysis of variable data to understand if they are inside the adequate range.

b) Data categories: Live data and historical data, different applications

c) Introduction to data uses: diagnostic, anomalies checking, performance evaluation.

d) Historical data analysis: Use of tables and programs to make a brief analysis of the historical data with spreadsheets, applying different types of functions to highlight anomalies; matching different types of data to evaluate vehicle status and driving performances.

METHODS

This learning unit is developed mainly by traditional lessons with the classroom to provide the knowledge about data types and categories. Cases study and example presentation are an important part of didactic, especially developing digital, mathematical and analytic competences.

The second part consists in a series of practical activities in a computer lab to work with data using spreadsheets for analysis. There could be a jointed work with math and ITC didactical modules if the training course has them in the planning.

ENVIROMENT

The learning activity is realized mainly in classroom and computer lab.

MEDIA AND TOOLS

The needs for the first part of the unit are a pc and a projector (or a IWB – interactive whiteboard) to show students different types of data and simulations. This type of data are provided by the telematic kit and by a web research to display different type of formats and data.

The computer lab requires a pc for each student (or maximum 2 trainees for every work-station) with a program that uses spreadsheets. For this activities the trainer has to have at disposal the historical data from the telematic kit as a spreadsheet and the possibility to change values.

EVALUATION

For the final evaluation of the activity, to each student will be delivered a series of data, simulated by the trainer using the telematic kit, some of them associated with a specific vehicle problem or a bad driving style. The students should identify the situations that trainers wanted to simulate. The final results depends on: students ability to choose most important data, identify outliers and associate them with a specific situations. Before the practical examination, a brief test could be administered to check the acquisition of the theoretical skills.

The self-evaluation of students is supposed to be realized at the end of all the didactical activities, through a final questionnaire to collect quality indicators and feedbacks on the whole curricular activities and on the single didactical units.

Time schedule of the learning unit 7

STEP	CONTENT	LEARNING OBJECTIVES	METHODS	LEARNING ENVIRONMENT	MEDIA & TOOLS	EVALUATION	TIME [min]	COMMENTS
1	Different sources, types and format of data.	Recognise the different sources of data of a vehicle	Traditional lesson	Classroom	Pc with a projector or an IWB Search engines. List of data generated by vehicle, classified by source (OBD, CAN BUS or GPS), evaluated element and measurement unit List of data provided by telematic kit.	Final test	10	Lesson should start asking students what they already know, creating a list of indicators indicating their source and what they measure. At the end of the lesson the teacher's list of data is delivered to each student
2		Identify the most important data to check and their measurement units.				Final test	15	
3		Associate values to a specific vehicle part or system.				Self evaluation	20	
4		Recognise data that should provide constant values and data with variable values and their different uses.				Self evaluation	15	This step could request more time if the students have not a basic background on data analysis and some concepts as Range or mean values have to be introduced

5	Data categories: live and historical data	Understand the meaning of live and historical data	Traditional lesson Case study	Classroom	Pc with a projector or an IWB List of data provided by telematic kit.	Final test	10	This is a theoretical module, during this activity different examples are shown to students only for demonstrative purposes
6		Understand how to use live data to control the vehicle status				Feedback from trainers	30	
7		Understand how to use historical data to control vehicle efficiency				Feedback from trainers	20	
8	Introduction to data uses: diagnostic, anomalies checking, performance evaluation.	Use data during diagnostic activities	Practical lesson Cases study	Computer lab	One workstation for each student Spreadsheet Series of screenshots from telematic kit.	Feedback from trainers	30	This content is developed showing examples to students presenting different cases.
9		Use data to identify lacking or anomalies				Final simulation	30	A series of screenshot will be delivered to each students to be discusses.
10		Use data do evaluate vehicle and driving performance				Feedback from trainers	20	
11	Historical data analysis.	Use of tables and programs to make a brief analysis of the historical data with spreadsheets, applying different types of functions to highlight	Practical lesson Cases analysis	Computer lab	One workstation for each student Spreadsheet Spreadsheets generated by telematic kit	Final simulation	60	Students work with spreadsheets generate by telematic kit and modified by trainers to show different situations. Duration could be raised if students don't have basic ITC knowledge, especially on spreadsheet and its functions
12		Identify trends and performance decay				Final simulation	60	
13		Matching different types of data to evaluate vehicle status and driving performances.				Final simulation Self evaluation	60	
						IN TOTAL	380 min	

Learning Unit 8

TITLE: Car malfunction diagnoses

TARGET GROUP 1: technical and vocational school students studying in areas connected to automotive industries – third or fourth year

TARGET GROUP 2: vocational subject teachers and practical classes teachers connected to automotive industry or similar branch (professional training and retraining for teachers, complementing their knowledge and skills, adapting to the current needs of the job market)

PRE-REQUIREMENTS

The introductory requirements include the knowledge in the following areas:

- Construction of vehicles (body, chassis, engines),
- Working principles of car systems, assemblies and mechanisms in vehicles,
- The basics of exploitation, maintenance, diagnostics and repair of mechanical systems and units/assemblies,
- The basics of electrotechnics and electronics ,
- The construction and working principle of electric and electronic systems and appliances in vehicles,
- The exploitation, maintenance, diagnostics and repair of electric and electronic systems and appliances in vehicles.
- The basics of vehicle diagnostics according to EOBD standards.
- The knowledge of general construction and tasks of the telematic system in a vehicle (teleinformatic)

LEARNING OBJECTIVES

Knowledge: The knowledge of specific functionalities of telematic system TelematicsBox and configurating it (in correlation with VIOS platform. The knowledge of methodology of carrying out the tests and analysis of the obtained data (in order to present them in a graphic form with the use of calculation software. The knowledge of diagnostic documentation and the possibility to use it to prepare conclusions from the testes and analysis.

Skills: plugging in and starting TelematicsBox ,using VIOS platform, configurating its functionality, plugging

Squarell (both to the vehicle and BOX2), plugging CanClick adapter to CAN net of a vehicle. Configuration and steering the Break - Out Box 1 and plugging external components, in order to introduce logic signals on VIOS platform in „Live" mode. The choice of proper option on VIOS platform in order to perform specific activities connected with vehicle diagnostics/ monitoring.

Data import from the server of telematic system to analyze them. Data research and analysis of the carried out tests, conclusions.

Competence: Students can freely configurate telematic system TELEMATICSBOX to perform specific research, measurements and monitoring/geolocation of an object. They obtain and analyze data from the system, draw conclusions from the performed research and analysis, prepare the action algorithm to remove identified failures and failures codes from the monitored object (

(BOX2 simulator or vehicle). Students design and make external electric circuit and implement Break-Out Box 1 in specific electric and electronic vehicle circuits to perform remote steering effect.

MAIN CONTENTS

a) The maintenance of telematic system TelematicsBox-VIOS.
b) Preparing and analysis of data.
c) Drawing conclusions.
d) Complete use of certain functionalities of the system.

METHODS

It is planned that the classes will be held in a form of practical task in car mechatronics lab (third year in case of vocational school students and fourth year for technical school). The tasks starts with an introduction (revision of basic, theoretical aspects of the subject), presenting the Telematics Box and VIOM platform, carrying out a practical task with the use of the system, preparing the analysis of the obtained results. The final point will be checking the filled in handouts as well as knowledge and skills acquired by students/trainees/ teachers in a form of short sum-up test and individual presentation of the ability of handling the TelematicsBox-VIOM system. It is also planned to carry out an evaluation questionnaire that will allow modifying the lesson scenario, if necessary.

ENVIRONMENTS: Lab equipped with 8 computer stands with access to the Internet, research stands (simulation mode) and vehicle diagnostics stand; a moving vehicle.

MEDIA & TOOLS: Training material in a form of paper documents, instructions for practical task, PowerPoint presentation, projector or IWB, computers with access to the Internet, worksheets for students, lab stands, diagnosed vehicle(on a research stand and on the move).

EVALUATION: Worksheet, checkup questions, evaluation questionnaire

Time schedule of the learning unit 8

STEP	CONTENT	TEACHING AIMS	METHODS	TEACHING PLACE	TOOLS AND RESOURCES	ASSESSMENT	TIME [min]	COMMENTS
1	Remote diagnostics and vehicle monitoring with the use of „TelematicsBox”	Getting to know how to implement the system in a test car. Obtaining skills of using the device and VIOM platform.	Practical task (a group of 3-4).		Test car, „TelematicsBox”, VIOM platform.	Observing the students	45	Practical task; work in „BOX” and „OBD” mode with the use of function „Live – current parameters ” and „Events ”.
2	Preparing and analysis of the obtained data statistic analysis).	Obtaining the skills of processing the test data as well as defining the criteria, analyzing the data and drawing conclusions.	Practical task (a group of 3-4).	Vehicle mechatronic lab	VIOM platform diagnostics documentation, computer stands with calculation software. Worksheets for students; print-outs, generated files.	Observing the students	90	Practical tasks; importing data from VIOM platform (History mode); Working out the data statistically with a help of spreadsheet; The analysis of exploitations parameters of the vehicle and recorded events (e.g. Engine failure codes}; conclusions.

3		Checking if the aims have been achieved	Discussion (questions and answers)	Vehicle mechatronic lab	Worksheets for students	The assessment of individual statements. Knowledge test	15	The summary of individual work or in groups
4		Checking if the aims have been achieved	Check test		PowerPoint presentation A film showing how to use telematics kit in a vehicle	Assessing the knowledge test Evaluation questionnaire	30	The summary of the subject
5		Notifying issues and correlation to the next practical classes A part of a film showing how to use telematics kit in a vehicle (i.e. YouTube).	A part of a film showing how to use telematics kit in a vehicle (i.e. YouTube).					
IN TOTAL							180 min	

Learning Unit 9

TITLE: Trouble shouting of telematics system failures

TARGET GROUP: Students of the third year of vocational training in the field of mechanics (3rd level EQF)

PRE-REQUIREMENTS: A thorough knowledge of the vehicle's telematic components is required, so this unit must be carried out at the end of the other teaching units.

LEARNING OBJECTIVES

Knowledge: Know the different vehicle communication modules and protocols.

Skill: Identify the position of the different communication modules of the vehicle, take measurements and compare the data with the normal parameters of different systems (high speed, medium speed, low speed and LIN BUS)

Skills: Students will be able to recognize the different components and communication modules of the vehicle, determining its proper functioning or identifying transmission errors.

MAIN CONTENTS

Vehicle communication modules, description and protocols:

- LENSES(ISO 11519-2)
- Medium Speed CAN
- High speed can (ISO 11898)
- VAN, Vehicle Area Network
- LIN, Local Interconnect Network
- MOST, Media Oriented Systems Transport
- TT CAN
- Flex Ray/E ray

Interfaces and connectors

Problem measurement and analysis

METHODS: Traditional lesson, practical exercises. Individual or group work (maximum 4-5 people)

ENVIRONMENTS : Class with PC and projector or LIM. Automechanical laboratory

MEDIA & TOOLS: Presentation of power point, networked PC for information search, measuring instruments, vehicle.

EVALUATION: Practical exercise, evaluation questionnaire.

Time schedule of the learning unit 9

STEP	CONTENT	TEACHING AIMS	METHODS	TEACHING PLACE	TOOLS AND RESOURCES	ASSESSMENT	TIME [min]	COMMENTS
1	**Communication modules**	Know the different communication modules of the vehicle, the protocols and carry out measurements and checks	Frontal lesson	Class	Powerpoint PC with projector	Questions to students during the lesson	60	
2	**Practical exercise**	Take measurements and checks of different vehicle communication modules to evaluate their operation.	Practical exercise (4-5 students)	Laboratory of automechanics	Car Measuring instruments	Teacher's observation	90	Consider allowing students to use personal tools to search for data on the Internet.
						IN TOTAL	150 min	

Learning Unit 10

TITLE: Cyber security
This didactic unit aims to give general information on computer security and sensitive data management. (anti-malware, privacy, data backup).

TARGET GROUP

The end user (car workshop / car electrician) or the student class (max.28) will need to learn the theoretical concepts to identify potential computer threats.

PRE-REQUIREMENTS

Learn about the core security-related terms (anti-malware, firewalls, rootkits, phishing, cryptolockers, backups, adware), basic knowledge for using a PC with Microsoft Windows operating system is required.

LEARNING OBJECTIVES

At the end of the learning unit the student will be able to recognize the potential cyber threats arising from the connection of devices in the network, identifying risky behaviors and good practices to be implemented to reduce the probability. They will also be able to define and put into practice the procedures for routine maintenance of the devices and to understand when extraordinary maintenance is necessary and which may be the most appropriate according to the different situations.

MAIN CONTENTS

This didactic unit has three main objectives

1. Cyber threat prevention

Who uses a Telematic Kit connected to a Windows PC or via smartphone (ios, android), must follow some basic rules to prevent cyber threat. To know the principal attack vectors:

- Hacking (Data theft, corporate espionage, identity theft)
- Social Engineering (Spear Phishing, Phishing, traditional SE)
- Internal attacks: Unauthorized access and access control
- Unsecure Smartphone OS with no security update.
- Installing 3rd party apps to the smartphone directly from the internet instead of via official stores such as Google Play or Apple's App Store.
- Malware (viruses, rootkits, bootkits, trojans, worms, ransomware)

Having a reliable anti-malware system, check that anti-malware is up to date, run full system scans periodically, changing passwords regularly, check files that are downloaded from the internet or email before opening them, check the sender's emails before communicating sensitive data, secure the wireless network, adopting backup, disaster recovery and business continuity policies.

2. Routine maintenance of the computing and smartphone environment.

- Firewall

Use a wired or wireless router with firewall features to provide additional protection for your PC and Smartphone connected.

A firewall can block malware that could otherwise scan your computer for vulnerabilities and then try to break in at a weak point.

- Anti-Malware (protect against viruses, spyware, phishing, rootkit, adware, ransomware)

Scan your system regularly, Use AV program with: real-time scanning, automatic updates, email scanning, many AV programs require an annual subscription.

- Update Your OS (windows, ios, android)

Turn on automatic updates in Windows PC and IOS and Android smartphone, configure auto-updates to patch the OS on demand, ensure that the device is on at the scheduled update time.

- Secure your Wireless Network Ensure your network envinroment has the appropriate Encryption enabled, some wireless routers allow you to restrict access to your wireless network by listing all your wireless devices MAC addresses, this will keep unwanted neighbors off your network.

- Encrypt your Data Protects the data if your laptop or smartphone is stolen, you can encrypt select files or the entire hard drive/memory, requires a separate password to un-encrypt the data before it can be accessed.

- Safe Passwords Do not use personal information, use mixed case passwords with numbers and special characters, change passwords often, use pass phrases rather than passwords, Select A Phrase That Is Easy To Remember = 5@ptietr

3. Extraordinary maintenance.

If the user has suffered a computer or smartphone attack (phishing, viruses, etc.), the first thing to do is isolate the device by disconnecting it from the Telematic Kit, from the internal network and from the internet, shut down the computer and contact a professional technician.

METHODS

This teaching unit is the result of an entire class of computer classroom students, where the 3 main objectives of the teaching unit are taught through the use of a PC and a specific software. Instead, the single user (garage / electric car) can be formed by a computer professional.

ENVIRONMENTS

The activities are carried out in a computer lab in the case of students or directly at the workplace as regards a workshop / electric car.

MEDIA & TOOLS

The needs for this units are:

- IT Lab with Windows PC and Smartphone

- Anti-malware software

- Backup software

EVALUATION

Quiz

Time schedule of the learning unit 10

STEP	CONTENT	TEACHING AIMS	METHODS	TEACHING PLACE	TOOLS AND RESOURCES	ASSESSMENT	TIME [min]	COMMENTS
1	Cybersecurity	Know the potential threats of network connection and the different effects on archived devices and data. Recognise appropriate behaviours to prevent risks.	Frontal lesson	Class	PC with projector	Questions to students during the lesson	30	A network connection may be appropriate to cite cases of chronicle of breach of computer security and effects
2	Routine maintenance	Carry out device maintenance operations to reduce IT risks (software updates, firewall management, network security checks, data encryption, etc.)	Frontal lesson	Class	PC with projector	Questions to students during the lesson	15	
3	Extraordinary maintenance	Recognise when extraordinary interventions are needed, isolate the threat and select the appropriate recovery strategy.	Frontal lesson	Class	PC with projector	Final test	15	
						IN TOTAL	60 min	

Learning Unit 11

TITLE: Ethics and customer rights

Telematics involves remote tracking of vehicles, their speed and location. This means effectively also the possibility of tracking the occupants of the vehicle, their whereabouts and their behaviour.

Permanent tracking of people conflicts with European law and so does unsafe storage of personal data of any kind. Therefore, it is necessary for a telematics serviceperson to know some basic rights and obligations related to the protection of personal data.

TARGET GROUP

Mechanics, salespersons, software developers and other groups involved in data tracking from vehicles.

PRE-REQUIREMENTS

No specific pre-knowledge is required.

LEARNING OBJECTIVES

Knowledge: The student is familiar with basic legal principles such as the right to personal data protection and the obligation of enterprises to handle personal data with care.

Skills: The student can use basic terms and expressions related to general data protection. The student can distinguish between personal and non-personal data.

MAIN CONTENTS

a) Data protection

b) ethics

c) customer rights

Within the telematics industry GM, Nissan, TomTom and BMW have all suffered from law suits or negative press coverage due to privacy-related issues.

As a working car mechanic, you will have access to personal data about the driver and the owner of the vehicles you work on. You need to be informed about your obligations to protect personal data.

What kinds of telematics data are sensitive?

Everything that can be used to identify a person, whether encrypted or not, is considered personal data.

“a person who knows all of another’s travels can deduce whether he is a weekly church goer, a heavy drinker, a regular at the gym, an unfaithful husband, an outpatient receiving medical treatment, an associate of particular individuals or political groups — and not just one such fact about a person, but all such facts”

Violating traffic laws, speeding, illegal parking etc.

Unsafe driving (insurance issues)

The European law on protection of personal data was last updated in 2016.

- All companies must have a DPO - Data Protection Officer
- Prohibition of constant tracking
- Right to deactivate
- Need for consent

Important terms and expressions:

- Connectivity
- Geolocation, geofencing
- eCall
- Big Brother
- Stalking
- Cookies
- E-privacy

METHODS

The teacher will explain about the Big Brother allegory, how it was first described in the book “1984” from 1948. Then move on the modern day connected vehicles and draw parallels to Big Brother.

Discuss with student which kinds of data could be misused and why a person on the EU has the right to protection of personal data.

The teacher explains the terms and definitions in section 5.

Finally, the teacher mentions the European laws of corporate responsibility when handling personal data, such as appointing a Data Protection Officer - DPO.

ENVIRONMENTS

The education is set in a classroom.

MEDIA & TOOLS

Written compendium. A/V equipment.

Further reading:

https://www.sbdautomotive.com/files/sbd/pdfs/514ib.pdf

https://www.itu.int/en/fnc/2016/Documents/Presentations/Stephan_Appt.pdf

EU laws concerning processing of personal data:

- Directive 95/46
- Directive 2002/58
- Directive 2016/679

EVALUATION

A quiz will be used to verify that the student has understood the basic messages.

Time schedule of the learning unit 11

STEP	CONTENT	TEACHING AIMS	METHODS	TEACHING PLACE	TOOLS AND RESOURCES	ASSESSMENT	TIME [min]	COMMENTS
1	Terminology	Recognise the specific terms used when talking about data protection and privacy policy.	Frontal lesson	Class	PC with projector	Questions to students during the lesson	10	The lesson can start as a discussion with the students to assess their initial knowledge.
2	Sensitive data and personal rights	Know the main personal rights in terms of data use, storage and traceability.				Questions to students during the lesson	10	A network connection may be appropriate to mention cases of chronicle of privacy violation and consequences.
3	Main regulations	Have a basic understanding of the regulations to be applied in terms of privacy protection and ethical behaviour, so as to follow compliant management instructions and avoid the risks associated with infringements.				Final test	40	
						IN TOTAL	60 min	

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