Erasmus+



Intellectual Output 01

Verification of the teaching model on drive systems at the vocational education level

Project information

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Programme	Erasmus+
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Project number	2017-1-PL01-KA202-038422
Beneficiary organisation	CKZ - Centrum Kształcenia Zawodowego w Wysokiem Mazowieckiem
Partner organisations	ARP - Akademie řemesel Praha - Střední škola technická AIJU - Asociación de investigación de la industria del juguete, conexas y afines PP - Perfect Project Sp. z o.o. ERA - Evropská rozvojová agentura, s.r.o.
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Prepared by	
Draft by	

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1. DESCRIPTION

As part of the result we will verify vocational teaching models to make them flexible for the needs of the labour market, its openness to lifelong learning and the educational and vocational mobility of graduates. The result will also be used to distinguish qualifications within the profession of automotive technician techniques included in the classification of vocational education occupations involving drive systems.

Automotive technician - a field of study related to the service of motor vehicles. An advantage of the course are teaching contents adapted to the requirements of automotive technology. Students educated in this profession become specialists in the field of repair and operation of motor vehicles as well as car diagnostics. We want them to be specialists in modern vehicles and the latest technological solutions in this field. We expect that thanks to information and abilities acquired through "AlterDrive" all the Project beneficiaries could prove, both in front of potential employers and as part of their own enterpreneurial activity, their knowledge of alternative propulsion systems, as such knowledge cannot (should) be obtained as part of current education programs and existing teaching models. Such modern knowledge will allow to achieve in the process of vocational education a specific and complete set of professional qualifications, enabling the graduate to run a business and to undertake employment, among others in:

- service and control stations for motor vehicles that accept modern vehicles;
- production and repair plants of motor vehicles with modern engines and drive systems;
- car dealerships and institutions dealing in the trade of automotive parts related to alternative sources of propulsion;
- car transport companies with the possibility of running innovation (in Białystok or Warsaw, public transport vehicles are already driven by alternative sources of propulsion);
- technical consultancy companies regarding automotive and hybrid, electric or alternative fuel vehicles;
- companies dealing with the liquidation of motor vehicles (so-called shakes, scrap yards), where knowledge about the utilization of such vehicles, eg after accidents, is not yet available among employees and will be needed very soon.

2. ALTERNATIVE DRIVES.

Alternative drives in automotive vehicles aim mainly at reducing the costs of car use, as well as reducing the release of harmful substances into the environment.

In this report, the team from CKZ in Wysokie Mazowieckie presents a proposal of alternative drives, which should be included on the platform within the framework of the AlterDrive project. The general information about alternative drives mainly in the "Polish Internet" as well as other sources is also presented in the report.

1. Alternative fuels for conventional internal combustion engines
    a. LPG
    b. CNG
2. Alternative drive systems
    1.1.1.1. hybrid systems
    1.1.1.2. systems driven by an electric motor,
    a. Electricity source for fuel cells (hydrogen)
    b. Source of electricity - battery

1. **Gas drives:**

    a. **LPG**

http://images.nexto.pl/upload/publisher/Dobry%20Ebook/public/samochodowe%20instalacje

%20demo.pdf

http://www.combustion-engines.eu/entityfiles/files/articles_published/ptnss-2013-sc-021.pdf

http://gazeo.pl/poradniki/eksploatacja/I-Generacja-Instalacje-podcisnieniowe-z-reczna-regulacja,artykul,6002.html

https://autokult.pl/5273,lpg-wszystkie-generacje-od-poczatkow-do-teraz

http://www.diaaut.home.pl/r8261c6x.htm

    b. **CNG**

http://cng-lng.pl/bank-wiedzy-cng-lng-pl/Uklady-zasilania-gazem-ziemnym,artykul,5633.html

http://cng.auto.pl/pliki/2013/2013.12%20-%20CNG%20w%20transporcie.pdf

https://cng.auto.pl/3321/czas-na-gaz-zdradzamy-tajemnice-instalacji-cng

http://www.zielona-energia.cire.pl/pliki/2/Gaz_ziemny_jako_paliwo194212144.pdf

2. **Hybrid drives**

http://www.szkomysz.pl/2017/hybryda.pdf

https://kdk.autokult.pl/26349,naped-hybrydowy http://hybryda-zsp1.prv.pl/strona2.html

http://www.magazyn-motoryzacyjny.pl/samochody-hybrydowe.html

https://pdf.sites.toyota.pl/kat_hybrydy_zbiorczy.pdf

https://autokult.pl/26950,uzywane-samochody-hybrydowe-co-warto-wiedziec-przed-zakupem

http://slideplayer.pl/slide/57838/

3. **Electric drives:**

    a. **Fuel cells (hydrogen)**

https://www.crazynauka.pl/wpcontent/uploads/2016/04/8_Mirai_Jak_Dziala_Zestaw_Ogniw_Paliwowych.jpeg

https://www.crazynauka.pl/wpcontent/uploads/2016/04/9_Mirai_Usprawnienia_Wprowadzon e_W_Ogniwach.jpeg

https://www.spidersweb.pl/2016/01/jak-dziala-samochod-na-wodor.html

https://autokult.pl/11543,samochody-napedzane-wodorem-jak-to-dziala

http://www.ekologia.pl/styl-zycia/eko-auto/auta-na-wodor-bardziej-ekonomiczne-i-ciche,21059.html

http://slideplayer.pl/slide/10382496/ https://www.youtube.com/watch?v=-8L1L1smHOE

http://slideplayer.pl/slide/2566927/ https://www.youtube.com/watch?v=rRv9PvhWgYs

https://www.crazynauka.pl/bateria-w-plynie-moze-zastapic-benzyne-i-blyskawicznie-ladowac-samochody-elektryczne/

http://moto.pl/MotoPL/7,88389,22369722,powstana-stacje-wodorowe-w-polsce-energetyczny-nosnik-przyszlosci.html

http://mojafirma.infor.pl/moto/eksploatacja-auta/naped-i-skrzynia-biegow/724513,Jak-dziala- samochod-na-wodor.html

https://autokult.pl/11543,samochody-napedzane-wodorem-jak-to-dziala

https://moto.wp.pl/jak-dziala-samochod-na-wodor-6068378376602241a

http://www.green-projects.pl/2016/05/auta-wodorowe-dzialaja/

http://www.benchmark.pl/aktualnosci/auto-na-wodor-jak-to-dziala-i-czy-ma-to-sens.html

http://www.elektroonline.pl/a/9893,Najbardziej-innowacyjne-napedy samochodowe,,Elektrotechnika

https://www.toyota.pl/articles/toyota-mirai.json

http://www.dsod.p.lodz.pl/materials/EwP08_A01.pdf

http://www.ogniwa-paliwowe.com/

http://www.ogniwa-paliwowe.info/zalety_wady.php

http://www.mechanik.media.pl/pliki/do_pobrania/artykuly/22/tyczka.pdf

https://www.auto-motor-i-sport.pl/technika/Samochod-na-wodor-to-juz-dziala,23295,1

https://www.motocaina.pl/artykul/paliwo-i-ogniwa-wodorowe-skad-sie-wziely-historia-6084.html

http://www.nauczyciele.mom.pl/files/Ogniwa_paliwowe_jako_zrodlo_zasilania_pojazdow_sa mochodowych-FL.pdf

http://www.zssplus.pl/prace_dyplomowe/praca_2_hybrydy.htm#2r22

b. Battery

http://www.komel.katowice.pl/produkcja2b.html

https://mlodytechnik.pl/hobby/motoryzacja/28500-

samochody-na-baterie

http://samochodyelektryczne.org/

https://www.odnawialne-firmy.pl/wiadomosci/pokaz/162,jak-dziala-samochod-elektryczny

http://energyfree.republika.pl/ae_bud.htm

http://bambus.iel.waw.pl/pliki/ogolne/prace%20IEL/252/02.pdf

http://forsal.pl/artykuly/1026332,naped-lepszy-niz-w-tesli-polscy-inzynierowie-opracowali- specjalny-silnik-elektryczny.html

http://www.etool.alphabet.pl/t/typy-pojazdow

https://www.ure.gov.pl/download/1/6430/EVUEraportpolskipodglad.pdf

https://outlanderphev.mitsubishi.pl/.../raport-samochody-elektryczne-i-hybrydowe-ko...

http://www.pg.gda.pl/~jarguz/papers/Infotech_2012.pdf

https://www.elektr.polsl.pl/images/elektryka/228/228-3.pdf

4. Alternative drives - generally

http://www.dsod.p.lodz.pl/materials/EwP08_A01.pdf

http://mojafirma.infor.pl/moto/eksploatacja-auta/paliwa/695559,Alternatywne-zrodla-napedu- co-bedzie-paliwem-przyszlosci.html

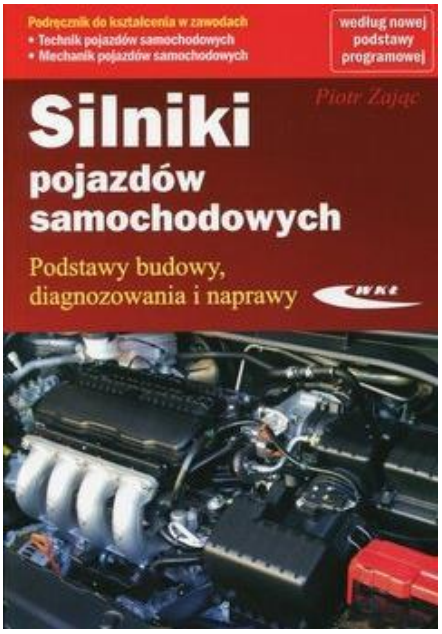
https://www.slideshare.net/qwertyra/napdy-alternatywne-pojazdw-

samochodowych

http://www.pan-ol.lublin.pl/wydawnictwa/Motrol8/Buczaj.pdf

5. Selected coursebooks which contain information about alternative drives:

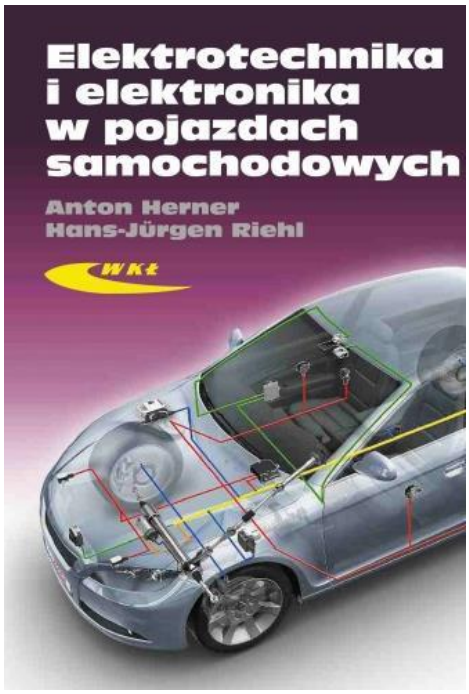
a. „Silniki pojazdów samochodowych”; Piotr Zając; WKŁ –one section of the manual is devoted to alternative drives: mainly electric, hybrid and CNG.



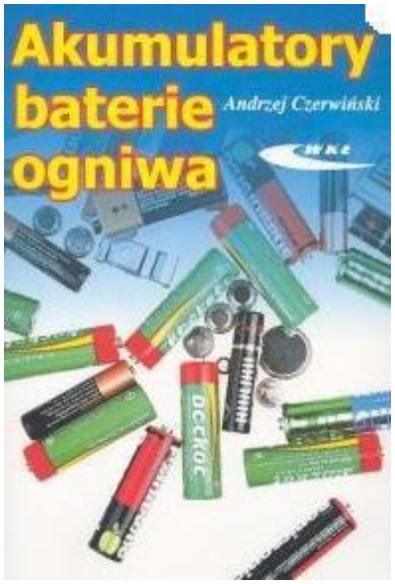
b. Praca zbiorowa „Napędy hybrydowe, ogniwa paliwowe i paliwa alternatywne”; Marek Brzeżański, Zdzisław Juda; WKŁ – the manual mainly talks about hybrid drives and fuel cells.



c. „Elektrotechnika i elektronika w pojazdach samochodowych”; Anton Herner, Hans-JürgenRiehl; WKŁ- this manual mainly talks about hybrid drives



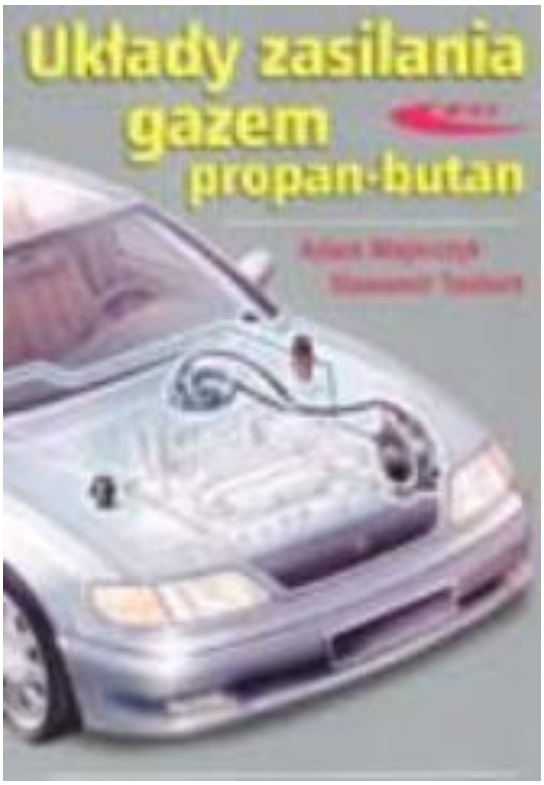
d. „Akumulatory, baterie, ogniwa”; Andrzej Czerwiński; WKŁ – the manual discusses the issue of powering drives from various sources such as batteries and cells.



e. „Instalacje zasilane gazem”; Marek Flekiewicz (poradnik serwisowy) – this guide is dedicated to drives powered by LPG.



f. „Układy zasilania gazem propan –butan”; Adam Majerczyk , Sławomir Taubert; WKŁ – the book describes the propulsion systems for LPG.



g. „Alternatywne zasilanie samochodów benzyną oraz gazami LPG i CNG”; Kazimierz M. Romaniszyn; WNT – the book describes drives powered by LPG and CNG.



h. „Układy elektryczne pojazdów hybrydowych”; Jerzy Merkisz, Ireneusz Pielucha; WYDAWNICTWO POLITECHNIKI POZNAŃSKIEJ –this book is mainly about hybrid drives.



Summing up, it can be said that for the time being knowledge about alternative drives is not systematized, but the European desire to have vehicles with alternative drives is constantly growing, as shown by the report presented on the website:

http://www.wyborkierowcow.pl/wiadomosci/napedy-alternatywne-w-europie-raport/

Attention:

The website addresses provided in the report were available as of 6th March 2018

The automotive industry is one of the most powerful environmental polluters worldwide. That's why research has been going on for years with what fuel to replace diesel and gasoline. The European Commission has declared a struggle to significantly reduce the emissions of carbon dioxide, hazardous greenhouse gas released into the air from automobile engines. How to meet a stringent European limit of 120 grams of CO2 per kilometer? Consumption of fossil fuels must necessarily be reduced and found drives on alternative fuels that should be made from renewable sources. Some solutions seem meaningful and have potential for the future - it protects the environment from emissions.

1/ Natural gas is currently the most promising alternative fuel. It can occur in two forms. **CNG** (Compressed Natural Gas), which is compressed natural gas at a pressure of 200 bar and **LNG** (Liquefied Natural Gas), liquefied natural gas at -162 ° C. It consists predominantly of methane and higher hydrocarbons with a small impurity inert gas. Natural gas is non-toxic, non-respirable and lighter than air. The benefits of natural gas are economic, safety and above all ecological. But it is a by-product of oil production, of course, it will reflect the current price of oil on world markets. The requirement is not met that alternative fuel should not be dependent on the price of oil is not met. But there is a requirement for lower emissions for alternative fuels. The advantage of CNG and LPG is a relatively extensive network of petrol stations, which is also built in our country.

There is no danger that you do not have to refuel. Usage also supports a lower excise tax on CNG and LNG than petrol. It follows that the fuel price is low. Approximately 250,000 vehicles for LPG drive are estimated to be here. However, the costly rebuilding of the car and the lower performance are the opposite. Natural gas is already used by the first trucks and buses. The disadvantages of LNG include storage at very low temperatures, evaporation from the tank during a longer shutdown of the vehicle, and more complex and costly technologies compared to CNG.

2/ **Other Alternative Fuels** - Biometan, BioCNG. In addition to **using raw biogas** for heating or cogeneration, there is another option to clean raw biogas for the quality of pipeline natural gas and the subsequent distribution of produced biomethane using existing gas pipelines for direct consumption or after compression of BioCNG filling into natural gas vehicles. This is a domestic, renewable energy source, compared to natural gas, the biomethane is a renewable source with

zero carbon dioxide emissions. BioCNG is used in Europe in Sweden, Switzerland, Germany, Austria or Spain.

3/ **Biofuels** - biodiesel, bioethanol.

Biological material can be used as fuel in several wals:

Vegetable oils (rape, sunflower, soy, ...) can be converted to a diesel substitute that can be used mixed with conventional diesel or pure biodiesel. Vegetable oil can be used as an alternative to diesel for trucks, but it is not the same as biodiesel. Vegetable oil is a purely natural product, while biodiesel is produced in a chemical process with vegetable oil as a basic raw material. Current engines must first be rebuilt to use vegetable oil. Vegetable oil has a higher energy value than biodiesel and does not usually lead to increased consumption or loss of power. The price per liter of vegetable oil fluctuates by region and depending on the season. The decisive advantage of vegetable oil lies in its environmental friendliness.

Sugar beet, grain and other plants can be converted into alcohol - bioethanol, which can be used as a gasoline or directly in pure form as a motor fuel. Future developments will make it possible to economically produce bioethanol from wood or straw. Ethanol in gasoline mixture can greatly improve its emission characteristics. On the other hand, harmful emissions of aldehydes occur in emissions. The condition of renewable source would be perfectly fulfilled. The higher ratio of biofuels is limited by the size of the cultivated areas; in the short term, their use is easiest. They can be used in existing vehicles and the distribution system does not require costly investment.

4/ **Hydrogen. Fuel cells.** The use of hydrogen in transport is essentially two:

1. Combustion of hydrogen in conventional engines: hydrogen (compressed CH2 or liquefied LH2) is burned similarly to conventional fuels. When burning hydrogen, only harmless water and small amounts of nitrogen oxides are produced. However, this method has two major drawbacks: hydrogen production is expensive nowadays, and hydrogen mixed with air is highly explosive.

2. Use of hydrogen in fuel cells: The vehicle's power unit is an electric motor, and electricity is, as opposed to electromobile-powered batteries, produced directly in the vehicle in fuel cells. Electricity is generated by the exothermic electrochemical reaction of hydrogen itself (compressed or liquefied) or hydrogen chemically developed also in a car with oxygen (air). In addition to electricity, water or water vapor is also produced. It is not a fuel burning, but a chemical reaction - the opposite of electrolysis.

For mass use of hydrogen in transport, it is necessary to build the required infrastructure. This is practically zero at present. All industrially produced hydrogen is consumed near the place of production. Storage of **compressed hydrogen gas** is less costly compared to liquid hydrogen.

Mostly, hydrogen gas is stored and distributed in high-pressure tanks. Steel cylinders with a volume of 50 - 70 liters are used and hydrogen is stored under 20 MPa. **Liquefaction of hydrogen** is highly energy intensive. The liquid state reaches up to -253 ° C. The energy required for liquefaction corresponds to about one third of its calorific value. However, liquefied hydrogen occupies 4.5 times less volume than hydrogen gas at 0 ° C and 25 MPa. The most likely is hydrogen stored in **metal hydrides**. Hydride-powered hydrogen drives appear to be a variant of the future. It does not require the construction of new infrastructure and petrol stations. The biggest obstacle is still the high price of hydrides and the relatively complicated path leading from the production of elemental metals and hydrogen and their transpor to the production of the hydride itself. In this way, hydrogen is stored in a solid phase. Many research centers and automakers are struggling to find the right compounds. Current high-grade hydrides (MgH2, LiBH4, NaBH4) are able to absorb over 10% of hydrogen.

Against the classic accumulators of electric motors, fuel cells have a number of advantages, above all a higher driving range, ecological cleanliness, discarded fuel cells do not burden the environment with heavy metals like conventional lead-acid accumulators. A number of world-class cars have been developing fuel cells for automobiles for years, with several dozen cars already on the road.

5/ **Hybrid vehicles:** hybrid vehicles are a possible alternative technology for the near future. They retain the benefits of gasoline (diesel) engines and electric vehicles, while overcoming their disadvantages. The hybrid vehicle has 2 engines, a combustion engine and an electric motor.

Depending on driving circumstances (acceleration, charge), the car uses the most advantageous mode. As the battery runs continuously while driving, the batteries may be smaller (and less expensive) than at conventional electric cars. Two engines and other technical improvements increase the price and weight of the vehicle. Several models of hybrid cars are already available on the market.

6/ Electromobiles: At present, electromobility is a hot topic, media-attractive and popular. In many countries pilot projects for the introduction of electromobiles are being put into practice, especially in world capitals. Driving an electromobile is different - the electric car is

not heard.

Thanks to the characteristics of the electric motor, driving is far smoother, any "tweaking" or vibration from the engine does not exist. The advantages are higher efficiency compared to the combustion engine, minimum emissions, noiselessness, simple charging, oil independence. Unlike conventional combustion engines, electric cars do not produce any direct emissions. The main disadvantages of electromobiles include a small number of charging stations, slow battery filling, low mile range, high price of vehicles, lack of legislation, expensive batteries, inconsistency of components such as rechargeable terminals. The fast recharging of an electric car on the road across the Czech Republic is an increasingly popular topic. Technological development has brought a significant increase in battery capacity, reduced weight and longer life. Modern technologies have also made it possible to improve charging control and speed up battery recharging. The

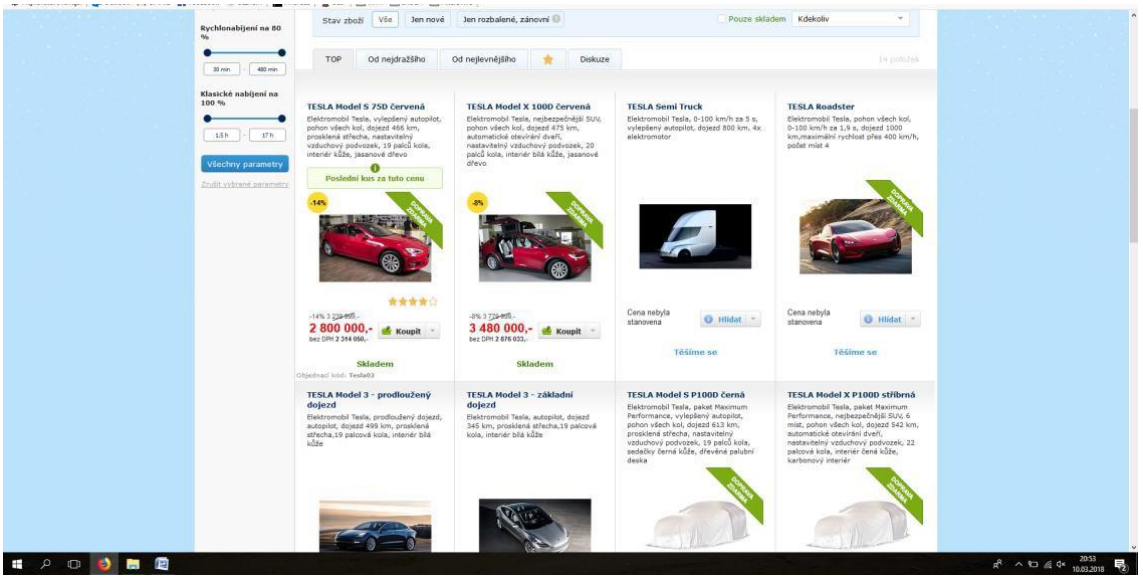
current average range of electric vehicles is between 120 and 150 km. ČEZ Group's electromobility operates the largest network of fast-charging power stations for electric vehicles supplied by ABB Czech Republic.

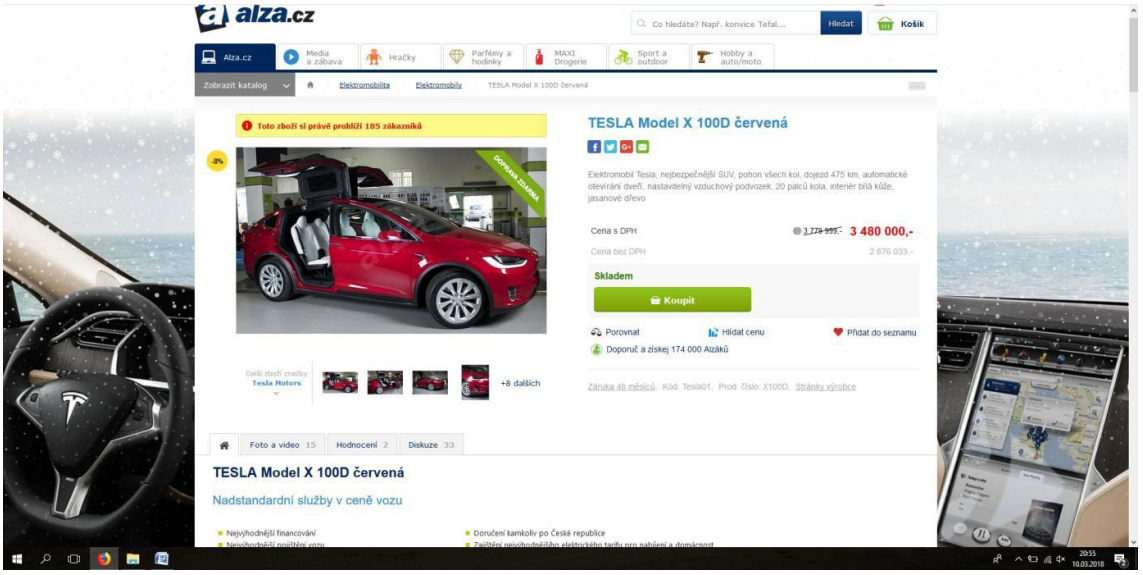
More and more electric vehicles are driving on Czech roads. ŠKODA AUTO will produce pure

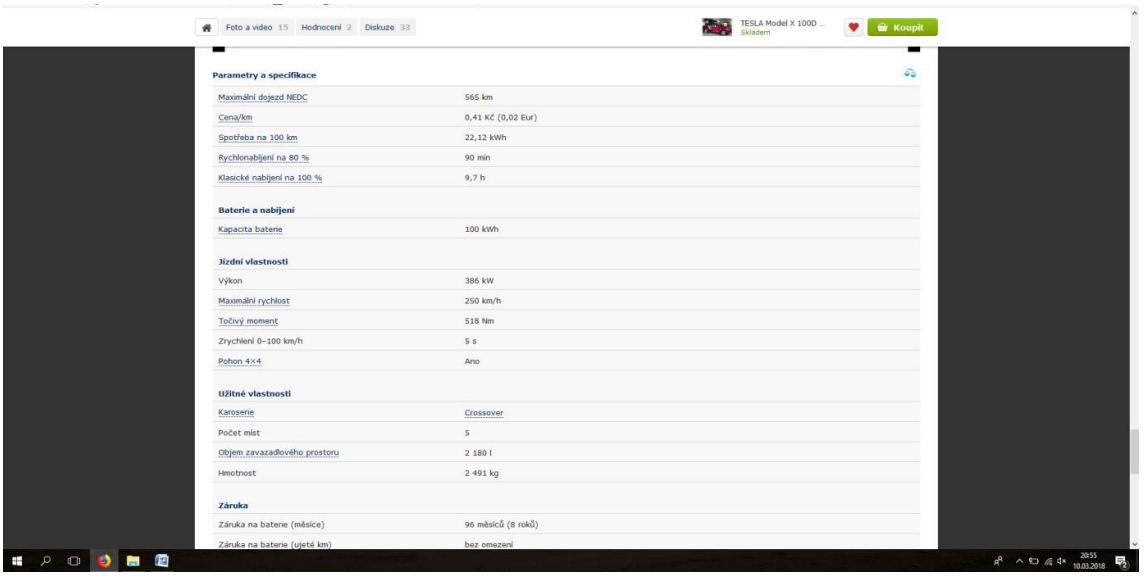
electric cars at the Mladá Boleslav plant. We are pleased that the first ŠKODA brand electric car will be produced in the Czech Republic. In addition to the production of electric vehicles, the electric components for the plug-in hybrid vehicles of several brands of the Volkswagen concern will be produced in Mladá Boleslav from 2019. The first electrified serial model of the ŠKODA

brand will enter the market as early as 2019: it will be ŠKODA SUPERB with a plug-in hybrid drive, which will be off the line in the plant in Kvasiny. In 2020, the first pure electric drive will be added to it in Mladá Boleslav.

In the Czech Republic, Tesla electric cars are also known by Tesla Motors, which is more like a computer-based start-up, founded in Silicon Valley in 2003. It was co-founded by billionaire Elon Musk, who became rich by selling Zip2 and PayPal. Tesla launched the first-ever Tesla electric car for the first time. Today you can also order this car at the Alza.cz online store:


Rychlonabíjení na 80 %
Klasické nabíjení na 100 %
Všechny parametry
Stav zboží
Jen nové
Jen rozbalené, zánovní
Pouze skladem
Kdekoliv
TOP
Od nejdražšího
Od nejlevnějšího
Diskuze
TESLA Model S 75D červená
Elektromobil Tesla, vylepšený autopilot, pohon všech kol, dojezd 466 km, prosklená střecha, nastavitelný vzduchový podvozek, 19 palců kola, interiér kůže, jasanové dřevo
2 800 000,-
Koupit
Skladem
TESLA Model X 100D červená
Elektromobil Tesla, nejbezpečnější SUV, pohon všech kol, dojezd 475 km, automatické otevírání dveří, nastavitelný vzduchový podvozek, 20 palců kola, interiér bílá kůže, jasanové dřevo
3 480 000,-
Koupit
Skladem
TESLA Semi Truck
Elektromobil Tesla, 0-100 km/h za 5 s, vylepšený autopilot, dojezd 800 km, 4x elektromotor
Cena nebyla stanovena
Hlídat
Těšíme se
TESLA Roadster
Elektromobil Tesla, pohon všech kol, 0-100 km/h za 1,9 s, dojezd 1000 km,maximální rychlost přes 400 km/h, počet míst 4
Cena nebyla stanovena
Hlídat
Těšíme se
TESLA Model 3 - prodloužený dojezd
Elektromobil Tesla, prodloužený dojezd, autopilot, dojezd 499 km, prosklená střecha,19 palcová kola, interiér bílá kůže
TESLA Model 3 - základní dojezd
Elektromobil Tesla, autopilot, dojezd 345 km, prosklená střecha,19 palcová kola, interiér bílá kůže
TESLA Model S P100D černá
Elektromobil Tesla, paket Maximum Performance, vylepšený autopilot, pohon všech kol, dojezd 613 km, prosklená střecha, nastavitelný vzduchový podvozek, 19 palců kola, sedačky černá kůže, dřevěná palubní deska
TESLA Model X P100D stříbrná
Elektromobil Tesla, paket Maximum Performance, nejbezpečnější SUV, 6 míst, pohon všech kol, dojezd 542 km, automatické otevírání dveří, nastavitelný vzduchový podvozek, 22 palcová kola, interiér černá kůže, karbonový interiér


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Košík
Zobrazit katalog
Toto zboží si právě prohlíží 185 zákazníků
TESLA Model X 100D červená
Elektromobil Tesla, nejbezpečnější SUV, pohon všech kol, dojezd 475 km, automatické otevírání dveří, nastavitelný vzduchový podvozek, 20 palců kola, interiér bílá kůže, jasanové dřevo
Cena s DPH
3 480 000,-
Cena bez DPH
2 876 033,-
Skladem
Koupit
Porovnat
Hlídat cenu
Přidat do seznamu
Doporuč a získej 174 000 Alzáků
Foto a video 15
Hodnocení 2
Diskuze 33
TESLA Model X 100D červená
Nadstandardní služby v ceně vozu
Nejvýhodnější financování
Doručení kamkoliv po České republice


Foto a video 15
Hodnocení 2
Diskuze 33
Koupit
Parametry a specifikace
Maximální dojezd NEDC 565 km
Cena/km 0,41 Kč (0,02 Eur)
Spotřeba na 100 km 22,12 kWh
Rychlonabíjení na 80 % 90 min
Klasické nabíjení na 100 % 9,7 h
Baterie a nabíjení
Kapacita baterie 100 kWh
Jízdní vlastnosti
Výkon 386 kW
Maximální rychlost 250 km/h
Točivý moment 518 Nm
Zrychlení 0–100 km/h 5 s
Pohon 4×4 Ano
Užitné vlastnosti
Karoserie Crossover
Počet míst 5
Objem zavazadlového prostoru 2 180 l
Hmotnost 2 491 kg
Záruka
Záruka na baterie (měsíce) 96 měsíců (8 roků)
Záruka na baterie (ujeté km) bez omezení

In 2012, a book was published - a comprehensive overview of issues for all types of technical automobile schools called: Special Combustion Engines and Alternative Drives

A comprehensively specialized publication introduces readers to the issue of using alternative drives. The first chapter is focusing on the world's energy consumption is followed by chapters about specialy designed engines - the combustion turbine, the Stirling engine, the Wankel engine and the modern steam engine. A separate chapter is dedicated to gaseous fuel vehicles. Deeper analysis is focused on the issue of alternative vehicle propulsion represented by electric battery vehicles, hybrid vehicles and fuel cell electric vehicles. The final part is devoted to fuels of biological origin and to the analysis of the future of motor vehicle propulsion. The book is intended for students of technical automobile schools of all types (higher vocational, high schools and colleges), of course, also for the professional public and for those interested in automotive technology.

3. EXISTING PLATFORMS WITH DOCUMENTATION ABOUT ALTERNATIVE DRIVES

Having searched polish websites the team from CKZ came to the conclusion that there no open platforms with materials regarding alternative sources of automotive power supply. One can only find closed platforms with information available only after logging in, for example university platforms. The information available on this subject is in the form of documents, articles, presentations, books or multimedia files, as presented in the report on alternative vehicle drives.

Platforms as a basis for further development:

- ALTERNATIVE CONCEPTS OF AUTOMOBILE DRIVE - DOCUMENT CO-FINANCED BY THE EUROPEAN SOCIAL FUND AND THE STATE BUDGET OF THE CZECH REPUBLIC LINK: HTTPS://KKE.ZCU.CZ/EXPORT/SITES/KKE/OLD_WEB/_FILES/PROJEKTY/ENAZP/02/MMP/019_ALTERNAT_IVNI_KONCEPCE_POHONU_AUTOMOBILU.PDF



- ALTERNATIVE DRIVES FOR ROAD VEHICLES - Bachelor thesis (2013) LINK: HTTP://BIT.LY/2IHIPFC

This bachelor thesis includes alternative drive systems for road vehicles. It provides a brief overview and descriptions of alternative drive road vehicles, which are the most developed and are currently used in mass production and sales. It deals with the causes and reasons why the alternative fuels are developed.

First part of the bachelor thesis is focused on electric motors, their operation principle and different types of energy storage. The other part describes different types of hybrid drives. The last section deals with hydrogen drive, hydrogen production and types of fuel cells for hydrogen powered vehicles.

Keywords: electric drive, battery, hybrid vehicle, hydrogen, fuel cell.

- ALTERNATIVE DRIVES FOR VEHICLES – PRESENTATION RWE PLYNOPROJEKT, S.R.O. (2011) LINK: HTTP://WWW.IFLEET.CZ/FILES/IFLEET/EVENTS/PREZENTACE/13642974593.PDF



- ALTERNATIVE DRIVE OF AUTOMOBILE- MASTER'S THESIS (2009). LINK: HTTPS://WWW.VUTBR.CZ/WWW_BASE/ZAV_PRACE_SOUBOR_VEREJNE.PHP?FILE_ID=16518

A survey of perspectice alternative drives in motor vehicles is processed in this work. There are main characteristic for each mentioned drive, their advantages and disadvantages and problems associated with their use in vehicles. The work is aimed at gas engines, electro mobiles, hybrid drives and hydrogen, therefore the most likely drives the future.

Key words: Alternative drive, electro mobile, hybrid drive, hydrogen, fuel cell, battery, CNG, LPG, biofuels, energy recovery.

- ALTERNATIVE DRIVES OF MOTOR VEHICLES (2004) –Brno University of Technology, Faculty of Mechanical Engineering, Department of Transport Engineering INK:HTTP://WWW.SINZ.CZ/ARCHIV/DOCS/SI-2004-04-212-224.PDF

Due to the depleted oil supply and the immense environmental pollution problems, people began to search for alternative energy sources twenty years ago. It was about energy that would be less harmful to the environment and at the same time guarantee that transport will not disappear from the planet in the future. Several types of alternative drives can be used in the automotive industry. The most important are gas, electric, hybrid and hydrogen drives. Solar and air drives are also being developed. But before these alternatives can be enforced, it will be necessary to solve issues such as performance, durability, milestones and costs.

- CHARGING STATION - EMOBILITA ČEZ
  presentation LINK:
  HTTP://WWW.ELEKTROMOBILITA.CZ/



- CHARGING STATIONS FOR ELECTROMOBILES – ABB LINK:
  HTTP://NEW.ABB.COM/EV-CHARGING/CS

- SUSTAINABLE MOBILITY VEHICLE CENTER – CVUM LINK:
  HTTP://WWW.CVUM.EU/

The activity of the research center focuses mainly on the concentration of resources and technologies that lead to the research of new solutions and consequently to the optimization of the concepts of piston engines for vehicles and power engineering.

Another area where the focus of the research center is directed is drive aggregates, including electric and hybrid, and their integrated management with regard to efficiency, environmental friendliness, mobility value and, ultimately, the resulting competitive ability of firms linked to the domestic industry.

4. KITS FOR LABS REPORT

Among all the technical education tools, ***kits for labs*** are an useful tool to introduce students to the amazing science of ***renewable energy technology***. Using lab kits, students can discover key principles that are essential for a comprehensive understanding, not just of solar, wind and ***fuel cells***; but also of electrochemistry, physics and engineering. Electrolysis, energy conversion, electrical circuits, mechanical energy – so many STEM concepts are integral to learning about future energy.

In this report, the team of ERA in Prague presents an ***overview of kits for labs providers*** on Czech market as well as some other useful tools and sources of information relevant to this topic.

HORIZON EDUCATIONAL

http://www.horizoneducational.com/didactic-material/#prod2

Horizon Educational is an American organization providing teaching materials in the technical field, including ***aids to explain the functions of sustainable energies***. They have a branch office in the Czech Republic.

Horizon Educational develop, produce and distribute hands-on teaching material and didactic equipment as well as online curriculums and educational programs. Their flag product are the ***STEM kits*** and ***technical training equipment*** that both have an international reputation for ***quality, educational content and award-winning design***. Kits and equipment are being developer for middle schools, higher education and vocational training facilities as well as colleges/universities.

STEM kits

- Electric mobility science kit
- Hydrocar
- Solar hydrogen science kit
- Fuel cell car science kit
- PEM reversible fuel cell
- Ethanol fuel cell science kit
- PEM mini fuel cell

- And many more

Technical Education

Products designed to teach ***more advanced engineering*** and science concepts on renewable energy and hydrogen fuel cell hybrid systems.

- Fuel cell developer kit
- H-12 PEM fuel cell 12W
- Renewable energy trainer
- And many more…

Fuel cell engineering

Fuel cells stacks specifically designed to be both light weight and high performance, commonly used in R&D projects and ***university mobility challenges***, continuously winning awards and podium places in international competitions.

Horizon's H-Series are one of the most efficient fuel cell stacks in the market. By having a range from 100W to 5kW, they are often the best choice for research and engineeringprojects.

Horizon Educational organized a contest H2AC (Hydrogen Horizon Automotive Challenge) race in 2017 in Prague, involving students from Czech VET schools all over the country. This event. Was organized in cooperation with Czech Technical University in Prague.

http://www.horizoneducational.com/uncategorized/2017-h2ac-czech-republic/

HELAGO

https://www.helago-cz.cz/eshop-kategorie-obnovitelne-zdroje-energie.html

Helago is a company developing the ***equipment for laboratories***, ***specialized schoolrooms***, scientific institutions, medical facilities etc.The company is always seeking to increase the ***quality of its products and service***. It has been a holder of Quality management system ČSN EN ISO 9001:2001 certificate since 2004. The effort to develop itself has become tradition in the company.

Apart from other products, Helago is focused on developing ***tools of education*** in fields of sciences, health education, prevention, pre-school teaching, seniors, etc.

Several ***easy to use*** and ***highly efficient equipment*** related to ***renewable energy sources*** are included. How to get energy from light through the solar cell to get energy from hydrogen using PEM article or simply to get energy from the wind? These ***energy sources are designed to replace traditional sources*** such as coal or oil. These devices can be easily assembled, and allow to understand the physical and chemical principles, on which the production of renewable energy based.

3B Scientific

A wide range of aids and devices for demonstration of basic physical and chemical principles are designed especially for primary and secondary schools. From individual components, it is possible to create assemblies for a practical demonstration of many experiments.

LeXsolar

Aids to help understand the issue of the use of renewable energy sources, creating intelligent networks, etc. The kits are suitable for all levels of schools.

Heliocentris

Educational systems of various technical levels, demonstrating particular the use of alternative energy sources to produce hydrogen and re-use in the production.

ELWE

Equipment for demonstration and study of electrical systems, control systems, automation, mechatronics, etc. Sophisticated tools designed especially for universities and secondary vocational schools.

Fischer Technik

From kindergarten to university - such a range of players can fully use these kits. From a simple car to sophisticated applications using sensors, drive units, etc.

OTHER PROMOTERS OF NEW ENERGIES EDUCATION IN CZECH REPUBLIC:

Professional training of pedagogical staff in the field of energy http://dvpp.eazk.cz/vyuka/obnovitelne-zdroje-energie/informace-o-vyuce/ A platform for further education of pedagogical staff.

Department of petroleum chemistry and alternative fuels – University of Chemistry and Technology in Prague

https://utrap.vscht.cz/science-and-research/equipment

The list of equipment used in the labs of UCT's alternative fuels department.

Unipetrol Foundation

http://www.nadaceunipetrol.cz/CS/default.aspx

The largest Czech petrochemical group Unipetrol is behind its creation. The company is also Foundation's biggest supporter.

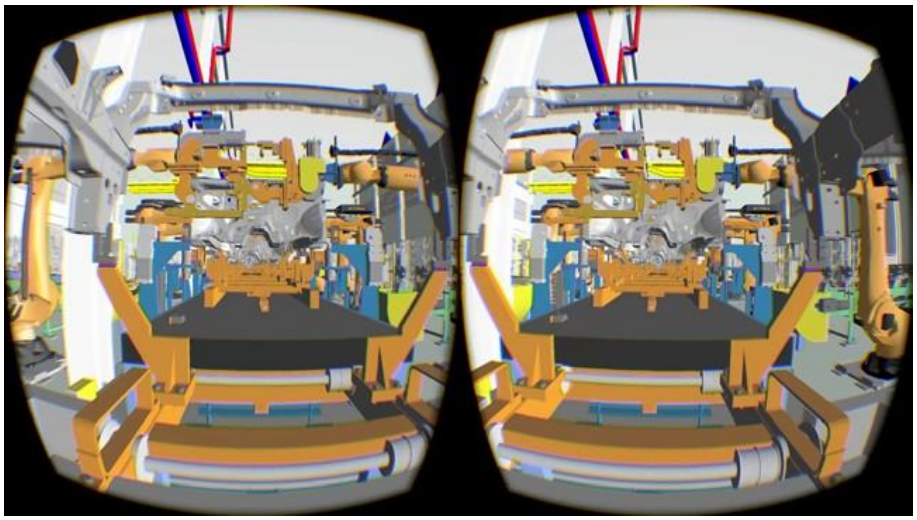
The Foundation's aim is to popularize natural and chemical study fields and support its students– both through scholarship programs and paid students internships as well as grant programs for high schools.

5. VR SIMULATORS

INDUSTRY AND EDUCATION



Payment tools for VR simulation



zSpace

eon reality

VR Immersive Education

Unimersiv

ThingLink

Ludus

Payment tools for VR simulation

zSpace combines elements of Augmented Reality and Virtual Reality. The zS- pace Learning Lab consists of hardware, software and educational content.

zSpace applications engage students in standards-based learning experiences that align with the curriculum. Students construct knowledge and understanding of con- cepts across multiple curriculum areas with a strong focus on STEM subjects.



Automotive Training

The Automotive VR Training System by GTA offers extraordinary hands-on experien- ces while improving student interest and performance in mechanic training. These applications greatly expand the opportunities available to students by eliminating consumables, reducing training space, and allowing students to practice in a safe environment.

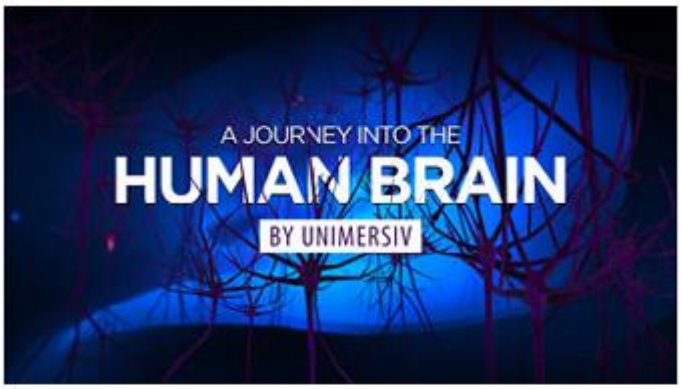
zSoace prepare students for careers in automotive mechanics, health and medicine, and welding with applications designed to provide interactive, hands-on learning ex-periences.

At Unimersiv, we believe that Virtual Rea- lity should not only be used for gaming purposes but that it can have a greater impact in our lives.



Anatomy VR

Unimersiv is the largest platform for VR educational experiences. By down- loading our app, you will have access to multiple experiences that will let you learn about history, space or the human anatomy.



A Journey into the Human Brain

We want to make learning something new fun again so we built the first Virtual Reality learning platform to help students of all ages learn anything faster through virtual reality.

IMPROVE THE PERFORMANCE OF YOUR TEAM IN VR

Your team is your most important asset. We use Virtual Reality to create immersive training programs that will save you time and money and that will help you eliminate risks.



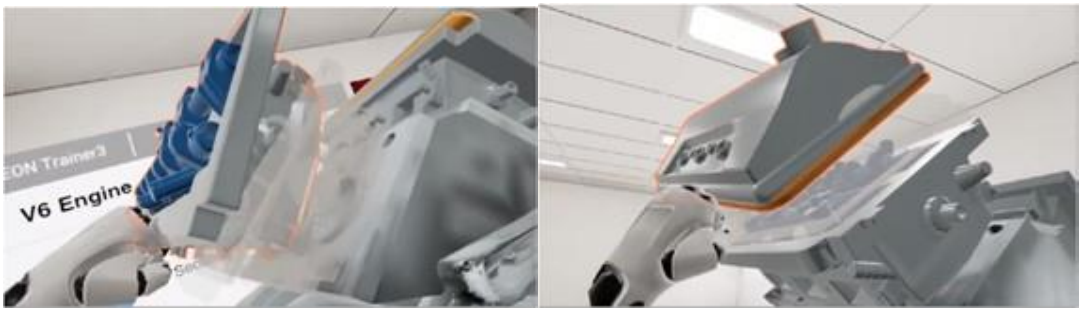
EON Reality is the world leader in Virtual and Augmented Reality based knowledge transfer for industry and education.



BUILD POWERFUL IMMERSIVE SIMULATIONS

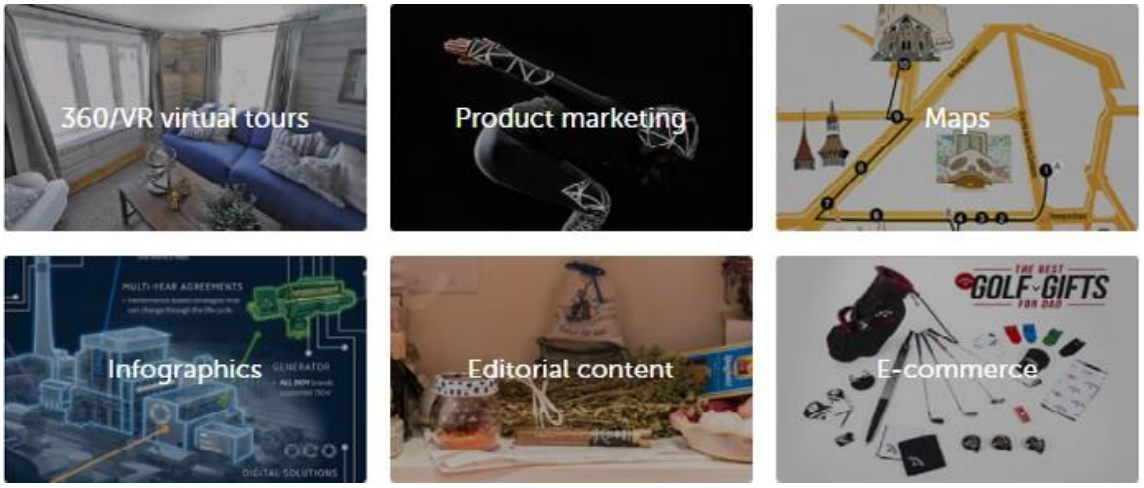
EON Studio is our flagship 3D authoring software for developing interactive 3D appli- cations. With EON Studio, users of all experience levels can build complex, high-qua- lity interactive 3D content with little to no programming experience.

Whether you create 3D applications for architecture, marketing or training, EON Stu- dio provides a unique range of benefits and functions making it a developer's prefe- rred choice.



Innovate, scalable solution for business and education.

We work with a wide range of professionals and leading organizations in business and education, powering interactive image and video experiences to over 35 million people every month.



Turn any image or video into a learning experience

ThingLink's image interaction technology helps students become fluent in using di- gital media to express themselves and demonstrate their learning. With ThingLink, teachers and students can easily create interactive infographics, maps, drawings, and engaging 360 documentaries in a classroom setting, at home, or on field trips.



IMMERSIVE EDUCATION
LEARN THROUGH EXPERIENCE

We are a virtual/augmented reality software company dedicated to transforming how educational content is delivered and consumed globally by providing educators the tools they need to create their own content in virtual classrooms or virtual trai- ning environments . Since we opened our doors in October 2014, we have released a range of educational experiences and won many international awards for our edu- cational software.



VR / AR is a new industry, and the benefits both inside and outside the classroom are only now being discovered. The company's vision for the future is to see virtual rea- lity become a staple tool for education and training and we strive to produce quality experiences that demonstrate this.



Dale's Cone of Experience is a model that incorporates se- veral theories related to ins- tructional design and learning processes. During the 1960s, Edgar Dale theorized that lear- ners retain more information by what they "do" as opposed to what is "heard", "read" or "observed". His research led to the development of the Cone of Experience. Today, this "learning by doing" has be- come known as "experiential learning" or "action learning"

LUDUS

LUDUS offers a virtual training system for industry staff providing identification and decision-making processes related to occupational risk scenarios and other security protocols.

Virtual reality technology allows workers to recreate realistic risky situation in first person, enhancing the perception of risk detection and creating a better aware- ness of the consequences of those situa- tions.

The simulation provides a safe environ- ment to practice the decision-making processes dealing with any risks.



Industrial machinery training



Emergency action plan



Lockout/Tagout processes



Risk perception and prevention



Training in industrial vehicles

The LUDUS training simulator for emer- gency corps offers an experience in tac- tical decision-making process in inter- ventions of emergency corps, such as firefighters, rescue teams or police.

Other tools for VR developments

Desktop Tools

Unreal Engine Unity3d



Web Tools

A-Frame React-VR



Desktop Tools for VR developments

Augmented and virtual reality technologies are evolving rapidly and becoming more powerful by the day. Even if you're starting with a simple project to learn VR or AR, Unreal Engine empowers you to build your team, your assets and your workflow with tools that can deliver on your creative vision and quality bar - now and in the future.





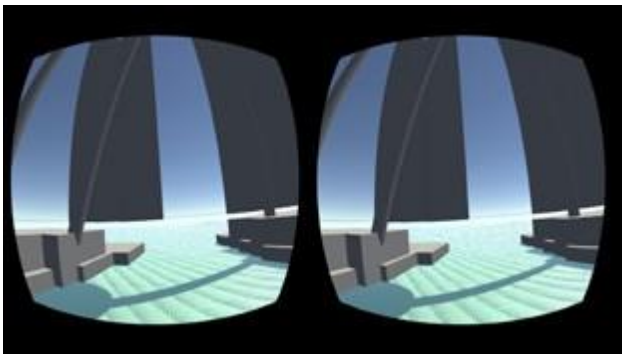
Free to use, Unreal Engine 4 can be downloaded and installed to classroom computers as well as personal systems at no cost. With full access to the complete source code and tools, Unreal Engine 4 levels the playing field to give everyone the resources needed to learn professional-quality development. In addition, schools and students receive regular updates, making it easy to stay current with the latest in development for games, cinematic content, visualization and re- altime production



Web tools for VR developments



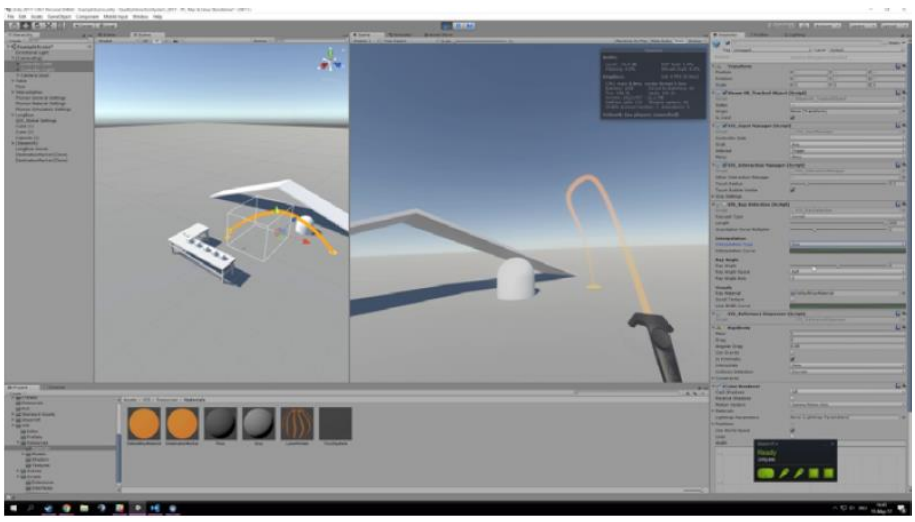
Unity is the most widely used VR deve- lopment platform, and more than 91% of HoloLens experiences were created with Unity.



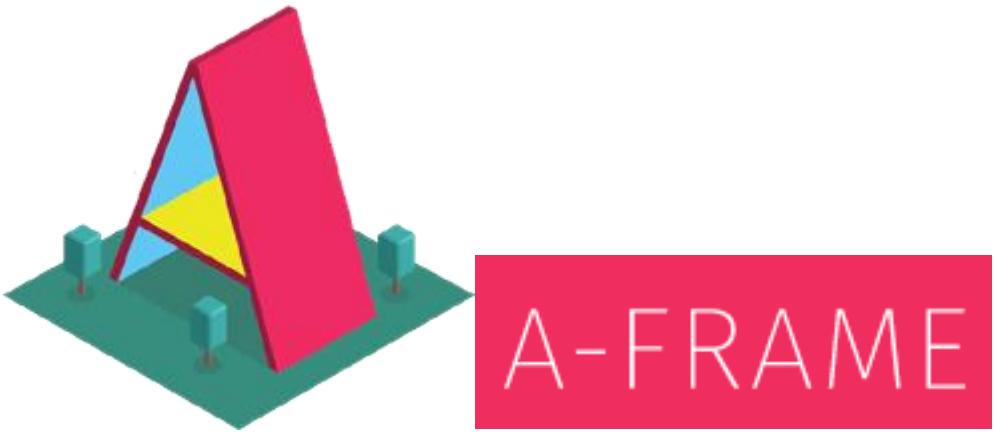
Unity is compatible with all the latest and most important platforms. Native support is now available for Oculus Rift, Steam VR / Vive, Playstation VR, Gear VR, Microsoft HoloLens and Google's Daydream View.



Thanks to a highly optimized stereosco- pic rendering pipeline and the tools that help you to further optimize your content.



Web tools for VR developments

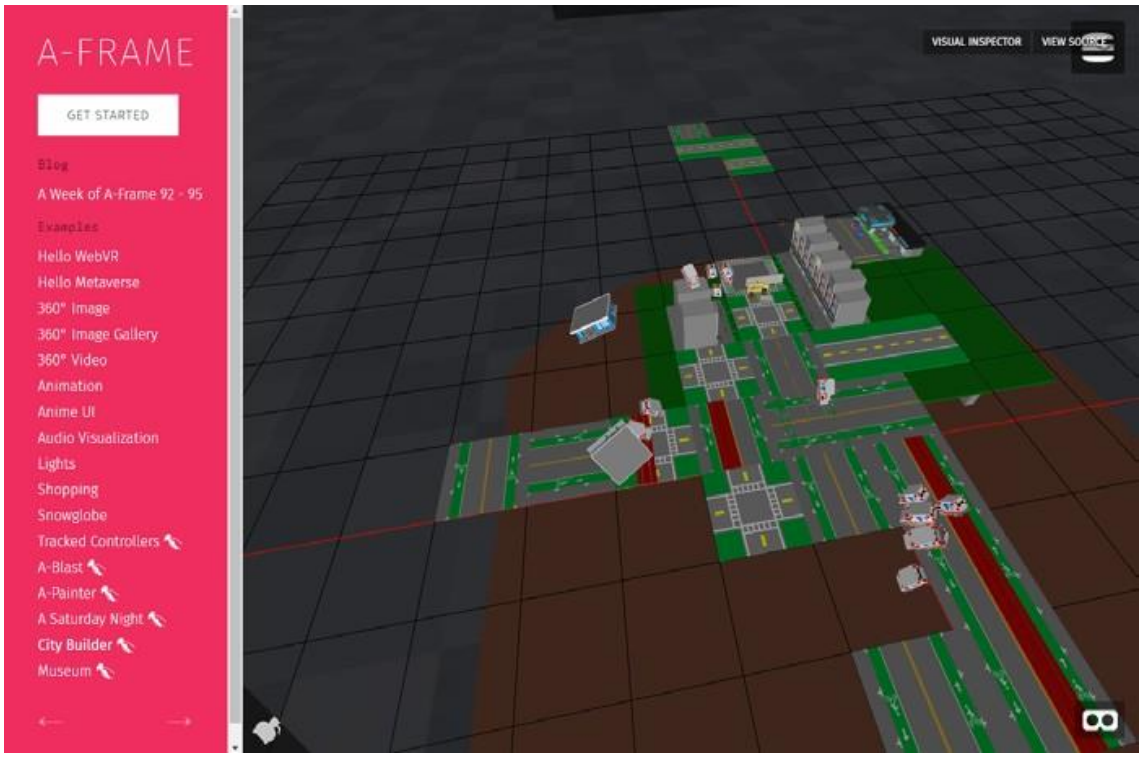


A-Frame is an open-source web framework for building virtual reality (VR) experien- ces. It is primarily maintained by Mozilla and the WebVR community.

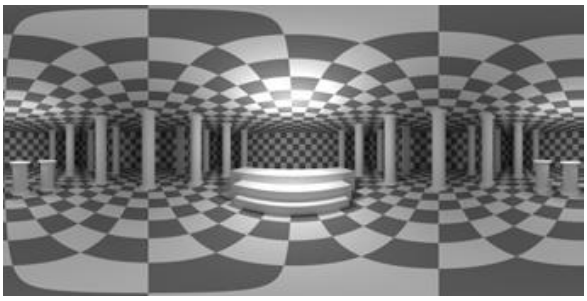
It is an entity component system framework for Three.js where developers can crea- te 3D and WebVR scenes using HTML.

HTML provides a familiar authoring tool for web developers and designers while

incorporating a popular game development pattern used by engines such as Unity.



Web tools for VR developments

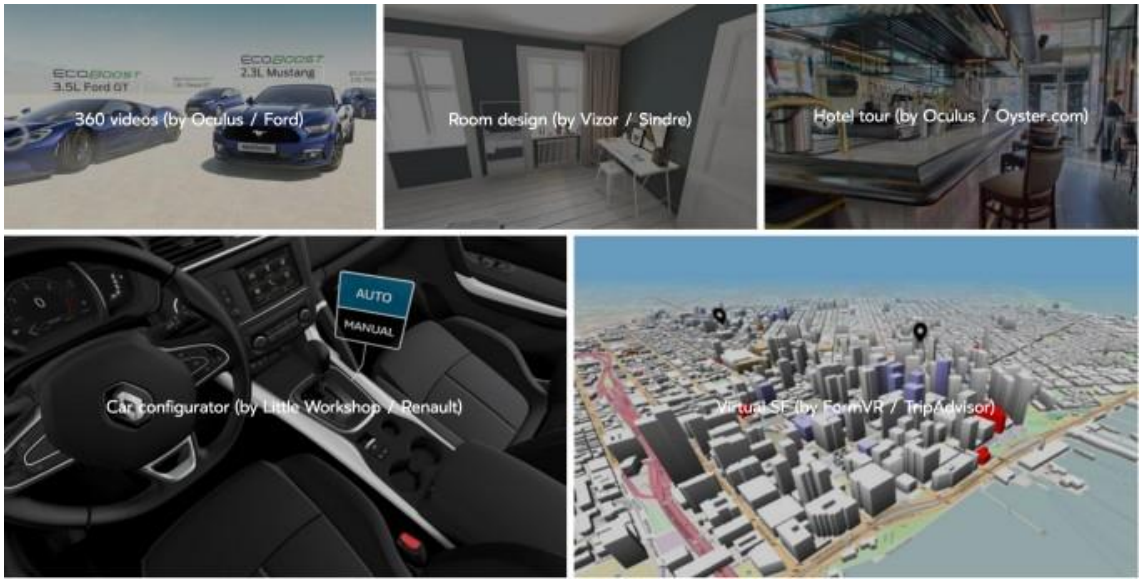


React is an open-source JavaScript library from Facebook that makes it easy to create interactive User Interfaces. React VR takes it to the next level, creating UIs and 3D scenes in virtual reality.



Anybody with experience in building React apps should be able to build React VR apps pretty easily.

Once you've built a compelling VR experience, chances are you'll want to share it on the web. React VR ships with a script to package everything up into a few files that you can place on your web server.



6. CONCLUSION

Currently the motor kits that exist in the market is not very safe for using at schools.

Mainly to solve security problems, it is decided to make a virtual simulator for mounting and dismounting motors.

Following the criteria of the schools CKZ and ARP, we decide to use an electric motor simulator that is the most interesting and most advanced engine developed. Therefore, it is decide that schools obtain the following equipment:

- HTC Vive VR
- Recommended Minimum Computer Specs
- Graphics*:
- NVIDIA® GeForce® GTX 1060 or AMD Radeon™ RX 480, equivalent or better. View the complete list ›
- Processor:
- Intel® Core™ i5-4590 or AMD FX™ 8350, equivalent or better
- Memory:
- 4 GB RAM or more
- Video out:
- HDMI 1.4, DisplayPort 1.2 or newer
- USB ports:
- 1x USB 2.0 or better port
- Operating system:
- Windows® 7 SP1, Windows® 8.1 or later, Windows® 10

It has begun working with new development. And the following survey has been passed in schools. Perfect Project has prepared the survey.

7. SURVEY REVIEW

This project has been funded with support from the European Commission. This report reflects the view only from the author and the European Commission cannot be held responsible for any use which may be made of the information contained herein.

ENGLISH VERSION

https://docs.google.com/forms/d/e/1FAIpQLSfLSdiagKBu9l1wwNOLJZEUGgerkNa-J2bTUa7_yNKBVthbJA/viewform?usp=sf_link

POLISH VERSION

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https://goo.gl/forms/CJfDI54TWluehC5T2

Attachments:

- AlterDrive questionnaire students answers_ARP
- AlterDrive questionnaire students answers_CKZ