2018

Polski
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Przyszłości

Awards catalogue

20th Annual Competition Polish Product of the Future

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AWARDS CATALOGUE

20th Annual Competition

Polish Product of the Future

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PARP
PFR Group

The National Centre
for Research and Development

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European Funds
Smart Growth

Republic of Poland

European Union
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Dear Readers,

Whether discussing companies, industry or country, innovation is a driving force for further development and modernity. However, in Poland, the scale of implementing innovative solutions is still not at the level it should be. Therefore, the need to increase innovation has been included in the five pillars of economic development of Poland contained in the Responsible Development Strategy.

One of the activities that falls under this trend is a competition organised jointly by the Polish Agency for Enterprise Development and the National Centre for Research and Development – Polish Product of the Future. It is the only competition that selects and awards breakthrough projects that are changing the face of the Polish economy. This year, there is a special edition – the 20th anniversary of the competition. Its history shows that despite the risk associated with implementing high-tech solutions, Polish engineers, scientists and economic operators are successful in the market, both at home and all over the world. It is them who should receive special thanks for contributing to the development of innovation in Poland.

The anniversary of the competition is also a great opportunity to thank over 300 experts from various fields of technology, who have supported us over these 20 years in the process of evaluating over 900 projects, and have participated in the work of the Jury. It is their dedication and professionalism that we owe the high level of the competition.

We would like to thank all participants in the competition for their participation, and we congratulate the winners and wish them much success on their way to development.

Please have a read of the catalogue, and participate in the next editions of the competition!

Patrycja Klarecka
President of PARP

Prof. Maciej Chorowski, DSc, Eng.
NCBR Director

About the competition

History

The objective of the Polish Product of the Future competition, which has been run since 1997, is to promote the most-innovative products and technologies developed in Poland that have the potential to be successful in not only the domestic, but also foreign markets. And we can certainly say that this is the case.

During the 20 years of the competition, over 900 projects have been submitted from various sectors of the economy, including medicine, pharmaceutics, electronics and electrical engineering, chemistry, and industrial automation. To date, the Jury – consisting of representatives of the most-important institutions in the country – has awarded 52 projects and distinguished 109. This has been done in three categories: product of the future of a scientific unit, product of the future of an economic operator, and product of the future of a consortium of a scientific unit and an economic operator.

The importance of the event is all the more highlighted by the patronage of the minister in charge of the economy, and this year also of the Ministry of Science and Higher Education. Many products developed based on competition entries have been successful in the market, and the scale of these achievements is impressive.

VIGO System S.A., winner of the 3rd, 7th and 12th edition of the competition (for the following projects respectively: 'New generation of medium and far infrared radiation detectors working without cryogenic cooling', 'Thermographic camera V-20', and 'Microbolometric thermographic camera VIGOcam V50'), has provided a mission to Mars with spectrometers allowing examination of the chemical composition of materials collected by the Curiosity rover. Its devices are used in almost all major laboratories. They are also used by Nobel Prize winners – the gravitational wave detector, thanks to which it was possible to confirm the existence of the gravitational field disturbances predicted by Albert Einstein uses the detectors made by the company from Ożarów. Currently, the company is conquering Far-East markets.

Transition Technologies S.A. – winner of the 6th and 12th edition ('Digital platform to optimise power generation' and 'Immunological optimiser SILO') – provides programming and engineering services based on state-of-the-art technologies (including neural networks) to energy and gas magnates, as well as industrial automation on all continents.

Braster – which in the 15th edition of the competition was awarded for 'Breastlife Tester – a thermographic tester for early detection of breast pathologies in women, including breast cancer' – debuted in 2015 in the main market of the Warsaw Stock Exchange. The distinguished invention – the first of its kind in the world – was implemented on a large scale and today enables women to use the System of Home Prophylaxis of Breast Cancer.

The Institute of Electron Technology – awarded in the 15th edition of the competition for 'Quantum cascade lasers' – is now among the world leaders involved in the development of the design and technology to produce the of the latest generation of semiconductor lasers.

The winners of the competition have also won awards and distinctions at innovation fairs and exhibitions, including ITM Poland International Fair: Innovations, Technologies, Machinery in Poznań, International Innovation, New Technology and Products Exhibition in Geneva, International Invention, Research and New Technology Fair: BRUSSELS Innovain Brussels.

These are just some examples, as it is difficult to mention all of them. The most important thing is that the Polish Product of the Future fulfils its task and contributes to promoting economic operators, scientists, researchers, and authors of innovative solutions working individually and in scientific and business consortia – people for whom the search for new solutions is a real passion.

The number of projects submitted to the 20th edition of the competition is record -breaking –111. This edition is also unique because it is organised jointly by two of the largest institutions supporting the development of enterprise and technological development: the Polish Agency for Enterprise Development and the National Centre for Research and Development.

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Product of the Future developed by a consortium consisting of a scientific organisation and entrepreneur

Special Award of the Minister of Entrepreneurship and Technology

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IntraLine-IOERT

The radiotherapeutic method of cancer treatment consists of delivering a therapeutic dose to the tumor-affected area, while conserving healthy tissue. Intraoperative radiotherapy is a particular example of this. It uses electron beams that penetrate the body to a depth of only a few centimetres. The therapeutic beam is delivered to tissue surrounding a previously removed tumor exposed during surgery, or directly to a neoplastic organ during surgery. This procedure helps shorten the entire treatment by up to several weeks, improve its effectiveness, and in the case of breast cancer, avoid a full mastectomy.

The accelerator used for intraoperative radiotherapy is a device that generates an electron radiation beam and delivers a therapeutic beam to the postoperative field. From a mechanical and electrical point of view, the intraoperative accelerator is both a linear electron accelerator and a mobile manipulator.

The mobile manipulator provides a very wide range of movements and full mobility. This means that it can be used in several operating rooms, at any operating table, and under any irradiation angle.

The lightweight design of approximately 800 kg and the battery power of the chassis make it easier to manoeuvre the device in operating rooms and throughout hospitals.

The fully operational accelerator model created as part of the project has been equipped with a beam collimator system, which allows obtaining field distributions, symmetries and irradiation field sizes with parameters that meet European standards, for each beam energy and for each applicator size. Thanks to the optimisation of this solution, the system is minimised, can be disassembled without special tools, and meets its shielding properties.

The solution has mounting accessories and beam collimation, allowing the use of any applicator type – transparent plexiglass applicators allowing viewing of the irradiation field, as well as thin-walled, non-transparent, surgical steel applicators. Other new solutions include the method of soldering the structure, changing the shape of resonators, and the use of the latest PLC modules.

The mobile device developed can be used during surgery to remove a tumor in a hospital operating room. It enables the

access of the accelerator controlled by an operator to an operating table, and combining the output of the therapeutic beam from the accelerator with the applicator in the process of fixing .

Implementation status

The IntraLine-IOERT intraoperative accelerator was built as part of the INTRA-DOSE project, co-financed by the National Centre for Research and Development as part of the Applied Research Program in track B.

· minimise geographical error (dose absorption – in a place other than planned) and, therefore, improve local cancer cure rates,
· minimise the discomfort of the patient during and after necessary medical procedures,
· reduce environmental pollution by eliminating the need for repeated visits of patients to clinics (fuel and energy consumption) and by using materials with a lower mass, including a smaller amount of lead.

The designed device IntraLine-IOERT is a fully mobile accelerator with five degrees of freedom. It delivers therapeutic bundles with electron energy of 4-12 MeV. The combination of mobility (weight of approximately 800 kg) and a wide spectrum of radiation energy means that the accelerator can be used in different locations. The device can be installed in one centre or operate as a mobile device, rented to hospitals to perform treatments.

As a result of cooperation with The Greater Poland Cancer Centre in Poznań, the first device is planned for launch in Poznań. It will also be a reference unit for potential clients. Efforts are also underway to launch the product on the American market.

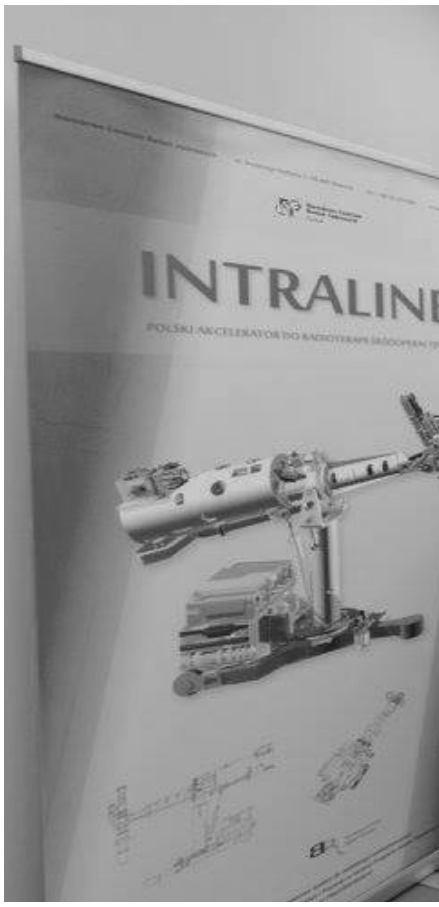
Thanks to the use of a mobile accelerator and intraoperative radiotherapy, it is possible to:

· shorten the patient's irradiation time compared with conventional radiotherapy,

Currently, there are two producers of intraoperative accelerators in the world: IntraOp Medical Incorporated (Mobetron accelerator) and Sordina IORT Technologies S.p.A (Novac accelerator).

The Novac accelerator is a mobile device weighing 640 kg. It offer electron beams in the range of 4-10 MeV, which in practice narrows its use in cancer therapy to only some tumor locations.

IntraLine-IOERT device

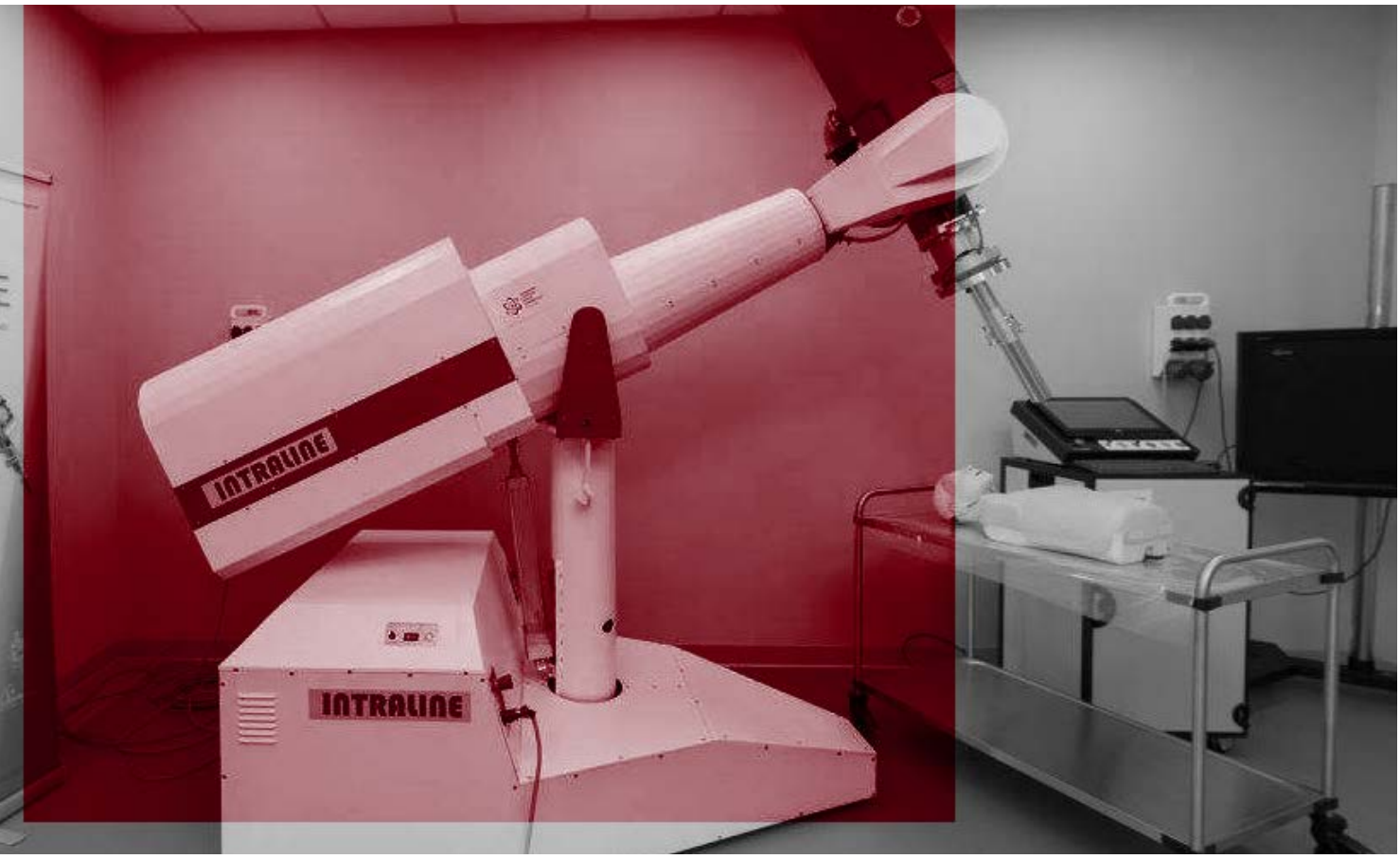


IntraLine-IOERT device

The Mobetron Accelerator produces therapeutic beams with an energy of 6 - 12 MeV. However, it requires a special, dedicated operating table provided with the accelerator. When docking the applicator, some movements are performed by setting the head (which, in this case, is almost the entire accelerator), and some by positioning the operating table with the patient immobilised on it. In practice, the positioning as well as the weight of the device (approximately 1400 kg) requires the table be moved to access the accelerator, which is located at the side of the operating room. This limits its use and requires dangerous and uncomfortable manoeuvres of the operating table with the patient on it, and the medical equipment connected.

The IntraLine-IOERT device designed by NCBJ is a fully mobile accelerator with five degrees of freedom. It provides therapeutic beams with an energy of 4-12 MeV electrons. The combination of mobility and a broad spectrum of radiation energy means that the accelerator can be used in various locations. The total weight of the device is approximately 800 kg. It can be installed in one centre or it can work as a mobile device, rented to hospitals for treatments.

Thanks to the above-mentioned innovative solutions used in the IntraLine-IOERT accelerator, the product is very competitive compared with existing solutions.



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NARODOWE CENTRUM BADAŃ JĄDROWYCH ŚWIERK

Polski
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Unmanned Aerial Vertical Take-Off and Landing System ATRAX

The Unmanned Aerial Vertical Take-Off and Landing Vehicle ATRAX is an advanced structure made of glass and carbon fibre composites. It has the ability to follow a preset route. Its 360-degree surveillance pod with a three-axis stabilisation system with 0.10° accuracy features thermal imaging and a daylight camera.

The Unmanned Aerial Vehicle ATRAX is controlled by the Ground Control Station (GCS) equipped with:

- a military tablet with software,
- a battery,
- a set of manipulators and programmable switches.

Commands for the UAV are issued from the operational software level activated on the tablet using the control panel. From the GCS, the operator has full control over the UAV and its head, and can conduct real-time data analysis. The GCS can be transferred by personnel and enables one operator to control one or several machines from any location within the range of the antennas.

Distinctive features of the ATRAX UAV:

- Polish product,
- replaceable optical modules,
- cost-effective and modern power plant,
- combat radius up to 10km,
- flight duration ~35 min. (up to 50 min. with an additional battery),
- modular structure of carbon fibre composites,
- highly reliable,
- mobile,
- can take off from various surfaces , without the necessity to use an airstrip,
- resistant to different weather conditions,
- low acoustic signature due to the electric power plant,
- can be adapted to be controlled by one operator,
- simple operation,
- easy to maintain,
- it is capable of being armed with different dispensers (combat, medical, chemical recognition, SAR, LIDAR).

ATRAX is adapted to military requirements and is integrated with the GCS and data transmission system, which means that the data transmitted by the machine can be sent anywhere in the world (command and control station, emergency operations centre, etc.). Data transferred by the System in Full

HD quality is secured at a distance of 30 km, which is unique on the international market. The UAV's equipment and dual-sensor optoelectronic head (infrared mapping and 30x optical zoom) are rare in other UAVs of this type. Thanks to the innovative approach to the safety of UAV flights, dual autopilot and power supply systems have been used.

The innovative power plant has, depending on the equipment version, between four and eight independent motors, which significantly improves the safety level (the flight can be continued with four motors out of order). ATRAX is furnished with a secure-coding data transmission system, ensuring the highest security level of transmitted data. All of the technology and production – both the composite structure and the electronics – were made at the Air Force Institute of Technology.

ATRAX is capable of being armed with specially designed dispensers, thanks to which it can carry between 4 and 12 dedicated grenades (flashbang, smoke, tear-gas and cumulative grenades) produced at the Air Force Institute of Technology.

ATRAX is equipped with four or six motors, and features a quiet electric drive and a modular structure made of carbon fibre. This UAV can operate in various environmental conditions, including naval – from vessel decks. The take-off weight of the UAV with a blade tip-to-tip span of between 1.2 and 1.9 m, depending on the version, is between 4.9 and 22 kg, while the payload capacity is 1.7 - 15 kg. The machine can operate up to 50 minutes at an altitude of 2,000 metres. The radius of action in open areas is 10 km, and in urban areas 2 km. The maximum speed is 80 km/h. The UAV features avionics equipment that consists of an autopilot capable of mission planning before the flight, and real-time updating of the mission plan. The autopilot was designed at the Air Force Institute of Technology. The UAV is equipped with systems that ensure the continuation of the flight in the case of a loss of communications and navigational signal; it also has a digital secure-coding data transmission system ensuring bidirectional communica-

The system is made of carbon composite, increasing its load resistance with a relatively small weight. Atrax can fly autonomously or along a pre-set route. It can be equipped with a 360° movement optoelecrtonic head with gyroscopic image stabilisation in three axes. The head has daylight and thermovision cameras. The Atrax system, including the technology, production, electronics and software, was developed at the Air Force Institute of Technology.

tions. ATRAX can be fitted with a full-HD camera and transmit images in real time; it can also be equipped with optoelectronic heads and special equipment, including armament devices, such as explosive charges and grenades.

In addition, ATRAX features numerous safety solutions, such as:
- dual propellers and motors,
- an emergency parachute launcher activated automatically in the event of a loss of load capacity or reaching a critical angle,
- automatic return to the take-off location or the location identified before mission launch in the event of a loss of communications,
- dual autopilot and power supply systems.

The research works commenced in 2014 and were conducted at the Air Force Institute of Technology. Initially, they included the production of the composite structures and the development of the technology for their manufacture; the first version of the 'autopilot' system, which was then further developed; as well as design of the On-Ground Control Station and dedicated software to control the Unmanned Aerial Vehicle. Over the next several years, these systems were improved by focusing on developing dedicated armament systems and advanced optoelectronic heads, as well as designing an application aimed at managing the on-board equipment. In 2017, advanced works were conducted on the autonomy of the UAV, which independently decides about the mission (direction, speed).

Currently, the Unmanned Aerial Vehicle ATRAX is used by the Polish Army to train military operators of UAVs (the Polish Air Force Academy in Dęblin), the Police, and in services operating under the Ministry of Internal Affairs of the Republic of Algeria. ATRAX Unmanned Aerial Vehicles are multi-purpose machines that can complete safety- and defence-related tasks, including surveillance, supervision, artillery fire control, and devastating terrain objects. On the civilian market, ATRAX can provide a wide range of tasks, such as support for SAR operations, assessing the effects of disasters, infrastructure control, and personal/asset protection.
The use of ATRAX Unmanned Aerial Vehicles on a large scale would unquestionably increase national security, in particular by improving the operational capabilities of law enforcement services – the Police, Border Guard, Military, and emergency response cooperation centres. As a Polish product, it provides jobs for qualified staff educated at Polish technical universities. Used in operations during the war and performing the same tasks as airplanes and helicopters, ATRAX reduces the risks of death of the crew of these aircraft.

ATRAX UAV rotor

Ground Control Station

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Machine aggregated with an agricultural tractor to collect and bale the wood material remaining after the cutting of tree branches, trees, and shrub suckers, as biomass for energy purposes

The machine has a working chamber with a gutter that contains a row of ribs arranged in parallel (embedded in the wall of the rear working chamber perpendicular to the axis of rotation of the rotor). Its heart is the rotor driven by an external gear mounted in the slots of long plate girders. It has the form of a cylinder, on the perimeter of which rows of parallel scraper blades are placed symmetrically – rotating between the rib slots.

Innovation

- The pick-up in the form of a cylinder, on the perimeter of which radially symmetrical shafts in the shape of cams are mounted. It is adapted to the type of material collected in orchards, vineyards, and olive groves.
- In the pick-up assembly, depending on the soil surface, a copying wheel or skids can be used. In this case, the reduction of unit ground pressure is regulated by a hydraulic relief system.
- Two chain transmissions with an overload clutch are used in the pick-up drive.
- Central adjustment of the position of the pick-up finger tips.
- Features a special construction of a tandem drive system. Four wheels are mounted on the left and right swing arms, which do not protrude beyond the machine. This allows the unit pressure on the ground to be reduced, and the machine's operation in inter-rows with small widths.

Application of the solution

The machine aggregated with an agricultural tractor is designed to collect and bale wood material left over after the cutting of branches, and tree and shrub suckers formed after care treatments performed in orchards, vineyards and olive groves, as biomass for energy purposes.

Implementation status

The machine was created as part of the implementation of the international research project EuroPruning No. 312078 (the result of the competition was announced by the European Commission under the 7th Framework Programme of the European Union) by the Industrial Institute of Agricultural Engineering in Poznań. According to patent PL No. 222933 of PIMR Poznań, the prototypes were assembled under the supervision of the inventors of the invention at PROMAR Sp. z o. o. in Poznań, and subjected to repeated tests in orchards in Poland, Germany and Spain. The tests gave a positive result. Currently, PIMR Poznań is conducting intensive talks with agricultural machinery manufacturers in Poland in order to sign licence agreements for the production of these machines for domestic and foreign customers in accordance with the invention of PIMR Poznań.

Advantages of the solution

The main advantages of the machine include:

- mechanisation of the work related to the harvesting and baling of branches left behind after the cutting of trees and shrubs in orchards, vineyards, and olive groves, as biomass for energy purposes,
- able to work in inter- rows with small widths,
- able to work on various substrates, including very stony soils (due to the use of height-adjustable pick-up fingers),
- improved hygiene in orchards, vineyards, and olive groves after care treatments,
- development of the felling of wood material as biomass for energy purposes, and improvement of environmental protection.

The machine aggregated with an agricultural tractor enables comprehensive mechanisation of the work associated with the harvesting and rolling into bales of branches after cutting the suckers of trees and shrubs in orchards, vineyards and olive groves, as biomass for energy purposes.

Comparison with the state of the art

Until now, after periodic treatments, cut-off branches and suckers of trees and shrubs were removed by hand and deposited in places designated for this purpose. After this, they went to storage, where they were chipped with the help of devices and machines, or gradually burned. On large horticultural farms, cut branches and shoots of woody plants were crushed or chipped on the spot, and the shredded material was left in the inter-orchards of the orchard where, after several years, it underwent natural decomposition.

The machine for collecting and rolling wood material during tests

A CAD 3D model of the machine for collecting and rolling wood material

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Hydrogenerator for a microhydropower plant

According to the Small Hydro Power Association, there are between 12,000 and 15,000 sites of former water mills and sawmills in Poland. They could become locations for small hydropower plants operating at small flows and low surge heights. In cases like these, the funds invested in building a small hydropower plant are not large, and in addition, many such facilities hold long-term water permits, according to which flowing water can be used to generate electricity. The energy industry is not interested in such sites due to small flows and low surge heights; however, they can be used to build small hydropower plants with several kilowatts of power. This information gave the incentive to commence work on a small hydrogenerator for the production of electricity, consisting of a water turbine and a generator designed for flows of 0.2 m3/s and water surge heights of approximately 2 m.

Propeller water turbine. This project has resulted in the construction of a propeller water turbine. The impeller blades with NACA 2412 profile are made of PA6 aluminum alloy. Water-lubricated ceramic

Hydrogenerator

bearings were applied in the turbine of the bearing-free generator, which made dynamic seals unnecessary. The turbine with a power of approximately 1kW reached 80% efficiency. The approximately 2m water falls adopted are significantly smaller than the anti-cavitation surplus of the turbine resulting from the water temperature and ambient pressure; therefore, in contrast to turbines operating with large falls, the height of the water fall can be achieved using a suction pipe. This allows the generator to be mounted freely over the turbine, which significantly shortens the drive shaft and prevents the generator from being flooded.

The small hydrogenerator, consisting of a water turbine and a generator, is designed for flows of 0.2 m³/s and water dams of approximately 2 m. It can work in places left by former mills or water sawmills and thus, can be used to build a micro power plant with a capacity of several kilowatts.

Generator. The unique generator with permanent magnets (Patent Application No. P.417047 of 29 April 2016) was designed to convert the mechanical energy produced by the water turbine into electricity. Exciting the generator involved the use of state-of-the-art neodymium magnets with high magnetic energy. With these magnets, the device generates voltage at any rotational speed and doesn't require any additional energy to be excited. For this reason, the solution has a high efficiency of converting mechanical energy into electricity (86%). The generator is highly efficient in a wide range of rotational speeds. What makes this generator unique is an exceptionally low value of the cogging torque, which is a phenomenon found in all machines with permanent magnets and a ferromagnetic core. In the example solution, this torque reaches 1.0% of the generator's rated torque, which is a global achievement in this field. This was possible thanks to a new rotor design, in which six misaligned segments containing permanent magnets were used.

Innovation of the solution

The product is a global novelty. Currently, there are no hydrogenerators on the market with such small powers operating at low surge heights and small flows in which the surge height is achieved using a suction pipe. The developed product has new features and functionalities compared with other products on the market. The available Kaplan turbines have the lowest power of approximately 20 kW, are expensive, and have an efficiency of 60% (at this power). The innovation of the developed turbine lies in it achieving efficiency of over 80% with power of just 1 kW, which is a global accomplishment for such a small turbine. The generator that works with the turbine is highly efficient – achieving 86% at the rated conditions. Although in the case of generators solutions do exist with a wide

power range, they have lower efficiency and a much higher cogging torque. For example, generators of the world leader in the field of low rotational speed generators – the French company ALXION – have a cogging torque at the level of 1.5% of the rated torque, whereas the generator developed in the project has this torque at the level of 1.0%. This parameter (cogging torque) determines the motion resistance and the moment the hydrogenerator starts to work; in practice, this means that the hydrogenerator begins to generate electricity at much smaller water flows.

Currently, talks are being held with several entities interested in the deployment of the hydrogenerator. The benefits resulting from its application are clear: an increase in the production of clean energy, a reduction in harmful-gas and particulate emissions, new jobs in the production and servicing of hydrogenerators, an increase in the rigidity of local power grids, energy consumption at the place of production (no energy transmission), and raising the technical awareness of the society.

Electric generator

Propeller turbine

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Triggo – Polish global innovation in urban electromobility

Triggo was designed for the rapidly growing global market for vehicle transport sharing platforms: car sharing or mobility as a service. It will be available to practically all residents of cities in which these types of services operate.

The heart of Triggo is the chassis system with variable geometry applied for the first time in the world. It combines the safety benefits and comfort of an urban car with the agility and ease of parking a scooter. It does not have the disadvantages and limitations characteristic of both categories of vehicles.

The unique design allows you to reduce the overall width of the vehicle – when driving at low speeds (up to 25 km/h) – making it narrower than many two-wheeled vehicles. Just like two-wheeled vehicles, it performs well in traffic jams. At higher speeds, where increased stability is required, the wheels move apart to the width typical of a small car.

The innovative solution also allows for parking perpendicular to the kerb.

It is easier to park a Triggo than most two-wheelers. Triggo was designed specifically for use in automatic rental systems. To serve this purpose, the vehicle construction as well as on-board telemetry and control systems are reinforced.

It is equipped with a system of replaceable battery packs. This makes it possible to avoid long hours of outage related to traditional charging of electric vehicles. A flat battery is simply replaced with a charged battery, just like in a torch. Triggo is equipped with a Drive-by-Wire control system. The connection between the user interface elements and the control systems are performed digitally.

The pioneer technology developed in Poland for the thermoforming of composite material was used to design the body. It allows for a cost-effective, serial production of lightweight and durable components with a high degree of repeatability.

The Triggo prototype has lived up to expectations. The road tests, conducted in experimental conditions, have confirmed

the potential and advantages of the construction.

Tests conducted helped solve a number of issues inherently associated with such an innovative construction, and to identify specific and correct technical solutions – mainly in the area of mechanics and automation.

Currently, a vehicle implementation prototype is being created, which has features of the future serial version of the vehicle. In addition to the constructors and engineers of Triggo S.A., scientists and experts of the Automotive Industry Institute are involved in the project. Design works – in the scope of the body construction – are also supported by the Polish design office of Edag Engineering, the world's largest supply of engineering and design services for the automotive industry. The construction of the pilot series is scheduled for the fourth quarter of 2018.

The construction is protected by international patents granted in territories inhabited by 2.5 billion people. The ambition of the creators is to make Triggo a recognisable Polish export product.

Triggo primarily improves comfort of daily life, saving time lost in traffic jams and searching for parking spaces. The scale of savings may be up to 200 hours per year on average.

Simultaneously, replacing a full-size combustion vehicles will contribute to the reduction of problems experienced by the inhabitants of cities.

These include: air quality, noise level and the mentioned congestion of streets and availability of parking spaces.

Triggo smoothly overcomes traffic jams and – thanks to a variable geometry chassis – it performs well where there aren't enough parking spaces. It is an innovative electric vehicle that can revolutionise urban mobility on a global scale.

Thanks to the ability to park perpendicular to the kerb, the Triggo rental station can accommodate up to five vehicles in one standard parking space at the same time. The cost of location lease decreases fivefold. Furthermore, the valuable urban space is put to even better use.

The time required to replace the set of batteries is a small fraction of the charging time of a typical electric car.

Triggo is, therefore, readily available for users. For a car-sharing platform operator, it means a 20-30 per cent return on investment. Moreover, the possibility of building small battery exchange points in place of

traditional, extremely expensive high-power charging stations brings about savings in investment outlays.

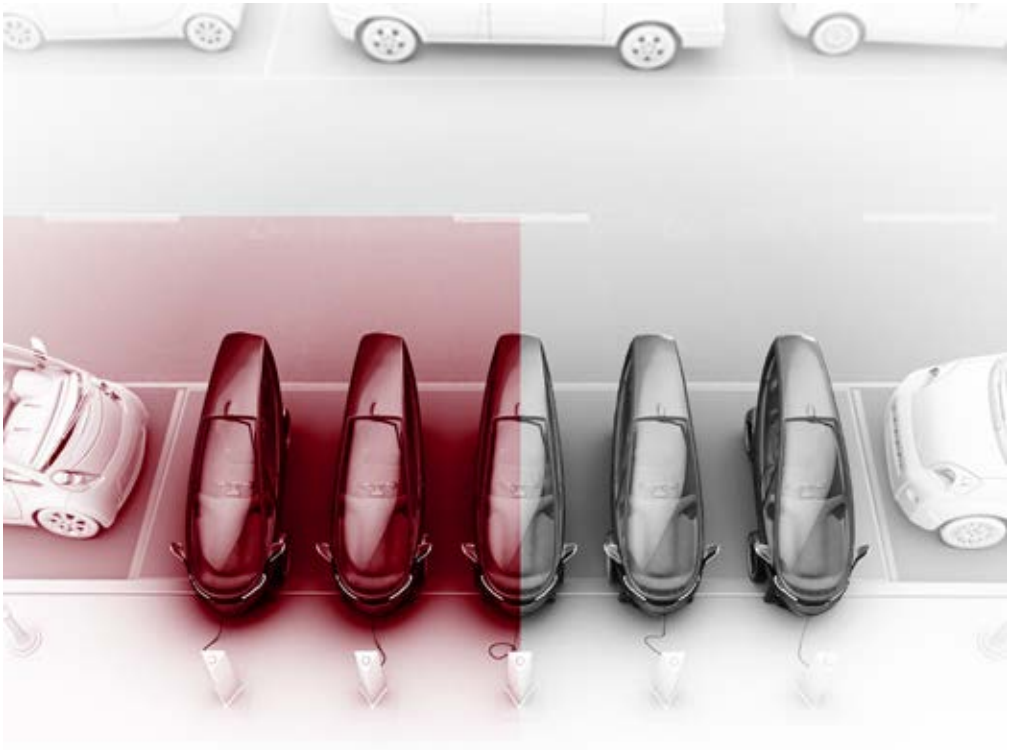
It also reduces current operating costs, and dramatically speeds up the implementation process of the rental network.

Digital control will facilitate the integration of future autonomy systems, which will enable the management of fleet deployment, depending on current needs or orders for vehicles to an indicated address.

Comparison with the state of the art

Triggo has no direct competition. There are only two vehicles with similar features: Toyota iRoad and Renault Twizy. However, the design of the Toyota permits for a maximum speed of less than half of the speed of Triggo. Renault, on the other hand, is approximately 50 cm wider and does not have a closed cabin. Neither of these vehicles provide for perpendicular parking.

Triggo in both configurations



Compact charging station - five Triggo vehicles in one parking space

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Triggo

Polski
Produkt
Przyszłości

Teemothy – a transoesophageal echocardiography simulator used as a doctor training programme

Our company's objective is to create an innovative educational platform for specialised doctors that provides an experience of medical examinations that is as real as possible. Our first solution 'Teemothy' is a transoesophageal echocardiography simulator (TEE simulator) and has been designed for cardiologists to provide them with an efficient and easy way to master TEE examination. A TEE examination, which is an essential test in a comprehensive heart diagnosis and very difficult to carry out, requires a team of specialists that are well trained in the field of ultrasound cardiological diagnostics to provide a correct diagnosis.

The core of the developed solution is a collection of heart models that are based on retrospective patient scans performed by computed tomography. What we provide are real cases from real patients, and not only artificial models obtained using computer graphics. It significantly enhances the experience of a real examination on a real patient, and provides high educational value. The solution is protected by a patent granted in 2015 by the European Patent Office for the system and methods of computed tomography data conversion for the purposes of the transoesophageal echocardiography simulator.

In addition to software, the product consists of specialised, lightweight and mobile equipment (medical phantom and manipulator) that can be connected to a laptop/computer via a USB port. The equipment has been designed and produced in such a way as to reflect an actual patient examination as closely as possible.

During the simulation, the echocardiography probe is inserted into the phantom's oesophagus.
By changing the depth of the inserted probe and determining the appropriate plane configuration (probe rotation is possible in the oesophagus, the setting of two knobs responsible for the bending of the

transducer and the angle of the section plane), the projection desired by the operator appears on the screen. Additional difficulty in identifying structures is provided by simulated disturbances and artefacts, characteristic effects of sound propagation phenomena in the tissues .

According to the American Society of Anesthesiologists ('Statement of Transesophageal Echocardiography'), the TEE study carries a small but measurable risk of physical damage (perforation of the oesophagus).

Teemothy – a transoesophageal echocardiography simulator used as a doctor training programme designed for cardiologists and other specialists who perform this examination. The simulator has initiated further development of the company in the field of simulators designed for teaching minimally invasive interventions performed with feedback from transoesophageal echocardiography.

However, an even greater risk is incorrect or incomplete interpretation of ultrasound projections. The physician performing the examination must manipulate the probe so that it shows the relevant cross-sections of the heart, and control five parameters of its settings at the same time. That is why the American Society of Echocardiography recommends that in order to gain enough experience, physicians should perform and interpret an examination at least 150 times in four years, and then a minimum of 25 in each subsequent year.

Implementation status

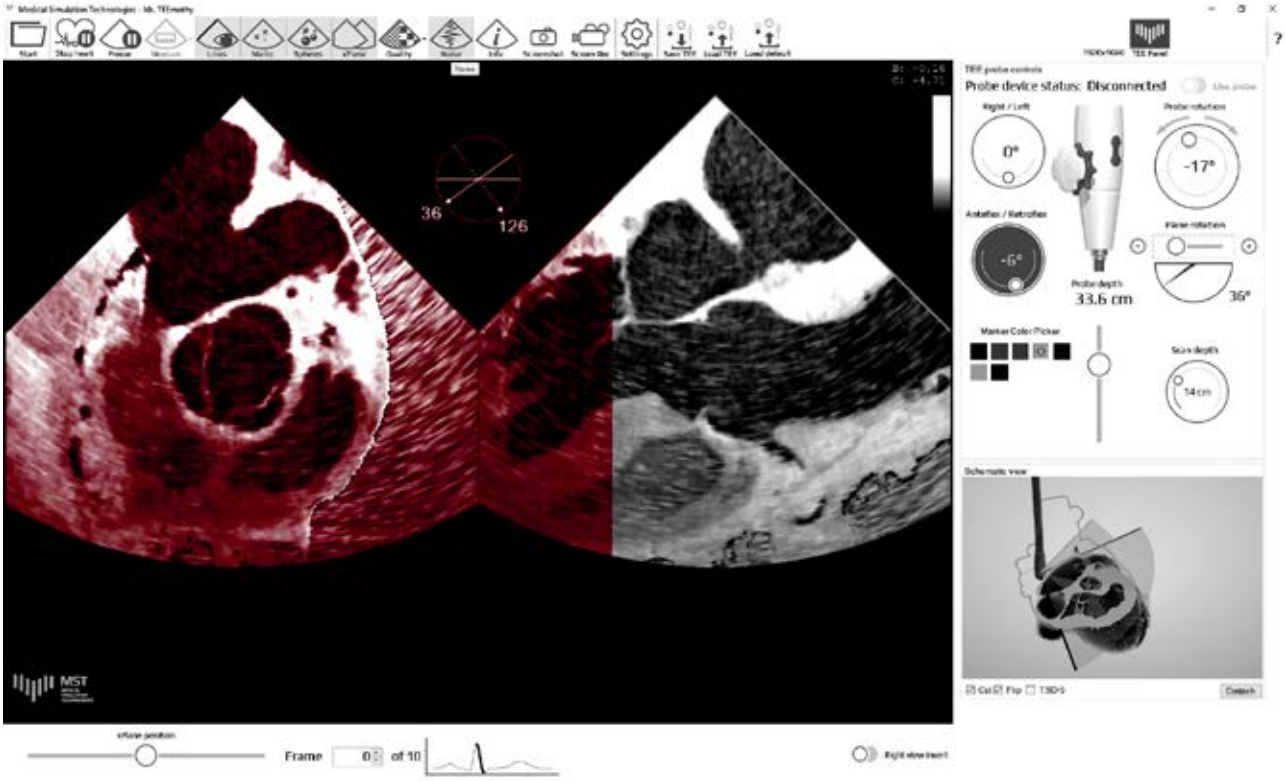
The Teemothy simulator is the result of over six years of research on conversion algorithms, and is a complete product that has now taken its first steps onto the market. Its first presentation took place in Leipzig during the world's largest conference devoted to ultrasonic imaging in cardiology – EuroEcho Imaging 2016 – and since then, it has enjoyed a good reputation among the greatest authorities in the world of cardiology. It has also proven itself during numerous workshops for cardiologists across the country and abroad.

Our company's mission is to educate cardiologists in the field of TEE examination, and to equip them with tools that will help them gain, maintain and extend their knowledge in a realistic way without the need to

involve patients. During observations of workshops with our simulator, it has been found that just several hours spent on the Teemothy simulator provide a rapid increase in efficiency in performing the examination, and are comparable with the experience gained from performing dozens of real examinations.

The solution, which is innovative on a global scale, has been developed by the founders of Medical Simulation Technologies and, in terms of TEE examination training, is currently the only existing such approach based on real patient data. The reality-reflecting appearance of the TEE examination was recognised by Polish specialists participating in the evaluation at the stage of development and implementation research, as well as when foreign physicians visited the MST stand during the EuroEcho 2016 conference in Leipzig. By applying real tomography data, users of the simulator can understand the exact anatomy of a healthy heart and familiarise themselves with pathological cases (congenital disorders, valve regurgitation, hypertrophy of the ventricle, calcification, etc.).

User interface with a single projection displayed on the computer screen



Members of the team demonstrating the Teemothy simulator

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MST
MEDICAL
SIMULATION
TECHNOLOGIES

Polski
Produkt
Przyszłości

Highly purified gelling (1,3)(1,4)-ß-glucan originating in oats, obtained by a biorefining process enabling the obtainment of high added value products

The solution implemented by Beta Bio Technology under the name 'Highly purified gelling 1-3,1-4 beta-glucan derived from oats obtained in the biorefining process that allows obtaining high added value products' is different to other solutions around the world thanks to several basic features:

- it's a waste-free, environmentally friendly method for biorefining the by-products of the cereal-milling industry, such as oat bran, in order to obtain high-value, biologically active products: highly purified beta-glucan, proteins and insoluble fiber
- the technology is effective and doesn't require the use of additional enzymatic treatments, after which contamination would remain in the product
- enables the obtaining of a beta-glucan isolate with a purity of up to 95%
- safe reagents, such as sodium hydroxide and hydrochloric acid, are used in the technology; they take the form of small amounts of NaCl table salt in the target products
- the technology is hardware optimised, which does not require the purchase of high-cost and complicated technological nodes prone to high operating costs
- bran fractions separated during the process of beta-glucan isolation: highly purified protein and insoluble fiber free of chemical impurities are very valuable additives to animal food, fodder, and pet food
- the ethanol remaining after the destruction of beta-glucan and water are recycled (recovered) in the process, and do not constitute a burdensome waste.

The solution developed by Beta Bio Technology was patented in the UPRP under the name, A method for the isolation of beta-glucan

from cereals', Patent No. P-409942, and is currently being processed in an EPO procedure. Based on research carried out at CBMIM PAN in Łódź, the company also filed a notification with the UPRP under the name ‚Medical use of beta-glucan' - P.421338.

PThe products that the Company plans to launch have many health benefits due to originating from oats, which are considered to be the healthiest grain. Beta-glucan has special pro-health benefits: it strengthens the immune system, reduces cholesterol, reduces glucose (sugar peaks) in the blood, increases the activity of macrophages, supports the functioning of the circulatory system, and prevents the development of cancer. The final products resulting from the solution implemented by the Company will be: beta-glucan from oats (1-3,1-4-B-D) with a purity of up to 95%, vegetable-protein formulations in the form of a concentrate (containing min. 30% protein) and isolate (min. 60% protein), preparations of insoluble oat fibre with increased antioxidant activity, as well as preparations of amino acids and plant peptides.
Highly purified gelling 1-3,1-4 beta-glucan will be innovative thanks to: high purity of up to 95%; a low level of impurities (starch, protein, cellulose); solubility in water; rheological properties in the solution and gel states; the ability to bind water, stabilise emulsions, and thicken and improve the texture and stabilisation of other products; a lack of odour; and colourlessness.

Pro-health, biologically active products obtained in accordance with the patented technology will find applications in: the broadly defined market of foodstuffs, dietary supplements, pharmaceuticals, cosmetics, and animals, as well as the medical market, in line with the latest research of the Company. Direct recipients will include production companies operating in these industry sectors, and target groups will include consumers of products offered by these enterprises (e.g. the social group of people with diabetes, cholesterolemia, and obesity, as well as cancer patients). An additional aspect constituting the attractiveness of the solution through the possibility of its commercialisation is EFSA (European Food Safety Authority) awarding the right to use two dedicated health claims on

Highly purified gelling (1,3)(1,4)-β-glucan originating in oats, obtained by a biorefining process enabling the obtainment of high added value products with high biological activity, acquired by means of this eco-friendly technology, is important in the fight against lifestyle diseases such as diabetes, hypercholesterolemia, obesity and oncological diseases.

the packaging of food products containing beta-glucan – these concern the regulation of the level of triglycerides, and the reduction of blood cholesterol levels and sugar peak levels. The third health claim dedicated to oat fiber confirms its beneficial effect on bowel function (gut health).

Implementation status

Beta Bio Technology plans to build a Research and Development Centre, which will be based on the cooperation of specialised laboratories: fractionation, biorefining, formulation and analytics. The final products resulting from the planned innovative technology will be: beta-glucan isolate, protein, and insoluble oat fibre. These products can be used in many industries. Additional results will include ready-made solutions regarding the formulation and technology of, as well as ready-made recipes, for products.

Cascade biorefining technology is an environmentally friendly and waste-free technology. The highly biologically active products obtained thanks to this solution are of great importance in the fight against civilisation diseases, such as diabetes, hypercholesterolemia, obesity and oncological diseases.

On the global market, products containing beta-glucan (concentrates) are produced on an industrial scale. They are substitute products for highly purified isolates achieved using innovative technology. Concentrates are usually obtained using dry, repeated milling and cereal-sieving technologies.

Laboratory work on 1-3,1-4 beta-glucan from oats

Highly purified gelling (1-3,1-4)beta-glucan derived from oats

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Polski
Produkt
Przyszłości

Gas Plant STAG 500 DIS for vehicles with direct fuel injection

STAG 500 DIS is a pioneer autogas solution designed for petrol direct injection engines. The system stands out thanks to its operating technology, which uses 100% gas as fuel, without petrol. Within the European Union, in a few years it will be impossible to convert your car from petrol to gas without this product. This is currently the only such autogas system in the world.

The completely new approach to fuelling petrol direct injection engines – that is a development of Gen-VI systems – eliminates their deficiencies related to the use of high pressure petrol pumps to increase gas pressure. STAG 500 DIS does not use it. The pump is switched off while running on gas. The elimination of the high pressure petrol pump from the autogas system is due to the fact that it is quite difficult to adapt it to pumping gas, and even impossible in workshop conditions. In addition, its elimination from being used in gas-supply systems means that there are no problems with evaporation of liquefied gas that could cause the engine to stall. The STAG 500 DIS installation kit includes two external pumps connected in a line, able to create pressure of up to 20 bar. Gas in a liquid state is pumped under this pressure into the universal tee, from which some of the fuel is directed into the petrol injectors (bypassing the high pressure petrol pump), and some (in a gaseous state) into the reducer-vaporizer and then in to the LPG injector rail. Thus, the system uses the injection of liquefied gas by the petrol injectors (as in Gen-VI systems) and gas injection into individual intake manifold channels (as in Gen-IV systems). The injection of liquefied gas represents approximately 30% of the total fuel dose. Such an innovative solution makes the STAG 500 DIS a Gen-VII autogas system.

Application of the solution

The STAG 500 DIS system is based on most of the typical components used in autogas systems offered by AC S.A. (reducers, injectors and solenoid valves). The system uses

standard parts, and the multivalve differs from a conventional one only in the additional fuel return stub pipe. In the STAG 500 DIS system, mixed fuels (petrol and LPG) don't flow to the tank, as the return line is opened only after the mixed fuels are used up in the engine.

The system is not complicated and is very flexible. It doesn't require any design modifications of the high pressure petrol pump, and can be used in almost all vehicles equipped with direct injection engines. These include cars, trucks, agricultural machinery, construction machines, and hybrid vehicles.

STAG 500DIS – a dual-fuel gas injection system for direct fuel injection engines – is a pioneering solution for engines with gasoline direct injection. The system is 100% powered by gaseous fuel, without gasoline. Within the EU, in several years it will be impossible to convert a gasoline-powered car to a gas-powered car without this project.

Implementation status

The project is in the final stage of system validation. AC has submitted all the necessary documents to the patent office in order to obtain a European patent to protect the unique, amazingly simple and original STAG autogas system solution against copying.

Advantages of the solution

Vehicle conversion from original fuel to gas has two principal advantages. Firstly, significant reduction of vehicle operating costs – even up to 50%. Secondly, reducing environmental emissions up to several dozen per cent (depending on the pollution component being considered – CO, HC, NOx, PM). There are no fuel alternatives for most new cars. Engine design changes make conversion to gas impossible. Seeing this gap, AC S.A. developed a universal autogas system that can be adapted to all vehicle types.

Comparison with the state of the art

The STAG 500 DIS innovation will be useful for those car users who want to save on fuel. Until now, this need was fulfilled by fuelling direct injection engines with gas (in a gaseous state). This didn't allow petrol to be completely replaced with gas, because it required secondary petrol injection for cooling and protecting the original petrol

STAG 500 DIS Dual Injection System

injectors from damage. Another solution that has been used on the market to date is fuelling direct injection engines with liquefied gas directly by the original petrol injectors. This solution enabled the petrol to be completely replaced with gas. However, this involved high conversion costs and contributed to the degradation of petrol injectors and the need to use additional lubrication. In addition, the conversion required interference in the original vehicle fuelling system – it was necessary to adapt the original fuel pump.

An original solution used in the STAG system designed by AC avoids all of the above problems faced by manufacturers. At the same time, it considerably reduces the cost of conversion to gas.

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Polski
Produkt
Przyszłości

Device and method for examining secondary caries using NLDS (non-linear dielectric spectroscopy) technology

Secondary caries develop in tooth cavities that were already treated by a dentist. Usually, this is due to insufficient cleaning of the site of the disease, or the penetration of bacteria into the tooth through micro-cracks and micro-leaks in the tooth or filling, as a result of natural wear of fillings or loss of their tightness.

Examination with the NLCariesDD device is carried out by connecting the device using two standard Raypex dental measurement cables with two points of contact with the patient's body – a lip hook and a standard insulated dental probe. When the dentist touches the tooth surface, a small amount of DC current (from the mini AA rechargeable batteries) flows from the probe through the tooth and the lip hook to the analyser in the device. Using the computational algorithm in the processor, deviations in the readings of levels of specific harmonic components of the tooth's electrical response are analysed, allowing, by comparison with the pattern encoded in the device, a dentist to detect the values characteristic of two specific strains of bacteria associated with caries, which is signaled by three blue diodes lighting up.

The effectiveness of the NLDS method in detecting secondary caries was confirmed in 2014 in the Numed clinical trial (at WUM – the Infant Jesus Clinical Hospital) on a sample of over 1,100 measurements (sensitivity 92%, specificity 96%).

The Numed method is an innovation on a global scale – until now, all detection methods used visual solutions – optical or radiological.

The device and the Numed method are based on NLDS technology (non-linear dielectric spectroscopy), which allows eliminating the interpretation limitations existing in other methods (clarity of the measurement result).

The Numed method is based on a combination, in the Numed NLCaries DD device, of an ultra-high sensitivity electric sensor and special software, enabling the detection, in specific areas of the tooth, of very small concentrations of biological objects with given parameters of feedback electrical signal. The identification of the occurrence of small concentrations of bacteria allows the location of even very small areas of caries with a very high probability (sensitivity and specificity of approximately 92-96%). Using special flat probes isolated on one side with a spray-coated layer of bio-polymers, the Numed device is able to examine the approximal surfaces of adjacent teeth, which other diagnostic methods cannot do.

Implementation status

The technology and device were developed by Numed Sp. z o.o. in cooperation with leading technological institutes and medical universities – the Institute of Industrial Chemistry of Warsaw, the Warsaw Medical University and the Technical University of Munich (TUM).

Based on the unique NLDS feedback analysis technology developed by the Numed Technical Team as a result of laboratory and in-vitro tests conducted over several years, a prototype-measuring device was developed for clinical trials at the Medical University of Warsaw. After completing these tests, a market version of the detection device called NLCariesDD was created; it passed all the required tests and approvals, obtained the CE mark in 2015, and was approved for sale in the European Union market.

The method and device for secondary caries detection based on NLDS technology are used to detect (with high efficiency of over 95%) all cases of secondary caries occurring under fillings, crowns etc. that are invisible or poorly detectable by traditional (mainly optical and radiological) methods.

Caries (primary and secondary) is a civilisation disease - a common contagious disease.

In the absence of dental treatment, this disease can cause inflammation of teeth and gums, tooth loss, general infection of the

body, and even diseases of other internal organs (e.g. the heart) infected with bacteria transmitted from a diseased tooth through the circulatory system.

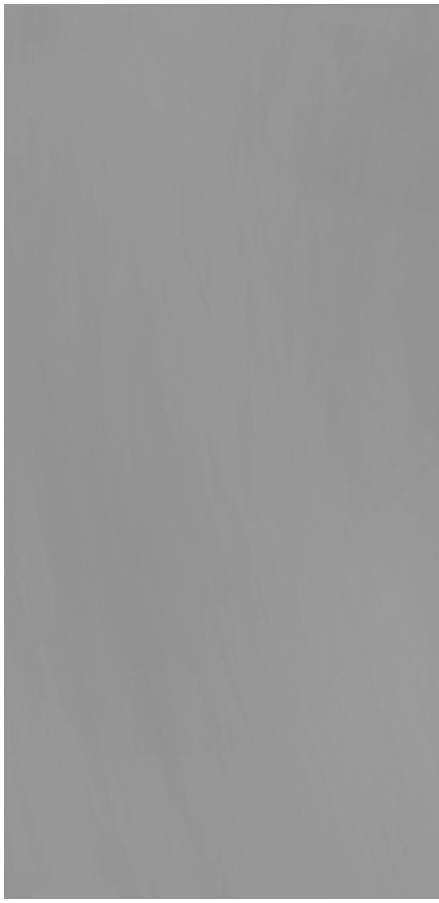
In developing countries, including countries of Central and Eastern Europe and Poland, the percentage of caries in certain population groups exceeds 85% – the majority (approximately 70%) are secondary caries.

The basic competitive advantages of the Numed technology compared with other methods are:

- A non-invasive and harmless nature of the examination,
- High (> 95%) effectiveness of secondary caries detection,
- The relatively low cost of the Numed device in relation to the offered efficiency and measurement effectiveness,
- High sensitivity to pathological changes, allowing the identification of secondary caries at an early stage of development.

The Numed technology is also a potential platform for the development of other applications in the field of dentistry, as well as other commercial applications in other areas of the economy – wherever it is necessary to quickly and reliably detect the presence of an undesirable substance in a given environment.

The Numed device and technology are unique solutions on a global scale – Numed Sp. z o.o. currently has six patents granted for the method and device (in Poland, USA, Russia, China, Australia and Israel); patent proceedings are still ongoing in several other countries (including Canada, India, and Brazil), and in the European Patent Office.



Secondary caries detection device NLCariesDD - Numed Sp. z o.o.

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Polski
Produkt
Przyszłości

Technology for the management of fly ashes, including municipal and industrial waste in the production of lightweight aggregates for construction

The technology of producing artificial lightweight aggregates involves using municipal and industrial waste to obtain high -quality modern aggregates. This technology has been based on the assumption of the simultaneous use of many different types of waste and their neutralisation in one process in order to produce a commercial product – a lightweight aggregate that meets all safety requirements and is appropriate for wide economic use. The method also makes it possible to dispose of waste materials that, due to their granulation and impurities, cannot be commonly used for other purposes. Our technology stabilises the heavy metal compounds present in the materials used. In the synthesis process, the compounds are permanently built into the structure of the obtained sinter, and create silicates just like in the case of natural minerals. Therefore, there is no risk of them leaching or reaching the environment, even during crushing or mechanical machining. The method can be used even with waste containing up to several per cent dangerous substances.

The method of obtaining artificial lightweight aggregates developed at the Institute of Mechanised Construction and Rock Mining (IMBiGS) is an innovative solution on a global scale. It is based on the reaction of components in the solid phase, where stabilisation of harmful elements (heavy metal compounds in sewage sludge) occurs at the molecular level. Such a solution is undeniably safer for the environment. The reaction in the solid phase gives a similar effect to that in vitrification, but the temperature at which the process occurs is much lower, thus influencing energy consumption and the economic effect. The method has obtained a national patent, and an application has been filed for international patent protection.

The technology is intended for a wide group of recipients, due to the fact that as a result of waste utilisation, a commercial product is obtained for general use in construction. The group of potential recipients includes:

- Entities producing or owning at least one waste material used in technology (including municipalities).
- Entities dealing with the disposal of at least one waste material used in the production of this type of artificial aggregate.
- Companies producing construction products (e.g. lightweight concrete).
- Companies wishing to expand their business.

Artificial lightweight aggregates are used in an unbound form (in, for example, geotechnical applications, thermal insulation, for the construction of embankments, exchange of low-bearing soils, etc.), and in construction products – mainly concrete ones – to improve such essential properties as insulation, reducing the weight of buildings, absorbing noise, etc.

During the LIFE+ project at the Institute of Mechanised Construction and Rock Mining, a mobile demonstration line with a capacity of up to 0.5 Mg/hour was built. It is adjusted to the amount of sewage sludge waste produced in small treatment plants. With this installation, the fifth level of technological readiness (TRL5) has been achieved. The installation can be useful for the management of sewage sludge from small wastewater treatment plants.

The technology of making lightweight artificial aggregates enables the use of municipal and industrial waste for the production of high-quality modern aggregates. It is based on the simultaneous use of different types of waste (even hazardous waste) and their neutralisation in one process. A commercial product created using this method meets all the safety requirements.

Based on the solutions developed at IMBiGS and with the use of European funds, NTI has built an industrial installation with a capacity of 5 Mg/hour. It must be emphasised that this line is the result of Polish technical thought, both in design and construction. Currently, the process of launching the continuous production of new aggregates is underway, and works are also planned on new technologies in which other types of raw material waste will be managed.

The technology gives both quantifiable and unquantifiable benefits. The environmental benefits result from the management of environmentally harmful waste (sewage sludge, contaminated glass, rock and coal mining waste) and from limiting the use of natural resources. The economic result is reinforced by the fact that the production of artificial aggregates does not include the costs of obtaining the resources. Producing such an aggregate gives profits from its sale and from fees for accepting sewage sludge and waste from incineration for utilisation.

The scope of waste usage for the production of aggregates is limited only by the requirements of standards. All aggregates are equal and the only criterion for the use of an aggregate is its properties. Using aggregates produced from waste does not mean agreeing to poorer quality; quite the contrary – artificial aggregates may meet the desired properties that natural aggregates cannot. The advantage of this technology is the possibility of adjusting the properties of such aggregates. Any modifications of the process influence the properties of the aggregates, thus allowing one to obtain aggregates adjusted to future use, i.e. obtaining aggregates for road construction with a high PSV and a bright colour.

Comparison with the state of the art

The use of various types of waste in construction is an increasingly common practice, both for economic and environmental reasons; however, this cannot mean a deterioration of the quality of construction products. Currently, sewage sludge is mostly stored, used for agricultural purposes, or subjected to organic and thermal recycling. These methods do not guarantee a comprehensive solution to the problem, because management in agriculture cannot relate to deposits contaminated with heavy metals. In addition, the EU is introducing legal provisions limiting the possibility of spreading sludge on the surface of the ground. Sewage sludge, despite valuable components with fertilising properties, also contains dangerous contaminants that pose a potential sanitary threat to the environment and human health.

Thermal recycling (mainly combustion) generates significant costs related to the need to dry all waste before the process, and the obligation of stabilising and managing the waste after combustion (ashes, slags). The problem of residues remaining after the combustion of communal waste (including sewage sludge) is solved, in practice, by the detoxification process or by solidification in the form of blocks. Due to the cost, detoxification is used for ashes containing dioxins and mercury. The stabilisation of dangerous compounds from ashes into concrete compositions is controversial – although the hazardous waste is surrounded by a layer of concrete, corrosion of concrete structures causes its slow leaching.

Furnace for burning lightweight artificial aggregate

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Polski
Produkt
Przyszłości

Social robot EMYS for teaching foreign languages to children aged 3–9

EMYS is a friendly social robot built to teach children foreign languages. It is designed for kids aged 3-9. EMYS stimulates all the senses of a child, makes sounds, speaks, responds to touch, can recognise faces, and expresses emotions. During the educational process, EMYS becomes a part of the child's world, stimulates their imagination, and speaks their language. Children get attached to it, and joint, regular play makes learning pleasant and extremely effective.

The process of learning foreign languages takes time, and it is best to start it as soon as possible. EMYS is designed with the unique preferences of early childhood education in mind. Thanks to its skills and friendly, sociable behavior, the robot gets children involved in fun, everyday activities. It becomes an animator, playing games that teachers normally perform during classes in kindergartens and schools. Using 'Total Physical Response' – a method of teaching utilising whole body movements – it becomes an extremely effective and modern tool that supports the teaching process. Children are rewarded for their progress with prizes in the form of new cartoons and games. The robot's expressivity coupled with a sense of accomplishment make daily language exercises a pleasant game in which kids gladly participate together with their friends.

The most important factor determining the success of the presented application was passing the 'toothbrush test'. The idea was to equip the robot with such a set of functions that the child would want to use the robot every day. In addition, from a technical point of view, the most difficult communication channel to implement is speech, due to the difficulties that speech recognition systems have with children's voices. To alleviate this, the robot was equipped with RFID technology that allows it to recognise physical objects. The robot comes with a set of small plastic objects shaped and painted to represent various words. Each of them has a small electronic chip with encoded data inside. Teachers and parents can constantly add new words by purchasing new, carefully selected word sets or by placing a small marker on a toy, photo or illustration, and programming the robot to recognise it. This solution enables parents and teachers to mark a children's favorite objects.

Consumers of our solution include both institutional and private clients. Institutional clients are mainly foreign language teaching schools – both private and public. With these clients, the main advantage of the solution is the possibility of ensuring a higher level of engagement among children and conducting enjoyable classes using modern technologies. Private clients are parents with children aged 3-9. They are people who were brought up in the age of the internet and are well versed in its use. They use technology on a daily basis, and are aware of the potential of using such solutions in applications requiring social skills.

It emits sounds, speaks, responds to touch, can express emotions, and recognise faces and objects. However, the primary function of the EMYS robot is education – specifically, teaching foreign languages to children aged 3-9. The robot has been meticulously developed to teach through play, which stimulates children's imaginations and develops creativity.

Implementation status

The first prototypes of the EMYS robot were created in 2009 at the Department of Cybernetics and Robotics of the Wrocław University of Science and Technology. Over the next few years, a series of experiments was carried out in which the prototypes were run autonomously under operating conditions. In 2016, the team decided to set up a spin-off company. From the very beginning of the company's existence, great emphasis was placed on developing the concept of a robot that could find a place in every home. In the following months, a branch of the company was set up in the USA and obtained support from the HAX accelerator managed by the American fund SOSV, which provided funding to create, from scratch, a prototype of a new social robot for the education of children. The acceleration programme was conducted in Shenzhen, China, enabling rapid development and precise estimation of production costs.

Tests of the current EMYS prototype conducted in language schools and among private users have shown that children effectively learn a second language at a rate of 30 new words per month. The team was invited to cooperate with language school networks throughout Poland. This reflects great interest in the product.

It is estimated that the size of the foreign language learning market is worth approximately USD 56 billion, of which English constitutes 63%. Compulsory foreign language education in Europe starts at the age of 3-8, and this age is constantly decreasing.

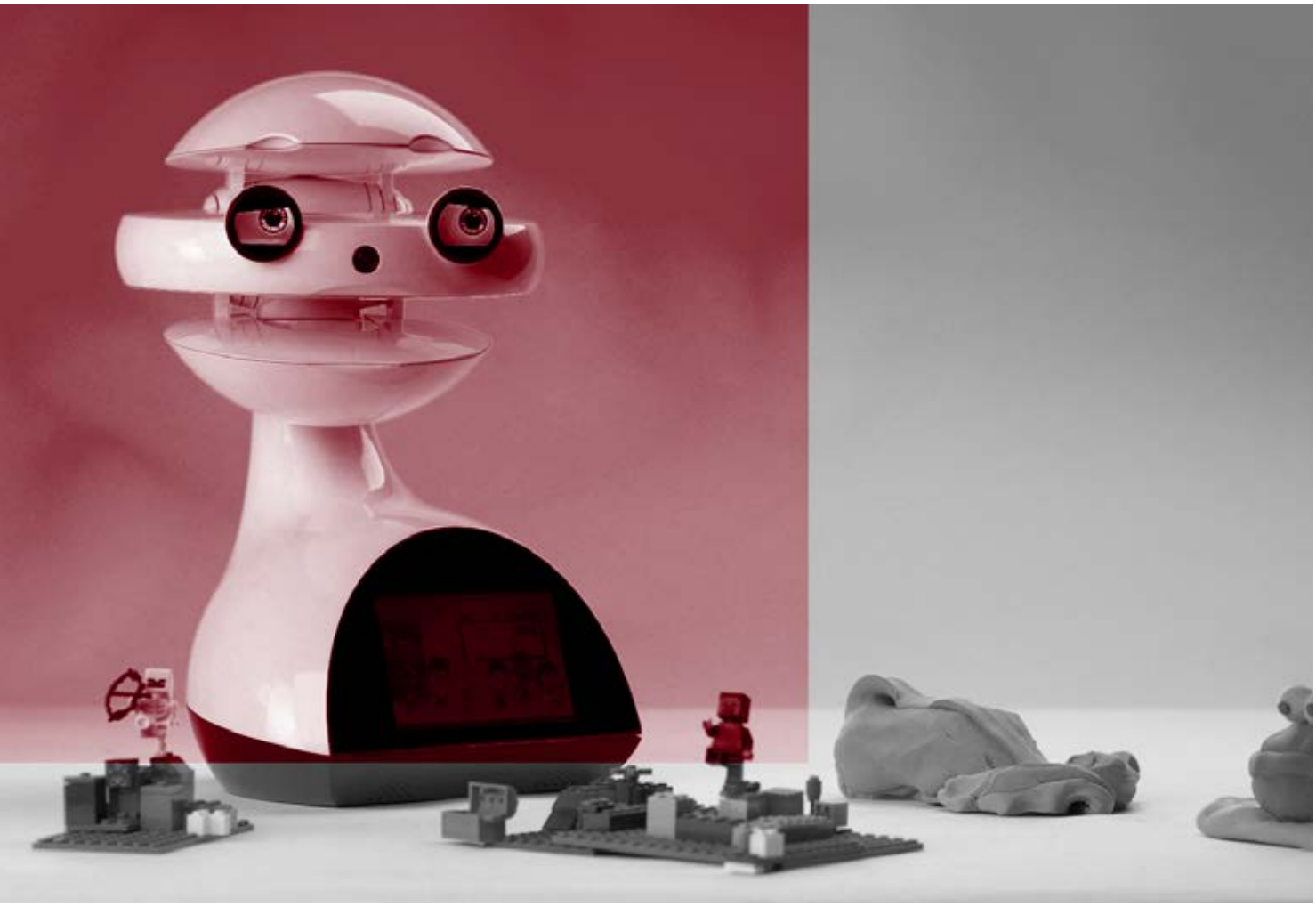
Demand for a solution such as the EMYS robot appears wherever there is a need to support teachers in their efforts, but it is problematic due to financial or time implications, or due to a lack of human resources. Between 2005 and 2014, the percentage of students learning a foreign language within the EU increased from 67.3% to 83.8%. This shows a growing social demand and increasing awareness of the importance of language education, and suggests the existence of a large group of potential consumers of the presented solution.

Comparison with the state of the art

The EMYS robot provides the latest technological advancements to children in a friendly format. This invention has a chance to be the first device of its kind in the world. Children identify with it and absorb knowledge in a format that no one has ever tried to apply on a large scale. Most parents utilise various types of mobile applications, computer games and educational television programs in home-based education. These solutions are widely available and convenient. Children often use their parents' smartphones, and have their own tablets or phones with internet access. The long-term use of such solutions has a negative impact on their social development. It causes various types of speech disorders, emotional development impediments, loss of concentration, decreased attention span, and may also contribute to a loss of appetite.

EMYS robot

The robot with children



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