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CONTENT

CHEMICAL TECHNOLOGIES

ANTIBACTERIAL INSERTS WITH COPPER PARTICLES

Asta Bronusiene, Remigijus Ivanauskas, Algimantas Ivanauskas, Ingrida Ancutiene

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

COVID-19 pandemic raised the need of effective, yet less human and environmentally damaging methods materials that would protect against bacteria and viruses. In laboratory experiments, it has been proven, that many bacterial species are killed within a few hours on copper or copper alloy surfaces. Inserts with copper particles in protective masks would not only mechanically block the entrance of bacteria and viruses into the human respiratory system, but would also effectively kill them in the entire volume of the filtrating material because of contact with copper particles. We managed to produce antibacterial inserts with copper and its compounds using the textile materials of various structures and fibrous compositions, manufactured by different technologies in Lithuanian companies. Studies of the bactericidal properties of the inserts have shown that they have excellent antibacterial properties. The bactericidal properties of the inserts used in the worn masks show that the diameter of the bacterial inhibition zones slightly decreases with increasing wear time, but the inserts have excellent antibacterial properties even after 8 hours of wearing the masks. A comparison of the protective efficiency of the masks using inserts with and without antibacterial properties showed that the increase in the efficiency of masks with inserts in mechanical braking of particles is as high as 12%. It should be noted that the additional insert in the mask does not complicate respiration. It is possible that these materials could be applied not only for the production of long-term individual protective equipment but for a wider range: to filter the air in various premises or by coating various surfaces in public spaces.

NOVELTY OF THE WORK

The novelty is a filter in protective masks that would not only block the entrance of bacteria and viruses, but would also kill them.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

The main aim is to help for world to fight with bacteria and viruses. Another advantage is based on ecology, as these masks could be reused and thus reduce the number of disposable masks.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The most important benefit is that protective masks with additional insert of copper and copper oxide particles protect human health because of killing bacteria and viruses. Also these inserts is possible to use a long time and wash.

Ag-In-Se LAYERS ON FLEXIBLE ARCHITECTURAL TEXTILES AS EFFICIENT MATERIAL FOR OPTOELECTRONICS APPLICATIONS

Lina Jatautė, Valentina Krylova, Nijolė Dukštienė

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Different international directives on the energy performance of buildings stipulate that in a near future all new buildings must be nearly zero-energy buildings. The solar cells are one of the most matured technologies and can be rather simply embedded in the textiles due to their simple device structures. In recent years various types of wearable solar cells have been extensively studied, including amorphous Si, organic, hybrid, dye-sensitized, and copper-indium-gallium-selenide (CIGS) photovoltaic devices. As architectural textiles are usually used to cover extensive out door parts of buildings, the development of the functional properties of these substances by integrating element modules converting solar energy into electricity is a highly promising activity allowing profitable use of the available space and the construction of energetically efficient buildings. From the broad literature searched, there is currently no work that has been reported on formation of $AgInSe_2$ thin films on architectural textile substrate by using aqueous chemical synthesis methods.

NOVELTY OF THE WORK

The chemical bath deposition (CBD) and successive ionic layer absorption and reaction (SILAR) methods are simple and low temperature preparation techniques to integrate different materials without vacuum system or high temperatures. In addition, either these techniques have the numerous advantages over the other synthesis methods such as cost effectiveness; does not require complex instrumentation, little or no hazards associated issues, ease of reproducibility and etc. From the broad literature searched, there is currently no work that has been reported on formation of $AgInSe_2$ thin films on architectural textile substrate by using aqueous chemical synthesis methods.

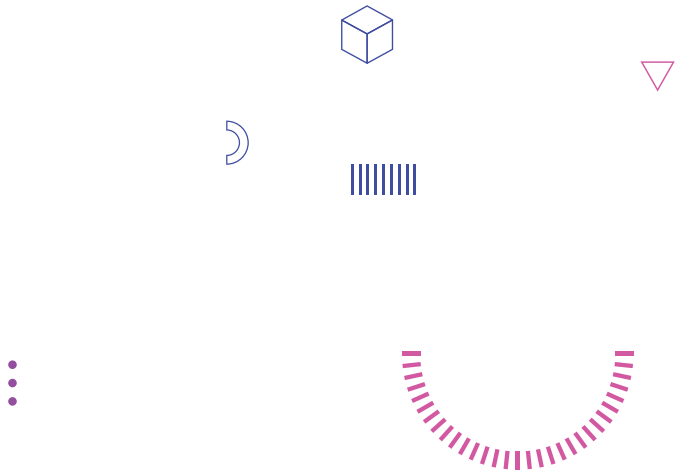
TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

In recent years, many different methods been applied for $AgInSe_2$ thin film formation on glass and indium doped tin-oxide (ITO)-coated glass substrates. The chemical bath deposition (CBD) and successive ionic layer absorption and reaction (SILAR) methods are simple and low temperature preparation techniques to integrate different materials without vacuum system or high temperatures. In addition, either these techniques have the numerous advantages over the other synthesis methods such as cost effectiveness, does not require complex instrumentation, little or no hazards associated issues, ease of reproducibility and etc. Thus, using this technique can eliminate complex processes, the use of expensive equipment, the use of many solvents, because the same equipment, solvents and other devices are used throughout the process. This would solve many ecological, economic problems and make complex processes simpler and cheaper by adapting our proven prototype.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

As architectural textiles are usually used to cover extensive out door parts of buildings, the development of the functional properties of these substances by integrating element modules converting solar energy into electricity is a highly promising activity allowing profitable use of the available space and the construction of energetically

efficient buildings. Most architectural textiles are dielectric materials that lack the required functionality. There are three major routes to impart photo-electronic functions in textile materials mesh: the first route is to embed micro photovoltaic devices in the textiles due to their simple device structures. the second is to build nano- or sub-micrometer structures inside the fibres building blocks [] and the third scalable functionalization method without losing much of the intrinsic textile properties is to form an electrically conductive and photoactive layers on the textile surface. The real application of architectural textile-based solar energy conversion systems is extremely inspiring but, at the same time, very challenging. All of this will bring great benefits to the consumer, and will potentially economically, cheaply, ecologically and flexibly insulate the architectural building by customizing our product / prototype. It will not take much effort for him to have a warm building.



BITTER ACID AND ANTIOXIDANT RICH ELLA HOP EXTRACT

TRL 4 technology validated in lab

Nóra Emilia Nagybákay, Vaida Kitrytė, Michail Syrpas, Audrius Pukalskas, Aušra Šipailienė, Petras Rimantas Venskutonis, Kristina Perminaitė, Daiva Majienė, Kristina Ramanauskienė

Kaunas University of Technology
Lithuanian University of Health Sciences

SHORT DESCRIPTION OF THE WORK

Hops (*Humulus lupulus L.*) and their products are widely utilized in the brewing industry, added primarily to provide the characteristic beer bitterness, aroma and taste. Besides the extensive use in the brewing industry, novel applications of various hop products, including mainly extracts, in food, agricultural, pharmaceutical, nutraceutical and cosmetic industries are fuelled by the research on the beneficial health effects of hop phytochemicals. The hop essential oils, bitter acids, polyphenols have numerous reported bioactive properties such as sedative, neuroprotective, antioxidant, anti-inflammatory, anti-carcinogenic, antimicrobial activities etc. In order to meet the demands of the functional food, nutraceutical, pharmaceutical, and cosmetic industries, hop extracts with different properties and bioactive compound assemblies will be required. Therefore, this work presents the pilot-scale production of extract from dual purpose hops cv. Ella via optimized supercritical CO_2 extraction (SFE-CO_2) combining high yield and bitter acid recovery with strong oxygen radical scavenging capacity. Since the infrastructure for hop processing into SFE-CO_2 extracts is already available, therefore, the manufacturing of hop bioactive compound-rich extract can be upscaled as well.

NOVELTY OF THE WORK

Optimized SFE-CO_2 process is developed to produce a multi-purpose extract with high bitter acid content and antioxidant-rich fractions from dual purpose hop cv. Ella. It offers up to ~3-fold higher extraction yield and antioxidant recovery, also substantially shortened exhaustive extraction of α- and β-bitter acids from hop pellets in comparison to the classical commercial one-stage SFE-CO_2.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

The commercial SFE-CO_2 of hops is mainly performed at relatively low pressures (up to 15 MPa) as one stage process with liquid or supercritical CO_2 to recover jointly aroma-rich fractions and a fraction of bitter acids from hops. This requires a considerable extraction time. Therefore, a more efficient approach is needed to reduce the operational costs of the process. Also, the currently available hop SFE-CO_2 extracts are basically tailored to the brewing industry's needs. However, the functional food, nutraceutical, pharmaceutical, and cosmetic industries require products with different properties and bioactive compound assemblies.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The Ella hop extract is obtained utilizing green innovative extraction technology SFE-CO_2 with relatively cheap, non-toxic, non-flammable, generally recognized as safe (GRAS) and readily eliminated after extraction food-grade solvent CO_2. The high antioxidant potential and bitter acid concentration, also the antimicrobial activity against Staphylococcus aureus and ability to significantly reduce the viability of C6 glioblastoma and skin cancer (A-375) cells were characteristic features of this product. Therefore, such extracts can be successfully incorporated into various functional phytopharmaceutical preparations.

This research was supported by the Research and Innovation Fund of Kaunas University of Technology (project grant No. PP54/202) and the Research Fund of Lithuanian University of Health Sciences (BioHops).

BREAD ENRICHED WITH KOMBUCHA

Gytis Kumpikevičius, Ugnė Tamkevičiūtė, Justė Vaičekauskaitė, Evelina Čepanonytė, Supervisor assoc. prof. Loreta Bašinskienė

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Kombucha is sweetened black tea that is fermented by a symbiosis of bacteria and yeast embedded within a cellulose membrane. As drink Kombucha has a long history, reputedly dating back thousands of years to the Qin Dynasty in China in 221 BC. Made from sweetened green or black tea and a specific culture known as a SCOBY (symbiotic culture of bacteria and yeasts). The bacteria and yeasts in the fermentation process gives Kombucha a distinctive sour taste, and adds a host of beneficial vitamins and minerals, including C, B, B1, B6 and B12. So our Kombucha bread is rich in vitamins, mineral salts and proteins, and has a very high nutritional value, which in turn is positive from a physiological and dietary point of view, especially if you have difficulty digesting bread. In addition to the fact that we used Kombucha to enrich the bread with vitamins and minerals, During the technological process we noticed that by giving Kombucha a longer shelf life, the bread stays fresh longer.

NOVELTY OF THE WORK

Use of Kombucha drink in bread production

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Kombucha enriches bread with various vital trace elements necessary for human health

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Kombucha does have some B-complex vitamins such as thiamin and niacin. That said, raw kombucha has the potential to be a good source of probiotics, which can be beneficial for your digestive health

BugFire CHIPS

Charli Richaud, Ieva Jurevičiūtė, Ričardas Maculevičius
Supervisor assoc. prof. Loreta Bašinskienė
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Insect flour is rich in protein, healthy fats, iron and calcium, and contain essential amino acids and low amount of carbohydrates. The idea was to design a bread snack that would not only be tasty, but also would have beneficial value. We chose to use paprika, turmeric and other spices to primarily give a nice taste and colour to the product, but also to mask the taste of the insect flour.

NOVELTY OF THE WORK

There are currently no bread products that contain insect flour in the Lithuanian market.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Incorporation of insects in food products would help to tackle the problem of malnutrition. Insect farming is more environmentally friendly than conventional farming – it requires less amount of land, water and feed and emits less greenhouse gases.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The product creates the value for the person and for the environment as well. Product contains higher protein and mineral content than regular wheat bread, therfore eating food products with insects that have low amount of fats in them could prevent obesity and related disease

BREAD CHIPS WITH CHICKPEA FLOUR, SHELLED HEMP SEEDS AND SUN-DRIED TOMATOES

Veronika Raimonda Urbonaitė, Miglė Vertinskaitė, Kotryna Strazdauskaitė

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

A diverse set of snacks is an integral part of every person's diet. An ever-increasing healthier lifestyle among society has led to the creation of bread chips that supplement the human body with essential substances such as protein and fiber. Our bread chips are enriched with chickpea flour, hemp seeds and sun-dried tomatoes. These key ingredients may be beneficial for people with diabetes because the fiber helps slow down the absorption of dietary sugars. One cup (92 grams) of chickpea flour provides about 10 grams of fiber – triple the amount of fiber in white flour. Furthermore, as protein is essential in building muscles and recovering from injury and illness, chickpea flour was chosen as it is higher in protein than other types of flour, including white and whole-wheat flour. In addition, hemp seeds contain over 30% fat. They are exceptionally rich in two essential fatty acids, linoleic acid (omega-6) and alpha-linolenic acid (omega-3). As a result, it may reduce one's risk of developing a heart disease. It's also important to mention that sun-dried tomatoes are packed with nutrients and anti-oxidants (including lycopene) that are believed to decrease the risk of certain types of cancers, neutralize free radicals and decrease inflammation. They are also loaded with vitamins C, which supports the immune system, and K, as well as iron.

NOVELTY OF THE WORK

In the production of these bread chips, we use chickpea flour and hemp seeds, and sun-dried tomatoes, which enrich the product with protein, fiber and good fat.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Introduce consumers to a healthy and delicious snack alternative.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Since the bread chips contain a relatively high amount of protein, good fats and fiber, the consumer can have a fast way to get the neccessary nutrients

CHEAP HOST MATERIALS FOR HIGH EFFICIENCY OLEDs

Dovydas Blazevicius, Gintare Krucaite, Daiva Tavgeniene, Saulius Grigalevicius, Raminta Beresneviciute, Shahnawaz Shahnawaz, Sujith Sudheendran Swayamprabha, Jwo-Huei Jou, Aivars Vembris

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Organic light-emitting devices (OLEDs) have been widely investigated due to their potential using in energy-saving lighting technologies as well as in new-generation flat-panel displays. Some OLED based devices, for example smart phones, have been already commercialized. Yellow phosphorescent emitters based OLED devices take an important role in the high-efficiency WOLEDs (white organic light emitting diodes) as well as in full color display applications. With this technology fully utilized about 15% of global energy consumption can be saved. We introduce novel host materials for efficient yellow OLEDs. New derivatives were synthesised during cheap, one step procedure by using carbazole or phenoxazine as building blocks. The best device fabricated using our host materials exhibited power efficiency of 32.2 lm/W, current efficiency of 35.8 cd/A and external quantum efficiency of 10.9 %. The maximum brightness of the device exceeded 23100 cd/m^2. These characteristics are roughly twice higher than devices that were designed with commercially available host material CBP. All this was done without inflating cost of materials.

NOVELTY OF THE WORK

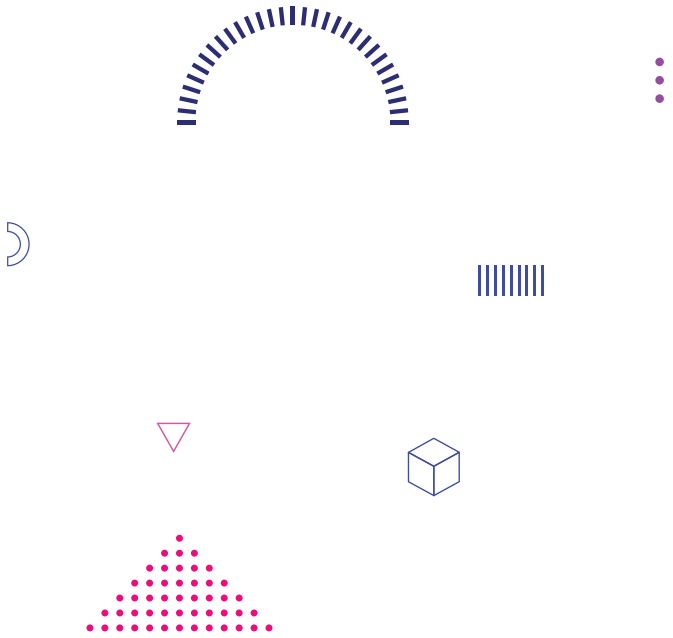
Complicated synthesis of host materials reduced to only one-stage procedure without sacrificing overall efficiency of the device.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

During this work we were able to simplify synthesis procedure of host materials for efficient OLED devices.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

This work can benefit users of OLED devices by cutting costs of final product.



CRISPY BREAD CHIPS WITH CARROTS AND FRUITS

TRL 4 technology validated in lab

Gintarė Baltuonytė, Simona Gurskytė, Rolana Gužauskaitė, Simona Ražanaitė

Supervisor assoc. prof. Loreta Bašinskienė

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Nowadays supermarkets offer consumers a wide range of different snacks which typically tend to have a low nutritional value. They usually are high in trans fats, calories and added sugar content. Also brings little benefits to consumer's health. The demand for healthier food products is extremely noticeable in modern society and each year it is increasing. Taking this into account we decided to create a healthy and nutritious snack – crispy slices of rye and wheat bread with carrots and dried fruits. This product is free of added sugar, the sweetness is provided by naturally found sugars in fruits and vegetables. These ingredients together with rye flour enrich the product's fiber content and also provide feeling of fullness for longer period of time.

NOVELTY OF THE WORK

Currently, the supply of similar products on the market is very limited. The supermarkets mainly offer dried bread chips made with wheat flour, seeds, nuts and fruits. The uniqueness of our product is the addition of carrots and rye flour. The carrot pieces provide appetizing appearance and give sweetness sensation.

Also our product was designed as an alternative for snacks such as fried potatoes chips, cookies or other high processed food which mainly junk food consists of. It could be sold in school's or company's canteens, snack and drink vending machines, fairs and also at the supermarkets.

The nutritional value of our bread crisps are quite high and could enrich not even adult's diet but children's as well. Crispy bread chips have rich composition and excellent functional properties: no preservatives; oven dried – no trans fats; no additional sugar or artificial flavour enhancers; high in fiber; suits for vegans and vegetarians.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Our team strongly believes that by creating healthy products we contribute to a healthier society. We cannot eliminate our habits to snack, but we can make those habits healthier and more beneficial to us and our bodies. At these times, people are used to filling their stomach with junk food due to stress or other reasons. But such a constant snacking usually leads to diseases like sugar diabetes, obesity, high blood pressure and etc. By finding the ways to substitute junk food with high nutritional value products we can try solve these common health problems or at least make them smaller.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

One of the common problems with junk food containing added sugar is that they tend to lack fiber unlike products with natural sugar. Fruits which are used in the recipe, not only provide sweetness sensation but they are natural sources of fiber, vitamins, minerals (iron, copper etc.) and antioxidants (flavonoids, carotenoids etc.). As well as rye flour is. Also food products with high content of fiber give feeling of fullness much faster, as the result you minimize the risk of overeating.

COFFEE GROUNDS FOR SOIL AND PLANTS

Dovilė Ragauskaitė, Rasa Šlinkšienė
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Nowadays one of the biggest environmental issues is a food waste. Accumulation and disposal of biodegradable organic waste causes various environmental, economic, and social problems. Large amounts of properly untreated coffee grounds release carbon dioxide and methane when disposed of in landfills. These gases have a particularly negative impact on the environment and increase the greenhouse effect. The main goal of this work was to obtain granular fertilizers using coffee grounds collected from different coffee shops located at Kaunas City. One of the key points in this work was to make fertilizers completely organic and use only renewable materials. Because of the high porosity coffee grounds cannot hold its shape without any additives, this work analyses and evaluates possibilities of mixing coffee grounds with different organic additives (e.g. buckwheat hulls ashes) and wetting agents (e.g. water, molasses) to make fertilizer pellets.

NOVELTY OF THE WORK

The novelty of this work is making organic fertilizers using coffee grounds and other organic waste.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

1. Accumulation and disposal of coffee grounds and other organic waste.
2. Soil degradation.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

1. Reduces the amount of coffee grounds and other organic waste.
2. Coffee grounds increases the amount of humic substances in the soil.
3. Provides the soil and plants with the necessary nutrients.

FRUITY BREAD CRISPS

Adrija Narbutaite, Simona Šimkutė, Erika Kižytė, Laurita Varnaitė

Supervisor assoc. prof. Loreta Basinskiene

Kaunas University of Technology

TRL 4 technology validated in lab

SHORT DESCRIPTION OF THE WORK

Nowadays there is a huge variety of different types of sweet snacks, however, not all of them have beneficial properties for human health. Currently, there is also a limited selection of healthier snacks in the Lithuanian market. Thus, the idea of this project was to create a functional sweet bread product that would have valuable substances for the human body. For this purpose, we used whole-grain flours, which are rich in minerals, fibers, and vitamins. It is known that berries have a lot of natural sugars, therefore we chose Goji berries that could help to reduce added sugar content. Moreover, they are rich in minerals, trace elements, antioxidants, are an excellent source of C and B group vitamins and amino acids. To improve the functional properties and taste of the product, we also used nuts, seeds, and dried fruits. We found the best combination of fruits, berries, nuts and seeds that enrich the traditional taste of bread. The product stands out with its colorful appearance that is provided with dried berries and fruits. Also, thinly sliced bread layers, nuts and seeds give a crunchy texture. Finally, fruity bread crisps are a better alternative for cookies because they have less sugar and are rich in fibers. Further, they can be consumed with different types of foods, for example, curd, cheese, sweet and spicy spreads, etc. This product could be suitable not only for traditional bread lovers but also for consumers with exceptional taste.

NOVELTY OF THE WORK

There is a limited selection of healthy fruity bread crisps on the Lithuanian market. Thus, our goal was to develop a new functional product, which would have beneficial properties for the human body.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Due to the lack of fruity bread crisps in Lithuanian market, our product would help to expand halthier snack choices.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Fruity bread crisps are high in fiber, minerals and vitamins. Goji berries could help to reduce added sugar content. Moreover, they are rich in minerals, trace elements, anti-oxidants, are an excellent source of C and B group vitamins and amino acids.

GREEN CHEMISTRY INSPIRED CARBAZOLE-FLANKED CYCLOBUTANES AS HOLE SELECTIVE MATERIALS FOR PEROVSKITE SOLAR CELLS

TRL 6 technology demonstrated in relevant environment (industrially relevant)

Šarūnė Daškevičiūtė, prof. Vytautas Getautis, Kasparas Rakštys

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Over the recent years, organic-inorganic hybrid perovskite solar cells (PSCs) have been attracting a massive world-wide attention due to their low cost and facile fabrication. HTM is one of the quintessential components required for the efficient and stable PSC devices. Currently, Spiro-OMeTAD is the most popular choice for the HTM layer, and is used for the majority of the state-of-the-art PSC devices. However, the synthesis of such spiro-type compounds typically requires a multi-step reaction scheme involving low temperature (-78°C), sensitive (n-butyllithium) and aggressive (Br_2) reagents resulting in a relative high material cost, consequently leading to a significant contribution to the total device cost and non-negligible environmental impact. Therefore, the hunt is now on for new organic semiconductors that are prepared by simple, cost-effective, and green chemistry without sacrificing the efficiency. Is known that photodimerized carbazole is an attractive building block

due to the simple, elegant and green synthesis. Herein, we disclose the development of novel HTMs, which comprises cyclobutane as a new structural core element for HTMs. Novel cyclobutane-based HTMs have been successfully applied in PSCs showing PCE up to 21%. Most importantly, to obtain novel HTMs we have applied protocols inspired by green chemistry, for the first time presenting that HTMs for PSCs could be synthesised eliminating the use of hazardous substances in order to reduce the adverse environmental impact without sacrificing the efficiency. And another issue of importance to commercialization is their large-scale production. Modules based on V1366 at a size of 6.5 cm × 7 cm were fabricated. The performance of module with high PCEs of 19.06%, as far as we know, this is the highest non Spiro-OMeTAD system PSC modules photoelectric conversion efficiency.

NOVELTY OF THE WORK

Novel cyclobutane-based HTMs; simple and green synthesis.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

To protected nature from agressive chemicals; the highest non Spiro-OMeTAD system PSC modules photoelectric conversion efficiency.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

An alternative cheaper and “green” energy source.

MIXED RYE BREAD WITH SPIRULINA PLATENSIS

Aurelija Zaicevaitė, Vaiva Grigoliūtė, Laura Večkienė, Vilius Karalius

Supervisor assoc. prof. Loreta Bašinskienė

Kaunas University of Technology

TRL 4 technology validated in lab

SHORT DESCRIPTION OF THE WORK

Usually, we can see bread products in every person's daily diet. Mixed rye bread is rich in dietary fiber, which is good for digestion, regulates blood sugar and cholesterol levels. With the rapid expansion of the cult of healthy eating, more and more people are turning to products offered by nature that benefit our health. One of them is algae called Spirulina platensis, also known as a superfood. It is indeed quite impressive how nutritious Spirulina platensis is! For example, 10 grams of Spirulina contains about 5,7 grams of protein (protein in Spirulina is considered to be impeccable even compared to eggs), essential omega-6 and omega-3 fatty acids, vitamin B1, B2, B3 and various minerals also. Besides, it is low in carbohydrates. We are proud to say that due to the added appropriate amount of Spirulina, our bread can be called a functional product by applying nutrition claims. The consumer, by eating this bread, will receive 14 % of protein, less than 1 % of fat and 4 % of dietary fiber in 100 grams of product (only by consuming two slices of our bread!) With the rapid expansion of the cult of healthy eating, more and more people are turning to products offered by nature that benefit our health. Thus, the consumer eating mixed rye bread with Spirulina platensis will not only feel the satisfaction of taste receptors when eating such bread but will also notice the benefits for his intestinal function and increased energy reserves.

NOVELTY OF THE WORK

Our product is new, therefore there is no such or ever similar bread in the market. Besides, only a few scientific articles have been published about bread enriched with Spirulina platensis powder.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Although nowadays consumers are paying more and more attention to their complete diet, most of them do not manage to provide their body with the necessary substances during the day. Therefore, bread enriched with spirulina is a great alternative for people in a hurry and those who live a healthy lifestyle and looks for new product for their daily diet. Moreover, this bread is also suitable for vegans!

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Our product can be called functional food, because it is the source of protein, free of additional sugar, high in dietary fiber and low in fat.

MICROBIAL FUEL CELL AS AN BIOELECTROCHEMICAL SENSOR OF NITRITE IONS

TRL 4 technology validated in lab

Egidijus Griškonis, Arnas Klevinskas, Kristina Kantminienė, Nerita Žmuidzinavičienė

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Laboratory experiments carried out by our team have demonstrated that a microbial fuel cell (MFC) can be used as an alternative biosensor to a selective nitrite ion electrode. Microorganisms attached to the anode in MFC – electricity-generating bacteria (exoelectrogens) – transfer electrons from oxidised organic compounds to an anode as the electron acceptor and thus generate electricity. The parameters of the electricity (voltage, current strength) generated by MFC are directly dependent on the bioelectrochemical activity of exoelectrogens, which is largely determined by the chemical composition of the bioanode and anolyte. Exoelectrogens, like other living organisms, are adversely affected by a variety of toxic substances. Therefore, the influence of toxic nitrite ions added to the anolyte-model wastewater on the MFC parameters was evaluated experimentally. Moreover, in some experiments, amine-modified graphite felt (GF) anode was used instead of bare GF to enhance MFC performance. It has been determined that at lower concentrations (0.1–10 mg/L) of nitrite ions in anolyte-model wastewater, the voltage drop in MFC depends logarithmically on the concentration of nitrite ions proving the potential of the use of MFCs for the quantitative monitoring of nitrite ion concentrations in wastewater and other surface water. Higher concentrations (100–1000 mg/L) of nitrite ions in anolyte- model wastewater cannot be accurately quantified due to a significant drop in MFC voltage. In this case MFC can potentially serve as a bioelectrochemical early-warning device for extremely high nitrite pollution.

NOVELTY OF THE WORK

A bioelectrochemical sensor of nitrite ions based on microbial fuel cell (MFC) technology solves several problems simultaneously:

- the device is self-powered, i.e. it does not require additional organic substrate for bacteria as long as there is enough organic matter in water for metabolic activities of inoculated exoelectrogens;
- it can operate on-site;
- it provides the continuous real-time monitoring of water contamination;
- it is reusable as voltage/current strength values are restored back due to the ability of electricity-producing bacteria to "self-heal" after removal of contamination source.

In addition, self-renewable MFC lowers operating costs and eliminates environmental risks.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

One of the most toxic nitrogen-containing ions is nitrite ion, therefore it is particularly important to ensure that nitrite ions are completely absent in surface and ground waters as well as in wastewater or at least their concentration does not exceed permissible levels. However, no selective ion electrode is available which would enable use of electrochemical sensor for the continuous measurement of nitrite ion concentration in wastewater or other water. Therefore, currently concentration of nitrate ions is monitored by periodic sampling for photometric measurements at the laboratory. A new type bioelectrochemical sensor has been developed for continuous monitoring of nitrite ion concentration in wastewater or other water as a promising alternative to currently used periodic sampling for laboratory testing. The technology developed provides not only around the clock monitoring possibility, but also is a much cheaper alternative to the laboratory testing.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Fast action early-warning device for nitrite pollution.

MIXED RYE ACORN BREAD WITH MIXTURE OF CHIA, SUNFLOWER AND SESAME SEEDS

TRL 4 technology validated in lab

Kristina Černavskich, Aurelija Judytė, Elžbieta Linkutė
Supervisor assoc. prof. Loreta Basinskiene
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

The whole idea of baking mixed rye acorn bread came into our minds for a few good reasons. One of them obviously is associated with people starting to lead a more healthy and fulfilled lifestyle. In this case acorn bread would be a great addition to their diet because modern research has confirmed the very high nutritional value and health-promoting composition of this raw material. The content of important minerals such as potassium, calcium and magnesium is significantly higher in acorn flour than in cereal flour. They also contain digestive fiber, B vitamins and more than 5% unsaturated fatty acids. Other valuable components are derived from seeds, for example chia seeds contain large amounts of fiber and omega-3 fatty acids, plenty of high-quality protein, and several essential minerals and antioxidants. Sesame seeds are a rich source of natural oils, lignans, antioxidants, protein, dietary fiber, and vitamins and minerals like calcium, iron, potassium, phosphorus, magnesium, B-vitamins, and vitamin E. Sunflower seeds were selected in an attempt to preserve the traditional taste of the bread. The other reason of baking mixed rye acorn bread would be sustainability. And by that I mean that we are able to grow acorn trees in such climatic conditions that Lithuania has to offer, it could open a possible demand on acorn flour and also create work places. Having this flour incorporated into our daily diet would mean that

not only do we eat healthy and stay active, but we can use our own locally grown produce to its full potential. After all a healthy person is a happy person and a happy person is more likely to help others in need and create a prosperous environment around them.

NOVELTY OF THE WORK

This a new unique market product, which has a high fiber and mineral content and is made from untraditional acorn flour mixed with various seeds: sunflower, chia and sesame.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

This product may solve the lack of fiber consumed by people, lack of minerals which are essential for a robust human metabolism, decrease oxidative stress and increase wellness.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Dietary fiber not only maintains bowel health and lowers bad cholesterol levels, but it also helps to control blood sugar levels and aids in achieving healthy weight, while minerals such as sodium, potassium, phosphorus, magnesium and calcium maintain fluid balance, nervous system, are needed to help muscles contract and relax also keeping the bones healthy and strong. Seeds have high protein, antioxidant content which could help reduce oxidative stress, boost metabolism, gain more strength and lower blood pressure.

ORGANIC CONJUGATE DYES FOR PHOTODYNAMIC TREATMENT OF CANCER AND BACTERIAL INFECTIONS

Gabrielė Varvuolytė, Neringa Kleizienė, Eglė Arbačiauskienė, Greta Ragaitė, Aurimas Bieliauskas, Vaida Milišiūnaitė, Sonata Krikštolaitytė, Algirdas Šačkus, Lukáš Malina, Barbora Hošíková, Hana Kolářová, Vladimír Kryštof, Asta Žukauskaitė

Kaunas University of Technology
Palacký University Olomouc

SHORT DESCRIPTION OF THE WORK

The invention provides a series of novel substituted pyrazole-indole conjugated derivatives that are useful for photodynamic therapy. Hence, they can be used as anti-cancer photosensitizing drugs in treatments of skin and epithelial tumors accessible to light irradiation, or as antimicrobial photosensitizing agents. Compounds cause cell death through DNA fragmentation and production of reactive oxygen species.

NOVELTY OF THE WORK

Photodynamic properties of pyrazole and 3H-indole derivatives were previously unreported.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

The novel dyes could be potential photosensitizers against skin cancer (melanoma) cells.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The invention could be an effective and non-invasive way to treat skin cancer.

PEAT EXTRACT AS A BIOSTIMULANT IN LIQUID FERTILIZERS

Goda Gudinskaitė, Danguolė Jakimavičiūtė, Rasa Šlinkšienė

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Not only fertilizers are enough for effective plant growth, bioactive substances are also needed, which intensify the absorption of nutrients. One of bioactive substances is peat extract. In this work it was obtained by extracting various types of Lithuanian peat. Prepared alkaline extract was added to the liquid fertilizer. This improved the properties of the liquid fertilizer. It also increases the efficiency of liquid fertilizers. Usability and demand are increasing.

NOVELTY OF THE WORK

Currently, Lithuanian peat is used only for the production of substrates but is not chemically processed. Therefore, obtaining Lithuanian peat extract is a novelty.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Peat extract reduces the process of soil degradation, solves the problems of restoring the balance of bioactive substances in soil and reducing the use of fertilizers.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Peat extract expands the areas of application of Lithuanian peat and enriches liquid fertilizers with bioactive substances.

p TO P (PEA TO PORK)

Aelita Zabulionė, Alvija Šalaševičienė
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

It is not just simple vegan burger. Pea to pork – is everything, that you could imagine as future food. It is made using sustainable materials, such as peas or brewer's yeast. All ingredients are common, but in this unique burger they are made in whole new way using smart technologies. To improve taste we used fermentation with probiotic bacteria and added hydrolysed brewer's yeast, which was already used in beer production and in other cases would be considered as waste. For creating meaty texture we ran extrusion process, which led simple pea flour or even press-cakes become nice meaty and juicy chunks. By modelling different sources of amino acids, mineral and vitamin blends we outreach meat analogue nutritional value incredibly close to real meat. And lastly, by regulating pH and improving technological treatments we reduced antinutritional factors to minimum limits. If we can transform pea to pork, can you imagine, what we could create next?

NOVELTY OF THE WORK

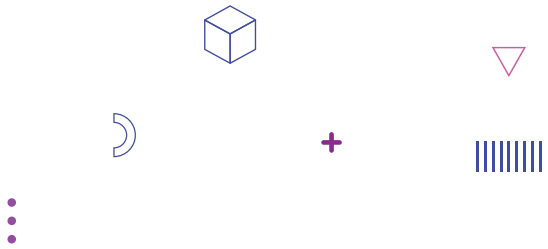
Pea to pork is unique by its composition and production way. For this analogue we gave second chance to already used brewer's yeast by hydrolysing them. Also we have improved taste and nutritional value by biofermentation with probiotic bacteria. And finally, extrusion helped us to not only create perfect meaty texture, but also turn various cereals, legumes and nuts press-cakes from waste to valuable meat analogue ingredient which improved technological properties.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Meat industry not only creates many green-house gasses, is not sustainable but also reduces forest areas by turning them into pasture. Furthermore, meat has very short expiration dates, and that leads to many tons of waste from manufacturers to daily consumers. Last, but not least – epidemiological studies indicates that the long-term consumption of increasing amounts of red meat and particularly of processed meat is associated with an increased risk of total mortality, cardiovascular disease, colorectal cancer and type 2 diabetes, in both men and women. In worldwide market there are many meat analogues. But none of them contain reused or recycled materials, such as brewer's yeast or press-cakes in our meat analogue. As base ingredient we choose well tolerable pea, instead of soy, which may have negative impact for fertile age woman.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Pea to pork – benefit for earth and for each one of you. Peas are great for environment, because they are perfect for crop rotation and increases nitrogen content in soil. As well as cereals, legumes and nuts press-cakes after vegan drinks production become valuable and nutritious part of our meat analogues. Hydrolysed brewer's yeast not also are favourable to earth because its reused, but also fulfils meat analogue with valuable B group vitamins. And lastly, unique amino acids, mineral and vitamin blend ensures full-fledged nutrition without a drop of blood.



RYE BREAD WITH MISO PASTE

Greta Marija Prakapaitė, Eglė Gasiūnaitė, Robertas Ingelevičius, Dovilė Butkauskaitė

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Miso is a fermented soybean product with beneficial properties for the human body. Since bread is probably the most common food product in Lithuania, our team decided that we could try to add something exotic to the common bread taste, which would also be beneficial to the body, but still maintain the appearance of traditional Lithuanian rye bread. Every consumer is encouraged to eat a balanced diet everyday, so that's why we decided that bread supplemented with vegetable proteins would be a great, balanced, everyday product, which contains such a large amount of carbohydrates from cereals, and a part of necessary protein. Therefore, with this project, we are trying to enrich the traditional bread with a new additive that would not only give our favorite bread color or taste, but also enrich the product with proteins.

NOVELTY OF THE WORK

Traditional rye bread enriched with vegetable proteins from fermented soybean paste "miso".

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Due to intense and fast rhythm of modern people life, it is surprisingly difficult to consume a balanced amount of nutrients everyday. When creating bread enriched with proteins, we aim to help people in a hurry to consume a more balanced product.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The modern consumer is paying more and more attention to products, enriched with vitamins, proteins or fiber, so the problem we solve is to enrich the consumer's everyday diet with plant proteins.

SUPERBREAD, WHICH CARES FOR YOUR HEALTH!

Laura Tamkutė, Laura Baužaitė,
Ieva Daugalaitė, Petras Rimantas Venskutonis
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Sea-buckthorn and blackcurrant berries are processed into juice, jams and other products. During processing besides the main product, a lot of by-products such as pomace are generated and nowadays are used very inefficiently or even discarded as a waste. Berry pomace has a unique composition of healthy nutrients such as valuable lipids, dietary fiber and phenolic compounds. Therefore, there is an urgent need of valorization of berry pomace ingredients and their application for enriching food products with health beneficial compounds is one of the most promising approaches. The idea of this work is to recover valuable lipids from sea-buckthorn and blackcurrants pomace by supercritical carbon dioxide extraction and to test the residual (defatted) pomace in bread for improving its nutritional value. Deffated pomace were tested in the wheat bread by replacing 5% and 10% of the flour with them. Berry pomace, as colourful ingredients, had significant effects on white bread colour, which in case of using sea-buckthorn pomace acquired yellow-brown hue, while in case of adding blackcurrants pomace became violet-brown. In general, sensory properties of bread with pomace ingredients were acceptable. Bread enriched with berry pomace had higher protein and moisture content was softer and more acceptable. Pomace additives remarkably increased antioxidant charactaristics of bread measured during in vitro oral, gastric and intestine diges-

tion using e-BQC device. It may be concluded that the addition of deffated sea-buckthorn and blackcurrants pomace increases nutritional value and some quality characteristics of bread. Therefore, bread with berry pomace may be recommended for healthy diets.

NOVELTY OF THE WORK

For the first time deffated sea-buckthorn and blackcurrant pomace were tested in the wheat bread by replacing 5% and 10% of the flour with them to improve its nutritional value.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

This work opens up opportunities to recycle berry production waste into very valuable nutritional ingredients that may significantly improve quality, sensory and nutritional properties of wheat bread.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Opportunities for businesses to reduce waste, create and commercialize new nutrition products, and consumers to get healthier and safer food

SWEET BREAD STRIPS WITH DRIED APRICOTS AND PLUMS, WALNUTS AND HEMP PROTEIN POWDER

Agnė Smirnovaitė, Milda Saračinskaitė, Neda Jaraitė, Agnė Vengraitytė

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Nowadays, when people are increasingly concerned about their appearance, health and well-being, one of the most important aspects is the alternative to healthier food. Our idea is a healthy, protein-enriched, sweet and crunchy bread snack. Sweet bread strips with dried apricots and plums, walnuts and hemp protein powder are an alternative to sweets and a healthier snack. Sweet bread strips are rich in antioxidants that improve the functioning of the human digestive system. These strips are also enriched with walnuts who are distinctive he combination of healthy fats, protein, and fiber in walnuts helps to increase satisfaction and fullness. Also sweet bread strips are enriched with hemp protein powder is rich in all 20 amino acids, including all 9 essential amino acids needed by humans from food. Hemp protein powder also contains fiber, which makes sweet bread strips a real alternative to healthier food. These strips for people who want to eat healthier but don't have enough time for cooking.

NOVELTY OF THE WORK

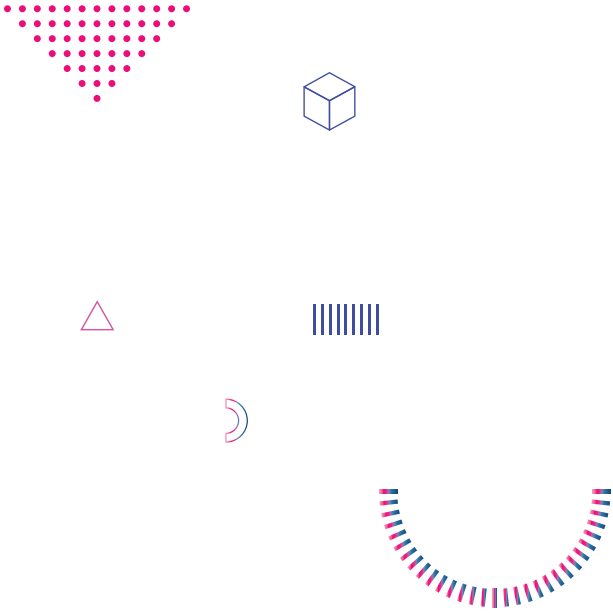
In these sweet bread strips, we used hemp protein powder, which enriches our product with protein.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Our idea is sweet bread strips, an alternative to a healthy snack. The carbohydrates in these strips, along with protein, allow a person to feel fuller for a longer period of time than with simple snacks.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Sweet bread strips are a healthier snack for working people. These strips are also good for athletes because they are rich in protein and carbohydrates.



THE SYNTHESIS OF ADSORBENTS/ ANTIBACTERIAL AGENTS BASED ON CALCIUM SILICATE HYDRATES

Tadas Dambrauskas, Anatolijus Eisinas, Kestutis Baltakys, Viktorija Eisinaite, Ausra Sipailiene

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

The creation of new high selectivity and performance adsorbents and antibacterial agents, as well as searching for new, inexpensive, eco-friendly and simple methods for their synthesis, is a major issue.

For this reason, an eco-friendly technology for obtaining adsorbents/antibacterial agents based on calcium silicate hydrates, which combine the hydrothermal synthesis of calcium silicate hydrates in dense samples and their solid-state sintering at lower than 950 °C temperature was created.

It was found that active silicates can be obtained by preparing the hydrothermal synthesis of calcium silicate hydrates in pressed samples. The obtained samples can be used for the purification of water contaminated with heavy metal ions.

It was found that samples obtained after adsorption process can be used for synthesis of antibacterial active wollastonite. The synthesis of such compound requires 100–200 °C lower temperature by comparing with traditional methods.

The proposed technology allowed to synthesize active calcium silicate hydrates in dense samples and apply them as adsorbents or in the production of antibacterial agents.

NOVELTY OF THE WORK

A new methodology for the production of adsorbents/antibacterial agents based on calcium silicate hydrates under two-step synthesis was developed.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

1. The preparation and synthesis methodology of active calcium silicate hydrates in dense samples was created. The obtained samples have good adsorption properties for heavy metal ions and can be applied for the purification of contaminated waters.
2. An alternative eco-friendly method for synthesis of antibacterial active wollastonite with controlled properties is created. The synthesis requires 100–200 °C lower temperature by comparing with traditional methods and no environmentally hazardous reagents are used.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The offered technology allows to obtain adsorbents in low temperatures (<200 °C) and to avoid granulation.

The technology allows to reduce the cost of production of active adsorbents and antibacterial agents, which increases the competitiveness of the products.


DESIGN

BRICKY BOY

Paulius Jažauskas

TRL 9
actual system proven in operational environment

SHORT DESCRIPTION OF THE WORK

Bricky Boy is a combination of brick-breaker and pinball genres, represented in a very original style of handheld gaming consoles from the ’90s. Combined with a 8-bit soundtrack, this game will let you enjoy the genuine feel of the long-gone gaming computers.

NOVELTY OF THE WORK

This game is completely original and is very new (finished 6-7 months ago)

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

This is a video game, it lets the player rest from a stressful day, and it may help to overcome emotional problems like sadness/depression.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Mostly emotional, as this game is made with very positive design style and has a nostalgic gameplay, it may help to decrease stress, sadness or other mental problems.

NATURAL AIR PURIFIER

Gerda Trifeldaitė
Kaunas University of Technology

TRL 3 experimental proof of concept

SHORT DESCRIPTION OF THE WORK

During the work, a natural algae-based air purifier was developed. This device not only reduces the amount of various air pollutants, such as CO_2, SOx and NOx, but also produces oxygen. User-friendly design ensures easy maintenance of the device and the ability to monitor air quality parameters in the screen of any smart device. Light sensors and led strips installed in the unit guarantee that the air cleaning process is being executed continuously. Required amount of electricity is generated by using solar panels.

NOVELTY OF THE WORK

The method of air purification by using algae is known. There are several prototypes of bioreactors based on algal photosynthesis.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Nowadays, air pollution is considered as one of the world's biggest health and environmental problems. Diverse factors such as burning of fossil fuels, active animal husbandry, various industrial activities and deforestation lead to an increase of carbon dioxide concentration and other air pollutants. However, indoor air quality is also a serious concern. According to the surveys, people spend almost 90% of their time indoors. Furthermore, as the COVID-19 pandemic caused a huge disruption in our daily routines, most of the people spend even more time at home. The negative effect of increased CO_2 concentration on individual's decision-making and reading comprehension skills is confirmed in several researches.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Unfortunately, most of the contemporary air purifiers use disposable filters that eventually end up in landfills. In this way, not only additional waste are generated, but also, consumers are forced to incur supplementary expenses in order to purchase new filters. During the operation of the natural air purifier, biomass is generated, which later can be used in various ways, for example, production of biofuel. Also, this device not only reduces the amount of various air pollutants, but also produces oxygen.




ECONOMY, SOCIAL SCIENCES AND HUMANITIES

BOARD GAME "KONDIGNO"

Salomėja Paleckytė, Judita Remeikytė, Greta Dekšnytė, Beatričė Valaitytė, Justinas Blažukas, Austėja Leonavičiūtė

Vytautas Magnus University

SHORT DESCRIPTION OF THE WORK

Kondigno is an exclusive board game that combines technology with a regular (physical) board game. The game provides good emotions, new experiences, challenging adventures. This game's uniqueness – it is adapted for the blind and visually impaired people, it creates the possibility to play without the help of the sighted, as the game uses only sound and touch sensors.

NOVELTY OF THE WORK

All the games for blind and visually impaired people are braille-based, even though they are much more interested in innovative games, like board games with apps, which are among the most popular in the world, but they are not adjusted for blind people. It led us to the idea of an app-supported board game, adjusted for blind and visually impaired.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Our product solves not only social exclusion for people with visual impairment, but also a problem of not being able to play without help from the sighted people.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The app-supported board game is innovative, fun, and easy to access. But the main value is social – it is adjusted for the blind and visually impaired individuals, thus, they can enjoy the game without any help and play together with sighted people, this way improving their relationships.

MODEL TO UPGRADE INNOVATIONS IN GLobal VALUE-CHAINS

Muhammad Faraz Mubarak, Monika Petraite
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

This research aims to improve the innovations' internationalization and innovation performance which upgrade the innovations of firms in international networks. Noteworthy to mention that the very intention is based on the vision to improve the overall process of various types of innovations – to better serve humanity during covid-19 crisis and post covid-19 to maneuver against such future global pandemics. In order to achieve this aim, the objective of this study is to develop a process model through which the firms could upgrade their innovations in global value chains.

NOVELTY OF THE WORK

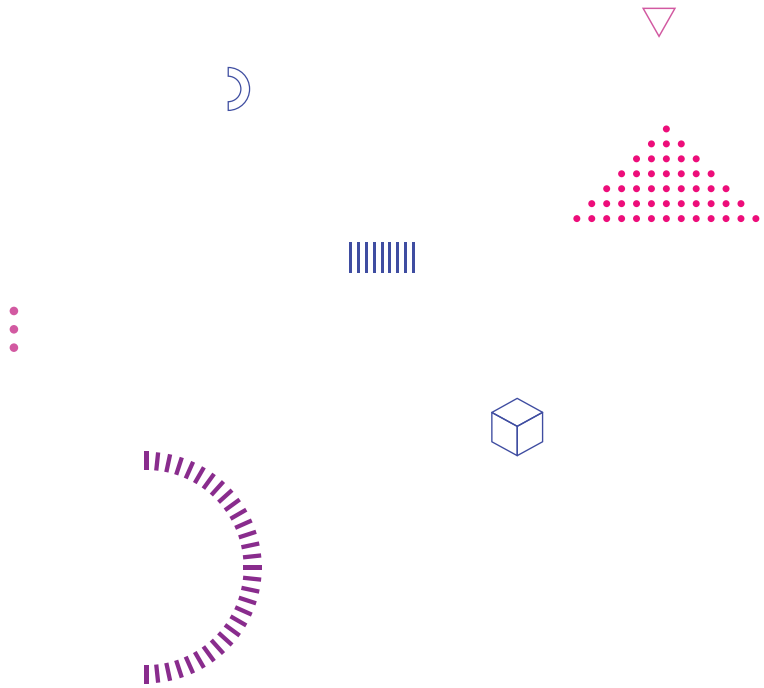
The process model of this study is an instrumental in guiding firms to Reduce their R&D expenses/budgets, where the firms would collaborate with external (industrial) partners through open innovation, without spending extra costs on R&D by avoiding the reinventing of wheel. Moreover, Through open Innovation and knowledge management, blockchain-embedded digital trust will enhance the level of cooperation of firms with external industry partners located at international locations, which would lead to effectively internationalize and ultimately upgrade the innovations in global value chains.

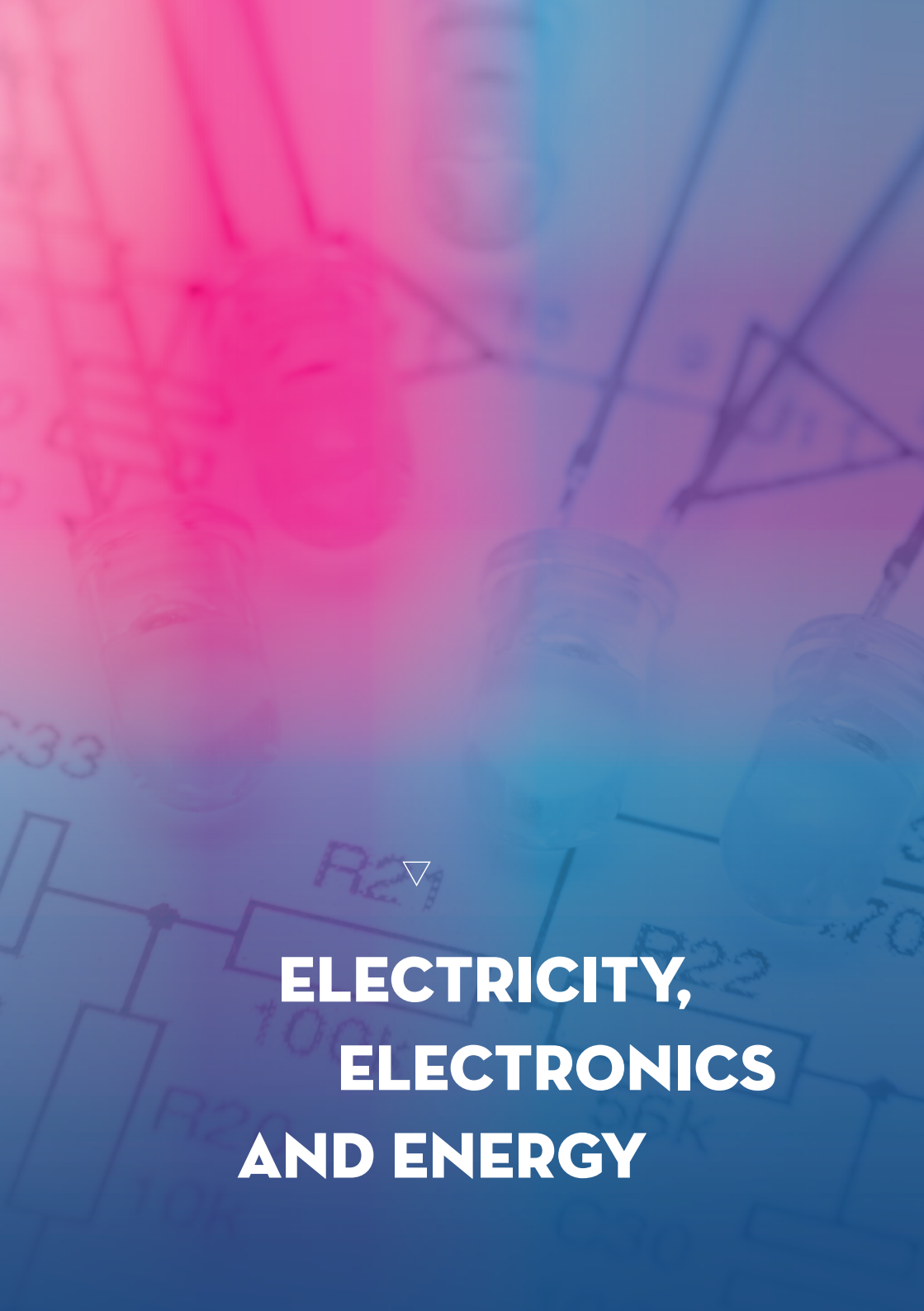
TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

The Process-Model of this research project will help firms to solve their problem related to contracting/diminishing of innovations life cycle by providing an appropriate mechanism to gain access to external resources and expertise to stay competitive in technological market.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The Process-Model of this research project will help firms to solve their problem related to contracting/diminishing of innovations life cycle by providing an appropriate mechanism to gain access to external resources and expertise to stay competitive in technological market.





ELECTRICITY, ELECTRONICS AND ENERGY

ANIMATRONIC HAND

Kasparas Elzbutas, Tautvydas Pilelis, Šarūnė Riaukaitė, Marius Saunoris

Kaunas University of Technology

TRL 3 experimental proof of concept

SHORT DESCRIPTION OF THE WORK

Our team created the animatronic hand prototype. It consists of 2 parts – the controllable glove, which is controlled by the user wearing it on the hand, and the animatronic hand itself, which can be at a distance from the controlled glove. The prototype mimics and allows replacement of the human hand in unsafe environments. So it can be used in chemical, space, medical, manufacturing industry and in military use. This hand is created according to the model of a human hand – it consists of 5 fingers and a palm which is connected to a forearm. Each finger, except the thumb, has 3 joints, while the thumb has 2. The first prototype allows you to take various objects ranging from 1.15 cm to 9.5 cm in diameter. The animatronic hand responds to the controlled glove movement within ~ 200 ms and each finger can bend up to 112 degrees.

NOVELTY OF THE WORK

The developed prototype allows the use of animatronic hand in unsafe environments.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Animatronic hand can be used in various environments where human hand can't be used directly.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Animatronic hand can be used to increase safety in workplaces and reduce workplace accidents. It can potentially save human lives.

HYBRID VERTICAL THRUST AIRCRAFT – ELECTROCOPTER

Darijus Pagodinas, Vytautas Dumbrava, Arvydas Tomkus, Robertas Audinys, Jokūbas Cikanavičius, Kęstutis Frankonis, Ridas Martinkevičius, Deimantas Dovidonis

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

The essence of the project idea consists of D. Pagodinas and V. Dumbrava in the international patent application no. PCT / IB2020 / 054978 discloses the idea of an electrocopter as a hybrid vertical thrust aircraft. A key aspect of this innovation is that the proposed flight principle separates the vertical thrust and control functions, which allows, differently from conventional drones, the use of larger diameter propellers to create a more efficient vertical thrust force, increase the ratio of generated thrust to power consumption. The patent application provides two functional implementations of the same idea:

1. A main vertical thrust power plant consisting of two counter-rotating power propellers and four peripheral control power plants with single propellers operating according to the principles of conventional quadcopter control.
2. A main vertical propulsion power plant consisting of two propellers rotating in opposite directions and three peripheral control power plants with duplicate propellers, each rotating in opposite directions.

NOVELTY OF THE WORK

The idea of patent authors D. Pagodinas and V. Dumbrava, which is used in the project, was compared by international experts with currently valid examples of patents performing a similar function. Several examples of such patents are available: KR20170018671A11 Hybrid drone system, CN109941429A10 Drone, DE102005046155A1 Helicopter with at least two coaxial main rotors, US2018 / 0029703A1 VTOL aerodyne with supporting axial blowers (s), US2016 / 0304or3A. It should be noted that none of the presented examples, judging by their design features, can fully implement the separation of vertical traction and control functions. In order to separate the vertical thrust and control functions with respect to all three axes X, Y and Z, it is a prerequisite that the peripheral control propellers are of the open type and arranged in such a way as to be able to interact freely with the surrounding stable air mass in all directions. Peripheral propellers housed in aerodynamic nozzles, as shown in the patent examples, would not be able to perform this control function. This arrangement of peripheral propellers allows the creation of an aircraft control function with respect to the vertical Y axis (Yaw). For the remaining X (Roll) and Z (Pitch) axes, the control is obtained by differentiating the thrust of the peripheral thrust power plants. The two central power plants generate exclusively vertical thrust and are not involved in the control of the aircraft. The composition of twin central thrust power plants, when both propellers rotate in opposite directions, creates a compensated total gyroscopic torque effect, which facilitates the control function with respect to the X and Z axes.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

The separation of vertical traction and control functions is very important in the development of the idea of an electrocopter as a hybrid vertical thrust aircraft. This enables the use of high torque motors and relatively large diameter propellers to create the main vertical thrust and thus obtain a better ratio of vertical thrust to power consumption. This results in a hybrid of a helicopter and a conventional drone, combining and exploiting the positive features of

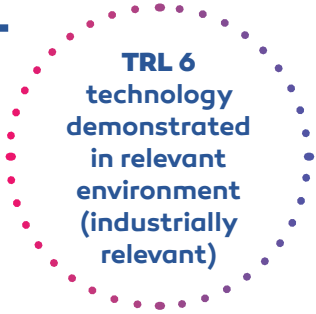
the first vertical thrust generation and the second easy-to-adapt electro-electronic controllability features to the smart vertical thrust aircraft (with GPS navigation and ultrasonic localization etc.).

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The use of such a design allows to significantly improve the following parameters:

- Simple adaptation of the concept by creating a manned vertical thrust aircraft.
- Flight ecology, relative pollution when moving a unit of weight at an appropriate distance is lower than with conventional vehicles.
- Flight economy – in terms of energy, the relative carrying capacity is higher than that of conventional drones.
- Various power plants can be used for the main thrust: the thrust motor, the hydrogen motor, the internal combustion engine, which basically allows to create the aerodynamic lift more efficiently.

PIEZOELECTRIC ENERGY HARVESTING FROM ENVIRONMENT FOR ELECTRONIC DEVICES



Chandana Ravikumar, Juozas Balamutas
Supervisor Prof. Vytautas Markevicius
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Technology of energy generation and storage are crucial tools for green energy establishment. Energy harvesting is revolutionizing the way to power devices allowing to build end-to-end IoTs cases. The device proposed is closely related to sustainable energy development as it is based on energy harvesting from environment for powering wireless sensor networks and low power electronic devices. The harvester uses the ambient vibration energy from various sources (industrial machines, automobiles, etc.) to produce electrical energy which can power electronic sensors making them independent of batteries or power cables. The idea is to implant our proposed energy harvesters in outdoor mechanical equipment with excess vibrations like garden tractors and tools for construction industries. The energy extracted can be used to supply low power service providers like Lora, Sigfox or other kind of IoT devices. Secondly, low power transducers that record and transmit real time data like temperature, humidity, location or condition of the device in use. Another application of the harvester is to be assembled in asphalt on roads and sidewalks. This would effectively generate power for road traffic sensors (road conditions, traffic usage and patterns, vehicle speed, mass, tire condition and axle quality). This research is a

grass root level concept and is majorly focused on the design and development of a piezoelectric energy harvesters from available raw materials like piezoelectric polymers and ferro-electrets. The proposed harvester design successfully generated an average power of 15 $mW/g/cm^3$ (where g is acceleration due to gravity on earth ($9.8ms^2$)).

NOVELTY OF THE WORK

Sustainable energy development and transforming electronics into regenerative and self-reliant applications without human intervention after installation.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Wireless sensor networks conventionally depend on rechargeable batteries for power supply where energy is always brought to the device externally causing high maintenance works. Energy harvesting allows one to use energy that is already available in the device location. However, energy harvesting comes with a set of challenges which our model has overcome such as:

- Low energy output.
- Low voltage output.
- High amount of external components.
- Large form factor on PCB.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The proposed energy harvester offers the following benefits to users:

- Eliminates the use of chemical batteries and power cable.
- The beam configuration of the harvester significantly contributes to cost reduction.
- Transforms “plug and play technology” to “plug and forget.”
- Promotes zero-carbon emission and sustainable energy generation through creation of alternative energy source using available mechanical vibrations.
- Benefits the global growth of individuals by creating affordable and clean energy thus, encouraging innovative ideas on eco-friendly products and diversifying renewable energy sources.

RENEWABLE ENERGY POWERED WIRELESS DATA RECORDER

Augustinas Babarskas, Mantas Ambraziūnas, Povilas Bendinskas, Aistė Kukanauskaitė

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

The created device can be used to help save money and time, protect the environment, and is designed to monitor various physical parameters in the industry. Ultra-low power sensors that offer longer device operating time from the battery are used to record values of temperature and humidity, pressure, and acceleration. Components were chosen by combining quality and price therefore giving an opportunity to develop a smart device at a reasonable price for a regular user. The microcontroller, responsible for data acquisition, analysis and transmission, has an integrated Bluetooth Low Energy module, allowing the device to send recorded data to a user's mobile device wirelessly in range up to 50 meters without connecting device by physical connection (wires). The ability to connect additional external sensors makes the device more functional and attractive to a consumer because the device can be upgraded in the future. Moreover, the device can be powered by any renewable energy source (solar energy, mechanical vibrations, thermoelectric energy). Renewable energy which is stored in an internal supercapacitor can be used to power device when a sufficient amount of energy is generated or after an internal battery depletes. Device can be used in automation, industrial goods, machine engineering, automobile industry for purposes such as the monitoring of technical plant and equipment, reduction of wear in installations, monitoring of process workflows, improving the performance of ma-

chines, dimensioning of bearings and dampers, noise reduction of motors, detection of imbalances, vibration measurements on refrigeration units, material tests, electronic transport monitoring, measurements for product development, fault diagnostics and research and development. The finished product could be sold in the market for consumers who want quality and functionality at an affordable price.

NOVELTY OF THE WORK

The device can be powered by any renewable energy source (solar energy, mechanical vibrations, thermoelectric energy) and renewable energy is stored in an internal supercapacitor. Highly customizable.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

The device eliminates a requirement for a wired connection between the monitoring device and sensors as the data is transmitted via wireless Bluetooth protocol and can be sent over a longer distance. The appliance can also store and use renewable energy which makes it environment-friendly. The ability to use renewable sources diminishes usage of non-eco batteries. The device is oriented to be used by a common consumer since it is more cheap, easy to use and doesn't require supervision.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The device is portable, easy to use, doesn't require supervision, is cheap compared to other similar devices presented in the market and provides an opportunity for customization meeting more specific end-user needs.

SandyLock – UNIQUE SMART BEACH CABINETS

Ignas Laugalys, Tautvydas Ptakauskas, Aistė Stefanskytė, Mindaugas Kapickas

SHORT DESCRIPTION OF THE WORK

Unique smart beach cabinets – open with finger print and manage payment through the mobile app. Power sockets inside each cabinet for mobile phone or other electronic device charging. Green energy produced by the solar collectors which are on the top of SandyLock cabinets.

NOVELTY OF THE WORK

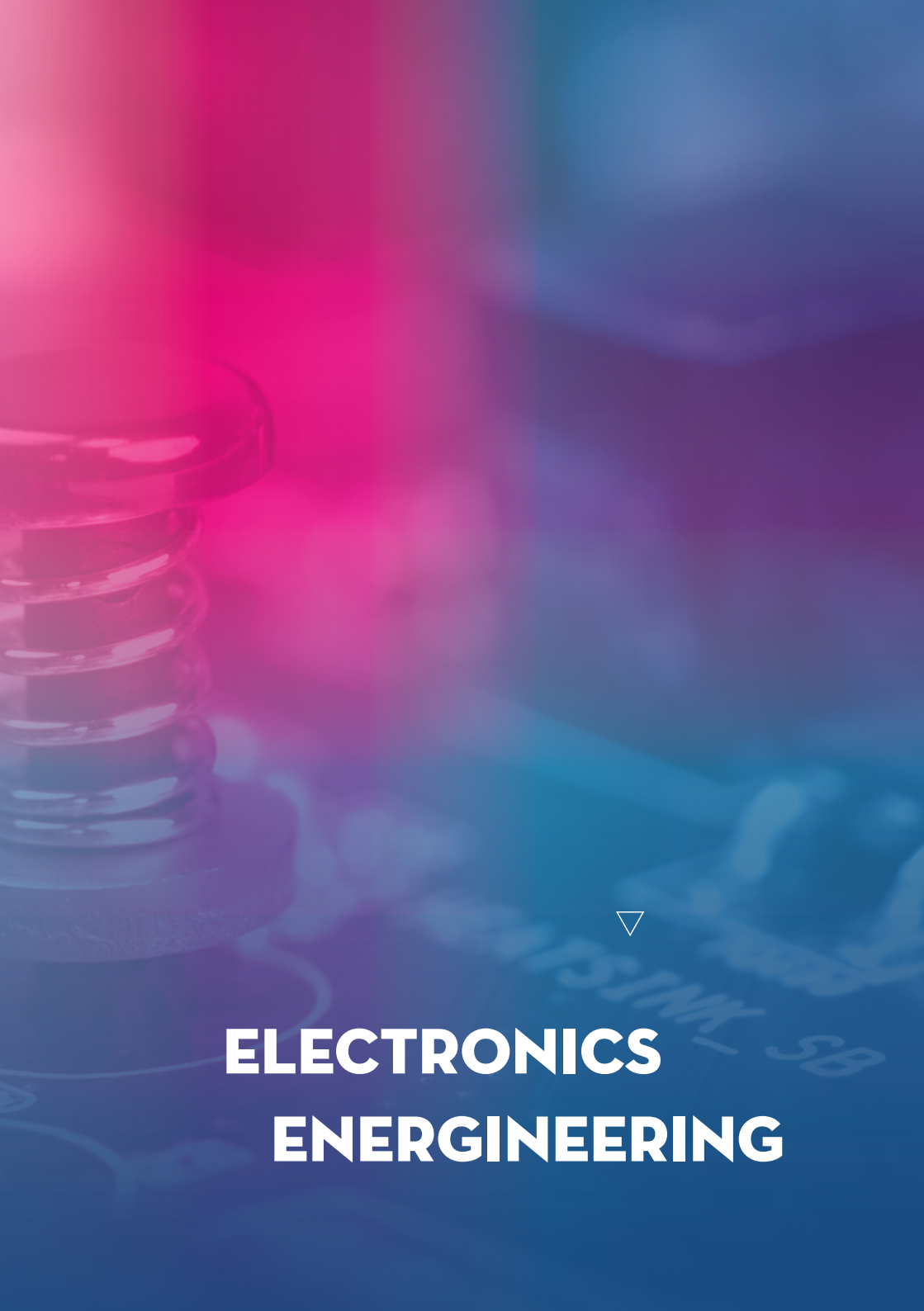
The main novelty is finger print opening with authentification on keypad with a code. That lets SandyLock to become novators in safe item storage at the beaches.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

SandyLock solves the main problem – where to put personal belongings safe while staying at the beach?

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Every user may put their belongings safe and enjoy careless time at the beach by paying little amount of money for the services.



ELECTRONICS ENERGINEERING

UWB TRAC

Arvydas Tomkus
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Nowdays most quadcopters use GNSS system for navigation. However GNSS is highly vulnerable to jamming devices and indoor environment.

Therefore a complementary quadcopter control system „UWB TRAC“ was designed, which enables beacon based tracking both outdoors and indoors. System can also be used to circle quadcopter around the beacon at a constant radius, which is useful for military perimeter defense. Angle and distance to object is measured using two 6.5 GHz UWB tags on the quadcopter and one anchor as a beacon, while altitude is measured using ultrasonic sensor. Experiments have shown, that angle to beacon is determined within 20° accuracy and distance to beacon within 20 cm accuracy. ARM microprocessor is used, to intercept standard quadcopter communications and take over roll, pitch, yaw and throttle controls. PID controller is implemented, to ensure tracking at a given distance and altitude. Flight data is displayed in real time on a touchscreen LCD display and blackbox data logging is performed to a microSD card.

“UWB TRAC” allows quadcopter to perform fully autonomous flight, so only minimal knowledge is required to operate. In the future UWB beacon could be replaced by UWB enabled smartphones or smart wearables, so there would be minimal effort required to deploy.

NOVELTY OF THE WORK

Beacon tracking is performed using minimal amout of tracking devices: two tags on a quadcopter and one anchor as a beacon.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Indoor navigation, GNSS alternative, automatic surveillance.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

This system can improve existing collision avoidance systems in both aircraft and ground vehicles, when video recognition or lidar fail.

HEALTH SCIENCES

ANTIMATERIALIS – INTEGRATED POSITRON EMISSION TOMOGRAPHY ANALYSIS SYSTEM

Lukas Arlauskas, Laurynas Varnas, Deividas Kairys

SHORT DESCRIPTION OF THE WORK

Antimaterialis is an integrated system which uses machine learning algorithms to analyze positron emission tomography (PET) scans and applies image correction algorithms to make image more readable. The system is tightly integrated with health care institutions' picture archiving and communication system (PACS) server and aims to analyze brain PET scans. The status quo is that positron emission tomography scans are really expensive and can easily cost over 8 thousand euros per scan. Furthermore, the contrast material used is radionuclides which are radioactive and must be administered at low doses. One of such known radionuclides is fluorodeoxyglucose (FDG). The key goals of this project are to reduce the time required for radiologist to read the scan and write the report by providing the second opinion, drive down the costs and increase patient safety by reducing the radionuclides required per scan and applying image reconstruction algorithms. Currently the idea is being focused on FDG-PET scans but the team aims to apply the AI methodologies to analyze PET scans which use other radionuclides.

NOVELTY OF THE WORK

The novelty of the work focuses on the fact, that we aim to predict the possibility of the person developing a neurodegenerative disease into the future so that there would be enough time to prevent such diseases. What is more, competitor analysis reveals, that some of our competitors' solutions feel like an extra hoop for an image to get analyzed by the AI and/or use external application programming interfaces (APIs) to analyze the data in the cloud thus introducing one more vulnerable point. As such, we intend to design the solution with the UX and safety in mind, meaning that all images get processed in hospitals and the solution would be easy to use even for those with relatively little computer literacy.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

- For hospitals – patient data safety when using our imaging solution.
- For radiologists – accelerated workflow, meaning less time is spent to analyze PET scan. The standardization of the procedure offers the greater analysis speed.
- For patients – less radionuclides used during the procedure and same great results, meaning less side effects and increased patient safety.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Our solution offers second opinion for the radiologist, faster and cost-efficient analysis and automatic report generation in case of a healthy patient. Our team thinks that our solution would help the medical facility industry save millions of euros, because they simply won't need that much radioactive pharmaceuticals. As far as benefits for the patient go we aim for lessened side effects from the PET scan, data safety, early tumour and neurodegenerative diseases diagnosis and/or prediction

DEVICES FOR BETTER PSORIASIS TREATMENT

Aurimas Mazuras, Evaldas Kalvaitis, Edvardas Satkauskas, Alina Vilkaite

Emplastrum

SHORT DESCRIPTION OF THE WORK

Psoriasis is a long-lasting autoimmune disease characterized by patches of abnormal skin. Around one-third of people with psoriasis report a family history of the disease, and researchers have identified genetic loci associated with the condition. Psoriasis has a strong hereditary component. The patient has the problem, but also there is a big chance that their family members also can be affected. More than 125 million people worldwide suffer from psoriasis including some of our friends and family members. Each year these people spend over EUR 8B on psoriasis treatment worldwide. Scientists and market researchers forecast that the global psoriasis treatment market will be worth $12B (€10B) by 2024. Emplastrum team has developed new and better way for psoriasis treatment. We created device that is a flexible, silicon patch with a small screen on top with integrated UVB LED lights. The innovation gives the opportunity to shift psoriasis treatment from hospital to home and makes the treatment itself more comfortable compared to current, time-consuming methods patients are not satisfied with, based on survey responses and research.

NOVELTY OF THE WORK

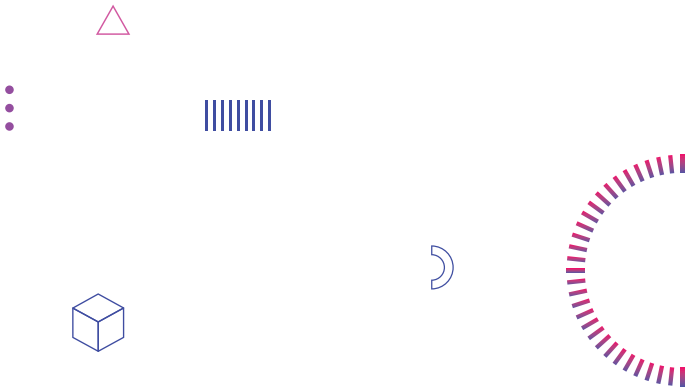
Product is patenting in Lithuania and North Europe countries. We are unique in the world. We made smaller, flexible and perfect sizes devices which enable people to have treatment at home.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

With our patches, people will be able to have treatment anywhere (at home, at work, in a car and etc.), avoid unnecessary UV rays and treat several damaged skin places at one time. Emplastrum solution gives the opportunity to shift psoriasis treatment from hospital to home.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

On average, patients spend more than 6 hours a week for psoriasis treatment. With our devices, patients would be able to spend approximately 35minutes/week. Especially this product will be suitable for older citizens bringing the treatment to home. The patients will save 10x more time (they do not need to go to the hospitals for treatment). More than 80% of unnecessary UV rays will not get on the patients' skin. 60-90% chance that the symptoms improve noticeably or go away completely for a while.



HOMINISEAT

Ieva Aleknaite-Dambrauskienė, Aurelijus Domeika, Berta Ylaitė, Donatas Daublys

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Researches show that many people more than half a working day and about 90 percent of their leisure time spend sitting. Prolonged sitting position increases lower back pain due to impaired musculoskeletal motor control mechanism. Therefore, very often people working in a sedentary job are offered to spend some of their working time sitting on various unstable surfaces (therapeutic balls, unstable, soft cushions, saddle-shaped seats, etc.) that activate the deep muscles. The created device test stand is an individualized sitting device controlled with feedback of trunk (abdomen and back) muscle activity. An individualized seat, creates a higher activity of the deep torso muscles, because these muscles perform a stabilizing function of the spine, which reduces the tension in the superficial muscles and improves the skeletal - muscle motor control mechanism. The individualized seat is distinguished by the fact that a safe level of instability can be adapted to each person individually. Our scientific experiments with the seat, studying sedentary workers, measuring their muscle, brain activity and kinematic movements, confirm the above statements that the seat is suitable for people as a training tool to help prevent musculoskeletal problems and is suitable for use in the workplace.

NOVELTY OF THE WORK

Comparing with other ergonomic chairs, our customized seat differs from others, the ability to change instability level according to trunk muscles activity. An additional advantage of this seat device is that it can act as a passive and active device. This means that a person can perform the movements himself by moving the seat and also, the seat itself can move by stimulating the human pelvic-trunk movements. In experimental studies, the activity of the cerebral cortex suggests that the activity of a particular area of the brain responsible for cognitive, motor, and somatosensory activity is increased by movement and individualized seating. As a result, the health and balance of employees improves, as the centers actively responsible for balance also increase labor productivity and reduce the musculoskeletal disorders which are related with sitting.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Examined the various office chairs and seats that have similar innovations with our customized seat and we notice that when sitting on different seats, they are moving freely around the axis in a variety of directions, and there is no option to increase/decrease instability or adapt to each person individually. This designed seat test stand moves in different directions, the special seat is mounted on bearings, on which the upper part of the seat moves in different directions, ie, back and forth and sideways, with the ability to change the amplitude of motion, adjust stability and adapt to each person. When sitting on an individualized seat, a wireless sensor captures the activity of the trunk muscles. The speed, amplitude and stability of the seat will depend on these parameters. Therefore, this innovation must be used not only in ergonomics, but also as an alternative, using it as a trainer, solving various sitting problems – muscle problems, where seating devices are tailored to each person individually, taking into account muscle activity, existing back pain or asymmetry in the body.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The American Heart Association (AHA) reports that from 1950 to the present, the number of jobs that require longer sitting positions has increased by 83%. According to EUROSTAT data for 2017, about 39% of Europeans work in jobs requiring a static sitting position. In the United States, that number is as high as 60% of the total population. And only about 50% of Lithuanians work in jobs that require moderate physical effort. Based on the statistics provided, it can be seen that sedentary work also increases premature mortality, i.e. 3.8 million people die each year as a result of a sedentary lifestyle (WHO, 2013). During pandemic, this problem became even greater as the most people work from home as a result we have reduced physical activity, increasing the risk of developing circulatory, musculoskeletal and other chronic diseases. In this situation, there is also an increase in various measures that improve the occupational health of sitting workers. Our long-term sitting position is one of the risk factors, disorders of the normal functioning of our musculoskeletal system, so the trainings are necessary to activate the whole body and reduce tension in the muscles, which appears due to long-term static positions. As an alternative to replacing the current office chair, there are often products on the market that cannot fully meet consumer expectations because they are developing according standard principles. The goal of an individualized seat is to meet the individual needs of the customer by selecting for each person an individual amplitude and speed of the seat movement, taking into account the individual's muscle activity parameters, thus creating added value for the health of consumers. The number of people in the US is 328.2 million, in Europe 747 million and in Russia – 144.4 million. 52% of them work in a sedentary job, so 3-5% of this number should be users of such a seat.

PROTOTYPE OF GAMMA SPECTROMETER FOR CITIZEN SCIENTISTS

Justas Beresnevičius,
Benas Gabrielis Urbonavičius
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Gamma ray spectroscopy is complicated in nature and requires relatively exotic equipment to perform. Cheap solutions for this problem are scarce and require a lot of knowledge to start. Our team proposes simple solution which can convert obsolete scintillation radiometers to perform gamma spectroscopic measurements. Cheap and simple device is to be an easy entry for professional and citizen scientist a like who would like to jump into ionizing radiation detection rabbit hole. Our device employs high voltage scintillating detectors which uses old photomultiplier tubes - PMTs. PMT require high voltage (up to 1500V) thus a simple charge pump was used that needs only 5V as a main power supply. To get the result from a detector, USB or Audio (3.5mm) interface can be used, which allows a multiplatform data receival. Use of this device allows gamma spectroscopy to be a simple and relatively low cost solution for a traditionally very difficult and expensive problem.

NOVELTY OF THE WORK

Designed system combines two technologies which are not supposed to work together – scintillating detectors with photomultiplier tubes and smartphones, computers.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Ionizing radiation detectors by nature require high voltage(up to 1500V) to work, but our solution requires only 5V, which means that with our device any detector which operates in high voltage can be powered from a smartphone or power bank. This device returns signal through USB or Audio (3.5mm) interface, so any exotic equipment is not needed. Because of the signal simplicity, results analysis does not require any paid tools – there are a lot of open-source software which can be adapted for this specific case. Also, it allows to use obsolete, thus relatively cheap scintillating detectors, for the second life. All mentioned things make professional or citizen scientist life easier to perform gamma spectroscopy.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

This prototype uses old scintillating detectors with photomultiplier tubes, which are 10x cheaper compared to other type ionizing radiation detectors with the same parameters. It lowers entry expenditure for citizen scientists a like and does not require any exotic components, where traditionally it is a high-cost problem

ZIVE ECG

Žilvinas Jančoras,
Ignas Griškevičius
ZIVE

TRL 6 technology demonstrated in relevant environment (industrially relevant)

SHORT DESCRIPTION OF THE WORK

Zive ECG – inexpensive, easy to use, medical certified heart monitoring devices for the home use. Simply put Zive ECG strap on and start monitoring. Launch Zive APP and get instant AI based analysis of Your ECG in real time. Zive ECG could be common at home as blood pressure monitor or body thermometer.

NOVELTY OF THE WORK

Business model focused on home use of cardiac device and telemedicine services In house developed, lightweight, easy to use CE certified Class II Medical grade ECG recorder. AI system for the instant analysis of arrhythmias. AI system for the analysis of long term ECG and other patient data for prognosis of the heart disease.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

People, who experience heart palpitations, cannot live in peace, they feel fear, but cannot capture these events data and share with a cardiologist. Cardiovascular diseases (CVDs) are the number 1 cause of death globally: more people die annually from CVDs than from any other cause. An estimated 17.9 million people died from CVDs in 2016, representing 31% of all global deaths. Of these deaths, 85% are due to heart attack and stroke. (World Health Organization) Abnormal cardiac events are not recorded as no medical grade devices are available for long term monitor-

ing at home and in normal life activities. Aging society will require more home care and monitoring Cardiac diseases are left undetected or detected only at a late stage Covid 19 demonstrated the need for home based telemedicine solutions.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

We help people with heart problems to live more calmly and comfortably. Providing real time heart ECG Data anytime, anywhere and alerts to rapid, potentially hazardous changes of Your heart.

INFORMATION TECHNOLOGIES

ABSTRACTMUSIC – MUSIC RECOMMENDATION SYSTEM BASED ON THE CLIP'S SIGNAL CHARACTERISTICS

Milita Songailaitė, Tomas Krilavičius
Vytautas Magnus university

SHORT DESCRIPTION OF THE WORK

The main idea of the project is to apply artificial intelligence methods to identify similar music, based on the sound signal profile of the fragment of the music piece selected by the user. Typically, such systems operate not on the principle of one particular fragment, but instead, based on the profile of the whole piece of music. Our proposed algorithm will focus on the extraction of the sound properties of one music clip and the search would be performed according to the characteristic profile created by this segment. By choosing such a methodology, we hope to achieve more accurate results of music similarity identification. The characteristics of each signal will be obtained by analyzing the audio frequency representations – Mel-frequency cepstral coefficients, the signal spectrograms formed according to these coefficients and other features reflecting the audio signals. Artificial intelligence algorithms, trained to find the characteristics of the most similar songs, would then find similar signals to the one chosen by the user and recommend them to the user. Although the idea is still in the research stage, we have already planned the possible result of the program.

In the prototype, the user would be able to either “cut” the desired part of the song, or select pre-detected parts of the song, which will already be detected by the program. After inputting the desired signal, the program would present complete songs whose audio signals were selected by the algorithm as similar.

NOVELTY OF THE WORK

The most commonly used recommendation systems are based on the choices of other users. Therefore, one user’s favourite songs may be recommended to another user, despite his or her taste. Another way is to recommend other songs by the same artist and, when one song is liked, offer the entire album by that artist. From a user perspective, both of these algorithms do not always work. Also, these algorithms can be often overfitted and offer very similar songs belonging to only one genre. Our algorithm would not withstand the previous choices of the user, thus avoiding the overfitting problem. In addition, we will create a new search system based on specific sound profiles of song clippings, rather than the characteristics of the whole song. Such an algorithm should be accurate enough to detect specific features of a song, as the range of input attributes will be significantly smaller than when examining the entire song selected by the user.

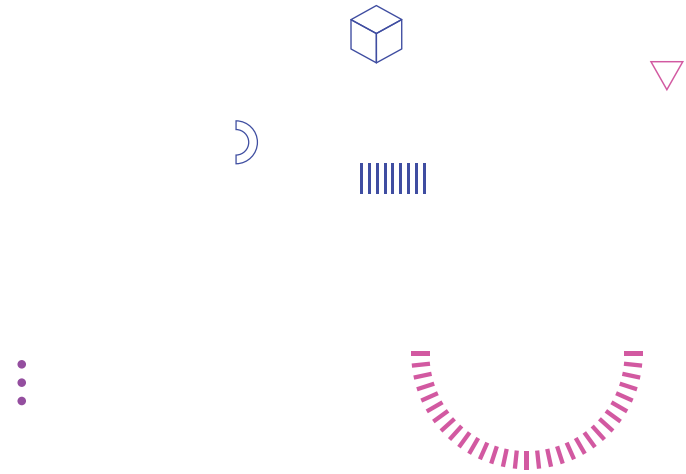
TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Our idea solves the problem of music recommendation. Almost everyone listens to music, but finding your favourite songs can often be a time-consuming process. Unlike the recommendation of movies, books, or other popular subjects, music recommendation systems are exposed to a particularly large amount of diverse content. One of the most popular music platforms “Spotify” currently offers more than 70 million songs of various genres. The average user will only be able to listen to a very small proportion of these songs, so the recommendation systems need to be constantly improved to adapt to changing human needs

and changing music styles. The algorithm we propose solves this problem from a slightly different angle than the systems used so far. Therefore, we hope to improve the current solutions and improve user accessibility to this large database.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Users will be able to get better access and recommendations to a fairly large database of songs that had already been created. They will also have the ability to perform more specific song searches based on a particular clip, melody, or rhythm of the song.



BreachDirectory

Lukas Vileikis

SHORT DESCRIPTION OF THE WORK

BreachDirectory is one of the biggest & fastest data-mining data breach search engine empires in the world. BreachDirectory houses hundreds of data breaches with tens of billions of people at risk – thousands of data breaches are yet to be imported. The search engine allows people to see if they are at risk of identity theft by letting them search for their email address, username, IP or other details and giving concrete tips on how people should protect themselves from data breaches both now and in the future. BreachDirectory is also able to predict human behavior in relation to data breaches by utilizing artificial intelligence capabilities on data breaches that have occured in the past and predicting data breaches that may occur in the future. BreachDirectory also has a blog analyzing the biggest data breaches in the world providing useful information to people who may not be interested in technology, developers, information security experts and database administrators alike, so it will be useful for everybody who has an interest in the service.

NOVELTY OF THE WORK

BreachDirectory is one of the biggest & fastest data breach search engines in the world housing all kinds of data breaches and it's the only search engine utilizing artificial intelligence and providing information to developers, security experts, database administrators and other people at the same time.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

BreachDirectory allows people to see if their identity is at risk of identity theft.

Quickly and easily checking if various account attributes are at risk of identity theft and educating yourself on the value of protecting your most sensitive data is an issue – BreachDirectory makes this easy.

The service is useful because it is able to quickly & easily solve problems relevant to multiple kinds of people – people not interested in technology will find helpful information to quickly & easily protect themselves from identity theft, developers & security experts will be able to dive into specific data breaches further, know what allowed specific data breaches to take place & protect themselves and other people in the future by knowing what services might be breached in the future, database administrators will be able to secure their database instances & optimize them for performance to make sure they always perform at the very best of their ability.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

BreachDirectory allows people to see if their identity is at risk of identity theft and act accordingly.

Security experts and people interested in technology in general are able to view information relating to data breaches (data breach analysis, classification etc.) helping them detect and prevent identity theft attacks both now & in the future, database administrators are able to see information that will help improve the performance & security of their database instances, less technology-savvy people are able to get advice that allows them to easily protect themselves and learn about threats on the web.

In the future BreachDirectory will expand further and animated data breach analysis will also be available allowing to educate even more people and reach them at scale.

CREATOR ACADEMY

Olegas Pridiukas, Valryia Batsian,
Anna Grigoryan, Karina Shakh

SHORT DESCRIPTION OF THE WORK

Learn livestreaming, community building, podcasting online together with other clever people http://communities.show.

NOVELTY OF THE WORK

We're teaching modern skills such as livestreaming, community building and developer relations online with a huge focus on community, individual learning path and personal goals. These are not recorded classes, these deliver new learning experiences.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

We efficiently teach new complex things online so that the students are happy, get their community network and are motivated to learn and have an easy way to practice their new knowledge.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Livestreaming, community building, podcasting, paid newsletters – modern skills that everybody needs to learn in the post-pandemic world.

FABULATOR: A SOCIAL MEDIA DATA GENERATOR

Veronika Gvozdovaitė, Justina Mandravickaitė, Danguolė Kalinauskaitė, Rūta Juozaitienė, Tomas Krilavičius

University of Oxford
Vilnius University
Vytautas Magnus University

SHORT DESCRIPTION OF THE WORK

The Fabulator would be a generator that imitates how humans behave on social media platforms. The need for a solution like the Fabulator comes from the concerns of data protection. There is an increasing need of training and testing data that could be used for the development of technologies and research. Due to data protection regulation, a lot of the data from social media becomes unavailable for use. The problem can be solved by generating synthetic data that imitates the properties of the human-generated social media data. This is the task for the Fabulator. It would be used for the generation of synthetic data, as well as the simulation of various events on social media. The final product should successfully generate high-quality, reliable social media interactions in the styles of different platforms such as Facebook or Twitter. Among the possible uses of the Fabulator is the prevention of cyber- and terrorist attacks by training the model to recognise the signs of such attacks on social media. The model could also be used for the simulation of different scenarios in social media, for example, the modelling of cyber- or propaganda attacks during election periods. Such simulations could help prepare for real-life scenarios by assisting research and helping strengthen the security systems.

NOVELTY OF THE WORK

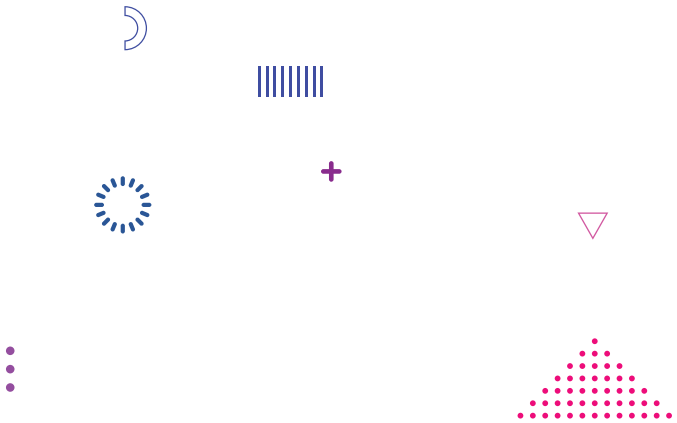
The existing solutions are scarce or still very limited. In particular, most are focusing only on the studies of structural interactions, while the textual contents are neglected. Moreover, most of the work in the field uses a single platform's (Twitter) data. Our prototype, the Fabulator, would combine the use of graph structures and text generation to produce high-quality synthetic data for different platforms.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Our work proposes a solution to the problem of obtaining sufficient amounts of data where data protection significantly limits the availability of the real-world data.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The primary benefit of the Fabulator would be for the advancement of research and the development of technologies, by providing the data necessary for such development. Then, the generator can be used to contribute to technologies that tackle various societal concerns, for example, the signs of cyber attacks and propaganda on social media.



FINANCIAL DISTRESS IDENTIFICATION USING ARTIFICIAL INTELLIGENCE

Dovilė Kuizinienė, Tomas Krilavičius
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Most of the credit scoring models rely on financial data, and only to a limited extent include macro-economic data, industry analysis, media, and social networks analysis, history of companies, and higher management behavior in the past, government regulation, discrete events (such as COVID-19 – related measures), etc. Moreover, most of the models predict bankruptcy, i. e. situation, when it is too late to get money from the company. The goal of this project is to estimate companies' financial health in almost real-time and timely inform interested parties about an increase in the risk.

NOVELTY OF THE WORK

Almost real-time prediction of the financial health of the company including all the accessible data.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Overdue financial health information Inclusion of non-structured data (media, social networks) and weak signals. Inclusion of discrete events (regulation changes, restrictions due to events such as COVID 19).

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Timely information on companies' financial health, early identification of risk increase.

MUSIC LOVER SOCIAL NETWORK

Valentinas Kasteckis

Kaunas University of Technology

TRL 7 system prototype demonstration in operational environment

SHORT DESCRIPTION OF THE WORK

A social network was created for music fans and lovers. Anyone can connect to the social network using a web browser. System users can see the song of the day, like it, can read and communicate in the chat window. Users can also participate in a poll that is created by the administrator. The user can scroll the feed page and see various posts, news, and planned events related to music. System users can read other people's posts, create, comment, and like them. For the convenience of users, the system has an infinite scroll functionality, which means that until the user scrolls down his screen, he will see various content, until the content ends. The social network also has a moderator role which can create news. Users can also participate in the TOP40 of songs, each user has 15 votes and can allocate no more than 5 votes per song. At the end of each week, the administrator can run the song rewinding algorithm and the songs will change positions. Users can also view artists, groups, albums, and songs on the social network. There is global search functionality that allows users to perform a search on every social network content type.

NOVELTY OF THE WORK

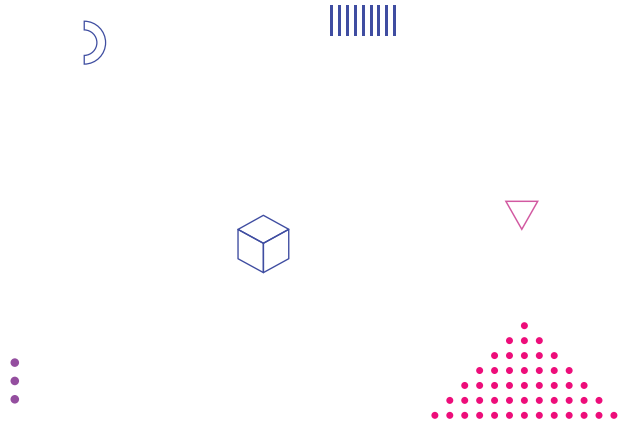
There is a couple of music-related websites in Lithuania, but most of them do not have infinite scroll functionality, users cannot create content, can only comment on posts that were created by an administrator, sites are not mobile-friendly, and so on. The system I created does not have these types of problems.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Anyone who loves music may like or follow certain pages on major social networks, but there is a problem that music-related content mixes with other types of content, advertisements, and so on. This newly created social network is exclusively for music fans, so the content you create is only related to music. Therefore, anyone coming here will only see music-related content.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Anyone who works in the music industry and creates songs, will be able to come into this social network and create a certain post describing the song or anything else related to music. Also, regular users will be able to communicate with their favorite people of the music world, comment on their posts, create their own posts and so on.



MOVEMENT TRACKING SYSTEM OF CUSTOMERS USING SELF-CHECKOUTS

Viktorija Varnaitė, Karolis Ryselis
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Movement Tracking System of Customers Using Self-Checkouts by using image recognition – a scientific study to determine whether using convolutional neural networks and deep learning, it is possible to identify which action of the product scanning action chain is performed by a customer. A model has been developed that is able to identify the action of the product scanning chain by the customer during classification. An additional system has been developed to represent the operation of the developed model. Image recognition is developed during the research performing the algorithm, changing the criteria of the convolutional network and analysing the obtained results. Test files can be loaded into this additional system and uploading this data allows image recognition to track the buyer movements, the buyer's action is identified and the recognized action is saved in an additional file. The data and results are videos, the report is saved in a text file.

NOVELTY OF THE WORK

Self-checkouts are constantly being improved and optimized. Since the shopping process is regulated by the store customer, it is important to check that all steps taken by the customer are correct and the purchasing process has been completed correctly. Customer scan actions usually consist of three processes. The first step is for the customer

to pick up the item from before the scanning area, followed by a second step in which the customer scans the product, and finally, the third step is when the item is moved from the scanning area to the post-scan zone. It is important that all these steps are performed and an important sequence of these steps is required for proper scanning and the process must follow this process flow. Security guards and cashiers are monitoring the process, however, the tracking process is complex as multiple self-service checkouts are monitored simultaneously must take place continuously and it is also important to quickly detect misconduct by the buyer, such as theft of goods. A possible solution for optimizing this process is the movements of customers using self-service cash registers development of a tracking system. Such a system would identify the actions of the buyer's scanning process action and provide the results of the analysis.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

It helps to track clients movement, so this data can be analyzed and this leads to theft prevention in stores.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Fewer thefts and this facilitates stores employes work.





NOMEX – MEDICATION MANAGEMENT APP THAT HELPS USERS TO TAKE THEIR MEDS CORRECTLY

Simas Gindriūnas, Marius Gindriūnas, Mantas Pabalys, Rimvydas Eitminavičius, Karolina Jančiulevičiūtė

SHORT DESCRIPTION OF THE WORK

Nomex is the application that allows the user to see information about their medicine, builds a schedule and sends reminders with notifications to take the prescribed medications. In addition, Nomex connects the user with the pharmacist, which allows the user to receive instant feedback about their medication usage.

NOVELTY OF THE WORK

We have a few competitors, but our app stands out from the competition. The intake schedule is automatically updated with the database and synced with the patient's phone. This is an innovative design not provided by our competitors.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

According to research, almost 50% of prescribed medication is taken incorrectly. This means that the patient does not get a proper therapeutic effect, or the medication has no effect at all. Also, patients sometime suffer from unwanted side effects or even intoxication of drugs.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Users will never forget to take their medication on time and will always take them correctly. As a result, people will not suffer from unwanted side effects or intoxication of drugs.

REMOTE WORKOUT APPLICATION “MusL”

Karolis Baranauskas, Martynas Maslauskas, Tadas Brazaitis, Linas Zinkevičius, Ernesta Petraitytė, Emilija Tolstova, Arminta Kairytė

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Our Team would like to offer the market a new workout application “MusL”, which is meant for people who want to workout in their own home conditions as well as using their own body weight or weighted equipment. This application has an exclusive feature – by using any smart watch/bracelet, that can measure your pulse, this application can dynamically display how much strain the user should put on their body in order to achieve the most effective results and an optimal workout. This feature will use the smart watch/bracelet sensors and Artificial Intelligence to make sure that the user is able to have a dynamic and effective workout while using their body weight and other tools. Also, to make sure that the users’ hands would be free during the workout and so that the risk of completing the workout exercises incorrectly is lowered to a minimum the application will be able to connect to a Smart TV. Another feature of “MusL” is the huge social network. The users of the application will be able to join a community, where they will be able to communicate with others who also workout, share their progress via pictures or videos and any tips they have for others. “MusL” will actively enlist professional trainers, who have experience and education in the field. These trainers will be able to provide live consultation and perform live workouts for our and their own clients.

NOVELTY OF THE WORK

This idea has been started around the month of March. Other competitors have their own workout apps with active subscriptions, while our application will be able to monitor the users condition during the workout, let them have live consultations with professional trainers or coaches as well as be part of a new community where everyone can share their progress. This sense of community will unite more people to join the platform of "MusL" and allow our users to feel included even while working out remotely.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Our idea will give struggling trainers and coaches work as well as allow regular people to workout from their homes without any additional equipment. Because of the world-wide quarantine some people are not able to go to gyms or have contact with other people. To keep peoples' bodies in shape we offer a remote workout application, which would solve the issue of wasted time going to the gym and provide a great community for all of our clients. The feeling of belonging to a community would motivate more people to come and join the "MusL" platform as well as use our services. For trainers and coaches we would offer a new work place where they would be able to earn their wages as contractors and we would be able to take a percentage of their pay as the price of using our platform. Even after the global quarantine is over this solution would be great as not everyone lives near a gym or has access to special equipment, this way we would be able to provide a great way for each and every person with a smartphone to workout correctly and effectively from home.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Our clients will be able to effectively workout remotely, this means that less people will be driving or using public transport to get to the gym and this would equate to less pollution in bigger cities. Less time would be spent for the client themselves as well as each person would be more comfortable working out from their own home, with their own conditions, rather than from a gym.

RIFT DRIFTER

Žygimantas Kadiša, Danielius Rugienius
Kaunas University of Technology

TRL 7 system prototype demonstration in operational environment

SHORT DESCRIPTION OF THE WORK

Rift Drifter is a 2D action-adventure platformer game, with Metroidvania and RPG elements, a rich story, and a hint of souls-like combat. The game features:

- 13 different enemies and 4 challenging bosses;
- unlockable movement abilities (wall climbing, double jump, dashing...);
- 3 playable player classes, each with unique skills and playstyle;
- multiplayer gameplay with up to 4 people (connection is through the Steam platform or via IP address);
- multiple hand-built levels and a random level generation system;
- more than 50 items that improve the player's attributes;
- multiple NPCs (non-player characters) who give quests, allow item crafting, tell the game's story.

The game will soon be playable on Steam
https://store.steampowered.com/app/1613080/Rift_Drifter/

NOVELTY OF THE WORK

We analyzed multiple other similar games and combined their best features while trying to put a unique twist on them.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

The game solves the increased need for entertainment due to the current lockdown.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Users will be entertained while playing.

ShootingAction

Aidė Barniškytė
Kaunas University of Technology

TRL 5 technology validated in relevant environment (industrially relevant)

SHORT DESCRIPTION OF THE WORK

A video game where the player needs to avoid enemies and obstacles to successfully reach the target. The enemies are moving by following the player while the obstacles are static. Collisions with enemies result in the player losing health points while collisions with obstacles result in the player being taken back to their starting position and having to restart the game. There are also health coins the player may pick up which either add health points or clear all currently existing enemies (if the health point value is at the maximum at the moment of picking up the coin). The player may temporarily hide from enemies by entering inside the sandbags. The enemies cannot attack the player while the player is inside a sandbag. The game can end in three ways – the player wins by reaching the target, the player loses by losing all their health points, the player loses by missing the target.

NOVELTY OF THE WORK

Enemies are trained to follow the player using machine learning.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

ShootingAction explores the possibilities of using AI/machine learning in game development

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Fun!

SPEAK KAUNAS

Narmin Aliyeva,
Marius Raskevicius,
Hugo Menino Aguiar
VšĮ SPEAK Kaunas

SHORT DESCRIPTION OF THE WORK

SPEAK is a social tech startup that connects migrants and refugees with locals through language and culture exchange experiences. SPEAK follows an Online2Offline (O2O) model – members sign up on our web platform (**www.speak.social**) or mobile app to learn or help others learn a language and the experience happens in groups that meet for 12 sessions of 90 minutes, either online or offline. Through our learning methodology and the safe and informal environment created, locals and newcomers stand as equals, having the space to share the value they bring to the community. With SPEAK, newcomers get the informal support network that helps them have access to the same opportunities as locals have.

Our technology allows the team to handle and automate training, payments, operations, communication and customer support through a single online portal developed in-house. This efficiency makes it possible for SPEAK offline activities to be accessible to users across 12 different countries and we have members participating online from many more.

Mobile App:

- Android **https://play.google.com/store/apps/details?id=social.speak.dev.SPEAKConversationMobile**
- iOS **https://apps.apple.com/pt/app/speak-language-learning/id1550779206?l=en**

NOVELTY OF THE WORK

SPEAK is a community-based solution, offering a language and culture exchange program as a means to bring newcomers and locals together. SPEAK's approach places migrants and refugees as bridge builders and ambassadors for cultural dialogue in their communities, empowering them to take action, as they are not only guests or receivers anymore; while also providing them with an informal support network upon their arrival, helping to break up the systemic vicious circle of isolation.

Our Online2Offline model makes for the most efficient use of resources and is geared toward growth because it uses technology to scale impact. Applications and payments take place online, while the learning and sharing experience can happen online or offline, in the real world.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

There are over 272 million international migrants in the world and in Lithuania, this number has grown 50% in the last 2 years, reaching 87.3 thousand in 2021. There are several reasons for an individual to be forced to leave their home. But whether in search of a better life or due to urgency caused by conflict, the problem of integration arises in the challenges migrants and refugees face in their new destination. The language barrier, lack of friends and family and bureaucratic processes are one side of the coin, while ethnic and religious discrimination is the other. SPEAK fights against the social exclusion of migrants and refugees caused by social barriers, discrimination, and anti-migrant rhetoric.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

SPEAK offers a web platform and mobile application for users to engage in language and culture exchange experiences that allows them to learn or practice a new language, while they are also meeting new people from different nationalities and become part of a supportive multicultural community. This online platform provides not only the opportunity for these people to connect, but also access to language learning materials, training, and community-organized events.

STRANGE AEONS

Karolis Dikčius

SHORT DESCRIPTION OF THE WORK

Strange Aeons is an upcoming game where you escape a cyber-hell as you chat with a neural net AI. The only way to interact is through your microphone. The followers of your cult are summoning you. You must escape this netherworld and reign in your rightful domain in the land of the living. To do so you must converse with the strange entities that surround you. This is a neural-net-AI, speech-to-text and text-to-speech powered experience. All of this works offline, without a back-end server or internet connectivity.

NOVELTY OF THE WORK

A video game where the gameplays is chatting with a neural net AI trained on movie scripts. Implementation of puzzles with neural net procedurally generated music and procedurally generated languages will be finished this Summer.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

It's a unique video game with a novel human-computer interface (speech/conversation).

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

This is a recreational game and is intended as a piece of entertainment. The first 30 minutes are available to be played at https://karolisd.itch.io/strange-aeons

VR/AR BINOCULARS FOR TOURISM

Paulius Juočeris, Tadas Bojarskas

SHORT DESCRIPTION OF THE WORK

We have created Virtual reality binoculars for public attractions, that are robust, precise and powerful. Using the binoculars we are able to show the scenery with an additional layer of digital information or even teleport the viewer to virtual environment of any object or location. We can provide rich visual and audio information in a pleasing way, multilingually.

NOVELTY OF THE WORK

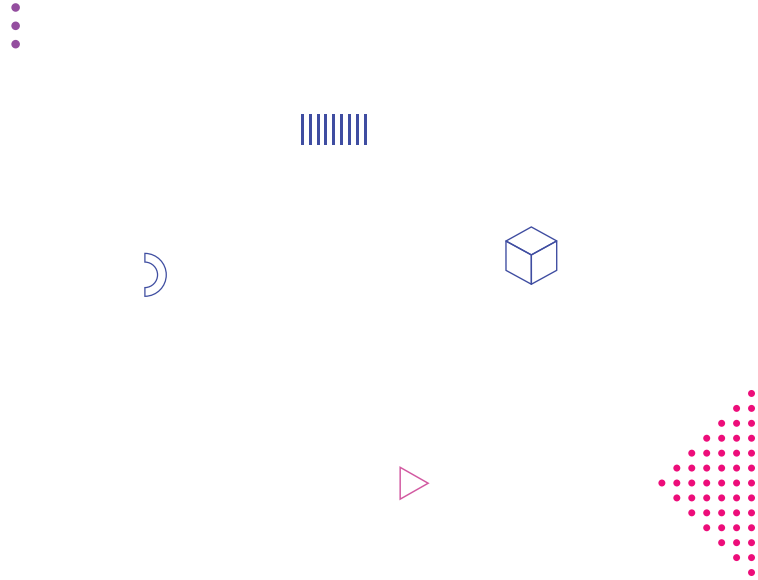
Implementation of both virtual reality and augmented reality for the classical tourism binoculars design. It's completely autonomous and can withstand Lithuanian weather conditions be outside all year long.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

The usual tourism stand is boring, unattractive, with only a dry fraction of written information about the location and in some cases can even be harmful to the location, if it's vandalised. The content is provided in max two languages, and in case of renewal or damage to the stand, it's quite expensive, requires construction work to replace it. With our solution, this is no longer a problem, we can provide rich audiovisual experience – tell a story or teleport the viewer 100 years back in history, incorporate marketing material, be multilingual and easily upgradable.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

We are mainly thinking to target B2B / B2G markets: Tourist centred governments, tourist information centres, regional parks, museums. Everyone who sees value in tourism infrastructure improvement. However since its modular design with implemented cashless payment module it can also be B2C. Making it self sufficient when it comes to needed repairs or new content creation. It will not only enrich the tourism experience, but also leave a high tech country impression.



VIRTUAL REALITY ADVENTURE GAME "GRIMWOOD"

Airidas Janonis
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

The gameplay is separated into two parts, which include searching the abandoned park for hidden artifacts and evading mysterious creature that is constantly chasing the player. The main goal of the game is to collect a certain number of these artifacts that are scattered across the game scene. If required number of artifacts is collected, an exit gate is opened. To successfully pass the level, the player needs to exit through the gate. To make every experience more unique and entertaining, the mysterious creature has randomly generated behaviors each time a new game is started. Each collected artifact provides a certain hint about the monster's strength or weakness that has been generated. If the player gets caught by the creature, or the creature uses a harmful effect against the player, the level will be failed. Also, the virtual environment consists of various interactive objects that make the gameplay even more immersive.

NOVELTY OF THE WORK

The game provides an opportunity to immerse yourself in an adventurous world of virtual reality, where every experience is going to be unique because of random gameplay elements.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Due to the global pandemic situation, most of the people had to comply with strict quarantine conditions, which led to spending most of their time at home. For many, this has caused problems of socialization and inactivity. The video game “Grimwood” is aimed to help people have more entertainment possibilities or a place to break from reality, even if only for a moment.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The main purpose is to provide users with entertainment possibilities and ability to test their orientation skills in a dark virtual environment.

WAKE UP WHISPER

Lina Skinderienė,
Rokas Urbonavičius

SHORT DESCRIPTION OF THE WORK

How many times have you woken up with last day negative thoughts or felt anxious about the upcoming day? Nowadays, more than ever, our environment is filled with stressful situations and endless noise and we are just rushing through our lives without giving ourselves a break. What if you could start your day in a silent way with a light and positive message? Wake Up Whisper is a mobile app which does exactly that and contains:

1. Soft & positive way to wake up.
2. Affirmations which are positive statements that influence our subconscious thoughts and by repeating them you can choose which thought will become your reality.
3. Original author's illustrations.

Art has an impact on our brain wave patterns, emotions, nervous system and can actually raise serotonin levels. If you want to feel better and start your day in a gentle way this app is for you since it's an easy, intuitive and digital way to change your life. This app could be used by every contemporary person and even more could become a useful tool for people who have serious mental health problems.

NOVELTY OF THE WORK

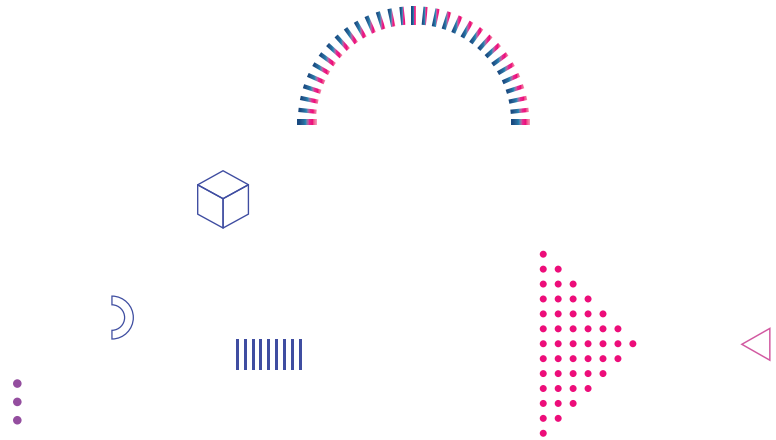
This is a new method to transfer stressful alarm into a soft way to start the day.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Daily positive statements/affirmations improve our well-being. Physical affirmation cards “Aš esu. Aš galiu. Aš leidžiu sau” have been released in 2020. They were well accepted and appreciated since they are being used not only by women for their personal use, but also by women’s crisis centres. Based on feedback we have received we can draw the conclusion that affirmations make a real difference in women’s mental health and users want to have it with them all the time. Therefore, physical cards that are digitalized and integrated into an app can help users have affirmations anytime and anywhere. And what is new with Wake Up Whisper app is that it is integrated with an alarm which makes it a soft and easy way to start a day with a positive statement.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Mental health becomes a key problem in our pandemic world. This app will help people to start their day in a soft way and with a positive message wherever or whenever needed.



ZEN REPUBLIC HQ

Thomas Tumosa,
Agnė Savickaitė

SHORT DESCRIPTION OF THE WORK

Zen Republic HQ is a VR-crypto social platform where people can attend virtual events, participate in game shows, view NFT art expositions and much more. This is a place for creative people to meet, share and discuss ideas.

NOVELTY OF THE WORK

Concept of a metaverse, combining with cryptocollectibles. People buy our digital goods as investments, which they can later sell for profit. Also meeting people from any place in the world

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Wanting to attend events but not able due to high cost of flying to another country, networking during quarantine, showcasing artworks in virtual environments

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Socializing, connecting with other people, networking.

MATERIALS SCIENCE

STARCH-BASED BIODEGRADABLE COMPOSITE FILMS FOR SUSTAINABLE PACKAGING

Lina Stabingytė, Laura Gegeckienė
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Recently, as the world's population grows and cities expand, so does the consumption of packaging. At the end of 2019, the globally widespread COVID-19 pandemic further increased the demand for packaging (food storage boxes, cups, bags, cutlery, wrapping films for vegetables). Polymer film is the main raw material for the production of a sustainable packaging product (bag, wrapping film, etc.). During the experiment films were produced from potato starch, plasticizers (sorbitol and glycerol) and fillers (yellow pea kernel fibres) to increase the mechanical resistance. After drying, the hardened film is peeled off the glass sheets and its mechanical properties are evaluated. Films with yellow pea fibres visually had a rougher surface, films without pea fibres were completely transparent. The plasticizer sorbitol gives higher values for the maximum tensile strength. Potato starch films combined with yellow pea fibres had a 48.11 % higher maximum tensile strength than potato starch films with sorbitol alone. Young's modulus values varies from 1.009 GPa to 1.138 GPa, thus the values are similar to polyethylene (1.00 – 1.40 GPa). Films with the plasticizer glycerol had the highest values of the contact angle. Therefore, they were the most resistant to moisture. Samples with yellow pea fibres and glycerol had 12.14 % higher values than samples with glycerol alone.

NOVELTY OF THE WORK

Although biodegradable packaging is becoming more common in larger supermarkets as an environmentally friendly alternative, its composition remains a mystery. Plasticizers, stabilizers and dyes in such products can hide under loud sustainability names, but make packaging more difficult to break. In this work, potato starch-based biodegradable films were developed without the use of synthetic stabilizers, plasticizers, dyes or other substances that can complicate the degradation process. This type of film would be intended for supermarket bags or wrapping film. The purpose of such packaging was to serve for a shorter time than a traditional bag, but not to leave micro / nano particles when they break down. This alternative was designed to compete with petroleum-based plastics in the packaging sector.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

In this work, it is discussed whether potato starch-based plastics can compete with petroleum-based plastics. The aim is to obtain the best possible mechanical properties by eliminating materials that prolong the shelf life, structural strength, due to which the packaging does not break down for a very long time.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Sustainability solutions are becoming inevitable in order to halt the current plastic consumption. Potato starch-based packaging with pea fibres is a more sustainable way to address the consumerism. Mankind cannot easily reduce the consumption of packaging, so there is a serious need to change the composition of it. The use of sustainable packaging contributes to the conservation of aquatic animals, of soil, water and the human health itself, as no substances that are hazardous to human health are used. The main goal of this work is to create a packaging product with a short shelf life and a short biodegradation time.

MECHANICS

AN INNOVATIVE SYSTEM FOR TRAINING, REHABILITATION AND PERFORMANCE TRACKING OF PROFESSIONAL ATHLETES

TRL 6 technology demonstrated in relevant environment (industrially relevant)

Deividas Zelickas, Liudvikas Milkintas, Valdas Grigaliūnas

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

During the project, a modern mechatronic system is being developed for strength and speed training as well as rehabilitation of professional runners. While technologies for healthy lifestyle and physical activity is one of the most popular areas of innovation, there is a lack of devices for top-level athlete training. Typically, professional runners use weighted sledges or parachutes to build resistance when doing strength training. To increase the maximum speed developed, bungee cables and an additional runner are used, which accelerates the sprinter to the overspeed required for improvement. The equipment used is mechanical by default, with no feedback and no ability to evaluate the parameters developed by the athlete or even the speed / load generated by the equipment itself. The system being developed (and its prototype) solves these problems and provides an opportunity to get clear feedback on the athlete's results. The key part of the system is a servo drive connected to a winding drum. The drive control system consists of a programmable logic controller and a microcomputer. An athlete is attached to system via a special belt and a cable that is wrapped on a drum. In resistance training, the drive provides constant

resistance at each step (no inertia). When training with assistance, the system forces the athlete to the target speed with the desired force, thus helping him to exceed his normal maximum speed (reaching overspeed). The actual speed developed by the athlete and required motor torque are read from the controller at 100Hz with the help of a microcomputer. Results are displayed in the user interface on a computer or tablet internet browser and recorded in a database.

NOVELTY OF THE WORK

Although sports science seeks to develop tools that can quantify the capabilities of athletes and assist in the training process, there are only a few such devices developed (1080 Sprint, h / p cosmos comet 3p). The system being developed replaces traditional mechanical training tools with a high-level device that provides an opportunity to both accurately assess your current capabilities and progress, as well as to improve during training process. Clear numerical information about the athlete becomes an integral part of the training process, and the training itself can be designed and implemented accurately and purposefully. The coach acquires the tools to determine how the athlete reacts to the load or how the rehabilitation process after an injury takes place. In this way, instant decisions can be made about adjustment of speed or force limits and the number of repetitions needed.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

This idea solves several problems that arise from the imperfection of existing training equipment. Above all, clarity and precision. Weight sleds do not create a constant load when training with resistance – the maximum load is during the start. The bungee cables for training with acceleration help the athlete to accelerate, but it is not at all clear what speed is being developed. In addition, an additional athlete is required to tension the cable, and the tension of the cable itself is not uniform over the entire distance either. The developed system creates a constant and uniform desired load during each step, and during acceleration the same force is applied from the first to the last step (or up to the desired speed). The servo drive is controlled exactly according to the desired parameters entered. Second, performance tracking.

Traditional training equipment has no ability to measure the parameters developed by the athlete, and special measuring equipment is very expensive and must be used during special tests. The developed system allows to perform both individual measurement runs (which are not actually different from training runs) and to measurements at 100Hz frequency during each training run. In this way, a huge amount of data is collected about each athlete, and it is possible to accurately track his progress both during training in the normal mode and e.g. rehabilitating after injuries. The collected data allows to assess the athlete himself and create optimal training program depending on preparation cycle.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

This idea solves several problems that arise from the imperfection of existing training equipment. Above all, clarity and precision. Weight sleds do not create a constant load when training with resistance – the maximum load is during the start. The bungee cables for training with acceleration help the athlete to accelerate, but it is not at all clear what speed is being developed. In addition, an additional athlete is required to tension the cable, and the tension of the cable itself is not uniform over the entire distance either. The developed system creates a constant and uniform desired load during each step, and during acceleration the same force is applied from the first to the last step (or up to the desired speed). The servo drive is controlled exactly according to the desired parameters entered. Second, performance tracking. Traditional training equipment has no ability to measure the parameters developed by the athlete, and special measuring equipment is very expensive and must be used during special tests. The developed system allows to perform both individual measurement runs (which are not actually different from training runs) and to measurements at 100Hz frequency during each training run. In this way, a huge amount of data is collected about each athlete, and it is possible to accurately track his progress both during training in the normal mode and e.g. rehabilitating after injuries. The collected data allows to assess the athlete himself and create optimal training program depending on preparation cycle.

COMPOSITE MATERIALS: FROM NATURE TO COSMOS

Gediminas Monastyreckis, Prasad P. Shimpi, Sharath P. Subadra, Kęstutis Špakauskas, Ayyappa Atmakuri, Tomas Vaitkūnas, Daiva Zeleniakienė, Paulius Griškevičius, Arvydas Palevičius, Giedrius Janušas

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Constantly growing automotive, aerospace, and wind energy industries require new material solutions for smart and long-lasting composite structures. The team of six doctoral students and three supervisors from the KTU Mechanical Engineering Department are working on several significant tasks regarding the composite materials: structure optimisation by finite element modelling, theoretical calculations and experimental testing in order to improve mechanical properties, impact damage and manufacturing induced defect analysis, development of self-sensing 3D woven fibre-reinforced composites with nanomodified electrically conductive polymer matrix, investigation of de-icing and temperature sustaining nanocoatings, development of self-healing thermoplastic composites with external and internal heating systems, bio-composites properties and recyclability investigation. The main focus of this team is to improve, create, and develop new advanced multifunctional composites for next-generation wind turbine blades, electric cars, high air-safety commercial airplanes, and even space crafts, such as satellites, rockets and rovers. The team has already published 10 scientific articles, from which 7 are published in the international publishers' Web of Science database with citation index and Q1-Q2 quartile, and participated in numerous high-level international scientific conferences.

NOVELTY OF THE WORK

A new approach of peridynamics theory for composites failure prediction; New structural health monitoring methods for 3D woven and sandwich-type composites with nanoparticle modified polymer matrix and nanocoatings; New self-healing techniques for thermoplastic composites; New recyclable processes and novel properties of green bio-composites based on natural fibres of banana, pineapple, okra, sisal and hemp.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

There is still no effective numerical methods to evaluate the damage caused by fatigue loading in composite structures. While current methods based on experimental testing are expensive and time-consuming, a reliable numerical model could solve this problem, increase the performance of the composite structure and finally lead to a positive impact on the environment. During the exploitation, composite structures incur high cyclic and impact loads, which over time lead to material cracking and overall structure degradation. Newly developed composites with multifunctional properties could not only detect the location of damage but also self-heal. Apart from being expensive, conventional non-destructive testing techniques cannot be applied for continuous monitoring of the 3D woven composite material during its actual usage. The nanosensors can serve as a sensor during the actual use of the composite. Using alternative resins like thermoplastic and bio-based fibres could make composites more environmentally friendly and easier to recycle.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Higher mechanical properties and durability, self-sensing, multifunctionality, recyclability with a lower carbon footprint. Nanocoatings and nano modified polymer matrix can be easily applied at joints and complex composite shapes where it is difficult to integrate traditional sensors.

MULTI-MOTOR ROCKET PROPULSION SYSTEM AND PRACTICAL IMPLEMENTATION

RT-400 = TRL 9
under use for military live-fire exercise
RT-400M = TRL 3
computationally analysed and prototyped created

Hari Prasanna Manimaran,
Habil. Dr. Aligimantas Federavicius,
Arvydas Survila

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Need (problem): military personnel need a live firing exercise with real hardware to familiarize themselves with the battle scenario. For handling an air-defence system, personnel need a target rocket to imitate a real missile. A target rocket should be with lesser velocity than an operating missile, high visibility, cheaper, and easy to set up and launch.

Solution:

- To fulfil the requirements team of researchers from KTU has developed a target rocket RT-400 equipped with an RM-12K motor. This rocket variant can be used for short-range exercise.
- For a medium-range air defence system, we have redesigned the propulsion system by adding additional motors and arranged four motors in a parallel configuration. This new system will burn 2 motors in the first stage and another 2 motors in the second stage and reach up to 20 km range.

We have analyzed different possible motor ignition sequence and finalized this configuration due to the satisfactory computational results. Data has been published in international conferences in 2018, 2019, 2020.

NOVELTY OF THE WORK

Parallel staging is used in satellite launch vehicle and long-range missiles. We this technology of arranging motors side by side (parallel staging) to increase the range. Most target rockets use a single motor or jet engine as the propulsion system:

- RT-400M uses four RM 12K motors to increase the operational range.
- First stage motors will not be detached or separated.
- Alternate motors are ignited to maintain rocket stability.
- Lithuania's only product to fulfil high-speed rocket target requirement.
- Possible to fulfil customer requirement from Baltic countries military and can expand to Europe and Asian countries.
- 19 out of 20 successful launches (95% success rate),
- Lithuanian patent has been applied, waiting for the confirmation.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Operational problem: drones and jet-powered rocket target cannot be operated in extreme weather condition. But RT-400M can be operational in all-weather condition. Maintenance problem: most rocket targets are jet engine-powered, which is difficult to design and required high maintenance. But RT-400 M uses a simple design by incorporating solid propellant. This variant can be fuelled and stored for a long time with minimal to no maintenance. Manufacturing cost: cost of manufacturing a jet engine is much higher than a solid propellant motor. As RT-400M act as a projectile it does not change its trajectory. So, control system, guidance and navigation system are avoided. This advantage has reduced the manufacturing cost dras-

tically. As we employ the same motor technology used in short-range rocket target, we had reduced R&D cost. Logistics: special vehicle has been designed to transport and launch at a different angle. This vehicle can be towed with most conventional vehicles.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

- The cost of the missile is much lesser than competitors;
- More rockets can give more practice for the personnel;
- This gives our customer a competitive advantage towards less practised personnel;
- The user can transport to any location;
- Operate in any weather condition;
- Launched at any angle as per the requirement;
- Require less maintenance;
- Easy and quick to learn the operation.

THE DESIGN OF AN ADDITIVE PRODUCTION SYSTEM USING AN INDUSTRIAL ROBOT

Liudvikas Milkintas
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

With the Industrial Revolution 4.0, various innovations such as additive manufacturing, advanced robotics, simulation, the Internet of Things are being applied to more efficient and effective production, and factories in most industrialized countries are moving to flexible manufacturing. Additive production plays a very important role in this phase, which includes currently popular technologies such as 3D printing, rapid prototyping, direct digital production and on-demand production. Advanced robotics also plays a very important role in flexible manufacturing, as robots are able to adapt to the changed work environment. Portal robots are currently the most widely used for additive production due to their simplicity of construction and control, and they are also among the cheapest. Therefore, the goal is to design an additive production system using an industrial robot. Such a system could print the object on curved surfaces without the use of auxiliary structures, thus adapting to the changed work environment.

NOVELTY OF THE WORK

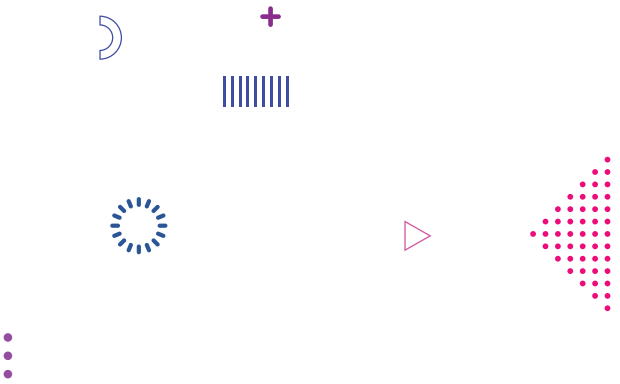
There are only a few similar systems in the world. The first such system was introduced in 2012.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Portal robots are currently the most widely used for additive production due to their simplicity of construction and control, and they are also among the cheapest. However, the capabilities of these robots are limited by their design, as they typically have only three degrees of freedom and can print parts that are smaller in size than the device itself. Auxiliary structures are also often used during printing, which turn into waste after printing, increasing the cost of the part produced.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Such a system would increase the flexibility, speed and surface quality of printed parts in 3D printing systems.



NATURAL SCIENCES AND MATHEMATICS

BALTIC FREYA

Core team: Robertas Katinas, Gediminas Kudirka, Vilmantas Raštutis

Mentors: Stella Spanou, Paulius Nezabitauskas, Lukas Bartusevičius

Advisors: Djouhara Westberg, Lina Ragelienė, Mindaugas Tamošiūnas

Startup Baltic Freya

SHORT DESCRIPTION OF THE WORK

Baltic Freya is an agritech startup focused on developing large-scale vertical farming technologies for indoor farmers and agri-companies. Our team is working on fogponics – the most advanced vertical farming technology so far. Plant roots are hanging in fog. This innovative controlled environment agriculture technology does not use any soil, circular system does not waste any resources and it uses up to 95% less water than industrial farming. Since vertical farming is done indoors, your produce are safe from harm. There's no need for nasty pest control chemicals, there's no fear of bad weather, floods and droughts. Innovations we are creating will take you to a new level of resource efficiency, will allow you to grow more plants, to do it a lot faster and all year long. This means fast returns on the investment for our clients.

NOVELTY OF THE WORK

Baltic Freya's proprietary fog generation system creates fog with the right physical properties for plants. It is also easy to operate and maintain. No mainstream high pressure nozzle system or ultrasonic mister system can offer you this.

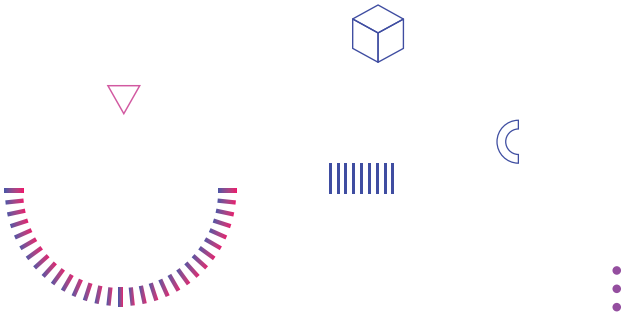
TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

The world has come to a conclusion that soilless indoor farming is the solution and right now, indoor/greenhouse/vertical farming market is dominated by hydroponics. Through our market research and customer interviews with hydroponics farmers we have uncovered the main problems and drawbacks this water-intensive method brings about:

- if one plant gets root disease – the rest of the production line gets it and all of it has to be destroyed;
- resource inefficiency – most of water and fertilizer used in hydroponics ends up as waste;
- time – plants grow only a little bit faster in hydroponics than field farming, e.g., for a fully grown lettuce to form it takes 5 to 6 weeks in the field and 4 to 5 weeks in hydroponic systems.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Firstly, it is almost impossible for root disease to spread through fog as fog is not a carrier. Secondly, our modular fogponic system will use at least 50% less water and 50% less fertilizer than hydroponics, because water and nutrient intake is faster in fogponics. Third – fog enables 4 more growth cycles per year and an increase in grown products volume, taste and quality.



POLYMER FOR SHIELDING OF FINGERTIPS OF NUCLEAR MEDICINE WORKERS

Vijayanand Sivakumar,
Diana Adlienė, Judita Puišo
Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

With the advancement of diagnostic nuclear medicine services like PET-CT, SPECT, bone scintigraphy, etc., the protection of the hands of health workers performing patient injections with radioactive substances is getting to be especially critical. It was found that the dose to the fingertips of the workers were much higher than indicated by the ring dosimeters worn by the staff. Studies show that the yearly aggregate dose to the fingertips frequently surpass the dosage limits of 500 mSv to the skin, hence expanding the chance of radiation-induced secondary cancer. In this pilot project we synthesized and characterized lightweight lead-free, metal particle-enriched polymer composites with a lead equivalence of 0.4 mm Pb, which provides satisfactory protection against the foremost broadly utilized Tc-99m radioisotope radiation in nuclear medicine. After attenuation, optical, chemical characterization of the polymer, we have proposed on fixing this polymer to fingertip portions of latex medical gloves which is used by the nuclear medicine workers.

NOVELTY OF THE WORK

The synthesized Bismuth based polymer composite is of novel constitution prepared under normal laboratory conditions negating the need for complex equipment or process.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

This cost-effective polymer composite can be very helpful in routine nuclear department associated activities, instead of expensive radiation protection gears.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

It helps in overcoming the fear of uncertainty observed in dose measurements to the fingertips of nuclear medicine staff, as it provides adequate protection with a lead equivalence of 0.04 mm Pb.

“PICK BOX” – IS A LUNCH BOX THAT CONTAINS EVERYTHING FOR A COMFORTABLE MEAL: PLATES, CUTLERY, CUPS, SALT SHAKER – AND ALL THIS IN ONE LUNCH BOX

TRL 3 experimental proof of concept

Nikolajs Filipenoks, Sergejs Lulaks
Riga Technical University

SHORT DESCRIPTION OF THE WORK

We create a versatile and compact lunch box that contains all the necessary components, which allows customers to use it on business trips and at work, as well as on picnics. We strive to create reusable lunch boxes that minimize the use of disposable tableware. The lunch box not only creates a comfortable environment for eating, but also allows you to reuse all the components. The product itself, we plan to create from polypropylene, this will allow the use of box components reusable, as well as to be stable in contact with hot food or during heating. The product contains 4 glasses, 4 plates, 4 sets of cutlery and a dispenser for salt and pepper. If necessary, the consumer can lay out the excess and use the required amount.

NOVELTY OF THE WORK

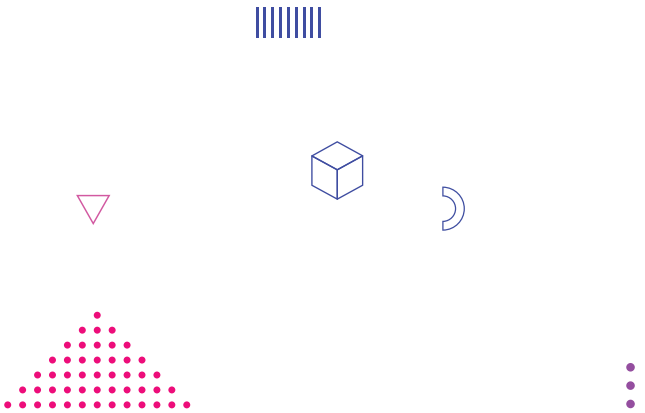
The key feature of the lunch box we are developing is its compactness and versatility. The lunch box contains everything you need for a comfortable meal (cutlery, plates, and glasses). Everything is contained in one box the consumer will not need to worry about forgetting something.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Due to the growing interest in the rational use of natural resources and the reduction of household waste, as well as the impending ban in the EU countries (from 2021) on the use of disposable tableware, our product will allow not only the use of reusable lunch boxes in various conditions, but also reduce consumer demand for disposable plastic tableware, thereby creating a culture of smart consumption.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Our product will not only allow reusable lunch box in various conditions, but also reduce the demand for disposable tableware. Lunch box will create conditions for increasing reasonable consumption among the population. By studying the market and the alternatives that are offered to customers in stores, we have identified the advantages of our product – compactness, ergonomics and modern design.



SELF-CLEANING COATINGS FOR SOLAR CELLS

Simas Račkauskas, Rasa Mardosaitė, Mantas Marčinskas, Mindaugas Ilickas
MB "Zinotech"

SHORT DESCRIPTION OF THE WORK

The self-cleaning coating is designed for solar cells and windows to reduce cleaning costs and increase efficiency. It is an innovative product, coating the surface of a solar cell leads to increase of the amount of electricity generated, which directly increases the profit or payback of the solar power plant. This coating reduces the price of generated electricity for consumers-producers, therefore the coating itself pays off during the first year of use, even without taking into account the reduced cleaning costs. The proposed solar cell coating also effectively reduces cleaning costs, the method used has no analogues on the market because the cleaning uses several properties at once, so it is cleaned from both organic and inorganic materials, as well as additional electrostatic protection from dust. In addition to the mentioned advantages, the coating is also an environmentally friendly product due to the production method and the reduced need for detergents. The coating also protects against harmful ultraviolet rays by converting them into visible light, and prevents birds from hitting the surfaces. This coating can be applied not only to the surfaces of solar cells but also to facades, windows or other glass surfaces.

NOVELTY OF THE WORK

The coating uses our recently discovered properties of nanoparticles. The produced coatings have no analogues on the market, the multifunctional properties of these

nanoparticles are used, at the same time protecting the solar cells from contamination, effectively cleaning organic pollutants, and at the same time not reducing the efficiency of the solar cells.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Solar cell coatings solve cleaning problems. Solar cells can lose up to 30 % of their original efficiency due to contamination and must be cleaned periodically. The coating we offer reduces cleaning costs without reducing the efficiency of the solar cell.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The efficiency of solar cells with our proposed coating increases, cleaning costs decrease. Coatings payback time is less than a year of use.

SENDIT SMART ECO STRAPS

Marius Tamošiūnas, Rokas Vaitkus, Tomas Ignatavičius, Vytautė Lipeikaitė, Danielius Skučas

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

Currently, every letter sent leaves a plastic zip tie and paper tag in the trash bin. For example, Lithuanian Post throws away up to 6 hundred thousand zip-ties and tags every year. Not only that – zip-ties, paper tags, ink, etc. cost considerable amounts of money every year. What if we told you that we came up with a simple idea that will help greatly reduce the plastic and paper waste of postal service providers? The product we came up with is painfully simple: "Sendit" velcro strips. The most important aspect of them is recyclability and reusability. With our product, the plastic waste of transporting letters goes down to nearly zero. We came up with the idea of replacing traditional paper tags with BAR codes attached to velcro straps. The Bar code contains all the required info which is stored in the database and changed whenever required. Additional information, which needs to be seen without scanning, is color-coded on the tag, for example, the weight range of the package.

NOVELTY OF THE WORK

The idea is simple and yet we see it as a merit. The solution is inexpensive and, surprisingly, many post offices in Europe still use the old zip tie technology, for example, Poland. Sendit Smart eco straps have no real competition in Europe. Everyone can buy a simple velcro strap but the features that make it Smart are only present in our product.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Plastic & Paper wastage.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

- Money saving;
- resource saving;
- eco friendliness.

INTERDISCIPLINARY WORKS

EquuSight – EMPOWER EQUINE DIAGNOSTICS

Rugilė Dauliūtė, Eimantas Mačius, Martynas Bartkus, Vilius Vaičiulis, Dr. Julius Ruseckas, Sara Serro Fidalgo, Giedrė Vilėniškė, Sigita Kazlauskaitė, Luis Vieira de Castro

LP "Innovatio veterinariae"

SHORT DESCRIPTION OF THE WORK

"EQUUSIGHT" is an artificial intelligence-based system for automated equine X-ray analysis. We have already developed a prototype which can detect fragments and fractures on equine fetlock radiographs. As soon as, we will reach the appropriate accuracy with these pathologies, we will move forward to implement more important findings, as well as further anatomical areas in our system. Orthopaedic pathologies in horses highly affect equine athletes and may lead to intensive therapy and sometimes even to untreatable conditions. Unfortunately, many of these radiological findings can be overlooked due to the rapidly growing number of images and lack of experienced equine radiologists. EquuSight will help veterinarians to improve the diagnostics of these diseases by giving an instant and accurate second opinion, reducing error rates and reducing the time needed for x-ray evaluation.

NOVELTY OF THE WORK

EquuSight is the first company to use artificial intelligence to evaluate veterinary radiographs in the field of equine medicine. EquuSight uses deep learning to train from a database of previously labelled radiographs to accurately diagnose common pathologies in horses' radiology. Deep learning techniques are already successfully implemented

in human radiography, as well as small animals (dogs and cats). We are the first company to develop the product for horses. As the similar examples from human medicine shows, artificial intelligence has huge potential to optimise the x-ray evaluation process by decreasing the time needed to interpret the images, as well as reducing the error rates and overlooked findings and allowing fast analyses of huge datasets. Moreover, it can help to prioritise patients, which allow veterinarians to provide quick and appropriate care for the ones who need it the most.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

With the ever growing availability of portable x-ray machines, the sheer number of equine x-ray images is rising. This, in combination with ambulatory work where vets are the jack of all trades, creates situations where veterinarians don't have enough qualified staff with adequate experience for all the x-ray evaluation. There is a lack of highly educated radiologists with an ever rising number of images to analyse. EquuSight has a potential to automate the x-ray analysis and provide veterinarians confident second opinion within a few seconds.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

EquuSight will benefit equine veterinarians by providing them with an instant and accurate second opinion on the x-ray evaluation, whenever they need it. As well, it will allow to automate image evaluation of huge datasets and reduce the time needed for the process, which not only allow to prioritise patients, but as well as highly increase the time needed to manage other most emerge tasks in veterinary daily practice. Moreover, the ability to analyse huge amounts of images in a short time, can serve as a scientific tool. To publish an article, multiple studies and literature must be reviewed. Doctors therefore spend a significant amount of time reviewing past images and collecting data for their own research. EquuSight can automate the process while providing lists and details of similar cases.

EDUCATIONAL HYDROPONIC GREENHOUSE

Paulius Briedis, Šarūnas Mickus, Žymantas Černius, Mindaugas Buožius
VšĮ Robotikos mokykla

TRL 7
system prototype demonstration in operational environment

SHORT DESCRIPTION OF THE WORK

This greenhouse solves the problem of students' practical misunderstanding of how plants develop. Moreover, it will be free to use in innovative STEM center of Panevėžys city. It is one of the first educational hydroponic greenhouse in all Lithuania and it is very perspective, because hydroponics is much more efficient compared to the conventional cultivation. It is fully assembled and prepared product and it is planned to launch it in September of 2021.

NOVELTY OF THE WORK

Innovative. One of the first in Lithuania. Especially in educational field.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

This greenhouse solves the problem of students' practical misunderstanding of how plants develop. Students from schools usually can not recognize particular plants in different vegetation stages because they never saw it live.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

It is almost fully automatically and requires less care than common greenhouses.

ECO-INNOVATIVE OPTICAL 3D PRINTED MEDICAL FITTINGS MADE OF BIORESINS

Miglė Lebedevaitė, Edvinas Skliutas, Saulius Lileikis, Mangirdas Malinauskas, Jolita Ostrauskaitė

Kaunas University of Technology
Vilnius University
JSC 3D Creative

SHORT DESCRIPTION OF THE WORK

In this work, a team of chemists, physicists and manufacturers succeeded in developing eco-innovative medical fittings from bioresins and testing their production on an industrial technological line. Demand for such components is unexpectedly urgent, especially during a pandemic, and their needs are difficult to predict. Short-term use fittings are required for medical devices from various manufacturers that have different standards for various mounts, couplers, splitters, masks, etc. Local and flexible manufacturing, enabled by optical 3D printing, is a quick solution to meet high demand and solve international delivery problems. Moreover, if the material used is bio-derived (bio-renewable content can reach > 80%) this simultaneously addresses time, transport, cost and environmental issues. Optical 3D printing as an additive manufacturing technology was used for the production of medical fittings. First, specific plant-derived photocurable resins were developed at KTU, later their optical 3D printing parameters were determined at VU, and finally the bioresins developed were tested on an industrial technological line of

3D Creative. The Computer Aided Design (CAD) models were obtained using the 3D scanning technique available at 3D Creative. After applying systematic optical 3D printing parameters such as layer height and exposure time, a series of eco-innovative medical fittings of different shapes and constructions were produced by 3D Creative. Judging from geometrical and mechanical properties the produced objects revealed suitability for the intended use. This work was supported by the EU ERDF, through the INTERREG BSR programme project ECOLABNET (#R077).

NOVELTY OF THE WORK

The eco-innovative medical fittings could be manufactured on demand and locally. The fittings could be made from bio-based materials, which can biodegrade after use and disposal.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Short-term use fittings are required for medical devices from various manufacturers that have different standards for various mounts, couplers, splitters, masks, etc. Stocking of all possible fittings would entail excessive costs, and their need could be difficult to meet in the case of production or international supply disruption. So, the local and flexible manufacturing, enabled by optical 3D printing, is a quick solution for solving such problems. Moreover, if the material used is bio-derived (bio-renewable content can reach > 80%) this simultaneously addresses time, transport, cost and environmental issues.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

Since demand for medical fittings is unexpectedly urgent, especially during a pandemic, and their needs are difficult to predict, this could be fulfilled by the local production. Optical 3D printing production of novel eco-innovative polymeric medical fittings from commercially available bio-based materials by combination of green chemistry and green engineering concepts could benefit medical institutions and manufacturing companies. Also, optical 3D printed medical fittings could be biodegradable and their waste management after the usage could be easier.

HEMP BASED BIOCOMPOSITE PLASTIC

Antanas Valčiukas, Andrius Ramonas, Austėja Platukytė, Mantas Našlėnas
MB Ekopolimeras

TRL 6 technology demonstrated in relevant environment (industrially relevant)

SHORT DESCRIPTION OF THE WORK

This biodegradable composite material is a perfect choice for those who are looking for healthier and more sustainable alternative to oil based plastics. Its main purpose was take away packaging for food and drinks, but it is easily adaptable for various other purposes. Content of the composite is easily modifiable to accommodate vast number of different specifications it can be used in construction, electronic, automotive parts or daily home appliances. It is not only the raw material, but also a technology how you can adapt it to your product of choice thus opening new possibilities in designing new products.

NOVELTY OF THE WORK

Biocomposite material developed by our company provides direct path for local farmers to process leftover waste from their crop directly into usefull plastic products for mass consumption. This allows to increase revenue of local producers, reduces dependancy on the import of raw material from third countries and strenghtens circurality and sustainability of plastic manufacture sector.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

First of all it changes source material from oil to plants without creating necessity for costly adaptations of production machinery. Products created using this material are fully compostable and biodegrades quickly into safe organic material which then can be returned back to soil, thus reducing effects of erosion. Unprocessed waste if it ends up in landfills or other places provides no danger of plastic contamination.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

For producers this material is safe and ecofriendly alternative to oil based plastics. For end consumers is a easy way to take their part in reducing global plastic waste.

NON-INVASIVE TRACKING OF PARTIAL PRESSURE OF ARTERIAL OXYGEN BY MONITORING HUMAN OXYGEN UPTAKE

TRL 6 technology demonstrated in relevant environment (industrially relevant)

Renaldas Urniezius, Arnas Survyla, Benas Kemesis, Lukas Zlatkus

Kaunas University of Technology
Cumulatis

SHORT DESCRIPTION OF THE WORK

Early diagnosis of human life support is fundamentally dependent on the amount of dissolved oxygen in the arterial microvasculature. Respiratory data was used to estimate the partial pressure of oxygen (PaO_2) in the radial artery non-invasively. The Cumulatis introduced a novel device function for this purpose. Usually, the PaO_2 sample analysis is an episodic action, and timely correction of hypoxemia requires convenient and accurate arterial monitoring of the arterial PaO_2. Analysis of the blood samples confirmed that the proposed sensor fusion method has an average estimation error of 1.77 mm Hg of PaO_2. The duration of the experiment was one hour and 46 minutes, and at the end of the trial, the bias drift of estimation was about one mmHg of PaO_2 when matched with the offline blood sample results. The preclinical trial also demonstrated the therapy effect that even relatively small overpressure, excluding head area, has a noticeable therapy effect when the healthy patient

continuously inhauls the 15-16% oxygen concentration air for one hour and 30 minutes. The investigation results are relevant for operating invasive and noninvasive lung ventilation and treating the current pandemic patients.

NOVELTY OF THE WORK

Currently, the PaO_2 is observed by manual puncture samples of arterial blood gases (ABG) tests, or existing market equipment only has short-term PaO_2 estimation (if respiratory-based), which drifts over time. Cumulatis and the KTU team implemented sensor fusion that guarantees non-drifting estimation of PaO_2 over the range of at least two hours with a precision of 1mmHg.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Noninvasive tracking of the PaO_2 allows avoiding unnecessary labor efforts on puncture ABG samples and helps to monitor the state of human lungs remotely by a doctor.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

A more apparent correction of hypoxemia-like symptoms using knowledge on PaO_2 will help doctors fight the severe acute respiratory syndrome coronavirus effects.

SPARROW

Matas Rarivanas, Karolis Petrauskas, Benediktas Žemaitis, Ugnė Dambrauskaitė, Dovydas Gražys, Dovydas Žilinskas, Lukas Adomas

SHORT DESCRIPTION OF THE WORK

We are designing modular drones, enabling the user to modify and repair the drone on the spot. Transparency Market Research analysts found that: "Currently, multi-rotor drones have not received any massive updates in terms of technology. However, this presents a huge opportunity for new and innovative solutions and upgrades". We are aiming to take advantage of this opportunity by creating fully modular drones.

NOVELTY OF THE WORK

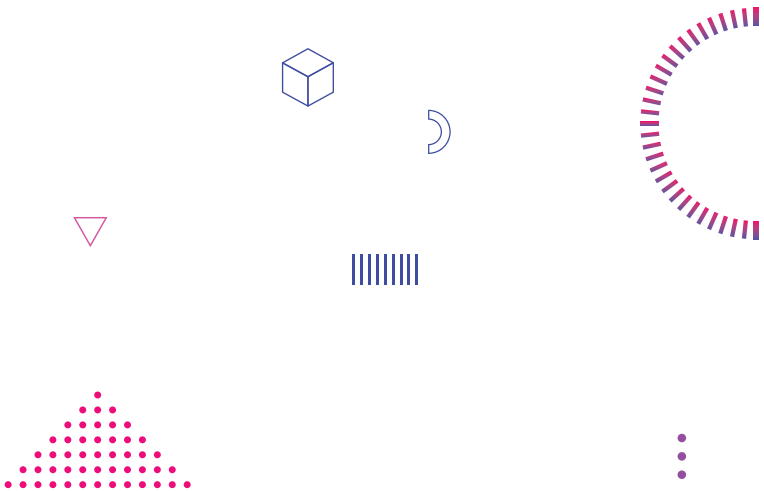
Our idea is supported by two innovative factors. First of all, the concept of modularity. Currently, on the market, it is very difficult to find a drone that could be easily modified. With our solution, this would become possible. All our customers would have to do is to replace or add a module, it could be a 3D camera, extra batteries, or a light spectrum camera, whatever you need for a specific use-case. This is an innovative solution for those who use more than one drone (~ 39% individual users on the UK market) and especially for those who freelance. Our second factor is 4G integration. Several commercial drone service companies on the market use this technology to connect with the drone. However, we want to adapt the possibilities offered by this technology to the general public. For example, one of many benefits of implementing this technology in our case is the transfer of footage to the cloud while the drone is being used, preventing the loss of footage. Combining both of these concepts into one would provide nearly limitless possibilities and growth opportunities for both us and our customers.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Think of a few situations: what choice would you have if your drone's elbow suddenly breaks or stops functioning but you need to use your drone at that exact moment? Current solutions require time, money, and in some cases - an intermediary who knows how to solve the problem. Today's drones are usually specialised for certain specific applications. As a result, users have to buy different drones for different situations. That is very expensive and inconvenient.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

With our drone, it would be enough to easily change a specific module and the drone would be ready for flight. One drone can replace several. Cellular connectivity integration no longer limits the fly distance and prevents data loss. If an accident happens, all you need to do is swap the damaged module with a new one. Thus making our drone versatile and multifunctional.



THE ONLINE ENGLISH COURSE „IšmOK“

Jurgita Bertulienė, Lina Meškauskienė, Gintarė Letkauskė, Džinara Meištaitė, Justina Frankaitė, Deimantė Gapšienė

Kaunas University of Technology

SHORT DESCRIPTION OF THE WORK

The online English course „IšmOK“ is designed to connect people. It helps elderly people to learn basic English phrases and vocabulary, so they can understand their grandchildren who live abroad. This course is for those who can not afford expensive English courses and prefer staying at home while learning for their safety. It is completely interactive. All tasks are checked and corrected automatically. This course is a set of 6 topics which include 4 lessons each. There you can find different types of exercises: for checking spelling, listening comprehension, grammar, and even pronunciation. There are also some games, which can be played after the vocabulary has been learnt. The project is meant to last for 6 months. Every month a new topic is revealed for the learners. If they face any uncertainty, they can write comments and ask questions in the Comments section located next to the learning material or call directly to the teacher and consult.

NOVELTY OF THE WORK

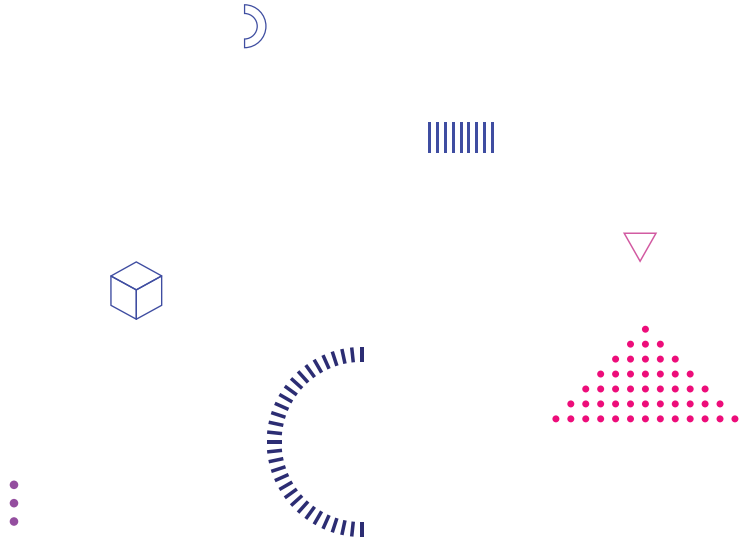
The novelty lies in two spheres. Firstly, the course is created for a special audience – elderly people whose relatives have moved to foreign countries and their children barely speak Lithuanian. Secondly, the project is the complete combination of all learning skills in a free English course.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

This work solves the problem of generational segregation due to distance and language barriers.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

The potential users may shorten the generational distancing due to the language barrier.



TRUNK-TYPE COBOT DESIGN AND SYNCHRONOUS CONTROL

TRL 3 experimental proof of concept

Renaldas Urniezius, Mindaugas Matukaitis, Deividas Masaitis, Mindaugas Mikalauskas

Kaunas University of Technology
Cumulatis

SHORT DESCRIPTION OF THE WORK

This presentation is about the design of a trunk-type collaborative robot (cobot). Authors built and tested all system parts, including, but not limited to, motors, electrical drives, moving elements, embedded controllers, and PCB supplementary tools. Simultaneously, the article "Synchronized Motion Profiles for Inverse-Dynamics-Based Online Control of Three Inextensible Segments of Trunk-Type Robot Actuators" has been published https://doi.org/10.3390/app11072946. Investigators validated the algorithm with experimental manipulation of all actuators. The collaboration between the operator and the robot has two options: holding and maneuvering the end-effector or using a joystick on each direct-drive actuator. The soft start and stop scenarios using ramp features were implemented. Sensorless excitation of engines employs the best practices of impedance control approaches. Furthermore, the Field Oriented Control (FOC) assures the highest efficiency. Moreover, the gear-less layout makes it lightweight and energy-saving, empowering the system for battery use. Optimal hierarchical control system merged with the best practices of sensor fusion.

The potential applications are painting, polishing, cleaning, and vision inspection tasks that require fast responses, small weight, high energy efficiency, and low introductory costs.

The first flexible Lithuanian cobot, fully, with all parts, manufactured in Lithuania!

NOVELTY OF THE WORK

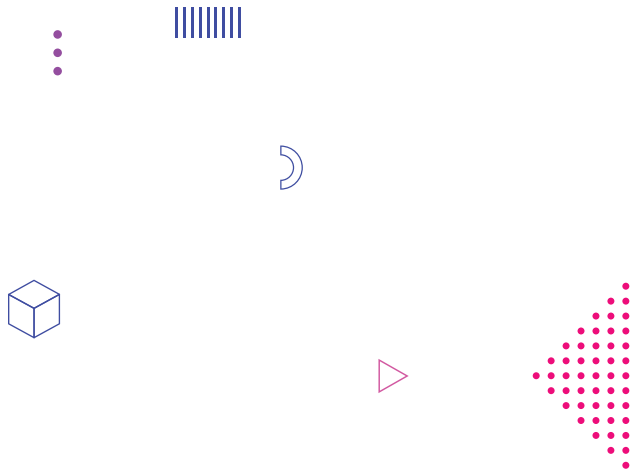
The biggest novelty is that inverse dynamic solution for trunk-type cobot is not only solved mathematically, but also demonstrated practically with synchronous control of direct-drive actuators.

TECHNICAL OR OTHER PROBLEMS THAT ARE SOLVED WITH THE WORK

Typically, an inverse dynamics problem has no immediate and obvious solution. The authors show that changing the perspective can make the new solution apparent and doable, including experimentation.

THE BENEFITS AND VALUE TO THE POTENTIAL USERS

We expect to shift the conventional labor costs away from the routine tasks in a factory to instead instructing duties in the existing industrial installations, which would increase human productivity.



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