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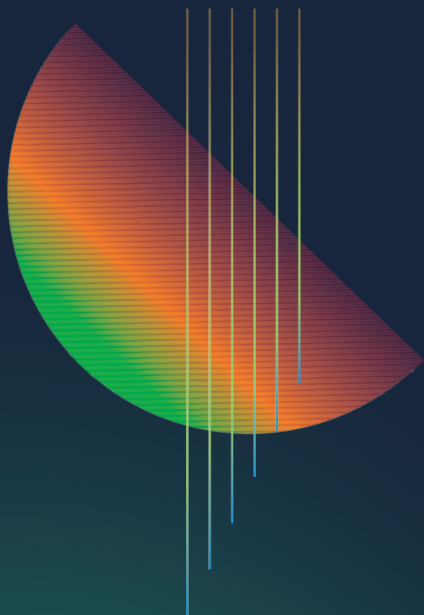Mechanics

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ZINC-ENRICHED GRANULAR NITROGEN-PHOSPHORUS FERTILIZERS

Klaudija Krasauskaitė
Supervisor: Assoc. Prof. Dr. Rasa Šlinkšienė

Kaunas University of Technology (KTU)

Solution area │ Food

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Description of the work

For long-term crop production and quality harvest, especially when the soil pH is high, the lack of zinc as a trace element is one of the most common plant nutritional disorders. This trace element is involved in physical, chemical, and biological reactions that determine its concentration in the soil. Therefore, fertilization becomes even more effective when compound fertilizers are used together with trace elements. This ensures sustainable and stable growth of various food grains, oilseeds, and legumes. Micronutrients are essential in agriculture in order to increase the yield and improve the quality of agricultural production. Although micronutrients are needed in very small amounts, plants consume them due to the important functions. Micronutrients can be directly incorporated into ammonium dihydrogen phosphate fertilizers during production. This ensures a constant concentration of the desired trace element in each fertilizer granule and a uniform distribution of the trace element in the granulated fertilizer.

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Technical or other problems that are solved with the work

These fertilizers supply plants with macronutrients (nitrogen and phosphorus) as well as the trace element zinc and enrich the depleted soil with organic carbon, which enters in the form of biodegradable material starch.

Plants use the starch polysaccharide to store sugar molecules that can later be metabolized to yield energy. The interaction of starch and water will release the glucose molecules to be used in energy production pathways (e.g., glycolysis, cellular respiration). Starch is involved in the growth process of the plant and can be used as a binder in the production of granular fertilizers.

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Novelty of the work

Potato starch solution is used as a binder to granulate the crystalline ammonium dihydrogen phosphate with zinc fertilizer.

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The benefits and value to the potential users

The obtained granulated fertilizers enrich the plant with nutrients and give it a new shape that is much more convenient for the potential users of the fertilizer.

Granulated Ammonium Dihydrogen Phosphate with Zinc
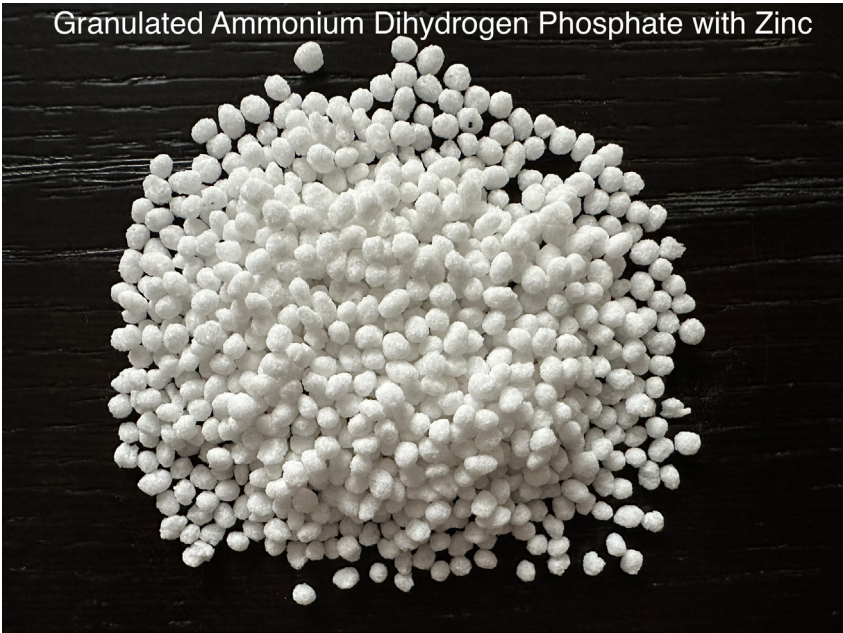
CAFF'BAR

**Eglė Tubelytė, Akvilė Zelbaitė,
Šarūnė Rimkutė, Živilė Žukauskaitė**
**Group supervisors: Assoc. Prof. Dr. Loreta Bašinskienė,
Assoc. Prof. Dr. Aušra Rūtelionė**

Kaunas University of Technology (KTU)

Solution area | Food

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Description of the work

Nowadays, consumers are offered a wide range of bars. Cereal, functional, and chocolate bars are available in supermarkets and online. However, most of the bars are high in added sugar, calories and are made from non-organic ingredients and food additives. Because of a growing consumer market that promotes healthy eating habits and is always in a hurry, it has been decided to create a bar that provides energy and satiety. The nourishing effect of CAFF'BAR is provided by the appropriate amount of caffeine and hulled hemp seed. The bar is made without GMOs and food additives. It has a lot of dietary fiber and contains only natural sugars, suitable for the consumers that are promoting a vegan diet. The main ingredients in the bar are guarana powder and hulled hemp seed. A 40 g bar contains 0.4 g of guarana powder, which contains 12.8 mg of caffeine. It was chosen to use dates, maple syrup, bourbon vanilla, and citric acid to give the product appropriate sweetness that would reduce the bitterness due to the used guarana. Oats, coconut flour, and cocoa powder enrich the innovative product with dietary fiber. The bar as well contains almonds and freeze-dried strawberries, which provide a pleasant taste and texture.

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Technical or other problems that are solved with the work

During the development of the new product, a recipe was created, and the production technology ensured the functionality and consumer acceptabil-

ity of the bar. Since there are little to no similar products on the Lithuanian market, the bar would introduce hemp and caffeine benefits to the consumers. The target market is young people aged 18–29 who are always in a hurry, often starting their morning with a cup of coffee. A survey was conducted to find out whether the bar that is being developed meets the needs of consumers of the target market. In fact, 80% of the respondents said that they would buy this type of bar.

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Novelty of the work

There is currently no energy-bar with the addition of guarana powder and hulled hemp seed on the Lithuanian market. In addition, the almonds in the product provide a pleasant eating sensation to the consumers. The bar is made without GMOs and food additives. It has a lot of dietary fiber and contains only natural sugars, suitable for consumers, promoting a vegan diet.

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The benefits and value to the potential users

CAFF' BAR stands out in the market because of the functional ingredients that are guarana and hulled hemp seed. Guarana has 2.5 times stronger effect than caffeine in coffee and tea. Other elements found in guarana include theobromine (increases energy level) and theophylline (relaxes body muscles). These components speed up the metabolic processes, reduce appetite, and improve physical and psychological well-being. Hemp seeds contain the necessary elements used by the human body: vegetable proteins, dietary fibers, trace minerals (Potassium – 980 mg, Calcium –71.9 mg, Copper – 1.73 mg, Magnesium – 564 mg, Manganese – 5.91 mg, Phosphorus – 1,150 mg, Zinc – 10 mg) and amino acids, methionine and cysteine, as well as very high levels of arginine and glutamic acid. Hulled hemp seeds are most valued as a source of omega-3 and omega-6 fatty acids.

METHODS OF USING THE WASTES OF INSECT BREEDING

Goda Gudinskaitė, Dr. Rasa Paleckienė, Dr. Rasa Šlinkšienė

Kaunas University of Technology (KTU)

Solution area │ Environment

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Description of the work

In Europe and Western countries, insect farming is a growing business. The sector needs to be adequately analyzed to rationally exploit the huge amount of potential. The benefits of frass as a by-product of insect larval production can increase the profitability of this fast-growing industry and create opportunities for providing nutrients in the supply chain by integrating the organic waste management and insect farming into the agricultural and food systems.

Under laboratory conditions, there have been carried studies on frass by the company UAB Divaks researching the suitability for the fertilizer production as well as selection of suitable additives to produce frass biofuel pellets. The conducted research on the residues of insect farming provides the prerequisites for the complex use of waste for biofuel and fertilizers. Frass and biofuel ash can be used to create fertilizer products that contain the nutrients needed by the plants and bioactive components. Obtaining such new functional fertilizing products that meet the needs of plants in different periods of vegetation by using non-traditional raw materials, i.e., the waste from agricultural production, contributes to the solution of extremely relevant tasks of competitive sustainability.

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Technical or other problems that are solved with the work

The current direction of development is the Green Deal, and its main goal is to create a sustainable, modern economy without harming the environment.

In order to avoid the negative effects of intensive farming, various options for sustainable agriculture are often offered, such as partially replacing synthetic fertilizers, replacing chemical plant protection measures with biological ones. The residues from other agricultural branches can be used as an alternative raw material to produce fertilizers. The current trends in insect breeding, which are gaining wider applicability and legalization for the use in the food industry, create prerequisites for the development of possibilities for processing waste products. In Lithuania, the cultivation of insects is developing rapidly, which means that the amount of frass will grow rapidly as well; thus, the search for its use is a very relevant issue.

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Novelty of the work

This topic is new in Lithuania: only on the 3rd of January of this year, the European Commission (EC) regulation was approved, which defines which insects can be used for human food and animal feed. It is envisaged that frozen, dried, and powdered domestic crickets will be allowed to be placed on the market as a novel food. Therefore, there is almost no information and possible solutions on the market, regarding the use of frass.

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The benefits and value to the potential users

The benefits of frass as a by-product of insect larval production can increase the profitability of this fast-growing industry and create opportunities for providing nutrients in the supply chain by integrating organic waste management and insect farming into agricultural and food systems.

STRESSAINIS – STRESS AND HUNGER RELIEF BISCUIT WITH ASHWAGANDHA AND HEMP SEEDS ENRICHED WITH DIETARY FIBER AND PROTEINS

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Kaunas University of Technology (KTU)

Solution area │ Food

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Description of the work

The work involved the development of an innovative, high-fiber, and high-protein product to enrich the daily diet of an active, highly-stressed person. In the search for innovative products that would relieve tension and combat stress, the team discovered Ayurvedic plant – ashwagandha, which according to Ayurvedic medicine itself, gives the "spirit of the horse", a symbol of absolute enduring strength, timeless energy, and endurance. Taking into account the concentration of this plant used in food supplements, the optimal amount has been chosen to enrich the product with beneficial substances (sitoindosides and acylsterylglucosides that are anti-stress agents) without altering the sensory and textural properties. In order to address one of the modern most pressing issues, it was decided to produce a gluten-free biscuit, thus attracting a wider range of consumers, because the product is made from functional raw materials and adapted to people with allergies or other health problems. The main goal in developing the product was to cre-

ate a healthy high-fiber and high-protein product that has functional properties, such as stress relief. However, it was important to provide consumers with fresh, familiar flavors; thus, the biscuit is enriched with dried berries, in this case, blueberries, transporting the consumer to an oasis of flavors that remind of midsummer. In order to give product a longer shelf-life, the moisture content of the product was reduced, thus prolonging its shelf life.

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Technical or other problems that are solved with the work

A variety of problems are faced by people who work and study a lot. The fast pace of life not only affects a person's diet but their psychological state as well. Often, the preference is given to sugary caloric snacks that are quick and easy to access instead of healthy, balanced food cooked at home. The created product would be a healthier alternative, especially for people who work a lot or face stress in their daily lives. Based on the market research, it has been found that as many as 70.5% of surveyed potential consumers are often stressed and tired; thus, this product would be targeted at people who are in a hurry, engaged in stressful activities.

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Novelty of the work

In order to produce a different product from the market, the search for raw materials that could give product different functionalities than the usual ones was launched. A literature and internet search led to the discovery of Ashwagandha, a plant used in Ayurvedic medicine, which according to the provided information, helps to combat stress and environmental factors and enhances the immune system response. While searching for the use of this raw material, it has

STRESSAINIS

Stresą mažinantis sausainis su Ašvaganda

been discovered that it is used in food supplements, various body-strengthening beverages and mixtures, but it was not used in confectionery; therefore, it was decided to develop a biscuit recipe that uses the optimal amount

of ashwagandha to relieve tension and stress for stressed people. Looking at the competitors' products on the market, it is noticeable that the products usually have only one function, i.e., high protein content or high fiber content, etc.

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The benefits and value to the potential users

The product is offered as a healthy snack that should complement one's daily menu with nutrients. The high dietary fiber and high-protein content will help to reduce hunger during the day. The product is enriched with ashwagandha plant powder that has sitoindosides and acylsterylglucosides. These bioactive compounds are anti-stress agents that will help to combat stress and stress-inducing environmental factors.

HEMP-BASED JAPANESE THIN CRACKERS: DON'T PANIC, IT'S ORGANIC!

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Group supervisor: Assoc. Prof. Dr. Loreta Bašinskienė

Kaunas University of Technology (KTU)

Solution area │ Food

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Description of the work

The team has developed a line of food product prototypes for Japanese-style thin crackers that are based on hemp. The developed products are rich in protein, vegan, gluten-free, and keto-friendly. The line has 4 products, each of which is a functional food and aids the body in carrying out a specific function. The functional ingredients that go into these products were carefully chosen.

These are the products with functional ingredients:

- Brain boost with ginkgo biloba: helps with a proper mineral and nutrient uptake by the brain and optimizes the blood flow from and to the brain for better clarity, focus, and mental well-being.

- Gut lover with beetroot and turmeric: easy on the digestive tract, helps with smooth digestion and digestive irregularities.

- Immunity boost with ginger: helps body to achieve good immunological response to diseases and makes the body stronger and healthier.

- Hunger control with ginger and chili: designed to suppress appetite, prevent overeating and is low on calories.

The prototypes have been developed, providing the team with a basic understanding of the nutritional composition of the products. Multiple sales channels and marketing campaigns have been evaluated that may be interested in the potential sales and marketing of the product.

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Technical or other problems that are solved with the work

The developed product wishes to solve the problem of unhealthy snacking. The urge to snack is typically fueled by hunger, which means that more often people are pushed to make irresponsible choices. This product is incredibly tasty while being healthy; thus, it does not give the impression of a bland whole food when eaten. The consumers can safely buy and snack on it, knowing that it is low in calories and healthy for the body, because the created products are functional foods.

The targeted audience is composed of health enthusiasts and junk food bingers who want to make a more responsible choice.

The global hemp-based food market is currently evaluated to be approximately € 1.18 billion. The estimates suggest that the market value would reach approximately € 2.81 billion in the next 5 years with a CAGR of 15.1% (2023–2028). The market projections are very optimistic with more people being aware of the benefits of hemp contributed by increased research and development in the exploitation of the hemp.

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Novelty of the work

This line of products includes the first-ever hemp-based Japanese thin crackers. They are rich in protein, vegan, keto-friendly, and gluten-free. They are functional foods with each product having its own function. The uniqueness of the product lies in it serving 2 functions simultaneously: they are healthy, low-calorie, protein-rich snacks that are functional food products as well. This makes sure that binging on or over-eating them cannot have any major negative effects on the body, unlike conventional crackers.

++

The benefits and value to the potential users

The product lines are functional foods. Apart from being just healthy and low on calories, each product has its own unique function listed below:

- Brain boost: helps in the proper mineral and nutrient uptake by the brain and optimizes the blood flow from and to the brain for better clarity, focus, and mental well-being.
- Gut lover: easy on the digestive tract, helps with smooth digestion and digestive irregularities.
- Immunity boost: helps the body to achieve good immunological response to diseases and makes the body stronger and healthier.
- Hunger control: helps to suppress appetite and prevent overeating.

The products are high in protein, vegan, gluten-free, and keto-friendly.

PLANT-DERIVED RESIN FOR STEREOLITHOGRAPHY 3D PRINTING OF SHAPE-MEMORY POLYMERS

**Auksė Navaruckienė, Viltė Šereikaitė,
Vaidas Talačka, Jolita Ostrauskaitė**
Group supervisor: Prof. Dr. Jolita Ostrauskaitė

*Kaunas University of Technology (KTU),
company AmeraLabs*

Solution area │ Environment

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Description of the work

Considering recent challenges related to the climate change and the state of the environment, it is particularly important to develop new materials that combine smart properties with sustainability and applicability to high-tech manufacturing. The use of plant-derived starting materials for polymer synthesis could give ecological and economic benefits due to their low toxicity, improved recovery and recycling options, less dependence on fossil resources and reduced greenhouse gas emission.

The idea of this work was to replace petroleum-based materials by plant-derived materials in photocurable resins for stereolithography 3D printing. Plant-derived polymers can show similar properties to petroleum-based ones and even add unique properties, such as shape-memory or antimicrobial properties. In this work, novel photocurable resin, based on plant-derived monomers, acrylated epoxidized soybean oil, and vanillin dimethacrylate, has been developed and tested in stereolithography (SLA) 3D printing by the company AmeraLabs. 3D printed polymeric objects showed high printing accuracy with smooth surface finish and good layer adhesion, con-

firming the suitability of the developed resin for this technology. The calculated biorenewable carbon content of the developed polymer was 76.45%. The obtained polymer showed high rigidity similar to the petroleum-based polymers and unique shape-memory properties, which makes it a promising candidate for high-tech applications.

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Technical or other problems that are solved with the work

This product solves environmental issues by replacing petroleum-based polymers with inexpensive plant-based polymers. This polymer as well has low toxicity and unique features, such as shape-memory properties. Polymers with such properties can be used in various areas, such as aerospace, biomedicine, etc. It is as well promising for companies that are producing complex plastic parts and single disposable products and in prototyping companies.

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Novelty of the work

Polymer products with shape-memory properties can be SLA 3D printed out of the developed plant-derived resin.

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The benefits and value to the potential users

The companies could use 3D printing technology for easy production of complex products and reduced waste, which is generated during other manufacturing processes. The developed resin is composed of commercially available plant-derived materials, which allow companies to combine green chemistry and green engineering concepts in their technologies.
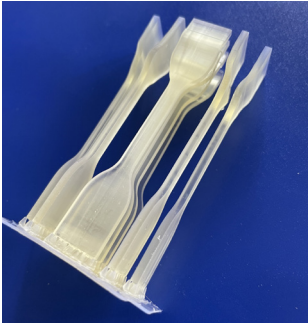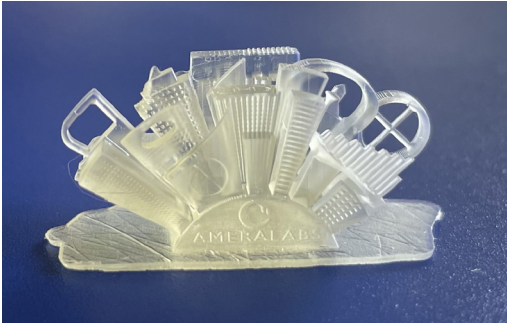
KANAPIUKAS – ONE BITE HEALTHY SNACK TO KEEP YOU FUELED THROUGHOUT THE DAY

Karolis Striška, Žygimantas Dumbliauskas, Rimvydas Kazbaras
Group supervisors: Assoc. Prof. Dr. Loreta Bašinskienė, Assoc. Prof. Dr. Aušra Rūtelionė

Kaunas University of Technology (KTU)

Solution area | Food

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Description of the work

One-bite snacks have become increasingly popular in recent years due to their convenience and portability. They are perfect for people on-the-go who want a quick and healthy snack to keep them fueled throughout the day. One such snack is a delicious and nutritious combination of hemp seeds, chocolate, protein powder, vitamin C, oatmeal, almonds, dried blueberry, and omega-3 oils. This snack is packed with protein, vitamins, and minerals, making it a perfect choice for those who are health-conscious and want to maintain a balanced diet. The combination of flavors and textures in this snack provides a satisfying and delicious experience that is sure to leave a person feeling energized and satisfied. Whether one needs a quick snack between meals or a boost of energy during a busy day, this one-bite snack is the perfect solution.

Speaking about the innovations of this snack, the team is obliged to mention that it is a convenient and healthy snack option that is designed to be eaten in one bite, making it easy to grab on-the-go or satisfy a craving with-

out consuming excessive amounts of calories. This type of snack is becoming increasingly popular in the modern fast-paced world, where people are looking for convenient and healthy options to fit into their busy lifestyles. Secondly, the snack is made of a combination of ingredients that are designed to provide a range of health benefits. The use of hemp seeds in the snack is more and more innovative in present industry. Hemp is a versatile plant that has gained popularity in recent years due to its potential health benefits and sustainability.

++

Technical or other problems that are solved with the work

This snack contains a variety of highly nutritious ingredients that offer a range of health benefits, such as promoting heart health, reducing inflammation, supporting brain function, and aiding digestion. While it may not solve a specific health problem, it can contribute to an overall healthy and balanced diet and help provide essential nutrients that some people may be lacking. It is a combination of protein, fiber, healthy fats, antioxidants, and vitamins and minerals.

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Novelty of the work

The novelty of this product lies in its combination of ingredients, which are carefully selected to provide a range of health benefits in one convenient and delicious one-bite snack. The use of hemp seeds, dark chocolate, protein powder, vitamin C, oatmeal, almonds, dried blueberries, and omega-3 oils in a single snack is a unique approach that offers a variety of essential nutrients, such as protein, fiber, healthy fats, antioxidants, and vitamins. The snack is designed to cater to the needs of health-conscious individuals who seek a quick and convenient snack that can sustain their energy levels and promote overall well-being. The innovative use of hemp seeds in the snack, a plant that is gaining popularity due to its potential health benefits, as well adds to the novelty of the product.

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The benefits and value to the potential users

This one-bite snack combines hemp seeds, dark chocolate, protein powder, vitamin C, oatmeal, almonds, dried blueberries, and omega-3 oils to create a convenient and nutritious option for health-conscious consumers.

The snack provides a range of benefits, including promoting heart health, reducing inflammation, supporting brain function, improving blood flow, lowering blood pressure, aiding in weight management, supporting the immune system, promoting healthy digestion, protecting the body from damage, caused by free radicals, and reducing the risk of heart disease. The combination of flavors and textures makes it a satisfying and delicious snack, perfect for people on-the-go who want a quick and healthy boost of energy during a busy day.

TRIPLE VALUE: HEALTHY MIND – HEALTHY BODY

**Gabrielė Pavalkytė, Rosita Raslavičienė,
Renata Kumpikevičiūtė, Erika Puškaitė**

Kaunas University of Technology (KTU)

Solution area │ Food

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Description of the work

Many have noticed the quick pace of everyday life, due to which there is no time to eat, and as a result, not very healthy snacks are consumed. The supply of bars in supermarkets is extremely abundant, but, possibly, their composition and function do not always provide benefits for the human body. Thus, the team decided to create new bars that would be tasty and good-looking and provide benefits to every user who chooses the created bars.

The new bars are made from various organic raw materials. One of the main ingredients is shelled hemp seeds and hemp protein powder, which are rich in fiber, protein, omega fatty acids. In addition, the team decided to enrich the bars with a vitamin B group complex, which could help to improve overall well-being, strengthen the nervous system, and help to reduce stress.

After conducting a survey with up to 62 respondents, it has been found that 44 percent would definitely buy the offered bar, and another 52 percent should think twice. It is clear that consumers pay close attention to the price, composition; thus, many product features are important: low sugar, high fiber, protein, organic.

Due to the growing popularity of the vegan diet, hemp-based food products are rapidly spreading around the world. In 2022, the market size for hemp-based products was USD 1.3 billion. It is expected that by 2028, their market will reach USD 3.1 billion, and in 2023–2028, the growth rate will reach 15.1%.

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Technical or other problems that are solved with the work

The market for food products, especially snacks, is overcrowded with unhealthy products with added sugar and synthetic sweeteners. Unfortunately, for consumers with specific dietary needs, it is very difficult to find suitable products, and their choice is extremely poor. In order to alleviate this problem, the team have created a vegan, no added sugar, dairy-free bar. What is more, it is suitable for gluten-intolerant and keto dieters, and all the raw materials of the bar are organic. The composition of this new snack is supplemented with hulled hemp seeds, hemp protein powder, and a complex of group B vitamins.

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Novelty of the work

There are similar products on the market as snack bars, but there are no such products as this with hemp and amaranth seeds, hemp protein powder, and B group vitamin complex; such results were obtained after the market analysis. According to the respondents, they are trying to eat healthy, and this product could help them to do that.

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The benefits and value to the potential users

This product is tasty and useful due to its unique composition. The bar is convenient to have, and after eating it, a person gets the recommended daily rate of group B vitamins, which ensure the proper functioning of the central nervous system. Moreover, hemp and amaranth enrich the product with dietary fiber and protein that improve the digestion as well general well-being. Thus, this bar is a great way to enjoy healthy snacks even when there is not much time.

COOKIE DREAM: HIGH IN DIETARY FIBER, ORGANIC, GLUTEN-FREE, VEGAN CHOCOLATE COOKIES WITH HEMP SEEDS

Svajūnė Norvilaitė, Gintarė Vaitkutė, Aušrinė Maslauskaitė
Group supervisors: Assoc. Prof. Dr. Loreta Bašinskienė,
Assoc. Prof. Dr. Aušra Rūtelionė

Kaunas University of Technology (KTU)

Solution area │ Food

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Description of the work

The team has created organic functional chocolate cookies with hemp seeds. It is a perfect guilt-free snack for people who are always on the run but willing to invest in their health. These cookies are produced to provide nutritious and convenient alternative to unhealthy snacks, without compromising taste. The product is suitable for vegans, people who are looking for gluten-free, lactose-free, and GMO-free snacks. The cookie is high in dietary fiber and is a source of protein, has no artificial food additives and no added sugars in the composition. The ingredients of cookie are almond flour, hemp flour, whole hemp seeds, and chia seeds, which add dietary fibers and proteins to the product. Dietary fiber has an important role in people's health. It aids digestion, helps to maintain healthy gut microbiome, reduces risk of heart disease, and increases the feeling of fullness. The sweetness comes from plant-based ingredients. The inclusion of hulled hemp seeds adds omega-3 fatty acids, antioxidants to the product, which contribute to a healthy heart and immune system. This cookie is ideal for people who have a busy lifestyle and want to maintain a healthy diet. It provides energy, is nutritious, and takes care of the gut.

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Technical or other problems that are solved with the work

This organic functional chocolate cookie with hemp seeds solves the problem of finding a healthy snack for busy people who are conscious of their well-being. It is suitable for vegans, individuals who do not tolerate gluten, lactose or limit daily sugar intake.

People spend EUR 48.8 million for cookies, bars, fruit snacks per year in Lithuania, and it is predicted that the market will grow in the next 5 years by 2.6% (according to Euromonitor International September 2022 Passport database data).

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Novelty of the work

There are currently no organic, vegan, gluten-free, lactose-free cookies, which are high in dietary fiber and protein in the Lithuanian market. These cookies are designed to improve gut health and are made with innovative hemp-based ingredients for busy people who promote a healthy lifestyle and seek a quick and healthy snack. It is a solution for sweet craving that does not make a person feel guilty.

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The benefits and value to the potential users

The potential users will get numerous benefits from organic functional chocolate cookies with hemp seeds. It is a delicious, nutritious snack, which is high in dietary fiber and a source of protein. High-fiber content promotes gut health, helps with digestion. There is no added sugar in the recipe, but the cookie is sweet because of the plant-based ingredients. After conducting interviews with 50 potential users, it has been discovered that they prioritize cookies that have no GMO, artificial food additives, and added sugar. In fact, 60% of those who were surveyed would purchase these cookies at least once a month due to their satisfaction with the cookies that meet all of mentioned requirements.

INNOVATIVE ICE CREAM BASED ON THE BEE PRODUCTS (BEE ICE CREAM)

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Group supervisor: Assoc. Prof. Dr. Jonas Damašius

Kaunas University of Technology (KTU)

Solution area │ Food

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Description of the work

The essence of this innovative solution was to create an ice cream that is rich in various bee products. Since bee products have positive properties (antioxidant and antimicrobial) for the human body, and ice cream is associated with a delicious dessert, the chosen strategy is to combine them into a single innovative functional food product. This created food product would have an exceptional taste as well as meet the needs of modern consumers.

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Technical or other problems that are solved with the work

Ice cream based on the bee products solves a need of functional food products for consumers. The product is created for all consumers of any gender and age group. Thus, the intended market is the whole world.

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Novelty of the work

In the market, there are no such examples of this product.

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The benefits and value to the potential users

This food product is unique in taste and flavor. This ice cream is with health promoting substances from bee products.

THE POWER OF STRAWBERRY SEEDS: INNOVATIVE MULTIFUNCTIONAL BIO-INGREDIENTS FOR COSMECEUTICALS AND NUTRACEUTICALS

Rugilė Grabauskaitė, Laura Jūrienė
Group supervisor: Prof. Dr. Petras Rimantas Venskutonis

Kaunas University of Technology (KTU)

Solution area │ Food

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Description of the work

Strawberries and their products are among the most popular foods in the world. The production of strawberry puree generates large amounts of by-products, consisting mainly of seeds, which have been fragmentally used as a skin care ingredient or raw material for oil extraction. Considering compositional complexity of seeds, an innovative high pressure cascade biorefining technology was applied to produce several different ingredients from strawberry seeds. Firstly, the seeds were subjected to supercritical carbon dioxide extraction (SC-CO_2), resulting in non-polar oily extract (product no. 1). The residue after defatting was re-extracted using pressurized polar solvent (70% ethanol) (PLE), obtaining a polar extract (product no. 2). Both methods belong to green extraction techniques, producing extracts that are safe to use in cosmetics and food. SC-CO_2 extract is a rich source of healthy fatty acids, tocopherols and phytosterols, while PLE extract exhibits great antioxidant, antibacterial properties and absorption of the UV

radiation. Both extracts contain highly valuable bioactive compounds, suitable for cosmeceuticals and nutraceuticals. The prototypes of face creams were developed with the application of separately incorporated extracts at a concentration of 2%. The addition of extracts resulted in creams with higher antioxidant activity in comparison to the cream without extract (control). The solid extraction residue (product no. 3) may be applied as a strawberry seed scrub or a source of dietary fiber.

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Technical or other problems that are solved with the work

Processing of fruits generates large amounts of by-products, which, nowadays, are used rather inefficiently or even discarded as a waste. It causes a loss of valuable bioactive compounds and other nutrients, which are present in the pomace, while, when discarded into the landfills, it increases the environmental pollution burden. Consequently, valorization of berry processing by-products into higher added value products is an urgent task both for researchers and the industry. The solving of this task is directly related to the increasing of sustainability of agro-food industries. The demand of natural bioactive ingredients has been increasing all over the world, particularly with the fast development of the concepts of cosmeceuticals and nutraceuticals, which may provide various health benefits to the consumers. Therefore, the target market of these types of ingredients as well as products with their uses is of a global scope. For instance, the global cosmeceutical market was valued at USD 52.5 billion in 2018 and is predicted to exhibit a CAGR (compound annual growth rate) of 8.2% over the period until 2026. The global nutraceuticals market size was valued at USD 291.33 billion in 2022 and is expected to grow at a CAGR of 9.4% from 2023 to 2030.

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Novelty of the work

Very few products from strawberry seeds are available in the market. Some small companies sell strawberry seeds as a cosmetic scrub. Limited amounts of strawberry seed oil are produced by cold pressing. Whole strawberry CO_2 extracts are available and used as aroma substances in cosmetics. Some small companies produce CO_2 extracts from the seeds as well. However, the extracts recovered by polar solvents are not marketed. In addition, zero-waste biorefining technologies have not been applied until
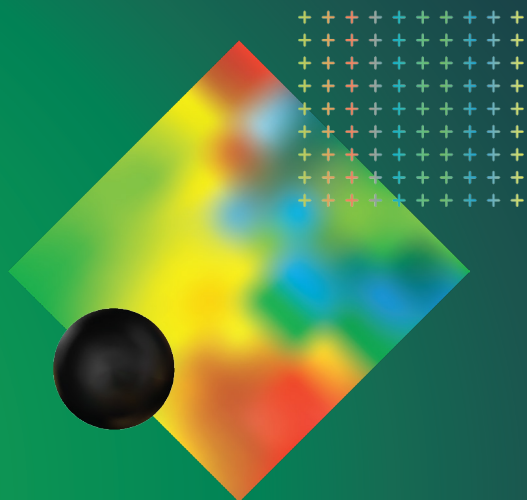
now. In this work, strawberry seeds have been biorefined into 3 valuable products by using cascade high pressure technologies, employing green solvents for the first time. Therefore, the products that have been obtained are new both regarding their composition and properties.

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The benefits and value to the potential users

The demand for natural products both in cosmetic and food industry has been remarkably increasing during the last decades, because the consumer preferences had strongly shifted towards nature-based ingredients vs. their synthetic counterparts. The developed ingredients from strawberry seeds will enable to develop new natural products including cosmeceuticals and nutraceuticals. The prototype of such cosmetic product has already been formulated. Considering the composition and the properties of ingredients, which have been recovered from strawberry seeds, their application may be expanded in formulating innovative health beneficial products with promising market perspectives.

Strawberry seeds

Cream prototype with supercritical CO_2 extract

Cream prototype with polyphenolic antioxidant extract

DESIGN

DEVELOPMENT OF ETHYLENE VINYL ACETATE AND WOOD FLOUR WASTE COMPOSITES: NIGHT LAMP 11 CLOUDS

Emilija Stankutė
Supervisor: Assoc. Prof. Dr. Kristina Žukienė

Kaunas University of Technology (KTU)

Solution area | Environment

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Description of the work

This night lamp was made of rubber (expanded ethylene vinyl acetate (EVA)) and wood flour waste, obtained from the footwear manufacturing. Waste is generated during the milling process with particles varying in sizes from couple millimeters to dust. The composites were fabricated using a hot pressing method. Polyamide powder waste obtained from the selective laser sintering process was used as a binder for better adhesion between the materials. The parts of the night light were milled from the created composite. In order to ensure its stability, the base was made from pine wood. Bamboo sticks were used as a support for the milled lamp parts. An LED lamp was chosen for lightning due to its energy efficiency and permanence.

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Technical or other problems that are solved with the work

Nowadays, one of the most relevant problems is the management of industrial waste. A large amount of waste is unloaded into the landfills or incinerated, emitting toxic fumes and decomposing in microplastics that pollute soil, water and enter body with food and air, causing ecological problems and diseases. One of the industries that produce high amount of waste is the footwear

industry. The footwear industry generates a large amount of wood and rubber waste. However, rubber can be recycled mechanically, which means that the chemical structure changes are minimal, resulting in the opportunity to use recycled material a few times. As the population in the world is growing, the lighting industry and lampshade industry grow as well. Recycling and reusing materials are becoming more relevant because of the reduced negative impact on the environment and minimized cost of raw materials.

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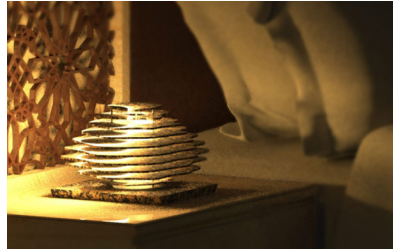
Novelty of the work

There are many companies and studios that use food or agricultural waste. For example, a Finnish company Sulapac offers cosmetic packaging, made mainly from wood and plant-based binders. Ottan Studios produce composites that can be implemented in the furniture, lighting, panels for electric kitchen gadgets, and elements in the automotive industry. Although industrial waste is mostly reused in the same processes to reduce the raw material cost, in some cases, it can be used in other industries, e.g., clothing can become house insulation. However, the recycling of industrial waste is limited. The 11 Clouds night lamp panels are made of rubber and the wood flour waste from the shoe manufacturing. The composite displays properties that are similar to cork, and therefore, it can be used for floor padding, sports equipment, cold insulation, or as a decorative interior element.

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The benefits and value to the potential users

11 Clouds solution:

- The material was obtained from the footwear manufacturing waste and reused in a completely new concept, resulting in a reduction in the negative impact on the environment.

- The pattern is unique and inimitable, because of the particles' position during the process.

- The organic shape of the panels provides a sense of calmness and naturalness as well as ensures authentic design.

- An LED lamp was chosen for lighting due to its of energy efficiency, permanence, and emitting less heat than bulbs.

MEETING THE WORLD: SELF-ASSEMBLY SUITCASE

Vaiva Balvočiūtė
Supervisor: Assoc. Prof. Dr. Kristina Žukienė

Kaunas University of Technology (KTU)

Solution area | Environment

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Description of the work

The self-assembling suitcase is a distinctive product that users can put together themselves prior to use. The assembly process requires only mechanical joints, eliminating the need for inner linings, zippers, or adhesives. This makes this suitcase easy to recycle and reduces the number of parts compared to the traditional suitcases. With two size configurations that share some of the same components, the product caters to the needs of various types of travelers. Its design allows for to purchase replacement parts, negating the need to discard the entire suitcase and buy a new one. At the end of its lifecycle, it is easy to recycle the suitcase, making it an eco-friendly option. Sustainable design prolongs the life of the product while minimizing its environmental impact, making it an excellent choice for sustainable travel industry.

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Technical or other problems that are solved with the work

Each year, hundreds of thousands of discarded suitcases end up in the landfills due to the damage from collisions, deformed shells, or broken wheels and handles, making them difficult to repair or recycle. In order to address this problem, a new product has been designed to be durable, recyclable, and repairable. Made from sturdy materials, this suitcase can withstand the wear and tear of frequent travel, and if it does get damaged, it can be repaired in-

stead of being discarded. Its recyclable components can be repurposed and reused, thereby reducing waste and environmental impact. This product offers a sustainable alternative to conventional suitcases and aims to tackle the issue of pollution caused by them. The target market for this product includes frequent travelers or leisure travelers, and the experts predict that this market will continue to grow significantly by 2030, making sustainable products like this increasingly important.

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Novelty of the work

This product will be available in two different sizes, using several identical parts, which will help to reduce the costs. Moreover, this product will be a more sustainable choice, as it will be made using recycled materials and will be easily recyclable. Additionally, the suitcase will be designed to be disassembled during the transportation, which will take up almost 50% less space than sending two traditional suitcases of the same dimensions.

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The benefits and value to the potential users

This product offers consumers a sustainable and fashionable suitcase option that can be easily assembled in parts, reducing its size for transportation and storage. Additionally, all parts are easily replaceable, saving money and ensuring a longer-lasting product. The materials that are used to manufacture this product are recycled, and the design allows for easy recycling of all parts. Two size configurations are available to cater to different travel needs. People can play their part in reducing global pollution by using this product.

Meeting World

16 parts – 2 suitcases
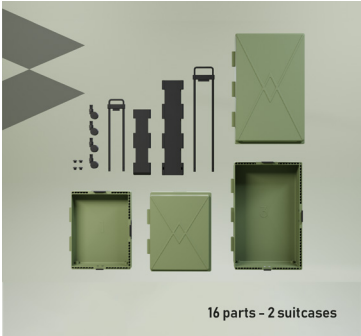
THE GREEN HIGHWAY GENERATOR: HARNESSING THE POWER OF TRAFFIC FOR A GREENER TOMORROW

Sai Vignesh Sreedhar Iyer, Stalon Solomon Goel Babu, Muhammed Ammar Abdullah, Michal George, Elshada Jasper

Kaunas University of Technology (KTU)

Solution area │ Environment

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Description of the work

The Green Highway Generator may be able to produce more power as the number of vehicles on the road rises, which would help to expand the clean energy production. The increasing demands of the transportation cause traffic delays and increased emissions, as a result of urbanization's growth and the rising need for transportation. However, The Green Highway Generator offers a special chance to use traffic to produce clean energy, thereby reducing the harmful effects of traffic on the environment. In order to maximize the capacity of renewable energy and take use of the wind energy potential, the system may be put in a variety of sites along the roadways, including urban and rural regions.

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Technical or other problems that are solved with the work

There are various environmental issues that The Green Highway Generator is addressing. First and foremost, it is combating climate change by depending on wind energy to provide clean, renewable energy rather than

fossil fuels, which emit dangerous greenhouse gases into the environment. The Green Highway Generator helps to combat global warming by lowering carbon emissions.

Second, The Green Highway Generator is assisting in lowering air pollution brought on by the snarled traffic. By using the wind energy created by the busy traffic, the generator eliminates the need for conventional power generating techniques that worsen air pollution. This is especially crucial in cities where poor air quality is a big problem.

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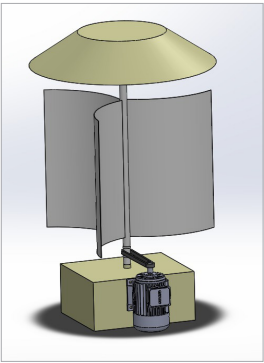
Novelty of the work

Charging stations for electric cars: The Green Highway Generator can power cheaper charging stations for electric cars and trucks, which promote the use of electric vehicles and lessen dependency on the fossil fuels, as these industries have been exponentially growing in recent times.

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The benefits and value to the potential users

Potential users of The Green Highway Generator can take advantage of a wide range of advantages and benefits, such as clean and renewable energy, cost savings, cheaper electric vehicle charging stations, lessened air pollution, sustainability, and economic growth.

HALVE – A PLATFORMER WHERE YOU HAVE TO CONTROL TWO CHARACTERS AT ONCE

Airidas Janonis, **Eligijus Kiudys**,
Miglė Zdanavičiūtė, **Gantas Liutkus**

Moonleaf Studio

Solution area │ Interactive and creative society

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Description of the work

A large spirit was accidentally split into two minor spirits. After splitting, their fragments were scattered across the world. Help two separated spirits find their way in this vast solo co-op platformer. Simultaneously, work together to overcome different challenges and unravel the spirit's true destiny.

Main game features:

- Simultaneously guide two spirits to solve puzzles and challenges.
- Explore beautiful hand-crafted environments of four different chapters, where every chapter has its own story to tell.
- Collect fragments to evolve, unlock new abilities and different ways to solve encountered challenges.

Gameplay:

- A large spirit was accidentally split into two minor spirits. After splitting, their fragments were scattered across the world.
- The player's goal is to explore this land, solve puzzles, complete platforming challenges, and gather soul fragments.
- Upon entering a new chapter, both of the characters will evolve, unlocking new abilities and different ways to solve the encountered challenges.

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Technical or other problems that are solved with the work

Halve provides a whole new and unique approach to the popular puzzle plat-
former game genre, i.e., a game where one player has to constantly keep on
paying attention to two characters, solve complex puzzles and challenges.
Moreover, in order to make it even more challenging and different, both of
the characters are controlled simultaneously by using the same movement
keys. The main target audience are players, who like visually appealing and
artistic games with puzzle platformers elements.

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Novelty of the work

The main novelty of the product is the ability to control two characters at
once by using the same movement keys. This concept that has a lot of po-
tential but is barely explored in the video game market.

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The benefits and value to the potential users

It is an entertaining and touching story about the journey of two separated
spirits while they try to find their way back to one another. Additionally, the
players will be able to experience unique platformer levels that are built on
top of the simultaneous movement of two characters.
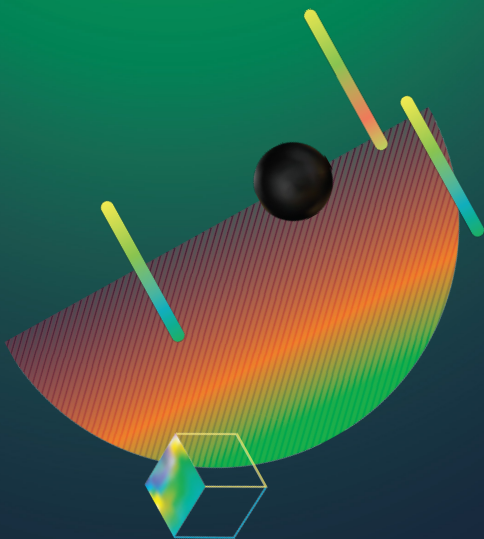
ECONOMY, SOCIAL SCIENCES AND HUMANITIES

U CAN!

**Justė Guliavičiūtė, Sairon Mindaugas Romeika,
Gvidas Jokubauskas**
Group supervisor: Assoc. Prof. Dr. Julija Ilonienė

Kaunas University of Technology (KTU)

Solution area | Digital solutions

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Description of the work

U CAN! is a work, volunteering, internship platform that is focused on students and other people, who are looking for a flexible work schedule, a more convenient and efficient job search. This platform would have plenty of filtering tools (salary, working hours, city, type of work, required languages, work area, experience requirements), the possibility to change the platform language to English, which would make job searches even faster and more convenient for Lithuanians as well as foreigners. The platform would have a place where individuals could put in their free time; thus, the employer would be able to know immediately whether the candidate will be able to fulfill their working time requirements. A platform would as well have a volunteering section that can be used by the students in higher grades (9–12) to gain experience in their field of interest and help them contribute to a cause that is close to their heart. The practice section would be the most useful for students that are close to getting their bachelor's degree and students who want to test themselves in a real work environment. On the platform, there would be tips related to volunteering, work, and internships with future students and employees, which would make client's path to their goal even easier.

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Technical or other problems that are solved with the work

In Lithuania, it is difficult for young people to find a job where an employer can offer suitable working conditions. Students face challenges when looking for

a suitable practice placement. People do not know about various volunteering opportunities, and there is always a shortage of volunteers. Thus, people often do not find or even do not know about the different employment opportunities that this platform could provide information about and in addition, help to solve the unemployment problem in Lithuania.

According to the data of the official statistics portal, in 2022–2023, the number of students in colleges and universities of all levels throughout Lithuania reached as many as 102,366 students. In addition, to this number, the number of gymnasium students who could use the volunteering section of this platform should be added as well. Moreover, in 2022, an article published by Lietuvos bankas noted that "the number of job vacancies in Lithuania is growing at a record level, which now amounts to almost 27 thousand". Thus, after evaluating these two important indicators, the growth potential of this platform is high.

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Novelty of the work

This solution could offer many employment options in one place; for the convenience of the candidates, the job reward would be immediately indicated on the platform, wide filtering options, language could be changed to English, which is useful for foreigners, an integrated job interview system, where the employer could conveniently and quickly contact the job candidate, work schedule, in which the student indicates his/her possible working hours, which would help both the employer and the job seeker. In addition, this platform would have an advice section that would help students looking for their first job as well as gymnasium students thinking about the most suitable choice of higher education and future profession.

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The benefits and value to the potential users

Firstly, this product would help students and others interested in flexible work schedules to find a job more conveniently because of the filtering options. Secondly, there would be numerous practice places in one platform; thus, this would make the student's job of finding the best one much easier. Moreover, students who are just starting with their career path choices could test themselves in different fields through volunteering and reading useful articles. Different firms could post their job ads for a better price and would

state their terms for the employee more precisely because of the filtering capabilities and get young, ambitious individuals who are determined and suitable for the required positions.

E-SCAPE: WE WANT YOUR E-WASTE!

Gintarė Gabrielė Gabšytė, Adomas Macevičius,
Aivaras Vaitkus, Skaistė Lukenskaitė, Aurora Vaidelytė
Group supervisor: Vilija Balčiūnaitė

Kaunas University of Technology (KTU)

Solution area | Environment

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Description of the work

Product in development is an escape room type of virtual game where the player completes tasks related to rare metals in order to break out of it. The player finds necessary materials and carries out actions to put together an electronic device whilst receiving educational material on found rare metals and how to recycle electronic devices.

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Technical or other problems that are solved with the work

The product educates the public about the increasing shortage of naturally obtained rare metals and motivates to recycle electronic waste to reuse those metals, promoting a circular lifetime of electronic devices. The market is students in high schools and higher education institutions. Various offices and workplaces could be expected to be included as well in the future when the product is more developed.

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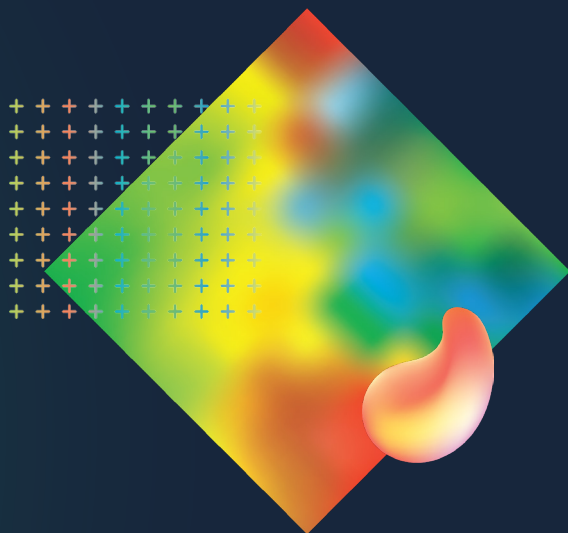
Novelty of the work

Other solutions either use a lot of gamification and are less educational, or there is too much educational content lacking gamification. This product is a game that is fun to play and provides enough educational material in the process. Those two are equally balanced.

The benefits and value to the potential users

The product will have an educational value: people become more responsible for doing good for the world, which raises overall happiness rates of the population.
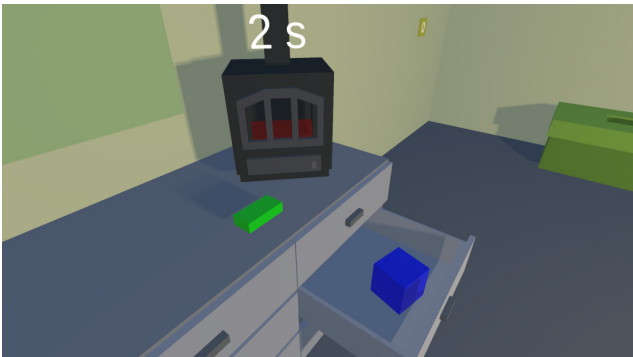
ELECTRICITY, ELECTRONICS AND ENERGY

SUSTAINABLE ENERGY USAGE WITH LORA BASED SMART ENERGY METERS

Chandana Ravikumar, Mukul Sharma

Kaunas University of Technology (KTU)

Solution area | Engineering

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Description of the work

A smart energy meter using LoRa communication is developed. Electronic energy meters are devices that measure the electrical parameters of a power network, such as voltage, current, power, energy, and power factor. They are widely used for monitoring and controlling the power consumption of various electrical devices and appliances. They play a vital role in the efficient energy utilization for the development of smart grids in power systems. The main advantages of energy meters include the easy monitoring of energy usage at home, reduced costs, transparency and flexible pricing, the integration of new technologies and innovations into the grid. Smart meters have benefits for consumers, suppliers, and networks, such as more accurate bills, easier switching, clearer energy use, and a smarter grid. They can help consumers save money by adopting energy efficiency measures or using smart tariffs that reduce charges at certain times or when there is excess of clean electricity available.

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Technical or other problems that are solved with the work

Traditional energy meters have some limitations, such as the need for manual reading, wiring costs, data transmission delays, and security risks. These energy meters require internet or wifi connections to transmit recorded data to the users. Such energy meters are highly dependent on the electricity

connection and always need to have connection to wifi. In order to overcome these challenges, wireless communication technologies have been developed to enable remote and automatic data collection and transmission from energy meters. In order to make such smart meters independent of internet or Bluetooth connection, the team has used the new technology of LoRaWAN communication, which has coverage of up to a few hundred meters and is highly efficient.

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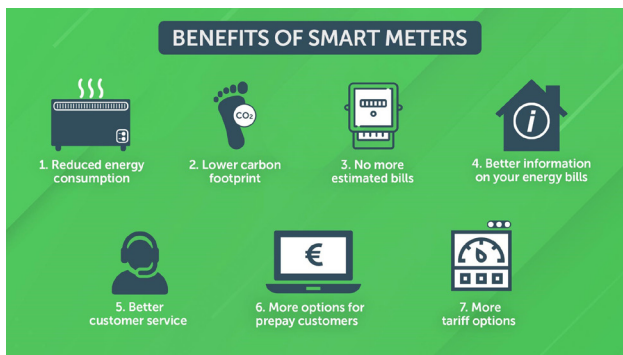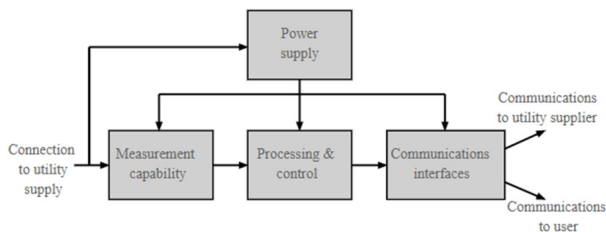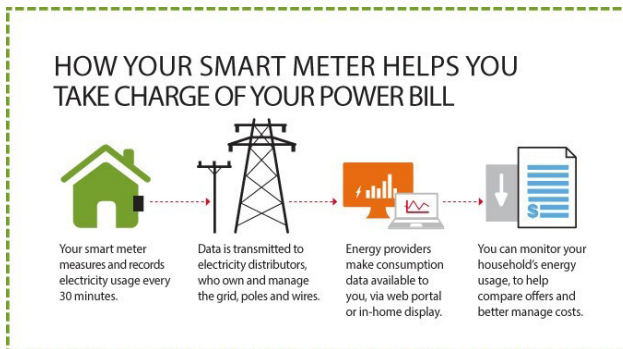
Novelty of the work

- It was a challenge to define the features and requirements of a smart meter clearly, as different types of meters for home and utility have different specifications and functions.
- The cost and modularity of the design can be optimized by choosing appropriate hardware and software components for the intended application. The building of the proposed smart energy meter costs just EUR 76.32, compared to the other commercial energy meters.
- In order to avoid false readings that can result from interference of other devices or power quality issues, the design uses appropriate filtering, shielding, and calibration techniques to minimize the errors caused by the harmonics, noise, or distortion in the signals.
- The research shows that having smarter heating controls at home could save around £60 and 310 kg of carbon dioxide a year. By installing a smart thermostat, it is possible to save up to $100 a year on energy bills, or around 11% of heating and cooling costs.
- Thus, the proposed smart meter puts consumers in control of their energy use, allowing them to adopt energy efficiency measures that can help to save money on their energy bills and offset price increases.

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The benefits and value to the potential users

- Electronic energy meters based on LoRa communication can provide various benefits for both power consumers and providers. LoRa energy meters can provide real-time and accurate information for consumers about their power consumption and metrics, which can help them to optimize their energy use and save costs. For providers, LoRa energy meters can enable remote meter reading and management, which can reduce operational costs.

- The PZEM-004T module is incorporated: it is a beneficial tool for measuring and managing energy consumption in various applications, such as smart homes, smart grids, industrial control, etc. It has advantages, such as high accuracy, low cost, easy installation, and compatibility with different platforms.

HOW YOUR SMART METER HELPS YOU TAKE CHARGE OF YOUR POWER BILL

Your smart meter measures and records electricity usage every 30 minutes.

Data is transmitted to electricity distributors, who own and manage the grid, poles and wires.

Energy providers make consumption data available to you, via web portal or in-home display.

You can monitor your household's energy usage, to help compare offers and better manage costs.

BENEFITS OF SMART METERS

1. Reduced energy consumption
2. Lower carbon footprint
3. No more estimated bills
4. Better information on your energy bills
5. Better customer service
6. More options for prepay customers
7. More tariff options

LoRa® Reduces Energy Use with IoT

SMALL FOLDING FIXED WING DRONE PLATFORM

**Paulius Obolevičius, Benas Šinkevičius,
Mindaugas Dagilis, Vytautas Mileris
Group supervisor: Prof. Dr. Renaldas Urniežius**

Kaunas University of Technology (KTU)

Solution area │ Defense

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Description of the work

A compact, fast-launching folding-wing drone platform is specifically designed for rapid and inexpensive manufacturing. Flight time of the drone varies depending on the mission configuration and payload, ranging from 15 to 40 minutes with maximum payload of 0.5 kg. Additionally, the radio control link has a range of up to 15 km, providing control and communication over long distances.

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Technical or other problems that are solved with the work

Drones are used in defense industry more than ever; there is a race who can build high numbers of dispensable multipurpose flying devices that can do multiple missions. This drone is manufactured using simple materials and is 90% 3D printed; a farm of a new generation of FDM 3D printers can produce high numbers of these drones every day. The defense market is one of the biggest in the world, but it is one of the hardest to enter. Once the development of the autonomous visual navigation software will be finished, there will be created a working product.

Novelty of the work

This drone is designed to be manufactured with simple methods, not requiring special expensive molds, complex parts, or much man hours to build it. It requires simply scalable factory because of no specific tooling is needed.

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The benefits and value to the potential users

It is very competitively priced in its category, easy to use with minimal training, easily modified for production regarding specific requests without changing the production line.
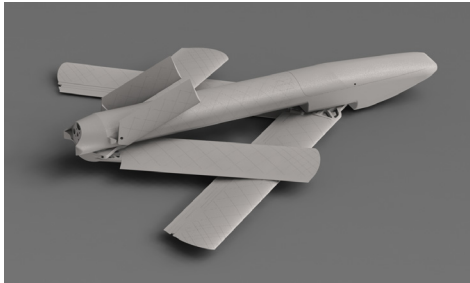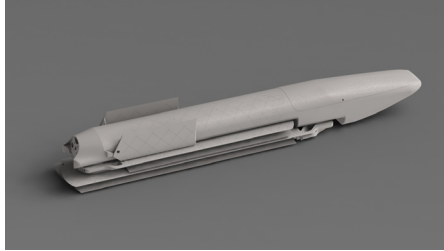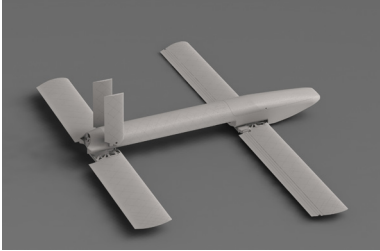
SMART AND ENERGY-SUSTAINABLE ROAD SIGN

Gintarė Poškaitė, Ignas Roličius, Justinas Krutkevičius, Eimantas Šerpetis, Gabija Paužaitė, Agnė Strielčiūnaitė
Group supervisor: Assoc. Prof. Dr. Jurgita Čyvienė

Kaunas University of Technology (KTU)

Solution area │ Mobility

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Description of the work

A mobile road sign, a traffic coordinator, would allow drivers to drive according to the instructions of a smart road sign in traffic jams, i.e., travel in a friendly manner towards other drivers ("do not pull in", "do not beep", etc.). A movable sign can help to adjust in places where there is a car accident or where road workers temporarily close one or another lane. When the sun shines, it powers the sign with the help of a solar panel. The energy from the sun helps to power the monitor, which shows an animation to the drivers. The animation informs drivers to merge lanes with the help of the zipper merge method. Currently, the team is working on a prototype of this idea. It consists of a monitor, solar panel, battery, inverter, solar panel controller. The team is hoping to get a stand before this event, that it would be possible to show how it would function as a real product.

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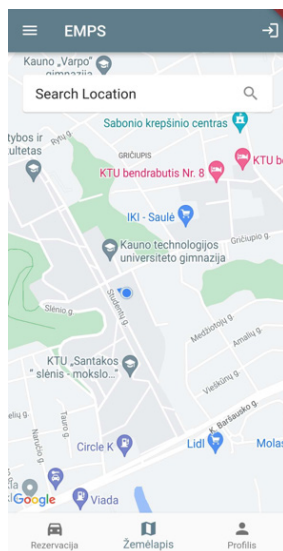
Technical or other problems that are solved with the work

It is aimed to minimize the traffic during road works. The target market is drivers, because, it is meant to help to decrease the time spent in traffic. This market is growing every year, and the drivers spend up to 173 hours per year in traffic. Thus, this product/idea should help drivers to spend less time in traffic and has the potential to grow and improve in the future.

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Novelty of the work

This product is not used in Lithuania and has no direct competitors. However, there are some indirect competitors. There are not many of these competitors, but they are as follows: traffic regulators, priority signs, and smart traffic lights.

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The benefits and value to the potential users

There will be spent less time spent in traffic jams, less road accidents. It will be better for the environment due to less car emissions, and the product runs on green energy.

WIRELESS POSITION TRACKING DEVICE

Dominykas Simpukas
Supervisor: Assoc. Prof. Dr. Pranas Kuzas

Kaunas University of Technology (KTU)

Solution area │ Engineering

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Description of the work

Wireless position tracking device or GPS_TRACK_v.1.0 is position tracking and transmitting device, aimed to be used in sport events and competitions, such as marathons, bike marathons, etc., where position tracking is mandatory, and the events last long hours or even days. It is designed to be low-powered, multi-protocol, capable of being used in harsh environments device that gathers GNSS data, calculates current position, and sends it via GSM/GPRS protocol to remote server; thus, the configuration could be done via GSM/GPRS or BLE (Bluetooth low energy). It has minimal user interface to preserve battery life; moreover, it could be charged by multiple power supplies. Special 3D printed case was designed to achieve IP64 standard.

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Technical or other problems that are solved with the work

The main problem is that currently, there are no cheap, low-power, long battery life, sports aimed trackers produced in Lithuania. The organizers of sports events have to rent these devices from other countries or search for alternatives. The demand was to create tracker, and the main goals were long working hours, small size, and durability. Currently, the market is not very big in Lithuania, but it is growing every year, because more and more people are getting into bike sports, running marathons, and overall healthy lifestyles.

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Novelty of the work

It is a simple locally made tracker with one purpose to track athlete's position and send it wirelessly. Most of the trackers are have many functions and features, but for the target market, these functions are unnecessary; thus, the simple option would be preferred.

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The benefits and value to the potential users

First of all, it will be a local product, aimed at the local needs and local events; thus, it will be easier for the organizers to set it up, resulting in easier logistics, and it could be localized, i.e., use Lithuanian language. Second of all, it is designed to be as cheap as possible; therefore, low rent costs or reasonable price is a big benefit. Since the market lacks these kinds of trackers, it will bring a lot of benefits to those who use them.
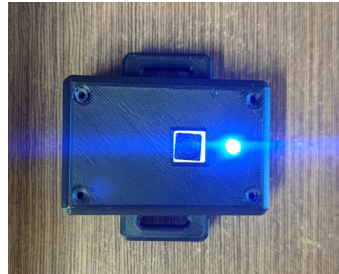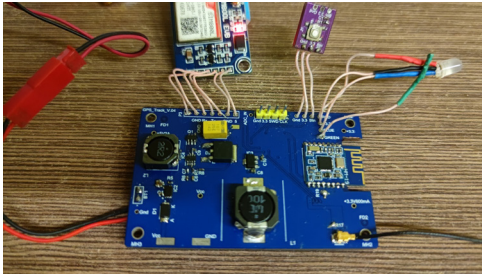
5TH WHEEL – INDIVIDUAL HIGH GRIP POWER STEERING WHEEL ATTACHMENTS TO ORDINARY WHEELCHAIRS

Chandana Ravikumar, Mukul Sharma, Ronaldas Antanavičius, Justė Galminaitė

Kaunas University of Technology (KTU)

Solution area │ Health

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Description of the work

5th wheel is an affordable circular economy-based wheelchair attachment to replace the existing electronic wheelchairs with the same features. Wheelchair users with mobility issues, such as neuromuscular diseases, have trouble moving with their own hands as well as people who got into serious accidents, or the elderly people having mobility issues. The e-waste is increasing, which is harmful to the environment. There are such problems as expensive electronic wheelchairs and portability of bulky electronic wheelchairs.

Patients with rare muscular/ neurodegenerative diseases encounter difficulties finding a suitable electric wheelchair

1. This idea brings a sense of independence by providing mobility options to wheelchair users and elderly.

2. This product is a battery powered wheel attachment that fits to any wheelchair and streets wheelchair using joystick/buttons.

3. It reduces the cost spent by the user on the electric wheelchair, the cost spent on the private nurses, the time of accompanying family members, as the user is able to move on his/her own.

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Technical or other problems that are solved with the work

The idea is to create a mechanism in the existing wheelchairs that can power the wheelchair for longer periods of time and help with the steering and traction. It is created for people who suffer from neuromuscular diseases and people who have mobility issues, such as elderly people or people who need assistance. There are more than 30,000 people in Lithuania alone who use ordinary wheelchairs, and they are the main target group.

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Novelty of the work

1. Offers affordable circular based wheelchair attachment to replace the existing electronic wheelchairs with the same features.

2. Makes relocation and travel life easy, carrying a wheelchair attachment instead of a big electric wheelchair.

3. Involves circular economy, developing a wheelchair that minimizes electronic waste by using recyclable electronic parts in the proposed wheelchair attachment, reduces e-waste because it cannot be decomposed in soil or burnt into the air.

NOVELTY

More Lubricants
Cooling Fan
Strong and Sturdy
High Torque
Metal Gear Durable

Innovative wheel design - uphill speed 8km/hour

4. Solves accidents and wheel slippage on icy roads during winters.

5. Minimizes e-waste, makes portability easier, attachment more affordable.

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The benefits and value to the potential users

1 The idea is to create a mechanism in existing wheelchairs that can power the wheelchair for longer periods of time and help with the steering and traction. It is created for people who suffer from neuromuscular diseases and people who have mobility issues, such as the elderly people or people who need assistance. This idea brings a sense of independence by providing mobility options to wheelchair users and elderly.

2 This product is an individual high grip power-steering wheel attachments that fits to ordinary wheelchairs and streets wheelchair using joystick/buttons. This product is still under development.

3 It reduces the cost spent by the user on the electric wheelchair, the cost spent on the private nurses, the time of accompanying family members, as the user is able to move on his/her own.

PROBLEM

Avg Weight 128kg
Avg standard width 60cm
Avg price 5099.85 €

Expensive
Heavy & Bulky
Sizes rarely suitable
Maintenance issues
Difficulty in parts replacement

NOVELTY

Precise movement - High grip tire technology

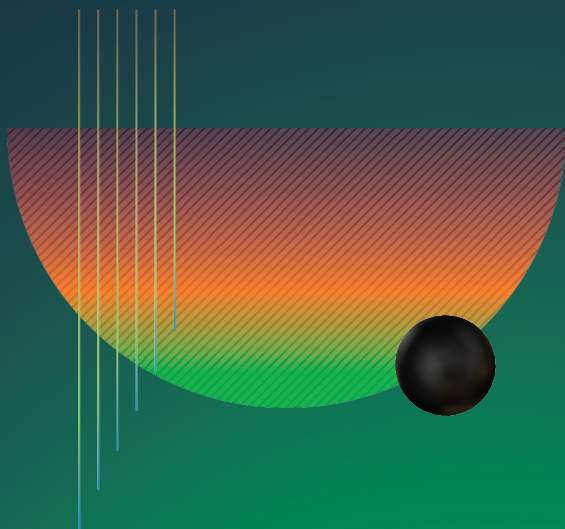MPPT Technology
Efficient Battery consumption

1 Product=Battery+Motor+Wheel

Bluetooth enabled Motor Control

HEALTH
SCIENCES

MEETELP IS A PLATFORM FOR PEOPLE, SEEKING MENTAL HEALTH CARE, TO FIND THE RIGHT PSYCHOLOGIST AND PROSPER THROUGH THE PROCESS OF THERAPY

Rimas Povilaitis, Laurynas Nacevičius, Elvinas Nėjus, Jekaterina Varlamova

Meetelp

Solution area │ Health

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Description of the work

Meetelp is a platform for people, seeking mental health care, to find the right psychologist and prosper through therapy. This started from a research conducted on more than 300 people, where it was found that 72% of people who went to see a psychologist, quit after the first session, and half of them did not try to search for another one.

SaaS tool has been created for therapists, which saves up to 90% of time for the administrative tasks. Thus, people who are seeking mental health care could have an app that primarily provides the user with a matching system

that shows them the best potential therapists. The algorithm behind the matching relies on filters, therapist's experience, and personality compatibility. After finding the right therapist, an ecosystem of services for both parties is provided to prosper a more effective therapy.

There are around 25 therapists and more than 2000 users on this app. The team understands the problem of seeing a therapist for the first time. Moreover, the team has connections with people who are working in the mental health sector.

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Technical or other problems that are solved with the work

It has been decided to put an end to the failing system of finding a therapist, and there was conducted a research with around 300 participants who had seen a therapist at least once in their lifetime. The results were shocking: 72% of them could not find a suitable therapist on their first try, and even more concerning is that half of these people did not try to find another specialist and continued to live with their problems. Additionally, when asked how difficult it is to find a therapist online, 71% of respondents admitted that it is difficult and 29% said it is extremely difficult.
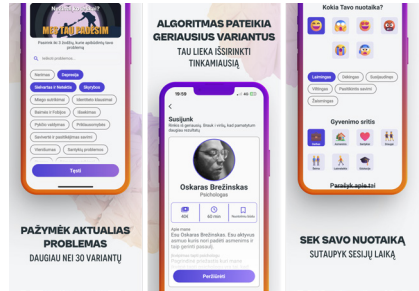

The problem is clear: finding a therapist with whom a person can connect (the importance of connection will be discussed later on) and actually solve personal struggles is too difficult for an average person. This leads to the high rates of alcoholism, suicide (Lithuania has the highest suicide rate in Europe), and unresolved depression (only 1 in 3 people suffering from depression receive the care that they need). This is a significant problem, but it is possible to reduce these numbers, starting with Europe and continuing worldwide.

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Novelty of the work

Meetelp offers a new way of connecting with the best psychologist for a person by addressing the user's therapy expectations, we factor in person-

ality, experience in the problem and technical traits. This produces the most desirable result for the client. Besides, this platform is currently the only one in the market that offers therapy services combined with CBD based tools.

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The benefits and value to the potential users

Having a matching system, it is possible to always provide client with the best specialists in the app. However, its uniqueness does not end there. In the app, the client matches with a fitting therapist and selects available times and books a session in a matter of minutes. This is a huge benefit compared to the manual calling, texting, and writing emails only to be rejected afterwards. Due to Meetelp, the client is fully taken care of: the bookings and calendar, as well as payments, are automated. They are as well presented with a pool of other services that help them to achieve better therapy results. These additional services, such as self-assessment articles and a mood tracking journal, are based on CBT and can be used by the client and therapist combined.
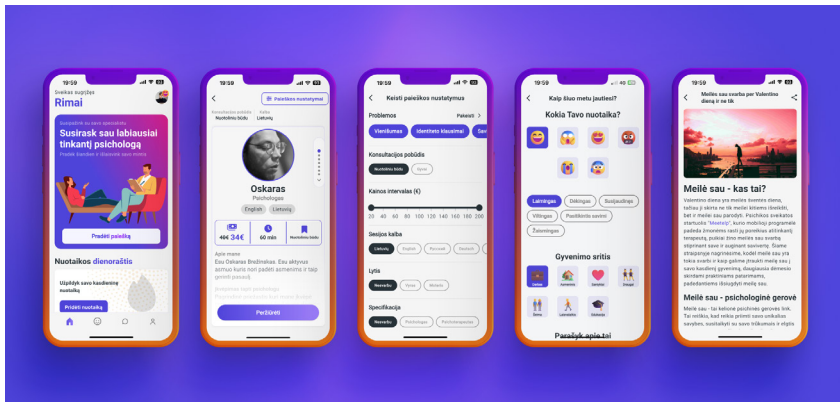
HEALTHPRESSO – QUICK WAY TO GET ALL THE NEEDED NUTRIENTS IN ONE PLACE

Albertas Pocius

Solution area │ Food

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Description of the work

The goal is to make fast food not only fast, but healthy as well. The shakes that have been crafted are fast to prepare, easy for the body to digest, and super nutritious. In the modern world, it is hard to find good alternatives to fast food during the work hours. That is why, there has been created Health-presso. Lyophilized shakes (freeze-dried) can be with different features: such as detox, energizer, beauty/ skincare, concentration, sport, and digestion. Each of the smoothies are crafted by the scientists. The shakes contain fruits of different sorts, some of the shakes contain up to 11 different fruits/ seeds. The design and the logo of the product packaging have already been created, and there has been left to add the final touches to the website. The plan is to craft 3 different website models (questionnaire, one pager, and standard selling page) and send paid traffic to the website on the 1s of June.

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Technical or other problems that are solved with the work

In the present fast-paced world, many people struggle to consume the necessary nutrients that their bodies need. Busy lifestyles and a lack of time to prepare nutritious meals have contributed to a growing trend of consuming highly processed, fast foods that lack essential nutrients. Additionally, many people are looking for on-the-go options that are convenient, portable, and still healthy.

Freeze-dried shakes provide a solution to these problems. Using whole, nutrient-dense ingredients that are preserved through the freeze-drying

process, the product offers a convenient and easy way for people to get the nutrition they need in a quick and efficient way. The shakes are made with fresh, whole ingredients that are carefully selected and freeze-dried to maintain their nutritional value.

After researching the competitors, it is expected that the TA is 25–45 aged women that are living active lifestyle and trying to find balance between work and family life. First, different TA is going to be tested with the website to see how well they resonate with the website, then checking the conversion rate and adjusting TA.

Currently, it will be started with the TA that has been mentioned before, and if everything succeeds, the product line is going to the expanded to nutritional gummies/supplements, further expanding the target audience to the health and wellness field.

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Novelty of the work

The ingredients that are in the freeze-dried shakes are different: all natural, no added sugar, vegan friendly. Usually, these kinds of freeze-shakes do not have protein in it, only fruits, whereas these freeze-dried shakes differ from other competitors in that way. It has protein, contains more fruits, and tastes more as a healthy drink rather than summer juice, and it costs cheaper.

What concerns pricing, it is hard to say how much cheaper it is going to be compared to the competitors, but currently it is 20% cheaper, but producing higher quality product. When the sales increase, better deals with suppliers can be negotiated, and the cost can be reduced even more.

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The benefits and value to the potential users

The benefits to the consumer is getting all the needed nutrients in one place. It is fast, nutritious, and tasty. The consumers will spend less time eating junk food and spend more time on the things they love to do.

As the sold shakes have different qualities, they have different benefits to the consumer, such as: energizer is focused to provide sustained energy without the crash; sport smoothie with electrolyte-rich ingredients to replenish what is lost during the exercises; digestion smoothie with Fennel seeds, Ceylon cinnamon, and carrots to support gut health and aid digestion etc.

MECHATRONIC DEVICE FOR REHABILITATION

Benas Tinteris
Supervisor: Dr. Valdas Grigaliūnas

Solution area │ Health

Description of the work

There has been developed a device that can be used as a tool during physical rehabilitation. The result of this work is a training device, in which the force for a patient is produced by an electric actuator. Currently, during physical therapy sessions, most professionals use dumbbells, resistance bands, and other basic equipment. A creation of a mechatronic system for rehabilitation is highly useful for the therapists, as they would be equipped with a device that would extend their possibilities. This device allows to easily select applied force and, after further development, can provide feedback from the movements completed by the physical therapy patients. There are two different working modes of device, i.e., standard and eccentric. During the standard working mode, the force provided by an electric actuator is constant, while during eccentric work regime, the force with which the training rope is retracted can be increased if compared to the force with which the training rope was extended. The device as well features a relatively compact and versatile design if compared to the other devices in the market that can be used for the rehabilitation.

Technical or other problems that are solved with the work

Currently, there are limited possibilities for providing physical therapy specialists with metrics on how their patients are improving. The creation of this device allows to apply correct or needed force in rehabilitation while having a capability of providing a feedback from this process.

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Novelty of the work

During the research, there has not been found any commercially available devices that rely on the electronic actuator and can be used for rehabilitation.

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The benefits and value to the potential users

This device allows professionals in the field of physical therapy to apply needed, sometimes quite small, force for patients. This would allow to avoid overloading, therefore increasing the effectiveness of the therapy.
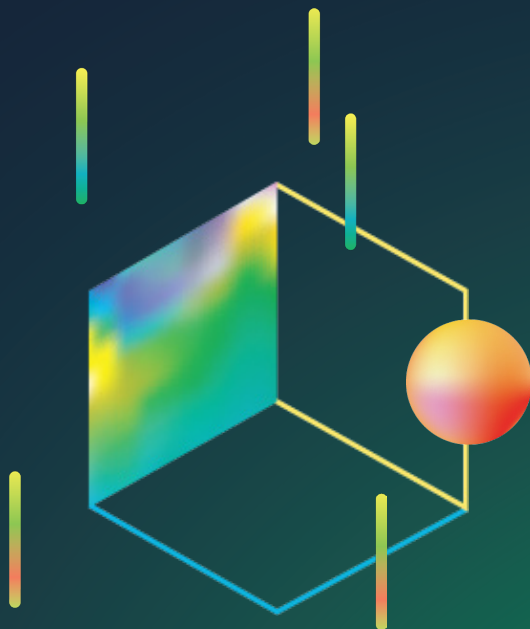
INFORMATION
TECHNOLOGIES

RECYCLERS UNITED

Benas Dorochinas, Arvydas Mazauskas, Ernestas Arlauskas, Pijus Navasaitis, Ingrida Mikutavičiūtė
Group supervisor: Dr. Justas Šalkevičius

Kaunas University of Technology (KTU)

Solution area | Environment

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Description of the work

The team (Trash Pandas) are developing a mobile idle clicker game called Recyclers United. This project is being developed as a real product during the course of Product Development Project at Kaunas University of Technology. The app is planned to be released first on the Android platform, and later, if the product is successful enough, it is planned to be launched on the App Store on iOS. The game starts in a small location full of rubbish. At the beginning, the player is given a number of volunteers to clean up the location. The volunteers collect rubbish from the surroundings and take it in bags to a container, where blue-helmeted loaders load the bags into a vehicle. While the volunteers are collecting the rubbish, the player's goal is to maintain the resources and equipment, recruit new volunteers, and strategize on where to spend the newly earned money. An important task of the player is to accelerate operations, invest in improvements, new workers, and expand to other parts of the world where volunteers are needed as well. Similar to the other games of its kind, Recyclers United will be free, but advertising will be used and possibly in-app purchases. The plan is to release it by the end of June 2023.

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Technical or other problems that are solved with the work

Ecology is a particularly important issue nowadays because of such problems as global warming and pollution. From an early age, children are taught how to recycle and maintain a green lifestyle. However, for many people, these ideas are not interesting or sound trivial and frivolous. Different me-

dia, such as films, social networks, games, etc., are very suitable for disseminating the ideas. The mobile games market is particularly suited for the diffusion of eco-ideas due to its high popularity among the users of all ages, its accessibility, easy-to-understand content, interactivity, and educational potential. This product is aimed at audiences of all ages, but the main focus is on the school-aged to middle-aged people who like to spend short breaks, public transport journeys, or some free time in front of their smartphone screens. This market is extremely large and growing every year, as smartphones have become more affordable and powerful and people spend more and more time on their phones.

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Novelty of the work

Recyclers United stands out for its unique gameplay mechanics, where players collect and manage rubbish to improve the recycling process. Unlike other similar games that focus on collecting resources, the aim of Recyclers United is to reduce the amount of rubbish on the game map in order to clean up the environment. The game as well has a unique element in the form of volunteers who help to make the collection of litter more efficient. This element allows players to improve their litter-picking process faster and adds an extra challenge when it comes to recruiting and upgrading the appropriate volunteers. Compared to other idle games, this product is unique in that it has a clear game objective to improve the litter management process.

+++

The benefits and value to the potential users

This project aims to raise awareness and encourage the target audience's recycling and litter-picking habits by making the process entertaining. Interactivity plays an important role in translating the actions that take place on the screen into the real-life situations. For example, a player who becomes proficient in the game might have an unexpected and impulsive idea to pick up a piece of rubbish while walking outside, as this action has been repeated many times in the virtual environment. What starts as a small piece of litter could, in the best of cases, escalate into participation in national cleanup campaigns, such as Darom, where the preservation of environment is encouraged.

KeepCHARGED

Vaiva Šarauskytė, Matas Ruša, Ignas Rutkauskas, Karolis Tarutis, Paulius Skliaudys, Norbertas Koncevičius Group supervisor: Prof. Dr. Jevgenijus Toldinas

Kaunas University of Technology (KTU)

Solution area │ Environment

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Description of the work

The initiative of this year's module is called European Green Course; thus, it is no coincidence that the topic focuses on the environmentally friendly electric cars. The team's task is to create a product that encourages as many people as possible to protect nature and choose less polluting vehicles.

In Lithuania, there has been a large fragmentation of companies serving electric car stations. There is no Lithuanian platform that combines all electric car stations in Lithuania, allowing to see the nearest free stations, their connection types, and prices, and create convenient routes. It has been noticed that none of the platforms has an invaluable function for drivers: the possibility of reserving a stop. Thus, the team believes that it is very useful for a driver to know when going to the stop that it will not be occupied during the time until he/she leaves.

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Technical or other problems that are solved with the work

The aim of the work is to create a system prototype that allows aggregating information about all electric car stations in Lithuania, creating routes, and reserving charging stations.

The work objectives are as follows:

1 Familiarize with the topic of the challenge, team members, and perform a macro-environmental analysis,

2 Design a product vision,

3 Get to know the product's target audience,

4 Perform the financial analysis of the market,

5 Create a prototype of the software interface,

6 Create the product platform keepcharged.lt,

7 Prepare clear API documentation.

After fulfilling the set work aim and its tasks, while nurturing the idea that is beyond the limits of the module, it is possible to potentially release a system to the market, which would be an indispensable tool for developers of products, aimed at electric car owners.

In Lithuania, there has been seen a large fragmentation of companies serving electric car stations. There is no Lithuanian platform that combines all electric car stations in Lith-

uania, allowing to see the nearest free stations, their connection types, and prices, and create convenient routes. It has been noticed that none of the platforms has an invaluable function for drivers, i.e., the possibility of reserving a stop. Thus, the team believes that it is very useful for the driver to know when going to the stop that it will not be occupied during the time until he/she leaves.

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Novelty of the work

This solution combines the information of all electric car charging service providers, and the charging station reservations are offered on this platform.

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The benefits and value to the potential users

The benefit of the product, which is being developed for the potential users, is that it will provide information about the availability of all the nearest electric car charging stations and their parameters as well as the possibility of reserving a charging station through the API. Electric car drivers that are using this system will be able to save time.

ELECTRIC VEHICLE ROUTE PLANNING SYSTEM

Arnas Burba, Viktorija Norkevičiūtė, Renatas Jočys, Modestas Seibutis, Ignas Gražulis, Motiejus Šlimas
Group supervisor: Prof. Dr. Jevgenijus Toldinas
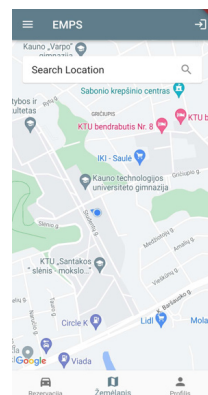
Kaunas University of Technology (KTU)

Solution area │ Environment

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Description of the work

The registered users of a mobile app can view and reserve EV charging stations. The user will be able to compare charging station pricing and select the one that appeals to him/her the best. Additionally, the client will be able to select their destination via the app, and the shortest and fastest routes will be generated for them to choose from based on the user's previously selected car type.

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Technical or other problems that are solved with the work

As the demand for electric cars increases, the need for charging stations does as well, but their number is currently quite limited. Thus, it is important to create information systems that provide information about available charging stations that the electric car users could effectively use them and achieve their desired goal, saving the environment and their time. The target market is electric car users. The created app will be intended for those members of the public who often operate an electric car and charge it at the public charging stations, are able to use the latest technologies, like to plan their time, and want a system that in-

cludes information about the stops as well as draws up routes and reserves stops. The number of electric cars on the road is growing; therefore, the number of users is likely to grow.

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Novelty of the work

It is possible to reserve a charging station.

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The benefits and value to the potential users

The app will help electric car users to plan their journeys more efficiently and make it easier to access charging station information and reserve them in advance.

INSTAGRAM ACCOUNT MANAGEMENT SYSTEM

Rimantas Mockus, Austėja Laurikaitytė

Kaunas University of Technology (KTU)

Solution area │ Digital solutions

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Description of the work

Instagram account management system is written in a particular way, using an appropriate programming language that can be easily integrated into website solutions. The system that has been developed is not the final product to be used immediately by the web users, but rather an interface to create and develop products that are useful to the ordinary users. The system uses a simple and intuitive Application Programming Interface (API) to easily output data into a graphical user interface, where the user is free to perform both manual and automated actions. The system that is being developed does not add any additional functionality to the Instagram platform, but extends the users' ability to track account metrics and facilitate certain actions by providing them in the form of a software code. In order to use the system, the user must be logged in to the Instagram account, thus ensuring the authenticity of the user. The product ensures the security of the user's data, as personal data is not accessed and stored.

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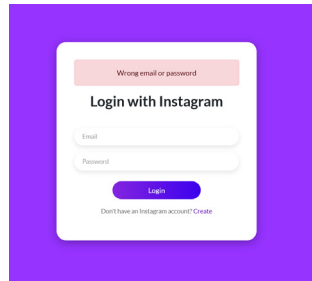
Technical or other problems that are solved with the work

The system that is being developed aims to make it easier for Instagram users to use the social network by automating the actions that the user would have

to do themselves and retrieving the necessary account information that can be used and shared outside the social network. The target market is influencers who use Instagram as a source of income and are interested in tracking their account's statistics and changes (number of followers, account reach).

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Novelty of the work

There are similar Instagram account management systems on the market, but they are implemented in different programming languages. This system is based on the PHP programming language, which in most cases is easier to integrate into the web pages.

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The benefits and value to the potential users

This Instagram account management system can automate some of the processes that an account user would have to do manually, making it easier to use and saving time. It makes it easier for the user to retrieve information from their account and then share it.
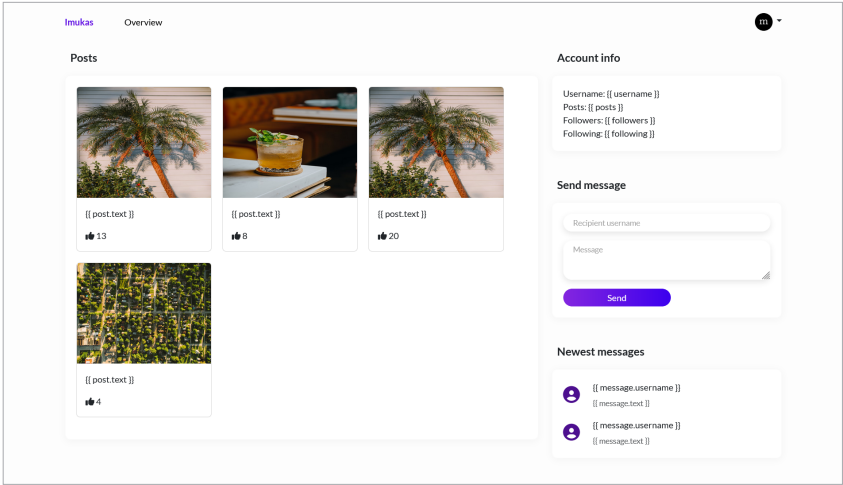
WASTE WARRIORS ACADEMY

Simas Alaunė, Emilija Barkauskaitė, Giedrius Jonaitis
Group supervisor: Lukas Paulauskas

Kaunas University of Technology (KTU)

Solution area | Environment

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Description of the work

Waste Warriors Academy is an interactive 2D computer game that puts children on the front lines of a crucial battle, i.e., the war of waste. As they journey through three levels, players are immersed in the exciting world of recycling, learning about every step of the process along the way. This game has everything from sorting trash into specific bins (such as separating food waste from glass), to using gears to power a shredding machine that turns garbage into small pieces, to discovering the wondrous new products that can be created from recycled materials.

However, Waste Warriors Academy is not only about teaching children how to recycle. It is as well about empowering them to become champions of the environment. The game inspires young players to take action in their own communities by emphasizing the importance of reducing waste and showing how every action can make a difference. Due to its engaging gameplay and dynamic visuals, Waste Warriors Academy is the perfect tool for parents, teachers, and anyone who wants to instill a love of sustainability in the

next generation. Get ready to join the waste warriors and save the planet: One piece of trash at a time!

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Technical or other problems that are solved with the work

The problem that the Waste Warriors Academy solves is the lack of awareness and education about the importance of recycling and its impact on the environment, particularly among children. Many children are not properly taught how to recycle or understand the significance of reducing waste, leading to harmful environmental consequences. The creation of an interactive and engaging game that teaches children about the recycling process from start to finish helps Waste Warriors Academy to fill this education gap and instill a sense of responsibility and passion for sustainability in the younger generation.

The target market for Waste Warriors Academy is children between the ages of 7 and 12, as they are at a crucial stage of development and more receptive to learning new concepts. However, the game can be beneficial to their parents, teachers, and anyone interested in promoting environmental education among children.

The potential market size for Waste Warriors Academy is significant, as it addresses the global issue that affects every individual and community. As the world becomes more conscious of the need for sustainability, the market for products, such as Waste Warriors Academy, is expected to grow in the future.

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Novelty of the work

Waste Warriors Academy's novelty lies in its comprehensive and interactive approach to teaching children about recycling and sustainability. Unlike other educational resources, the game takes children through the entire recycling process from sorting to shredding and repurposing and even discovering new products made of recycled materials. Waste Warriors Academy as well empowers children to take action and make a difference in their com-

munities, promoting a sense of responsibility and passion for sustainability. This unique approach sets the game apart from other recycling games and educational resources on the market.

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The benefits and value to the potential users

The potential users of the Waste Warriors Academy, primarily children, will benefit from the game in several ways. Firstly, they will gain a better understanding of the importance of recycling and how it can help to protect the environment. The game's interactive nature will help to educate children in a fun and enjoyable way, making them more likely to remember the lessons taught in a game.

Secondly, children will develop critical problem-solving skills, as they progress through the levels of the game. They will learn about teamwork and collaboration, as they work together to complete tasks and achieve common goals. Thirdly, the game will inspire children to act in their own communities and make a positive impact on the environment.

EDUCATIONAL RECYCLING APP FOR CHILDREN VĖŽLIUKAI RŪŠIUOJA

Aurimas Būta, Agnė Gečaitė, Emilija Gailiūtė, Adrija Kučinskaitė, Irmantas Linkis, Povilas Tamulis
Group supervisor: Assoc. Prof. Dr. Ingrida Lagzdinytė-Budnikė

Kaunas University of Technology (KTU)

Solution area │ Food

Description of the work

The climate crisis has become an urgent and significant challenge for society, and while there are several ways to address it, recycling is one of the most effective ways in which everyone can contribute to a greener environment. Unfortunately, the circular economy is yet to

become part of the daily routine. In order to help to solve this problem, the team developed an app called Vėžliukai Rūšiuoja to educate the younger generation about recycling in a fun and interactive way.

The app features an AI-driven scanner that helps users to learn how to properly recycle packages. The users can scan different types of packages with this feature and receive assistance on how to recycle them. This can be particularly helpful for children who are not familiar with recycling practices. In addition to the AI scanner, the app provides children with other features,

such as reward collection, interactive courses, and a quiz, all designed to motivate them to learn new eco-friendly habits and values.

This app will bring eco-friendly habits and values to the next generation and give parents and teachers a new tool to educate children as well. They can teach children about recycling and other important environmental topics in an innovative and engaging way with this app.

Vėžliukai Rūšiuoja can make a real difference in creating a greener future for everyone. As more and more people become aware of the climate change, the team hopes to see a positive impact on the environment and the world.

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Technical or other problems that are solved with the work

This product mainly focuses on the promotion of recycling in the younger generation. The team has surveyed to check children's knowledge about recycling and whether their parents believe that their children lack common knowledge in this field. The results showed that there is a need to improve children's understanding of recycling, and in order to do that, it has been decided to create a product that will educate children on how to recycle trash in an interactive and entertaining way. Because of this app that will allow children to scan packages and provide interactive instructions about how to recycle them, children will


have a chance to learn about ecology in their home environment. The team will draw attention of the younger audience with additional features, such as educational quizzes for collecting points and unlocking profile customization, mini games for competing with their friends as well as a rewards section to keep track of their recycling journey. This app will as well give a new and innovative way for parents and teachers to teach about recycling and other environmental topics. Overall, this app will empower the next generation to create a more sustainable and green future.

Novelty of the work

This solution offers a unique and engaging approach to educating Lithuanian children about recycling. While there are various products available, such as video content and simple video games, they are often outdated and not suited for the Lithuanians, as they are primarily in English. In contrast, this interactive app provides a modern
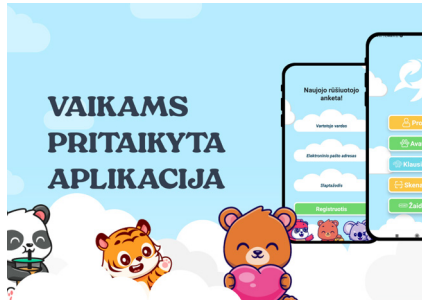
learning experience and features an AI-driven scanner, which is a novelty in the current market. This app is specifically tailored to the needs of the local market with all text and audio in Lithuanian. Overall, this app provides a novel and effective way for children to learn about the importance of recycling in an entertaining and interactive manner.

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The benefits and value to the potential users

This interactive app offers valuable benefits to the potential users. Firstly, it makes the learning process about recycling engaging for children. The app provides a fun and interactive way for children to learn about recycling, which can encourage them to adopt sustainable habits at an early age.

Secondly, the app features an AI-driven scanner that can assist users in properly recycling packages. This is particularly helpful for those who are unsure about how to recycle a specific item.

Thirdly, this app can help to develop eco-consciousness in children, an increasingly important skill in the modern world. Parents and teachers can educate children about the importance of recycling and encourage them to become more environmentally aware by using this product.

BOTTLE MIRROR

Gerda Žemaitaitytė, **Arnas Švenčionis**,
Vaiva Šarauskytė, **Gabrielė Bražėnaitė**

Kaunas University of Technology (KTU)

Solution area │ Food

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Description of the work

Bottle Mirror is a mobile app that combines the power of AI and visual recognition to detect a specific wine brand. Once the app is launched and a camera is pointed at a wine bottle, the app analyzes the label and identifies the specific wine that is scanned. After the wine is recognized, the app provides user with additional information, including residual sugar scale (how dry or sweet the wine is), detailed tasting notes, including flavor profiles, aromas, suggested serving temperatures, and recommended drinking time. All this information is presented as a pop-up table in an AR environment with the addition of some 3D visualizations, represent-

ing specific flavor notes of the wine (for instance, apples, vanilla, or tobacco leaves), which appear next to the wine bottle. Moreover, the users are offered to see meal suggestions that go well with the wine. Such recommendations appear as another pop-up table. In the development of this program, several software programs were used. Photoshop and Blender were used for object editing and creation, while Unity and Vuforia were used for arranging them in the required locations and bottle recognition.

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Technical or other problems that are solved with the work

Bottle Mirror app simplifies the process of learning about wine. Instead of relying solely on labels, users can quickly and accurately identify wine and

access relevant details about it. It is especially useful for those who are new to wine and need help in differentiating them.

The target users of such an app are those who enjoy using technology and learn about things and may be described as:

1 Wine enthusiasts: users who have a deep passion for wine, enjoy exploring different varieties, and want to expand their knowledge and understanding.
2 New wine drinkers: individuals who are new to the world of wine and seek guidance in understanding and selecting wines based on their preferences.
3 Wine shoppers: individuals browsing wine shops or supermarkets who want to learn more about a specific wine before making a purchase decision.

Wine has a broad appeal and attracts a diverse range of consumers to use an app such as Bottle Mirror. The global wine market has experienced significant growth over the years. According to a report by Market Research Future, the global wine market size was valued at around $324 billion in 2019 and is projected to reach approximately $444 billion by 2027.

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Novelty of the work

The most similar solution in the market is Vivino app. It leverages the power of community-driven data and user-generated content to provide information about wines. It includes wine scanning and image recognition. However, Vivino does not provide taste information and meal suggestions, unless other users leave such recommendations. Unlike Bottle Mirror, Vivino does not use AR, which could make Bottle Mirror more interactive and engaging for a user. Lastly, Vivino does not have Lithuanian wines in its database; therefore, Bottle Mirror could fill this gap in the market and propose a new way to learn about wines for the Lithuanian market.

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The benefits and value to the potential users

Value of Bottle Mirror for the users:

1 Enhances knowledge and understanding of the wine,
2 Enables users to make informed decisions, discover new wines in a fun and interactive way,
3 Is a great shopping companion for those who have a new or non-professional interest in wine and need help in differentiating wines.

TVARKIS – GARBAGE MONITORING AND COOPERATIVE CLEANING SYSTEM IN THE CITY OF KAUNAS

**Žilvinas Žitkauskas, Erika Paulauskaitė,
Justas Višpulskis, Mantas Vaitkus**
Group supervisor: Lukas Paulauskas

Kaunas University of Technology (KTU)

Solution area │ Environment

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Description of the work

This system encourages people in the area of Kaunas to group up or individually clean the city from trash or non-toxic pollution. The main benefits of this system are ease of use, familiarity, and, of course, environmental protection. This website can be reached through a personal computer or mobile phone; the interface is similar to the maps application. Users pin a location and add a picture that other users could see the amount and type of trash. The next step is clearing the polluted area, for example, loose trash: users can organize a clean up, and after providing a picture for verification, get points for cleaning the area. Later, those points can be used to get perks and gifts from the potential sponsors, encouraging the process. All in all, the system's goal is to increase engagement in environment protection and make those good deeds noticed and rewarded.

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Technical or other problems that are solved with the work

The rubbish mapping system is very relevant today due to the growing concerns about the climate change, weather pollution, and other environmental problems. The goal of the project is to create a mapping labelling system that would have a positive impact on the environment and the economy.

The rubbish mapping system will allow users to create pins in those places on the map where pollution is the highest. This will allow for a more accurate and comprehensive understanding of the extent and distribution of pollution in different areas. This data can then be used to inform waste management policies, improve pollution control efforts, and promote better waste disposal and recycling practices.

The target market for this product is persons aged 20–24 who are environmentally conscious and interested in taking action to address pollution and climate change. This demographic is concerned about the environmental issues and is more likely to engage in environmentally sustainable behaviors. In addition, this age group is more likely to use technology and social media to engage with environmental issues and share information with their peers.

The size and growth potential of this market is significant, given the increasing public awareness and concern about the environmental issues, including pollution and climate change.

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Novelty of the work

The main ways, in which this website differs from others in the Lithuanian market, are as follows:

- Localized focus: this website is focused specifically on the city of Kaunas, which helps to concentrate efforts and address the unique challenges (opportunities) in the community of Kaunas.
- Community-driven approach: the website is focused on building a stronger community by encouraging people to come together to clean up their city. It addresses the issue of climate change by reducing waste and increasing recycling. This approach fosters a sense of pride and ownership in the community and can help to create a culture of sustainable living.

Gamification element: the website includes a gamification element by awarding points and prizes for cleaning up the trash spots. This encourages people to take action and makes the process more entertaining and engaging.

Data-driven insights: as people use the website to pinpoint trash spots, the team will be collecting valuable data on where the most littered areas in Kaunas are located. This data can be used to inform city officials and other stakeholders on where to focus their efforts to improve the cleanliness of the city.

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The benefits and value to the potential users

Firstly, it will allow users to contribute to a more accurate understanding of pollution in their local areas. Users will be able to identify areas where pollution is particularly high by creating pins on the map and bring attention to these issues.

Secondly, the system will enable users to connect with other like-minded individuals who are interested in environmental issues and engage in discussions and collaborations aimed at pollution.

Thirdly, the rubbish mapping system will provide a valuable resource for environmental organizations who are working to address pollution and promote better waste management practices.

Overall, the pollution mapping system will bring significant value to its target market by empowering individuals to take action on the environmental issues.
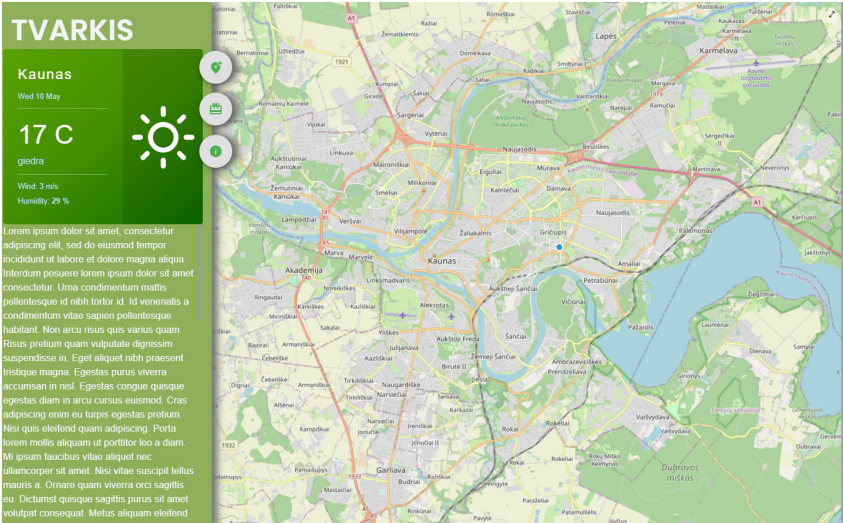
RooMates – AN APP THAT WILL HELP PEOPLE FIND ROOMMATES AND HOUSING: SHARE A SQUARE!

Deimantė Kilkytė, **Tautvydas Kilkis**, **Deimantė Kilkytė**, **Viktorija Ašiuraitytė**, **Gabija Miliūnaitė**, **Nojus Raškevičius**
Group supervisor: Sandra Paštuolytė

Kaunas Saules gymnasium

Solution area │ Digital solutions

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Description of the work

The goal is to create an innovative and reliable app that makes it easy for users to find a roommate or accommodation according to their interests and needs. The aim is to ensure smooth running of the app as well as build an active and strong community where users can share experiences and help each other.

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Technical or other problems that are solved with the work

Every year, rental prices of housing increase, and the utility taxes are constantly rising; thus, living alone causes a particularly strong increase in expenses.

The team aims to solve these recent problems with this app as well as promote community by creating a virtual environment for user communication.

Novelty of the work

At the moment, there is no such ser-
vice in the market. Therefore, this solu-
tion is unique. Even though Facebook
groups are similar to this solution, it is
still different from them in many ways.
This service will be centralized in one
app with many functions, such as, peo-
ple's preferences, communication tabs,
identity verification, and community
discussion tab.

UA2W – MARKETPLACE FOR SELLING UKRAINIAN GOODS AROUND THE WORLD WITH AUTO TRANSLATION INTO 102 FOREIGN LANGUAGES

Iryna Bielotska

*Kaunas University of Technology (KTU)*

Solution area │ Digital solutions

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Description of the work

UA2W (https://ua2w.com) is a free online marketplace for selling Ukrainian goods and services around the world with automatic translation.

More than a year ago, a war began in Ukraine, and the life of the Ukrainians has changed significantly. Some of them lost their jobs, houses; about 8 million people left the country. Despite this fact, even being far from home, Ukrainians want to be useful and earn by their own labor. They sew clothes, draw pictures, create toys, provide services. According to the calculations of the Polish Institute of Economics, during only 9 months of 2022, Ukrainians registered 13,800 companies and sole proprietorships in Poland, which is more than 7% of the entire business sector of Poland.
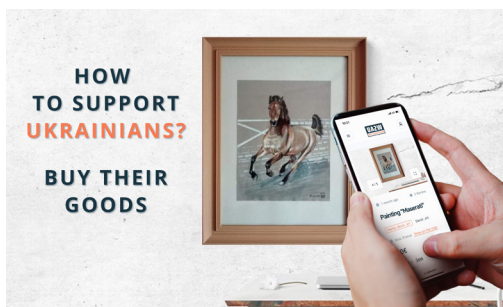
UA2W platform is a contribution to the development of Ukrainian business in the international market and help to the Ukrainians who are facing difficulties. Thus, anyone can add their ad in less than a minute for free, and it will be available worldwide with translation into

more than 100 foreign languages. The functionality includes: publication of ads, automatic translation into 102 foreign languages, internal chat for users, search by keywords, filters by cities, categories and characteristics, interactive map with ads.

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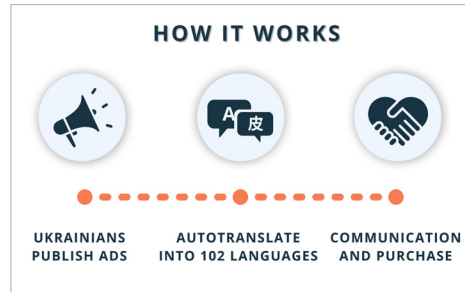
Technical or other problems that are solved with the work

Ukraine is a country filled with hardworking and talented people who produce amazing goods that are loved all around the world. Due to the ongoing war, it is becoming increasingly difficult for the Ukrainians to sell their goods and earn a living. Unfortunately, not all of these people have enough foreign languages and technical skills, and financial resources to, for example, create a website, set up Facebook sales ads, pay marketing specialists, or use complex international marketplaces, such as Etsy or eBay. It is a fact that it is impossible to register on Etsy (a platform for selling handmade goods) from Ukraine, according to the company's rules.

Therefore, a free platform has been developed that does not require a user to be a specialist in programming, marketing, or know foreign languages, but at the same time, it will enable Ukrainians to sell their goods and services around the world.

The second group of users is buyers who are interested in buying Ukrainian goods and services. It can be both Ukrainians and foreign citizens. Potentially, UA2W can as well become an effective platform for banner advertising and a source of useful information.

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Novelty of the work

A key feature of the UA2W platform is that this marketplace is easy to use. Even persons without any technical skills will be able to add their ad or find

the right product, service in less than 1 minute. There is no need to know a foreign language or create hundreds of ads in different languages: the platform will automatically translate the ad from Ukrainian into a user-friendly language and show buyers on the map what goods and services they can buy nearby.

Last but not least, the platform is completely free for both sellers and buyers. This is not a commercial project, but a way to support people who need support.

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The benefits and value to the potential users

In fact, 30 years ago, my grandmother was selling milk at the market. Now, my mother runs a company that makes armored doors. Despite the fact that these doors are presented in 15 showrooms, more than 75% of customers come via Internet.

Although bazaars and shops continue to exist, but, as Bill Gates said: "If your business is not on the Internet then your business will be out of business".

UA2W is an online classifieds platform that allows Ukrainians to sell their products to people all over the world.

At the same time, using the UA2W platform, people from all over the world will be able to support Ukrainian businesses and families and help them get through these difficult times.
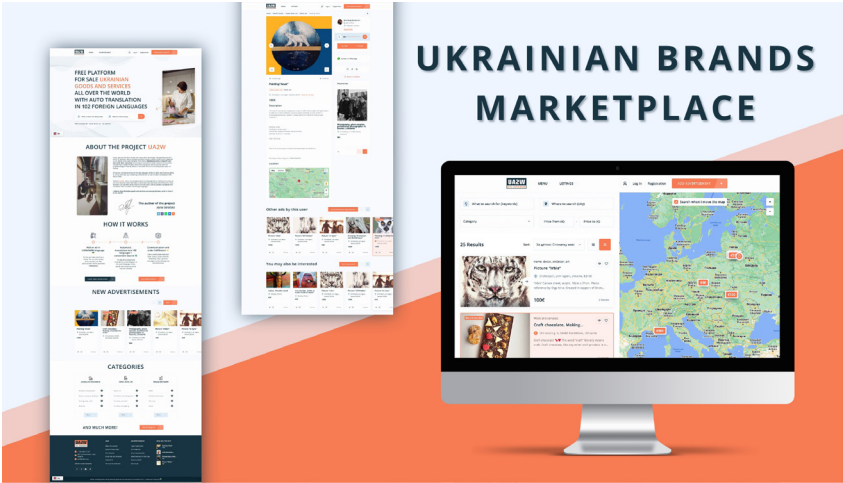
PASSIVE SMD ELECTRONIC COMPONENTS ASSEMBLY INSPECTION

Evaldas Katilius, Eidenis Kasperavičius

Kaunas University of Technology (KTU)

Solution area │ Digital solutions

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Description of the work

One of the worst things that can happen to electronics manufacturers is a product failure due to a malfunctioning (or non-functioning) printed circuit board (PCB). For example, in September 2022, KIA recalled about 70,000 cars due to faulty PCB. One of the main reasons why a designed board may not function is improperly soldered components: improperly placed, too much or too little solder, and wrong melting temperature. It is crucial to diagnose these problems before the final assembly of the product; thus, the optical inspection is one of the main steps in producing printed circuit boards. During this stage, every electronic component that is placed is checked: whether it is placed on the right side, in the right direction, whether the right amount of solder is used, and it is properly soldered because it is cheaper to fix early-detected component assembly errors. At this stage, it is especially
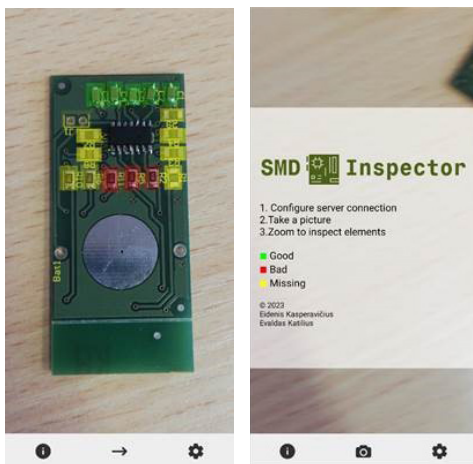
worth applying artificial intelligence methods, one of the fastest-growing tools for processing optical images, thus reducing the inspection costs, time and ensuring good quality.

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Technical or other problems that are solved with the work

This product can ensure the assembly quality of the printed circuit board.

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Novelty of the work

This device is unique in that it is mobile and easy to use. The devices available in the market are industrial, and this one can be used in a personal smart device.

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The benefits and value to the potential users

It is easy to use, does not take up space, and can be used by any electronics technician or any enthusiast.

PORTABLE AIRCRAFT TRACKING SYSTEM ADS-B TRAC

**Simonas Riauka, Kipras Jasiūnas, Tadas Rybelis,
Lukas Nagulinas, Tautvydas Dirsė, Kasparas Jasiūnas,
Almantas Karosevičius, Assoc. Prof. Dr. Darius Kybartas
Group supervisor: Assoc. Prof. Dr. Pranas Kuzas**

Kaunas University of Technology (KTU)

Solution area │ Digital solutions

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Description of the work

ADS-B TRAC system is designed to receive ADS-B communication packets that are mandatory in commercial aircraft. ADS-B packets include aircraft ID (as well known as tail number), GPS coordinates, altitude, velocity, planned trajectory, etc. USA government has plans to make ADS-B transponders mandatory in every consumer drone under ~250 grams. ADS-B devices allow consumer drones to use Sense and Avoid system. ADS-B TRAC started out as a semester project at the Electronics Engineering Department of Kaunas University of Technology and was developed by students to fully functional prototype stage.

ADS-B TRAC system is able to track aircraft in two methods:

1 ADS-B packet decoding method: receive and decode ADS-B packets, using only one ADS-B TRAC unit.

2 Multilateration method: received ADS-B packets are processed in server, and aircraft position based on the packet arrival timestamp is calculated. This method requires at least four ADS-B TRAC units for 3D coordinate solution.

The research goal is to assess aircraft tracking speed, resolution, and precision, using these two methods, and explore the possibility by using this technology for high-speed tracking of consumer drones and other types of aircraft in distance limited areas, up to several kilometers range.

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Technical or other problems that are solved with the work

Portable ADS-B tracking system ADS-B TRAC can find its use as a local solution for drones and other aircraft, equipped with ADS-B transponders tracking, and in those cases, when aircraft does not transmit global coordinates in the ADS-B message.

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Novelty of the work

The novelty of the work is based on the embedded solution of the tracking system, which possesses a flexible ability to discriminate the required signals or patterns in the selected frequency band.

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The benefits and value to the potential users

Integrated modular portable solution ADS-B TRAC has the ability to track, process, and time stamp the arriving ADS-B packets and store the data in Internet server for the analysis, visualization, and long-term storage. The prototype solution is offered in a water-resistant case with the ability to operate autonomously up to two hours, using 12–15 V external power supply.

HIGH RESOLUTION PCB UV EXPOSITION DEVICE

Rimas Bacevičius, Martynas Kišonas, Vytenis Kibildis, Abdul Salam Asif, Tchuisseu Ndjionkou Armel, Gante Shankar Dhanalakshmi
Group supervisor: Assoc. Prof. Dr. Pranas Kuzas

Kaunas University of Technology (KTU)

Solution area │ Digital solutions

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Description of the work

The prototyping in electronics engineering is related to the PCB manufacturing. The factories in Europe and China offer very attractive services in terms of making the PCB prototypes. However, in the development process (especially in the initial stages), it is not always necessary to have the finished PCB with a silkscreen, metallization, and solder mask. There are situations when relatively large area PCBs are necessary in prototyping (power sources, patch antennas, etc.), which increase the cost of prototyping. The manufacturing turnaround time is as well significant in rapid prototyping. In order to decrease the cost of the prototype, cheap services may be selected, and this increases leading times. The manufacturers in Europe are able to make PCBs in several days, but this increases the cost significantly. Therefore, there is strong motivation to have rapid PCB prototyping alternative in the laboratory at the fingertips of electronics engineer. The prototype production, using the chemical etching method, gives good results, but the outcome heavily depends on the quality of the UV exposition. The proposed laser exposure device is a high-resolution solution. In order to get the best results from the laser exposure, the proper lightweight mechanical system and software/driver solution for driving were designed. This is an engineering problem, including both mechatronics and electronics fields for the best result. When using the proposed high resolution PCB UV exposition device, fast and accurate PCB prototyping results can be achieved, the production cost can be minimized, and less chemicals are used.

Technical or other problems that are solved with the work

The presented high resolution laser exposition device allows to expose the photoresist of conductive layer of the PCB prototype faster and with high resolution for further processing, using chemical method. The resources and materials are saved by using this device in the manufacturing process of the PCB prototype because of the reduced percentage of failures; the environment is polluted less in those cases when the PCB prototype can have less layers than the final PCB.

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Novelty of the work

The proposed high resolution laser exposition device has a compact foot-print. The functional advantages are that it can operate without external computer; the data is transferred using SD memory card; the data file content can be opened by using any text editor for checking; the exposition file can be generated directly from the image files. The device has extended functionality for precision coordinate homing cycle and software support for double side PCB exposure.

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The benefits and value to the potential users

The potential users would benefit from the proposed high resolution laser exposition device, having it in the electronic engineering laboratories to improve the prototyping process in those cases when the PCB prototype can function, having only conductive layer(s). The high-resolution laser exposition device allows to prototype PCBs with modern small form factor SMD devices.
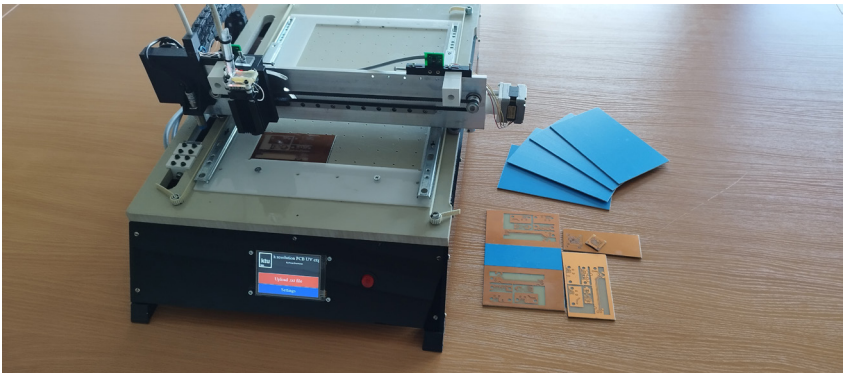
MAINS VOLTAGE SWITCH CONTROLLED BY BLUETOOTH INTERFACE AND SOUND

Dominykas Jankauskas, Gintarė Ligeikytė, Justas Petkus
Group supervisor: Assoc. Prof. Dr. Pranas Kuzas

Kaunas University of Technology (KTU)

Solution area │ Digital solutions

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Description of the work

Due to the current situation in the energy price market, consumers increasingly pay attention to how much electricity is consumed by devices in their home. Smart meters have become a tool that allows to see the consumption data, analyze and change consumption habits easily and understandably. How-

ever, it can be difficult to monitor and evaluate the electricity consumption of an individual device, since the meters installed in the residents' homes only show the total amount of electricity consumed, and the solutions for displaying the readings to the user show the energy consumption, refreshed every 15 minutes. Monitoring the device's electricity consumption in real time (with 1 second resolution), for example, in smart devices via Bluetooth interface, could allow the user to evaluate the device's electricity consumption, perhaps, even testing its different working modes to find out the most efficient one and thus reduce the overall energy consumption. Moreover, a user does not always have the ability to turn on/off a certain device, such

as a water, air heater, or other electrical devices; thus, the same Bluetooth interface can be used to control the device's on/off. In some cases, turning the device on/off mechanically is inconvenient or difficult in the case of a disability; thus, sound control was implemented as an additional function of the device, which could eliminate inconvenient movements. The delivered device is intended for controlling (turning on/off) mains powered devices connected to it via a Bluetooth mobile application or by sound. Moreover, measured electricity consumption results are transmitted to a mobile device, where the data is displayed graphically and can be stored for further analysis.

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Technical or other problems that are solved with the work

Due to the current rise in electricity prices, consumers are paying attention to the consumption of electricity. The product that is being developed provides an opportunity for the user to monitor the electricity consumed by the devices in real time through a mobile application. There is as well a possibility to turn devices on/off through a mobile application or with the sound of claps. The target market of the device being developed is smart consumers who are focused on reducing the energy consumption of their electrical devices.

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Novelty of the work

The created device differs from the existing devices in that the device implements synchronous measurement of voltage and current through separate galvanically isolated channels. The device is controlled through a mobile application, which records the energy consumed by the mains powered devices in real time (with a periodicity of 1 second).
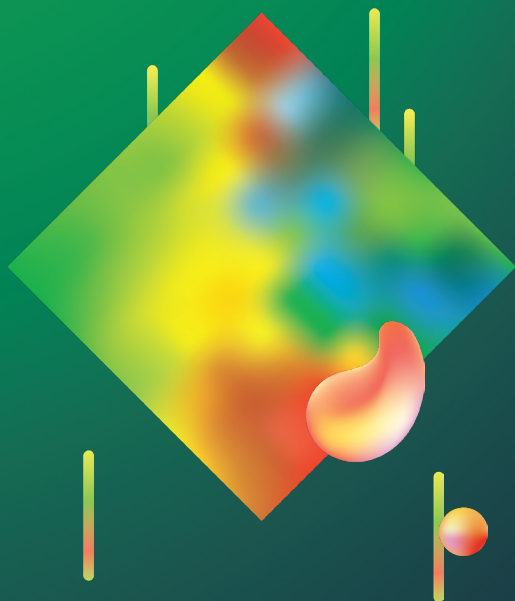
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The benefits and value to the potential users

Users will have the opportunity to monitor the power consumption of their devices through a mobile application. They will as well be able to turn devices on/off through a mobile application or with the sound of claps.

MECHANICS

INNOVATIVE KETTLE

Mantas Šiupienius, Skaistė Paškauskaitė, Rugilė Ambrakaitytė, Mykolas Adomaitis, Andrius Mezencevas, Joris Gagilas
Group supervisor: Assoc. Prof. Dr. Benas Gabrielis Urbonavičius

Kaunas University of Technology (KTU)

Solution area | Environment

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Description of the work

This new innovative kettle has been designed to reduce water and energy consumption in the kitchen. It has a unique feature: it only boils a specified amount of water. This means that it is not necessary to boil a large amount of water to make a drink or tea. Additionally, this kettle conserves water reserves, because it does not have excess water that could be poured back into the spout.

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Technical or other problems that are solved with the work

This kettle is an energy-saving device. This is achieved because it uses only the necessary amount of water and does not boil excess water. This kettle can be regulated to achieve the desired water temperature level. This is especially useful when boiling water for different types of products or dishes.

This kettle is not only useful in home kitchens but in workplaces, restaurants, and hotels as well. It helps to reduce water and energy costs, which means that one can lower personal expenses and contribute to a smaller environmental footprint.

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Novelty of the work

This kettle has a unique water saving feature that allows users to boil only the amount of water they need, rather than the full capacity of the kettle, as in the traditional kettles. This provides more benefits and helps consumers to save water and energy. This kettle is safer than the traditional kettle because it does not use the excess water and does not pose a risk of heating the water. This is especially important for the environment, consumers, and the safety of homes. Due to the water and energy saving features of this kettle, it contributes to the lower carbon dioxide emissions and thus helps to save nature. This is very important for consumers who care about protecting the environment and contributing to a sustainable future.

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The benefits and value to the potential users

It has the following benefits:

- Water and energy saving: this kettle helps users to save water and energy by boiling only the required amount of water and not boiling the excess water. This means that consumers can reduce their costs and thus contribute to a smaller footprint on the environment.
- Convenience and efficiency: this kettle is convenient and efficient as it allows users to boil the right amount of water without excess. In addition, the kettle can be adjusted to achieve the desired water temperature level, which is especially useful when one needs to boil water for the preparation of different products or dishes.
- Versatility: this kettle can be used not only at homes, but at workplaces, hotels, restaurants and cafes as well, making it more attractive and widely available to the potential users.

DYNOSTAND FOR ELECTRIC SCOOTER

Matas Kuncevičius, Deimantas Dovidonis
Group supervisor: Assoc. Prof. Dr. Pranas Kuzas

Kaunas University of Technology (KTU)

Solution area │ Digital solutions

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Description of the work

The work consists of a physical stand that holds electric scooter in place and an embedded system, which measures the driving dynamics of a scooter. The scooter's motor is placed between the dummy wheel and driven wheel, which creates the controlled mechanical resistance. As the electric scooter wheel motor spins, the stand creates mechanical resistance by using air pressure controlled clutch. The intensity of the resistance along with the data from force and RPM sensors are collected in a computer with the help of an embedded system. The measurements are displayed in graphs. The result of these measurements is the RPM's and torque data at a certain level of mechanical resistance with respect to time.

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Technical or other problems that are solved with the work

In the market of electric scooters, there is a lack of detailed information on the products that are being sold. The maximum motor power specification alone (the one that the manufacturer provides) is in abstract units of measurement, because the conditions at which maximum power is achieved are unknown. The manufacturers refuse to specify parameters, such as maximum RPM's and torque. An advanced customer who knows these parameters is able to evaluate if their electric scooter of choice suits their needs better. For instance, if an electric scooter is often used to climb hills or carry

heavy loads, then a scooter capable of driving a high-torque motor would be preferred. For the proposed device, the target market would be focused on the electric scooter repair shops, tech journalists, and enthusiasts that review the electric scooters. The electric scooters are gaining more popularity each year; thus, the need for more detailed information on the product will be required to differentiate between various electric scooter models.

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Novelty of the work

To the best of the authors' knowledge, no such product exists in the market. Similar solutions for cars and motorcycles have been in existence for decades, but nothing similar has been offered in the market for electric scooters yet.

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The benefits and value to the potential users

The target customer of dynostand for electric scooter would be able to understand the capabilities of the selected electric scooter better. If the scooter is to be tuned or modified, then such product would provide the measurements required to customize the scooter's performance. If electric scooter is experiencing technical issues, such as lack of torque, such product would be useful in finding the root cause of failure.
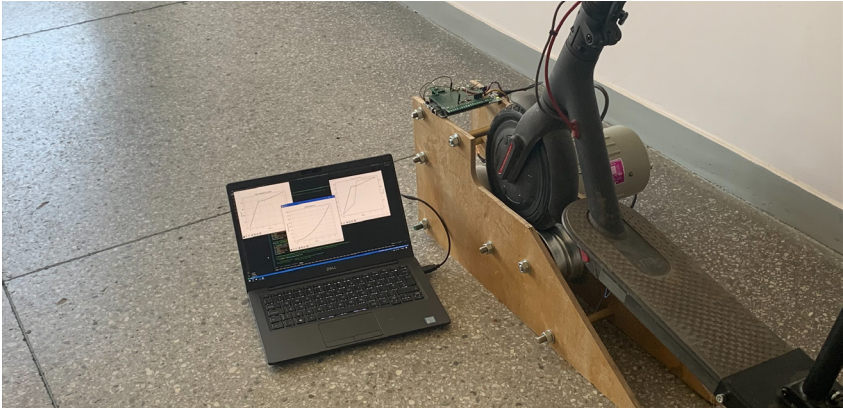
3D ENVIRONMENT SCANNING DEVICE

Lukas Nagulinas, Rimas Bacevičius
Group supervisor: Assoc. Dr. Prof. Pranas Kuzas

Kaunas University of Technology (KTU)

Solution area | Digital solutions

+ +

Description of the work

The 3D environment scanning device is oriented towards gathering spatial (3D) data, using Lidar sensing technology. The coverage angle of the proposed device is 360 in the horizontal plane, 250 degrees in the vertical plane. The range of operation is 0.5–6 m. The horizontal angle resolution is 1°, which could be maximized to ~0.35°. The distance measurement resolution is <2 mm. The scanned data is written into the memory card of the device or sent via Wi-Fi communication in a default point cloud format (*.xyz), which is compatible with the modern point cloud import tools, 3D visualization, and editing software. The device is suitable for scanning objects, recreating shapes and areas, which are difficult or sometimes impossible to measure with traditional contact techniques. The 3D environment scanning device is powered from an external battery.

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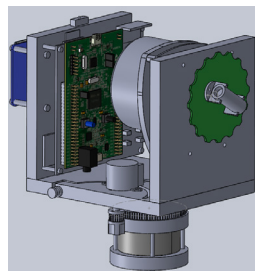
Technical or other problems that are solved with the work

Ancient architecture usually has high ceilings and columns, and there appear difficulties of recreating them for restoration. Moreover, in a newly built house, an architect or a designer can scan the area and by importing point

cloud it to appropriate software, make a design for a client. The bulky items, car body parts, and other objects can be scanned without moving or dismounting them.

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Novelty of the work

The majority of analogous 3D scanning devices on the market are expensive, and smaller offices of architects/designers cannot afford such devices. The proposed device would give an opportunity to implement 3D scanning of moderate range and resolution for small businesses, freelance artists, model makers, etc.

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The benefits and value to the potential users

Users may find it useful getting the point cloud with additional information for determining the position and orientation of the point cloud, which is implemented using the GPS position sensor, accelerometer, gyroscope, and magnetometer data, which create a unique time and space data stamp. The recreation areas and shapes become easier, as the result work efficiency grows. The places that are difficult to reach due to the human limitations can be scanned. The convenient user interface is designed by using the touchscreen LCD display with a possibility to extend the functionality (e.g., to limit the scanning area by using the laser pointer aid).
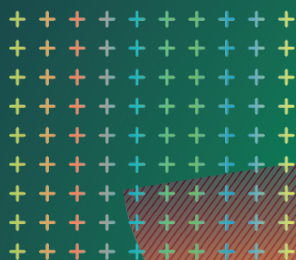
NATURAL SCIENCES AND MATHEMATICS

DEEP-LEARNING BASED SYSTEM OF DETECTION OF SURFACE CRACKS

Ugnė Orinaitė, Minvydas Ragulskis, Mayur Pal, Viltė Karaliūtė

Kaunas University of Technology (KTU)

Solution area | Digital solutions

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Description of the work

Deep learning-based methods, especially convolutional neural networks, have been developed to automatically process the images of surfaces for crack identification tasks. Although deep learning-based methods claim very high accuracy, they often ignore the complexity of the image collection process. Real-world images are often impacted by complex illumination conditions, shadows, the randomness of crack shapes and sizes. In this work, the team explores the complexity of image classification for surface crack detection in the presence of demanding illumination conditions. The challenges associated with the application of deep learning-based methods for detecting surface cracks in the presence of complex environmental conditions are elaborated in this presentation. Novel augmentation techniques are developed to increase the accuracy of automatic detection of surface cracks.

++

Technical or other problems that are solved with the work

The developed methodology allows for the detection of cracks on various surfaces under complex lighting and environmental conditions. The target market for such a product consists of accreditation and maintenance companies of complex technical systems. Typical examples are companies performing the certification of high-rise chimney structures, inspection of

bridge supports, testing of underwater structures and pipelines. This market of potential customers is rapidly developing and changing, especially considering the dynamic geopolitical situation both in this region and the global markets.

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Novelty of the work

The novelty of the proposed solution is primarily represented by the recent research publications of the team in leading specialized scientific journals. Two main aspects of scientific innovation could be noted. Firstly, these are the new aspects of architecture of neural networks. Secondly, these are the new augmentation algorithms that allow expanding the training databases collected in laboratory-based environments.

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The benefits and value to the potential users

The proposed product provides significant added value to the target market. For example, the monitoring of the structural damage of underwater pipelines is an expensive and even dangerous task, especially when human divers are involved in the process. Underwater robotic cameras with the proposed image analysis software would allow to automate complex monitoring processes and increase the accuracy and efficiency of such monitoring exercises.
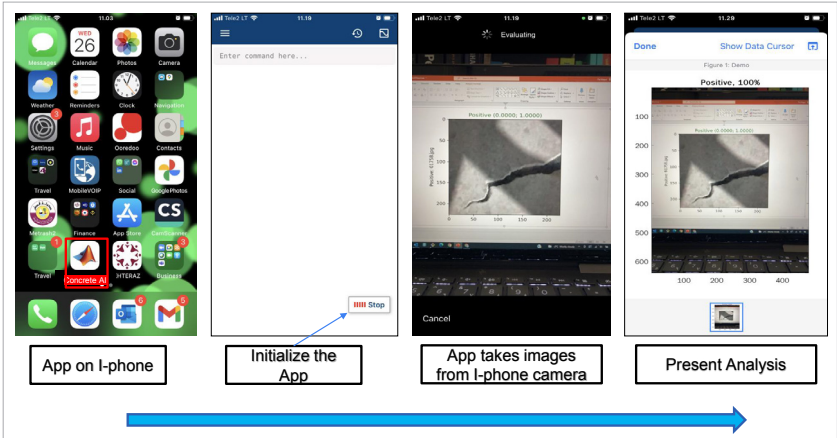
KNYGNEŠYS

Agnė Kazakevičiūtė, Saulė Bielevičiūtė, Viktoriya Brazhenko, Elzė Pilibaitytė, Gabija Šeškauskaitė, Tadas Šopis
Group supervisor: Assoc. Prof. Dr. Jurgita Čyvienė

Kaunas University of Technology (KTU)

Solution area │ Digital solutions

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Description of the work

The product idea is a mobile app that acts as an intermediary between the employees of Kaunas Municipal V. Kudirka Public Library, clients, and couriers (volunteers). When using this app, the library clients can order books to be delivered to their home or workplace when they do not have the time or ability to pick up their order at the library. Book delivery is carried out with the help of volunteers, and the team relies on the idea that most of the volunteers will be students who are collecting social-civic activity hours.

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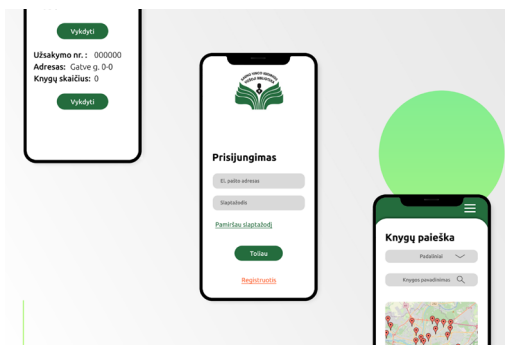
Technical or other problems that are solved with the work

This product helps to solve the biggest problem of limited access to the library for customers who do not have the time or ability to physically visit the library to pick up the books. The created mobile app facilitates the process of ordering and delivering books and provides people with an easy

way to access the library's resources from their home or workplace. Due to utilizing volunteers as couriers, the students are encouraged to engage in social-civic activities. Overall, the product expands the accessibility of the library's resources and increases the civic engagement of students.

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Novelty of the work

The novelty of this product lies in the combination of several functions, which together create a unique and innovative solution to the problem of limited access to the library resources:

- Mobile app: the service is provided through a mobile app, which allows users to order and receive books directly to their home or workplace.
- Volunteer couriers: the service uses student volunteers as couriers who deliver books to the users, which provides a valuable service to the community and promotes social and civic engagement among the young people.
- Focus on accessibility: during service delivery, great emphasis is put on the accessibility, making it easier for users to access library resources from anywhere and at any time.

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The benefits and value to the potential users

The potential users of this product, such as busy professionals, students, and others who may not have the time or ability to physically visit the library and pick up the books, will benefit from the convenience and accessibility provided by the mobile app. The benefits of the product include:

- Convenience: users can order and receive books directly to their home or workplace without the need to physically go to the library.
- Time-saving: users can save time by not having to travel to and from the library to pick up books, which can be especially useful for those with busy schedules.
- Increased accessibility: the product enables users to access the library's resources easily and from anywhere, which can be particularly beneficial for those who live far from the library or have mobility issues.
- Social and civic engagement: due to utilizing volunteers as couriers, the product promotes social and civic engagement among students who can earn social-civic activity hours while providing valuable services to the community.
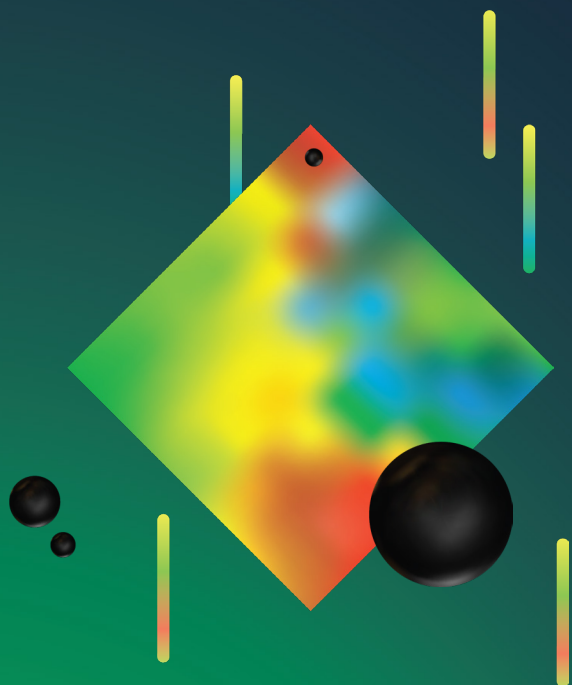
INTERDISCIPLINARY WORKS

NOVEL EASILY SYNTHESIZED HOST MATERIAL FOR EFFICIENT OMNI-FRIENDLY CANDLELIGHT OLED DEVICES

**Dovydas Blaževičius, Raminta Beresnevičiūtė,
Dr. Daiva Tavgenienė, Dr. Gintarė Kručaitė
Group supervisor: Prof. Dr. Saulius Grigalevičius**

Kaunas University of Technology (KTU)

Solution area │ Health

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Description of the work

Low color temperature candlelight organic light-emitting diodes (OLEDs) are human and environmentally friendly because of the absence of blue emission that might suppress at night the secretion of melatonin and damage the retina upon long exposure. Thus, the team demonstrated a lighting device, incorporating a phenoxazine-based host material, 3,3-bis(phenoxazin-10-yl-methyl)oxetane (BPMO), with the use of orange-red and yellow phosphorescent dyes to mimic the candlelight. The resultant BPMO-based simple structured candlelight organic LED device permitted a maximum exposure limit of 57,700 s, much longer than a candle (2,750 s) or an incandescent bulb (1,100 s) at 100 lx. The resulting device showed a color temperature of 1,690 K, which is significantly much lower than oil lamp (1,800 K), candle (1,900 K), or incandescent bulb (2,500 K). The device showed a melatonin suppression sensitivity of 1.33 %, upon exposure for 1.5 h at night, which is 66% and 88% less than the candle and incandescent bulb, respectively. Its maximum power efficacy is 23.1 lm/W, current efficacy 22.4 cd/A, and external quantum efficiency 10.2%, all much higher than the CBP-based devices. These results

encourage a scalable synthesis of novel host materials to design and manufacture high-efficiency candlelight organic LEDs.

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Technical or other problems that are solved with the work

During this work, the team was able to significantly increase the efficiency of OLED devices by using a new host material. These results were achieved without inflating cost of materials, and OLED devices could be manufactured by a simple and cheap method of spin-coating from solutions. Furthermore, the fabricated candlelight organic LED is far better than incandescent bulb (CT of 2,444 K) and candle light (CT of 1,884 K) in prospects of both the retina damage and melatonin suppression, i.e., 52.4 times human eye-friendly and 8.6 times melatonin generation-friendly than the incandescent bulb, while 21 times human eye friendly and 200% more melatonin generation-friendly than candlelight due to the absence of blue-emission. This work will enable the fabrication of highly efficient candlelight organic LED lighting devices with the feasibility of solution processes.

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Novelty of the work

It includes the design, synthesis, and application of new easily synthesized and cheap host material for efficient human and environment-friendly candlelight OLED devices, which do not suppress the natural melatonin secretion.

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The benefits and value to the potential users

The most important benefits to the potential users are cheaper and more efficient devices that use less electricity and are safe to use at dusk and dawn because of the complete absence of blue-light emission.

TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

SLIBINOMOBILIS

Ieva Janušaitytė, Arnas Kripavičius, Titas Dobilevičius, Augustas Činga, Dovydas Lukoševičius, Gintarė Gabrielė Gabšytė, Kasparas Pečeliūnas, Skaistė Lukenskaitė, Skaistė Paškauskaitė, Gustas Kriščiūnas, Gabija Dūdaitė, Agnė Gečaitė, Lina Sankauskaitė
Group supervisor: Assoc. Prof. Dr. Benas Gabrielis Urbonavičius

Kaunas University of Technology (KTU)

Solution area │ Raw materials

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Description of the work

Slibinomobilis (in English: dragonmobile) is a character created by Kaunas Physicists, whose lifelong goal is to show that Physicists in Kaunas can implement even the craziest ideas and by joining them, one can become the best version of oneself. Jaguar XJ40 is a car with a "soul" that is hidden under the skin of Slibinomobilis. The idea of sustainability played an important role in its development. More than 20

different materials, based on their properties, were used to implement the project. A urethane coating (Raptors) was used to create the effect of dragon's rough skin and additional resistance. Additional elements are made of used polystyrene. Slibinomobilis contains about 3 kg of various 3D-printed parts made of recycled plastic, i.e., from gums to a special rear bumper.

There were installed colored eyes of the dragon and additional light-up elements on the back that can be controlled via Bluetooth. The car was planned to be destructed before starting the project.

Every time it appears in public, Slibinomobilis invites to get to know Kaunas Physicists and wants to inspire everyone to implement even the strangest of ideas.

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Technical or other problems that are solved with the work

There is a common misconception that one can become a physicist only in Vilnius. This is actually not true. This project aims to increase the awareness that Physicists in Kaunas are as good as (if not better) in Vilnius. Slibinomobilis project wants to show that Physics students at KTU can weld, grind, drill, glue, design, and "do a skid" while employing their vast knowledge in physics and material engineering, not forgetting the strict deadlines.

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Novelty of the work

This is the only project in the world, a colleague to the legendary Lithuanian Physics symbol Dinas Zauras. This is a generally new development in the promotion of fundamental and engineering sciences at KTU.

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The benefits and value to the potential users

As it is a social innovation, its main value is the created awareness of the importance of fundamental and engineering sciences, their value, and potential for the society.

LAPOMATAS

Kristupa Šeškauskaitė, Augmantas Jasutis, Augustinas Zinkus, Gabrielė Galdikaitė, Julius Čeponis, Miglė Kraskauskaitė
Group supervisor: Assoc. Prof. Dr. Benas Gabrielis Urbonavičius

Kaunas University of Technology (KTU)

Solution area | Environment

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Description of the work

The idea of this project came after hearing about the European Green Deal initiative, i.e., the European Union's commitment to a sustainable economy and environment. During the survey, the team realized that collecting used paper as a raw material for recycling is difficult and inconvenient for ordinary people. Thus, the team came up with a solution to this problem, i.e., the Lapomatas system. Lapomatas aims to reduce the amount of wasted printed paper and increase the volume of collected recyclable paper.

The principle of operation is similar to the already widely used reverse vending machines. People bring paper and drop it in a box. The weight of the paper is measured by the weight sensors, embedded inside, and the user interface is provided by a touch screen on top of the Lapomatas cabinet box, which provides more information on

the Lapomatas and sustainable resource consumption. The reward is not money, but the trees planted in forests in return for the weight of the paper that is submitted. Once the saplings have been planted, a photograph of the sapling and its GPS coordinates are sent to all those who have contributed and wish to do so. This system would be used in public spaces with a large number of visitors or in institutions with high paper consumption. The team hopes to implement the prototype first at Kaunas University of Technology, helping the university to become even more sustainable.

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Technical or other problems that are solved with the work

Around 2.5 billion tonnes of waste are generated in the EU every year. Recovered paper makes up around 30% of all municipal waste, of which 30% is disposed in landfills or incinerated. Although paper consumption, specifically in Lithuania, is decreasing yearly, there is a decrease in the percentage of recycled paper compared to the total paper that is discarded. Therefore, there is a need for innovative ways to collect paper, as it is a material that can be successfully recycled and used as a resource for production.

Currently, paper is collected for recycling, but there is a lack of attractiveness and signs indicating, which paper products are recyclable. The aim is to ease people's sorting difficulties and increase the percentage of paper collected for the recycling. The product is aimed at everyone who uses paper, and the collection points are planned to be in public sector institutions, as their activities involve a lot of paperwork and bookkeeping. In addition, such companies are more likely to have problems with the storage of physical (printed) documents or recycling of paper; thus, the potential demand for this product is expected to grow until the full digitalization of documentation is achieved.

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Novelty of the work

Paper is collected by recycling companies, which only collect waste paper in bulk. A drop-off point would ensure that the paper that is dropped is recyclable, and non-recyclable rubbish (e.g., plastic cup) is not dropped. This product, designed to collect recyclable paper directly from people in small quantities and offer a certain reward, has no analogue in the current market. Some attempts to develop a Lapomatas system have been seen in Asian countries, but there has not been any wider application of this system, or

any application in Europe at all. There is the potential and societal benefits of this product, as the proposed product would help to collect low-volume paper waste and promote a sustainable approach.

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The benefits and value to the potential users

This project is relevant because it would reduce the consumption of new resources and increase the amount of recycled waste, i.e., two factors that are key in ensuring compliance with the European Green Deal. Sustainability and recycling initiatives are encouraged in society, and the product itself can be used for the commercial purposes and to promote social awareness.

Based on the amount of paper brought in, tree planting will be carried out. In other words, people who bring in the paper will be able to enter their contact details and will be sent the coordinates and a photo of the tree they planted. This hopefully will serve as a motivation to save the environment and use resources sustainably.

ENVIRONMENTALLY FRIENDLY DISPOSABLE PACKAGING

Ugnė Zasčiurinskaitė, Aistė Balčiūnaitienė
Group supervisor: Prof. Dr. Virginija Jankauskaitė

Kaunas University of Technology (KTU)

Solution area | Environment

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Description of the work

In recent years, environmental protection has become one of the most important issues in the world, and one of the main problems is the increasing amount of waste. Industrial product packaging is one of the biggest causes of this problem, as it is often only used once and later disposed in a landfill.

However, some manufacturers and project developers are trying to find alternative solutions to reduce the packaging problem. Environmentally friendly packaging can help to reduce the industrial waste: this type of packaging is made from plant-based waste pulp, and it is completely biodegradable. This means that consumers can simply toss this

packaging into compost, where it will gradually break down. Additionally, such packaging can be made from plant waste; thus, no additional resources are in need to be used.

More and more consumers are choosing to buy products based on the product life cycle, products with less packaging or with eco-friendly packaging. Therefore, the implementation of environmentally friendly packaging solutions is an important step towards a sustainable industry future.

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Technical or other problems that are solved with the work

The main problems that the innovative packaging will help to solve are environmental pollution and resource depletion. Innovative and eco-friendly packaging is becoming relevant because of industry trends and growing environmental awareness. The target market for such packaging is companies that use disposable packaging for their products. For instance, the European Union has proposed a new regulation to replace the Packaging and Packaging Waste Directive 94/62/EC. The proposal aims to reduce the amount of packaging in the European Union market and make all packaging recyclable by 2030. This regulatory push creates an opportunity for companies to adopt environmentally friendly packaging solutions to comply with new standards. The target market for environmentally friendly packaging as well includes companies that value sustainability, i.e., large corporations, small and medium-sized enterprises that may be more willing to explore new solutions. Companies can contribute to solving environmental problems and enhance their brand image and appeal to consumers who value sustainability by adopting innovative environmentally friendly packaging.

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Novelty of the work

Compostable packaging, made from plant waste residue, is a new and innovative step towards sustainable and environmentally friendly industry. This packaging is completely biodegradable, as it can be composted. This is important because the traditional plastic packaging often ends its lifecycle as waste, and it takes a long time to decompose. In addition, the packaging that is made from plant materials is environmentally friendly and cost-effective, because this type of packaging can be made from waste.

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The benefits and value to the potential users

Firstly, such packaging helps to reduce the environmental footprint of companies, as innovative packaging is completely biodegradable and can be composted, which means less waste, since companies contribute to the waste reduction. Additionally, it is an excellent opportunity for companies to improve their environmental image and attract new customers or increase the loyalty of consumers who value sustainability and environmental protection. Finally, such packaging is economically beneficial, as it can be made from cheap and easily accessible raw materials, helping companies to reduce their production costs.

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