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23 - 25 MAY, 2025

ICE USV

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Suceava, 2025

THE IXTH INTERNATIONAL FAIR OF INNOVATION AND CREATIVE EDUCATION FOR YOUTH (ICE-USV)

STEFAN CEL MARE UNIVERSITY OF SUCEAVA, 23 - 25 MAY 2025

Responding to the objectives provided in the Europe Strategy and in the National Strategy for Tertiary Education, the Stefan cel Mare University of Suceava has assumed the role of „catalyst of creativity and innovation in Romanian society" becoming in recent years national leader both in regarding the number of patent applications as well as the number of patents obtained, according to the rankings made by the State Office of Inventions and Trademarks for the university environment. These results have been achieved through the education and massive involvement of PhD students, master students and even from the undergraduate cycle in the field of invention and scientific creativity.

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- Lect. dr. eng. Corneliu BIRTOK-BĂNEASĂ

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Editor: Lect. dr. eng. Mihaela PAVĂL

Program

23.05.2025

- ***12:00 – 15:00*** *Participant registration (Building E)*
- ***12:00 – 15:00*** *Visit the* ***National Olympiad of Scientific Creativity 2025*** *event (Building E)*
- ***18:00*** *Dinner (USV Restaurant)*

24.05.2025

- ***08:30*** *Breakfast (USV Restaurant)*
- ***09:30*** *Participant registration. Arrangement of stands by exhibitors (Building E)*
- ***10:00*** *ICE USV Open ceremony (Hall E)*
- ***11:00*** *Evaluation of ICE USV inventions/ projects by the international jury. Panel discussions and presentations by exhibitors. Media interviews with official delegates.*
- ***12:00 10-InSTED*** *(10 minutes about Innovation in Science, Technology, Engineering and Design) (Atrium Hall – Building E)*
- ***13:30*** *Lunch (USV Restaurant)*
- ***14:30*** *Evaluation of ICE USV inventions/ projects by the international jury. Panel discussions and presentations by exhibitors. Media interviews with official delegates.*
- ***16:00*** *International Jury meeting*
- ***18:00*** *Official Dinner*

25.05.2025

- ***08:00*** *Breakfast (USV Restaurant)*
- ***09:30*** *Award ceremony. Announcement of the results of the ICE-USV* ***2025*** *competition (Auditorium "Joseph Schmidt")*
- ***10:30*** *Participants departure*

REGULATION

This regulation establishes the methodology for the progress and the awarding of the International Fair of Invention and Creative Education for Youth, ICE-USV, eight edition, organized by the "Ștefan cel Mare", University of Suceava.

Article 1. Purpose

The project is dedicated both to promoting and encouraging student inventions and scientific creation and also for disseminating successful examples regarding creative education, raising awareness in society of the importance and the contribution brought by young researchers in technological development.

The exhibition event aims to increase the interest of the young generation for innovation in all fields of knowledge, establishing bridges between young people with common concerns, highlighting the elements of innovation and inventiveness that has as young researchers (students, master students, doctoral students, doctors and researchers with a maximum age of 35).

Article 2. Thematic categories

Works from all fields of applied sciences and engineering are accepted, which can represent solutions or technical achievements in a field of knowledge and which present novelty and progress towards the known stage, but do not affect the moral, the right to life or the security of any kind of persons. The International Fair of Innovation and Creative Education for Youth has two main sections:

1. Patented inventions/innovations, patent applications;
2. High school project, students and PhD student projects.

Article 3. Registration in the competition

Each work must be registered using the Registration form of the inventions/ projects at ICE – USV 2025 at least 15 days before the start of the event (according to the calendar) at the mentioned addresses.

The registration form must contain the purpose, the procedure/ method underlying the work, information regarding the accomplishment of the work, conclusions, other elements that are representative for the work and which highlight the innovative activity of the authors.

Article 4. Acceptance of works

The files of the works proposed and registered according to the calendar at the address above mentioned are automatically accepted at the event. Then they are analysed by the Scientific Committee of the event regarding the creative, deontological, scientific, technological and engineering level.

Article 5. The manifestation

The event will begin with an opening festivity where the organizers and the jury will be presented.

The organizers will provide sufficient time in the program for arranging the stands before judging the works.

The evaluation of the works will consist in presenting the work by the authors and clarifying some aspects at the request of the members of the jury. The time required for the judging will be according to the complexity of the work, the way it was presented by the authors and the clarification of all aspects related to the judging grid.

The event will end with an award ceremony in which the main conclusions of the jury and the organizers of the event will be score.

The event will include a session of workshops and presentations on creative education and the role of creative thinking in the context of sustainable development.

The program will also include social, cultural and sports activities designed to strengthen the links between the participants and allow the generation of an environment conducive to the exchange of ideas and information.

The presentation of the research results within the exhibition, depending on the capacity of the exhibition location, is logistically and financially supported by the organizing institution with the help of the partners and sponsors of the event.

Organizers do not provide funds for moving teams or transporting exhibits.

Article 6. Presentation of the works during the event

The work may be presented as a poster (mandatory) and exhibited (recommended).

The maximum poster size is 80 x 120 cm. The posters will be visible, will strictly refer to the project and will be displayed vertically.

Maximum size of the exhibit (model, layout): depth 50 cm (front to back), width 80 cm (from one side to the other), height 180 cm (bottom to top). The exhibit may contain calculation techniques included in the model or for the presentation of graphic elements related to the project (photos, films, graphics, simulations, modeling, etc.). Files and notation regarding the tests or determinations made in the experiments can be attached to the model.

Article 7. Elements of ethics and deontology

Scientific fraud and immoral behavior are not accepted at any level of the event. This includes: plagiarizing, using or presenting other people's ideas as their own projects.

The projects that prove fraud will be removed from the competition and the intention will be popularized in the educational and scientific environment.

Article 8. Mandatory requirements

Participants must accept the following rules:

– All projects must respect the ethical elements presented above.

– The introduction of pathogens, toxic chemicals or any dangerous substances in the exhibition area is forbidden.

– The exhibits must comply with the exposure and safety requirements set out in this Regulation.

– It is the responsibility of each participant to check the requirements and restrictions of the competition.

– It is required to respect the calendar, the program of the event as well as the conditions of registration.

Article 9. Judging

The approval of the participation in the competition will be made on the basis of the *Registration Form* and will be made by the scientific committee of the event.

The jury will be made up of personalities with concerns in the field of invention and innovation at national level, university professors, representatives of companies, organizers and sponsors, science journalists.

The judging will be done through individual discussions of the jury members with the author of the project, the study of the registration form and the exhibits.

The jury criteria will take into account:

– The actual activity of the young participant in the presented project;

– Respecting scientific and / or mathematical rigour;

– The importance and relevance of the project in the field;

– The level of deepening of the theme;

– The novelty level of the presented project;

– Design and activity of the young participant in order to achieve the project objectives.

In the discussions between the jury and the participants will be followed:

– Creativity,

– The scientific approach, the complexity of the study approach that led to the completion of the theme,

– The usefulness of the proposed solution,

– Clarity of project presentation (visual and oral).

The hierarchy of works established by the jury is considered final and no contestations, discussions or completions regarding the judging procedure are accepted.

Article 10. Warnings

It is not allowed to use on the presented stand:

– Living organisms;

– Living or fluid tissue elements of the human or animal body (blood, urine, etc.);

– Dangerous or highly odorous chemical materials;

– Hazardous substances or devices (poison, drugs, weapons, ammunition, sharp devices, with the risk of breakage, flammable substances, unprotected lasers, generators and sources of ionizing radiation, ultraviolet or infrared, open flame);

– Devices at risk in operation for the competitor or for the public (eg damaged batteries, voltage sources or capacitors with d angerous voltage and with uninsulated terminals, etc.)

– Prizes, medals previously obtained by the competitor, bank cards, flags, company logos or institutions (except the represented institution), contracts and / or approvals (graphic or written) unless they are fully included in the project;

– Photographs or visual representations describing animals in surgical techniques, dissections, necropsies or other laboratory procedures, minors (except when the parents' agreement exists).

TABLE OF CONTENTS

EXHIBITED PAPERS

3D-PRINTED ELASTIC LATTICE STRUCTURES

Marko MARIČEVIĆ, Tibor SKALA

University of Zagreb, Faculty of Graphic Arts

Elastic mesh structures, created through 3D printing, represent a revolution in product design and functionality. This innovative manufacturing approach enables the creation of variable thicknesses and densities, allowing for the adjustment of strength and flexibility according to specific needs. Adaptable mesh structures enhance comfort, while optimized load distribution extends the product's lifespan. In addition to aesthetic advantages, this production method allows for complex designs that are both functional and visually appealing. This technology presents an opportunity to improve production processes, offering solutions that are adaptable, functional, and sustainable.

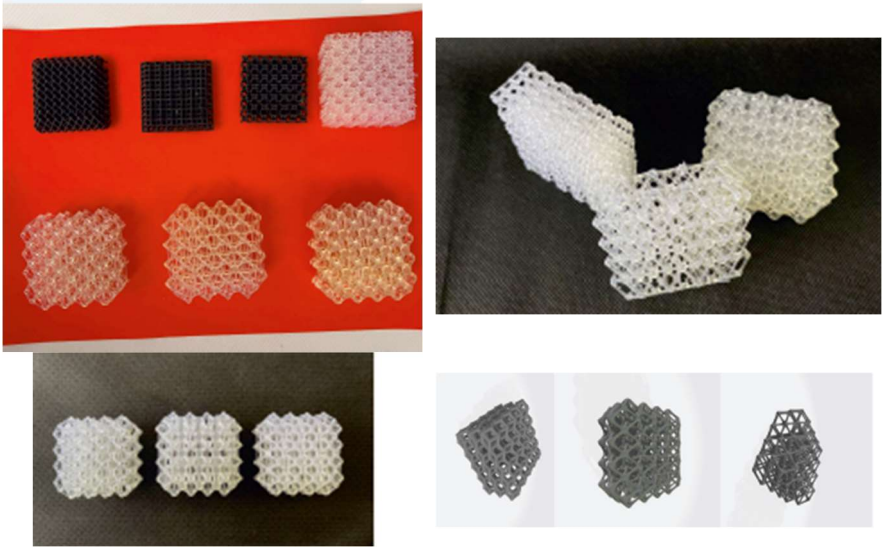

Fig. 1 3D-Printed Elastic Lattice Structures

Advantages :

· functionality customization: variable thickness allows for the adjustment of strength and flexibility in specific parts of the structure.

· weight reduction: mesh structures with variable thickness can reduce the overall weight of the product without compromising strength.

· increased comfort: variable thickness can improve comfort and adaptability, allowing for a better fit.

· aesthetic possibilities: variable thickness can create interesting visual effects and allow for more complex designs.

· improved ventilation and breathability: variable thickness can enable better ventilation and breathability, enhancing comfort.

· better load distribution: mesh structures can distribute load more effectively.

APPLICATION OF PRINTED COMPUTER GENERATED HOLOGRAMS AS SECURITY ELEMENTS

Vladimir CVILJUŠAC

University of Zagreb, Faculty of Graphic Arts

The innovation is in the algorithm for computer-generating holograms and making preparations for printing in correlation with the parameters of production printing techniques. This enables the quick and low cost production of unique CGH that have broad applications in security. The final product, the security element is not only based on a hologram diffraction grating. Instead, the innovation offers a synergy of three security elements; computer manipulation of objects and composition of holo-blocks in order to achieve a large number of combinations; progressive binarization, which is used to imprint the image on the surface of the hologram and connect the input parameters of the algorithm with the parameters of the printing technique used. All this strengthens security while preserving the ability to print at low cost on standard commercial machines. While the manufacturing process is based on a well-known printing techniques, the security basis of this approach lies in the latest advantages of computer science.

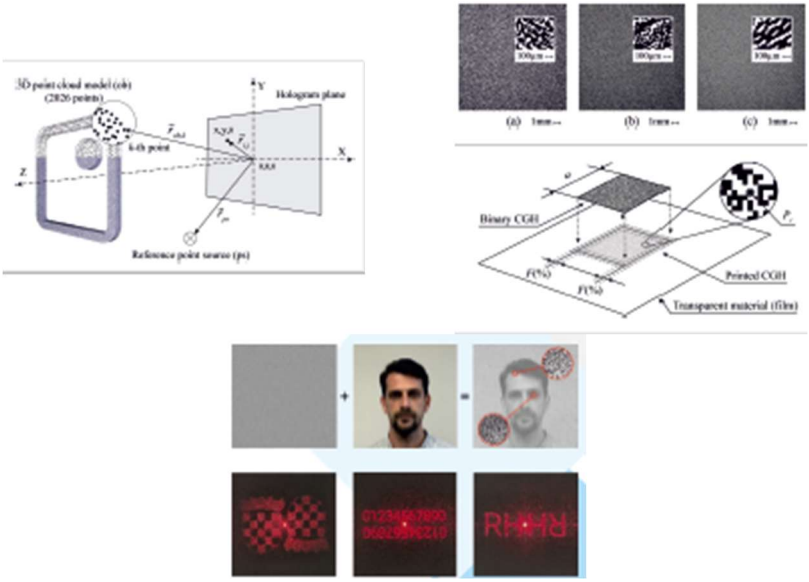

Fig. 1

HYDROGEL CELL FOR DIFFUSION MEASUREMENT (HYDROCELL)

Anita ŠALIĆ, Ana JURINJAK TUŠEK, Bruno ZELIĆ

University of Zagreb, Faculty of Chemical Engineering and Technology

The efficient diffusion of molecules through hydrogels is a key parameter for the efficiency of enzyme immobilization, especially in biotechnological applications. The diffusion of molecules through a gel depends on the gel structure, cross-linking density and pore size. Higher concentrations of the substance from which the gel is made and stronger cross-linking reduce the pore size and slow down diffusion, while lower concentrations increase diffusivity but reduce the stability of the gel. Diffusivity also depends on conditions such as temperature, pH and the presence of other substances.

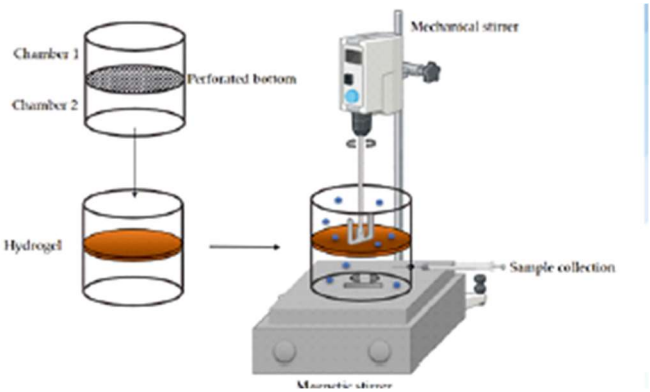

Fig. 1 Experimental set-up of Hydrocell a for measuring the diffusion of molecules through hydrogel

The proposed innovation Hydrocell enables the study of diffusion kinetics of different molecules through a gel with potential applications in various biotechnological industrial processes, including drug development, optimization of biosensors and evaluation of substance transport in controlled drug release systems. The proposed system not only enables precise measurements, but is also characterized by its ease of use, dimensional adaptability and wide range of applications.

Fig. 1 Experimental set-up a) perforated bttom b) assembled chambers

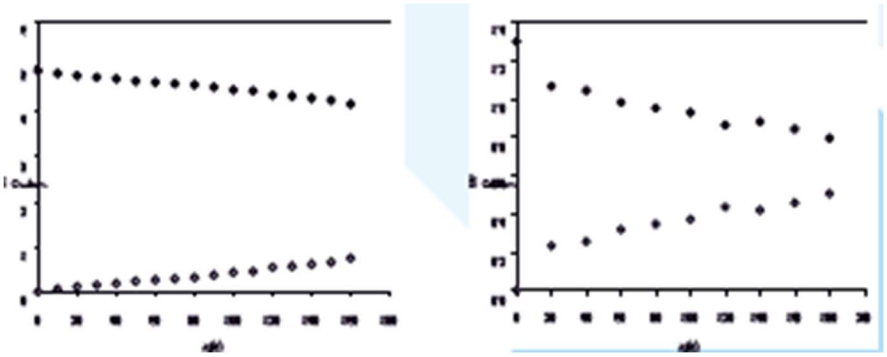

Fig. 3 Example of changes in (a) glucose and (b) NADH concentrations in chamber 1 () and chamber 2 (◦) during the time

CLOSED WATER CYCLE IN TEXTILE INDUSTRY: INNOVATIVE REUSE OF TEXTILE WASTEWATER FOR INDUSTRY AND AGRICULTURE

Iva ĆURIĆ

University of Zagreb, Faculty of Chemical Engineering and Technology

This innovation introduces a revolutionary approach to water management in the textile industry, enabling a closed-loop system through mulyi-stage eastewater reuse.

A hybrid ultrafiltration, nanofiltration (NF), and reverse osmosis (RO) system allows maximum water recirculation:

- NF penetrate used for dyeing, bleaching and washing ;
- RO permeate: used for boilers;
- RO concentrate (concentrated 35-50%): mixed with tap water for irrigation of salt-tolerant crops;
- 95% water reuse: reducing potable water consumption up to 20 times;
- Zero liquid discharge significantly reduces the industrys environmental footprint;
- Scalable and market'readz solution for sustainable industrial applications;

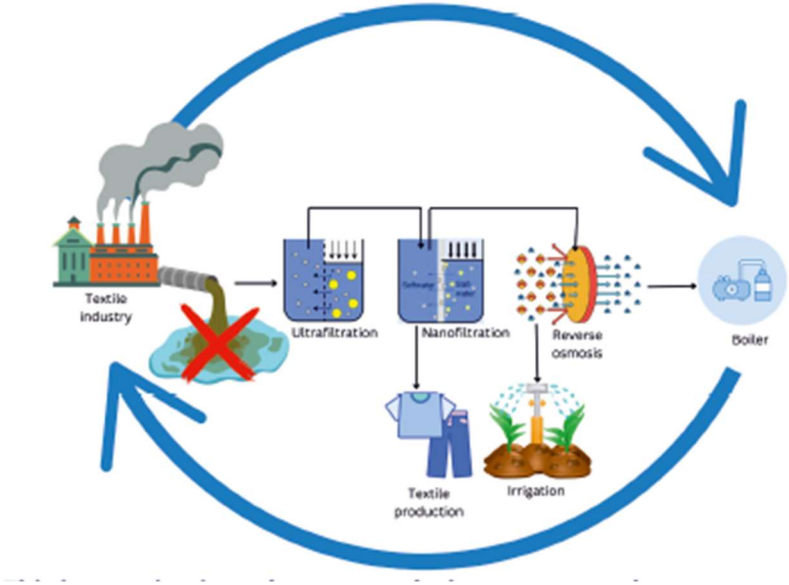

Fig. 1 Closed water cycle in textile industry

METHOD FOR MEASURING DIELECTRIC LOSSES IN TEXTILE MATERIALS

Dubravko ROGALE, Snježana FIRŠT ROGALE, Željko KNEZIĆ

University of Zagreb Faculty of Textile Technology

Parts of protective clothing made of artificial polymer materials are connected using a high-tech method with a high-frequency electromagnetic field, which ensure air tight and watertight connections.

The energy required and the bonding time depend on a number of parameters. One of the most important is the dielectric loss factor in the material. The dielectric losses are known for pure and homogeneous materials (polyurethane, polyamide, polyester, etc.), but the problem of determining the dielectric losses arises when, for example, textile materials are coated with one type of material (e.g. polyurethane) and made of another type of material (e.g. polyester), where the fabric or knitted fabric consists of variable geometric structures with air spaces in the presence of dyes and other textile finishing materials. The dielectric losses can then be measured using a special measuring method consisting of a variable frequency

generator, a measuring bridge, a bridge equilibrium indicator, a measuring capacitor with the tested material and a computer to calculate the dielectric losses based on the measured parameters (reactance and ohmic resistance) of the sample in the measuring capacitor.

Fig. 1

REMOTELY CONTROLLED UNDERWATER VEHICLE

Magdalena ANTOLKOVIĆ

University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture

A remotely operated underwater vehicle (submarine) was designed and built, which can be used for underwater exploration or work. Creating a remotely operated underwater vehicle requires solving numerous engineering challenges related to safely sealing the interior of the submersible and the difficult transmission of signals through water. The vehicle's diving depth is controlled using ballast tanks that are filled or emptied with water, depending on whether the submarine needs to dive or surface. The submarine is controlled using an Arduino microcontroller. The propulsion of the underwater vehicle is achieved using electric motors powered by a battery.

The remotely operated underwater vehicle makes it possible to explore areas that are too deep for humans to safely dive on their own, and such underwater vehicles can remain underwater much longer than human divers, extending the available time for exploration. The underwater environment is harsh and dangerous,

and the depth at which humans can dive is limited, making the underwater robot an important tool for underwater research.

The created prototype can serve as the base for a research vehicle that, with the addition of a sonar, could scan the seafloor, or with a camera, record underwater objects.

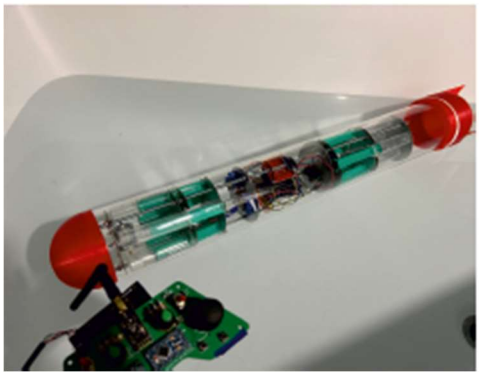

Fig. 1

AUTOMATIC DRUM MACHINE

Ivan Diego ĆOSIĆ

University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture

The term 'industrial music' refers to a musical genre that relies on harsh, mechanical, intriguing, or provocative sounds and themes. An automated mechanical drum achine can create simple rhythms and experimental music, developing a unique approach to music generation with ambient and mystical overtones using power electronics components. By adjusting the speed of the drum strikes, it is possible to create a wide range of rhythms for various music styles. The basic set of a mechanical drum machine includes a kick drum for deep tones that form the rhythmic foundation, a snare drum for producing higher tones that be_er shape the feel of the rhythm, and cymbals which, depending on the structure, can produce mid-high or the highest tones. In principle, the term drum machine refers to digital software used to create rhythm in a song and percussive sounds—those produced by instruments through striking, plucking, or vibrtition—in the absence of a drummer and/or drums.

Fig. 1

AIR - ANONYMOUS IDENTITIES RECOGNITION USING ARTIFICIAL INTELLIGENCE (AI)

Tomislav BRONZIN

CITUS. Innovation, Consulting, Education. Croatia

AIR is an innovative solu_on that enables the recogni_on of anonymous identies, based on many physical characteris_cs of a person, using ar_ficial intelligence. Using a stereoscopic camera and advanced image processing, a person's biometric and kinesiological characteristics are recognized in real time, from a distance, without the need for physical contact. Ar_ficial intelligence based on an innovative UI model compares the scanned data with already recorded profiles of anonymous persons and concludes whether it is a person for whom data has already been recorded somewhere as an anonymous iden_ty or whether it is a new anonymous identity. Compliant with GDPR and other data protec_on laws, AIR offers a non-invasive way (using posture and gait analyses) to track and identofy an unknown person, even if he/she is masked or has altered appearances.

Fig. 1

The AIR solution is applicable in various industries and scenarios, such as security and sales loyalty programs. The target groups are companies, governments, and public institutions.

ACUSTIC SCALE

Šivak SAŠA, Andrija RADAS, Maks BLAŽEK

First School of Technical Sciences Tesla, Zagreb, Croaţia

Measuring weight with a personal scale is only possible for people with relatively good vision using a digital display. Blind people are not able to measure weight independently. The personal scale for measuring weight has been expanded with a system that enables acoustic pronunciation, so it is primarily intended for blind or visually impaired people. In addition, it contains a so-called Braille display that can be used by blind people with hearing problems In addition to personal use by the visually impaired, the device can be used in ducational rehabilitation centers.

Instructions for use. The device is turned on in the stand, wait a second, step on the scale sensor, calm down, press the red button. Afterer a few seconds, the speaker will say the weight, and the informa_on in Braille will be activated on the front panel.

Fig. 1

SMART TRAFFIC LIGHT

Emanuel CAJSA

School of Electrotechnics, Zagreb, Croatia

The project consists of a fully functional model or prototype of a smart traffic light at a traffic intersection. The model consists of traffic lights for cars and pedestrians; loudspeaker (buzzer), 7- segment display (indicator) with 4 digits and pedestrian keys (button). The speaker emits a sound signal that can also help people with poor vision. The button shortens the time of the red light for pedestrians and the green light for cars. The 7-segment indicator counts down the transition from the green light for cars to the green light for pedestrians. While driving, car drivers receive information onthe duration of green and red lights on a large screen, which greatly improves traffic safety and eventual passing through red lights. The button enables faster switching of the traffic light. The button can be controlled via smartphone with the Blynk app. It is enough that the smartphone is connected to a wireless network and has a free application installed. The application requires authorization via email. By physically pressing a button or controlling it via phone, it is possible for people with hearing impairment to control the traffic lights and ultimately free passage. The speaker has adjusted the speed of the traffic light countdown to provide information about the change in the traffic light status to people with visual impairments and severe hearing abilities. This resulted in a model that is fully adapted to blind and hard-of-hearing people when crossing a traffic intersection.

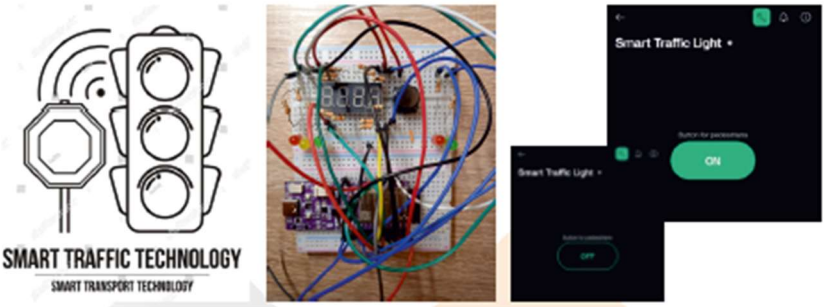

Fig. 1

ARDUINO VOLTAGE REGULATOR WITH AMMETER AND VOLTMETER

Luka KARLOVČEC

Mechanical technical school Faust Vrančić

Following a commercial power supply design, this project was supposed to look and function like one. However, instead of regulating through a Logic Motherboard, it's relying on an IRLZ44N Logic Level MOSFET. The switch of components assures that the entire input voltage spectrum fed to the MOSFET is 100% available as output for a running load.

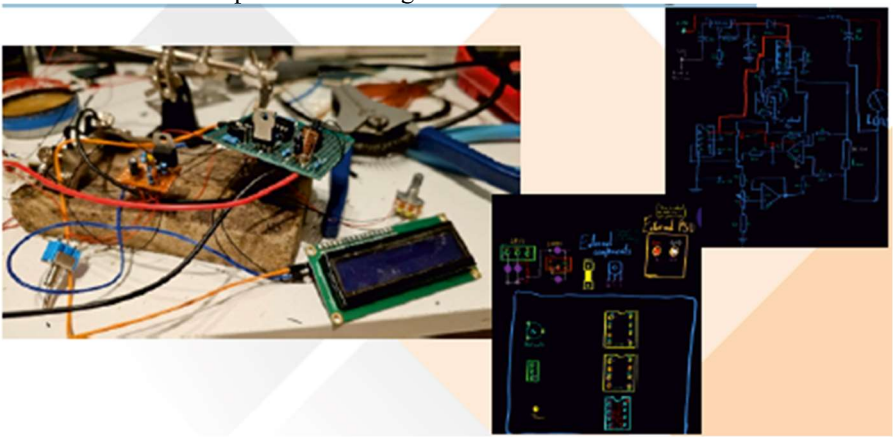

Fig. 1

PEK SYSTEM – EARTHQUAKE EDUCATIONAL CONTAINER

Vjekodlav MAJETIĆ

DOK-ING d.o.o, Zagreb, Croatia

The earthquake education container is an earthquake simulator in the form of a container and is designed for educational purposes. It is intended for use in public places (town squares, schoolyards, etc.) and serves to raise public awareness about earthquakes. It has the technical ability to simulate earthquakes up to IX MCS including IX MCS. It can enable exercise participants to experience different types of earthquakes from ground level to the 20th floor. It is made on a transport platform

in the form of a loader and is intended for transport using a standard container loader truck.

Advantages:

-educational simulations of earthquakes up to the 9th stage of MCS
- simulation of the earthquake experience up to the 20th floor
- the shape of the container
- transport by standard truck with container loader
- the possibility of using up to 4 users at the same time
- use of a system with 2 operators
- seismic cabin powered by electric motor hexapod
- power supply from the network or built-in generator
- automatic switching between power sources

Fig. 1

SMART OUTDOOR BICYCLE

Josip Tonč

Technical school Zagreb, Croatia

The bicycle can measure velocity, the length of the current trip and its own angle. The bicycle can get locked by the owner. In the event that the bicycle is stolen it can detect its own movement and will consequently send an SMS message to the owners phone informing the owner that it was stolen and will subsequently send the owner its own location using SMS messages.

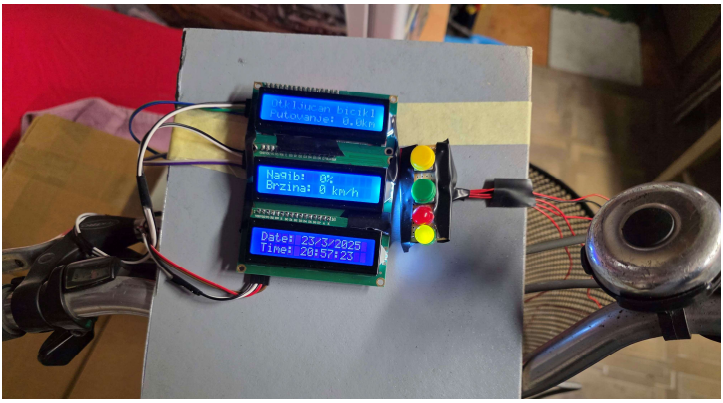

Fig. 1

AUTOMATIC PILL DISPENSER

Petar ČORKALO

Technical school Zagreb, Croatia

This device is designed to be used in nursing homes, where medical staff (such as nurses) can load the pill compartments in advance. Each day, the dispenser automatically releases the required medication into an accessible compartment, making it easy for users to take the right pills at the right time. It is ideal for elderly users who often forget to take their medication or are unsure which pills to take on which day.

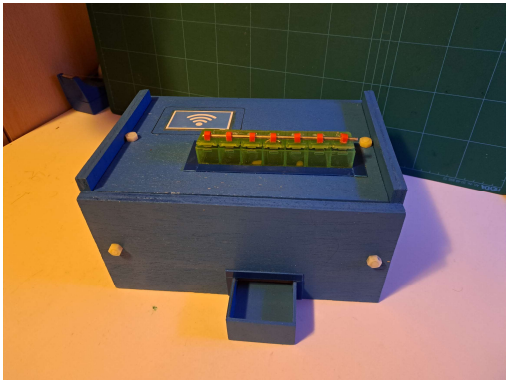

Fig. 1

SMART RAIL TRACK SWITCHING

Karlo PUŠKARIĆ

Technical school Zagreb, Croatia

The Main track is split in one more direction. Near an intersection a signal is put for train stopping.

When a train stops its ID is scanned and a Arduino microcontroller controls; first a motor that is used for switching tracks, than a signal is turned off, that signals that a train can pass. Than an Arduino waits for a next ID scan.

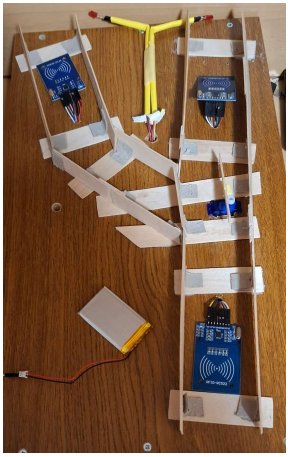

Fig. 1

SMART SHOE FOR THE VISUALLY IMPAIRED

Ivano SVEDREC

Technical school Zagreb, Croatia

This Arduino-based smart shoe helps visually impaired individuals detect nearby obstacles. It uses an ultrasonic sensor (HC-SR04) to measure distance and activates a vibration motor to alert the user when something is close. The closer the object, the stronger the vibration. The system is powered by a 9V battery and can

include an ON/OFF switch for easy control. It's a simple, wearable assistive device designed to improve safety and navigation

Fig. 1

SYNCHRONIZED (PORTABLE) TRAFFIC LIGHTS

Bruno CARNIER

Technical school Zagreb, Croatia

A system of two portable traffic lights which have direct communication between one another with the goal of reducing wait times. They are battery powered ESP32 boards and use ultrasonic sensors for distance. Everything but the electronic/working parts is a custom design and 3D printed.

Fig. 1

BONBONSANTE: SMART CHOICE OF SWEETS

Daniel CRISTEA

State University of Medicine and Pharmacy „Nicolae Testemitanu", Republic of Moldova

BonBonSante is an innovative project in the form of a digital application, designed to help consumers make informed and safe choices about food, especially sweets and candy. Given the concerns about the high sugar, additives and preservatives content of these products, the application gives users the opportunity to scan the labels and get detailed information about the internal composition of the products. Thus, children, parents, people with a predisposition to diabetes and health professionals can assess the health impact of consumption and reduce the risks associated with excessive consumption.

The BonBonSante app integrates nutritional analysis technologies, presenting the data in an easy to understand format, similar to the results of a blood test, making it easy to compare the actual values with the recommended ones. This revolutionary approach helps to educate the public and promote responsible consumption of sweets. In addition to the health benefits, BonBonSante has a positive impact on pregnant women, helping them avoid food excesses that can negatively influence fetal development. Moreover, the project plays an important role in gender equality, ensuring access to nutrition information relevant to all social categories.

With growing concerns about food health, BonBonSante is becoming an indispensable tool in making informed decisions about eating sweets. By analyzing the composition of products and comparing the nutritional values with the recommended limits, the application helps to prevent diseases caused by excess sugar, additives and preservatives. Thus, users can make healthier choices, protecting both their own well-being and those of their loved ones.

Through a modern communication strategy that includes social networking campaigns, collaborations with health influencers and educational activities, BonBonSante aims to become an essential tool for all those who want to consume food consciously. Thus, the application not only informs, but also promotes a healthy lifestyle, protecting public health and providing a smart solution for choosing sweets.

ECOTREND: PROMOTING INNOVATION THROUGH RECYCLED TEXTILES

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EcoTrend is an innovative project that promotes the use of recycled textiles, addressing environmental and social issues through an integrated and sustainable approach. The initiative focuses on reducing textile waste and supporting social inclusion by creating employment opportunities for women with disabilities. By transforming recycled textiles into unique promotional materials, the project contributes to raising public awareness of the importance of responsible consumption.

The project is carried out in four main stages: the collection of textile waste, its transformation into raw materials, the production of recycled materials and the marketing of products. The collection process includes strategic partnerships with clothing stores, the use of dedicated collection containers and the organization of specific events. Textile transformation involves innovative recycling methods, such as chemical and manual techniques, while ensuring quality control of recycled materials. Within the production workshop adapted to the needs of women with disabilities, a wide range of promotional materials are made, which include customized products for various organizations. The marketing stage is supported by online platforms, partnerships with physical stores, participation in fairs and contracts with various entities.

EcoTrend brings significant results both socially and ecologically. By employing a significant number of women with disabilities, the project promotes social inclusion and improves their quality of life, contributing to the development of professional skills and community awareness of the problems of people with disabilities. From an environmental point of view, the initiative significantly reduces textile waste, helping to save natural resources and reduce greenhouse gas emissions. Promoting the circular economy and responsible consumption are key elements that define the positive impact of the project on the environment.

Cultural and economic aspects are also essential. EcoTrend encourages creativity, artistic expression and the valorisation of local traditions through product design, thus strengthening the cultural identity of Moldova. From an economic point

of view, the project is viable due to revenues generated by sales of recycled products, production contracts and support offered through various subsidies. This initiative exemplifies how sustainable development can be achieved by integrating social, environmental and economic aspects into a sustainable business model.

EcoTrend is an innovative solution that meets the contemporary needs of reducing pollution and promoting sustainability, being an initiative that reflects the authors' commitment to ecological and social progress. Through the integration of technology and social values, the project contributes to building a more responsible and inclusive society by providing an example of good practice in the field of textile recycling and the social economy. This initiative demonstrates the potential to turn textile waste into a valuable resource while strengthening the cultural identity and economic sustainability of the community. EcoTrend is an eloquent example of innovation that promotes social responsibility and environmental protection, being a valuable contribution to the sustainable development of the Republic of Moldova.

MOLDGUIDE: INNOVATION AND DURABILITY FOR MOLDOVAN TOURISTS

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Moldguide is an innovative mobile application designed to combine state-of-the-art technology with sustainability, thus transforming the tourist experience in the Republic of Moldova. The project is developed by a group of motivated students, who have set out to support tourists through an accessible and environmentally friendly tool, while contributing to the promotion of the local cultural heritage. The application offers a diverse range of integrated functionalities, designed to facilitate the responsible and informed exploration of the region by users.

Among the main features of Moldguide are interactive maps, which provide detailed information about tourist places, medical services, hotels, cultural events and local gastronomic options. It serves as a reliable digital guide, ensuring that visitors have quick access to the most relevant tourist resources. A distinctive feature of the app is the custom carbon footprint calculator, which allows users to assess their environmental impact during travel and adopt more sustainable practices.

Moldguide also includes an instant live chat support system that promptly answers questions and needs of visitors, complemented by a large section of frequently asked questions.

The app is available in several languages, including English and French, making it easily accessible to an international audience. This feature is essential for attracting more tourists from outside the country and for strengthening the image of the Republic of Moldova as an attractive tourist destination. In addition, Moldguide plays a crucial role in promoting local cultural traditions and values, connecting visitors with authentic events and activities that reflect the identity of Moldova.

The expected impact of Moldguide on local tourism is significant, both ecologically and culturally. The application not only encourages responsible and sustainable tourism, but also supports the preservation of the country's natural and cultural heritage. Thus, users are motivated to actively participate in reducing their impact on the environment, while contributing to the development of local tourism.

From the point of view of originality, Moldguide stands out by integrating modern digital functionalities with ecological and cultural values. This is an essential tool for contemporary tourists, responding to their needs through a combination of advanced technology and a commitment to sustainability. The authors of the project have taken the responsibility to support the responsible exploration of tourist destinations and to contribute to the ecological and cultural progress of the Republic of Moldova.

Moldguide is an eloquent example of innovation in the digital age, addressing both local and international tourists. With a significant positive impact on the environment, the local economy and the image of the country, the application is an ambitious but achievable project that reflects the values and dedication of its authors. By promoting sustainable tourism, Moldguide demonstrates that digital innovation can be a powerful force in supporting the development of local communities and the protection of natural and cultural resources. This project represents a valuable initiative, which contributes to the positioning of the Republic of Moldova as a modern and sustainable tourist destination on the international stage.

RISK OF EXPOSURE TO TICKS AND ASSOCIATED DISEASES AMONG THE POPULATION OF THE REPUBLIC OF MOLDOVA

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The exposure to ticks poses a significant threat to public health in the Republic of Moldova, being associated with a number of tick-borne diseases affecting the population. The study examines public perceptions of the risks involved in tick bites, as well as the degree of knowledge and preventive practices of the population. The research highlights important gaps in education and preventive behaviour, highlighting the need for further measures to inform and educate the public.

According to the analysis, climate change plays a crucial role in expanding the distribution area of ticks and intensifying their periods of activity, thus contributing to the increase in the incidence of diseases such as Lyme borreliosis and tick-borne encephalitis. The study used a structured questionnaire, comprising four sections, to assess population knowledge, attitudes and practices related to tick-borne disease prevention. Of the 300 questionnaires distributed, only 92 responses were collected, with a response rate of 30.6%. They revealed a variable level of awareness among the population and an urgent need to implement more effective education campaigns. The results obtained indicate that although most respondents acknowledge the risks associated with tick bites and take preventive measures, only a part of them are familiar with the correct methods of removing ticks. The major problems identified include the low frequency of pet inspection and the insufficient use of preventive strategies. Symptoms reported from tick exposure range from itching and headache to fever and muscle pain, highlighting the need for a high degree of alertness. Respondents' attitude towards tick-borne encephalitis vaccination is generally favourable, which provides an opportunity for public health initiatives to promote the use of vaccines. The study highlights the importance of involving health professionals in community education, as well as the need to step up epidemiological surveillance to combat tick-borne diseases. The authors propose a multidisciplinary approach that integrates preventive, educational and research measures to reduce risks and protect the health of the population. The project highlights the growing threats posed by ticks and their associated diseases and the

impact of climate change on the spread of these vectors. Increased public education, more effective preventive measures and active support from health institutions are needed to effectively manage these risks. The study contributes to the development of more informed public health policies and highlights the need for coordinated interventions to reduce the incidence of tick-borne diseases in the Republic of Moldova.

DEVELOPMENT OF FORMULATIONS AGAINST TOMATO PHYTOPATHOGENS BASED ON AUTOCHTHONOUS NATURAL SUBSTANCES AND THEIR DERIVATIVES

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The project's main objective is to develop bioactive formulations with fungicidal and immunostimulatory properties for use in agriculture, focusing on protecting tomatoes from diseases. Specific objectives included the synthesis of triazolic and spiro[cyclopropan-oxindole] compounds, obtaining chitosan from natural sources, developing formulations with different compositions, and studying the fungicidal and growth-stimulating properties of the tested substances.

Natural sources such as champignon mushrooms and dead bees were used to obtain chitosan. Additionally, a synthetic chitosan solution was prepared for comparison. The process involved specific hydrolysis conditions in the presence of hydrochloric acid.

For the targeted synthesis of compounds with fungicidal activity, six new substances from the triazole series were synthesised and characterised using physico-chemical methods, along with four compounds from the spiro[cyclopropan-oxindole] series with antiviral potential. Four triazolic compounds with patented fungicidal properties were also sourced from the laboratory's stock for biological testing on tomatoes.

A total of 30 preparative formulations with varying concentrations and compositions of active substances were developed. These formulations included simple solutions, mixtures with chitosan, and solutions stabilized with surfactants.

Biological tests on fungicidal properties demonstrated that the tested substances were effective against *Fusarium spp.*, with efficiency comparable to

commercial preparations such as Topaz and Fitosporin. The activity was validated through qPCR analysis of the pathogen DNA.

The effects on tomato growth were also studied. It was observed that the tested substances had a stimulatory effect on root and stem growth, particularly under biotic stress conditions.

Among the most notable results obtained were: -four previously patented substances for activity against wheat fungi showed promising results against tomato fungi; -the newly synthesized substances demonstrated significant biological activity, offering prospects for their use in agricultural treatments; -both natural and synthetic chitosan exhibited fungicidal effects and proved useful in the tested formulations, including combinations with active substances; -*in vitro* tests confirmed the antimicrobial activity of the preparations against several species of bacteria and fungi.

The scientific impact of the project lies in the generation of new knowledge about the structure-activity relationship of bioactive compounds, contributing to the development of advanced synthesis and evaluation methodologies. The social impact involves the potential reduction of agricultural losses through the use of eco-friendly alternatives to conventional fungicides, supporting sustainability. The developed formulations provide opportunities for producing innovative commercial products, reducing treatment costs and losses caused by pathogens.

SYNTHESIS OF HETEROCYCLIC COMPOUNDS OF THE CARAN SERIES

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The work consists of the synthesis by means of the cycloaddition reaction [3+2] and the presentation of the biological properties of (S)-1-((1R,3R,6S)-4,7,7-trimethylbicyclo[4.1.0]hept-4-en-3-yl)ethyl 5-methyl-1-(2-oxo-2-phenylethyl)-1H-1,2,3-triazole-4-carboxylate obtained from keel acetylacetate and 2-azido-1-phenylethanone. Also presented are the results of cytotoxicity of 1H-1,2,3-triazolulium obtained on the following types of cancer: Pancreatic Adenocarcinoma, Acute Lymphoblastic Leukemia, Acute Myeloid Leukemia, Non-Hodgkin Lymphoma.

Capan-1 is a human pancreatic ductal adenocarcinoma cell line. These cells grow in adherent tissue culture and display epithelial morphology. In culture, these cells are capable of invading through an extracellular matrix, such as Matrigel. The Capan-1 cells are resistant to 5-fluorouracil, reminiscent of the original tumor from which they were derived. They form poorly-differentiated tumors when injected into immunocompromised mice. These cells harbor a single base-pair deletion in the BRCA2 allele, which results in the expression of a truncated and dysfunctional protein. In addition, they have an oncogenic mutation in K-Ras (G12V) and an inactivating mutation in p53. These cells express elevated levels of the Epidermal Growth Factor Receptor (EGFR) and do not express SMAD4 protein (i.e., SMAD4-null). The Capan-1 cells are useful both as a xenograft model for pancreatic cancer and as a cell system to study the effects of BRCA2-deficiency.

Acute lymphocytic leukemia (ALL) is a type of cancer of the blood and bone marrow — the spongy tissue inside bones where blood cells are made. Acute lymphocytic leukemia is the most common type of cancer in children, and treatments result in a good chance for a cure. Acute lymphocytic leukemia can also occur in adults, though the chance of a cure is greatly reduced.

The HL-60 cultured cell line provides a continuous source of human cells for studying the molecular events of myeloid differentiation and the effects of physiologic, pharmacologic, and virologic elements on this process. HL-60 cell model was used to study the effect of DNA topoisomerase (topo) IIα and IIβ on differentiation and apoptosis of cells and is especially useful in dielectrophoresis studies, which require an aqueous environment with suspended and round cells. Furthermore, these cells have been used in order to investigate whether intracellular calcium plays a role in caspase activation induced by reactive oxygen species.

Non-Hodgkin lymphoma, also known as non-Hodgkin's lymphoma, is a group of blood cancers that includes all types of lymphomas except Hodgkin lymphomas. Symptoms include enlarged lymph nodes, fever, night sweats, weight loss, and tiredness. Other symptoms may include bone pain, chest pain, or itchiness. Some forms are slow-growing while others are fast-growing. Unlike Hodgkin lymphoma, which spreads contiguously, NHL is largely a systemic illness.

Synthesis 1-((1R,6S)-4,7,7-trimethylbicyclo[4.1.0]hept-4-en-3-yl)ethyl 5-methyl-1-(2-oxo-2-phenylethyl)-1H-1,2,3-triazole-4-carboxylate (3) figure 1.

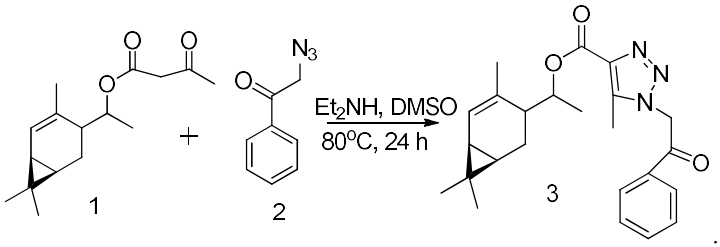

Fig. 1 The reaction of obtaining triazole using acetylcarene with 2-azido-1-phenylethanone

To the solution of compound 1 (15 mg, 1.9 mmol) in DMSO 5 ml we added 3 drops of diethylamine, then we add compound 2 (23 mg, 4.8 mmol). The reaction occurred for 24 hours at a temperature of 80oC.After rectifying the compounds, the reaction was spilled into water and extracted with ethylacetate and left under Na2SO4. Finally, we evaporated the solvent and recrystallized from the ethanol.

Below we present the CC50 results for the compound (3) and compounds used to cure these diseases (Etoposide and Nocodazole) .

Compound 3 showed the following results for Capan-1, DND-41, HL-60, Z138 43.8; 59,3; 47,2; 63.9 at 100 μM compared to Etoposide 0.1; 0,1; 0,2; 0.1 and Nocodazole 0.02; 0,02; 0,05; 0.06 with concentrations of 10 μM and 1 μM respectively.

LOW-TEMPERATURE SINTERING OF In_2O_3:Sn CERAMICS

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This study presents an innovative approach to synthesize of indium-tin oxide (In_2O_3:Sn or ITO) ceramics via a low-temperature sintering with a participation of chemical agents, offering a cost-effective and energy-efficient alternative to traditional methods. ITO is widely known for its excellent electrical and optical properties and is an essential material for semiconductor technology, especially as transparent conductive films for displays and solar cells. However, the deposition technology of ITO films requires ceramic targets with high homogeneity, conductivity and density for subsequent sputtering. Traditional ceramic production

methods require high temperatures (up to 1500 °C) and use of expensive crucibles and nanopowders. The main part of the costs of producing ITO films is the cost of ceramic targets. The proposed method uses chemical vapor transport to facilitate sintering at low temperatures down to 800 °C. The advantages of this innovative approach are the following: decrease in sintering temperature, absence of material loss and interaction with a crucible, no need to use expensive nanopowders, minimal deviation of the ceramics diameter, effective dissolution of SnO_2 dopant (high doping homogeneity), low resistivity down to 3×10^{-2} Ω·cm, high thermal stability of targets and higher structural perfection of ITO thin films deposited by high-power magnetron sputtering.

PRODUCING CONDUCTIVE CERAMIC TARGETS AND THIN FILMS OF $Fe_2O_3\cdot(ZnO)_k$ ALLOYS AT LOW TEMPERATURES

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This study presents an innovative approach to synthesize of Fe2O3·(ZnO)k ceramics by low-temperature sintering with chemical agents, which is a cost-effective and energy-efficient alternative to traditional methods. Fe2O3·(ZnO)k thin films have a wide range of potential applications (photocatalysts, gas sorbents, sensors, or magnetic materials) due to their excellent chemical and optical properties. However, the deposition technology of such films requires ceramic targets for subsequent sputtering. Classical ceramic production methods require high temperatures and the use of expensive crucibles and nanopowders. Conventional Fe2O3·(ZnO)k ceramics have high resistivity, it degrades under local plasma heating, which limits the sputtering power. Low sputtering power results in poor structural quality of the films. Usually, such thin films are dielectrics. The proposed innovative method uses chemical vapor transport to facilitate sintering at low temperatures and has the following advantages: reduction of sintering temperature from 1500 °C to 1050 °C, no material loss and interaction with a crucible, no need to use expensive nanopowders, minimal deviation in the ceramics diameter, high homogeneity, low resistivity down to 5 Ω·cm (the decrease by 3–5 orders of magnitude), high thermal stability of targets and higher structural perfection of thin

films deposited by high-power magnetron sputtering. An increase in the conductivity of Fe2O3·(ZnO)k thin films by 3–5 orders of magnitude expands the application prospects ot this compound.

NEW TOMATO VARIETIES SOLANUM LYCOPERSICUM L. DARGEN

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New variety of tomato, created by intraspecific hybridization. The variety *Dargen* is early, vegetation period is 103 days. The fruits of the variety are circular (round), small, average weight – 32,2 – 40,0 g, the surface of the fruit – smooth, without a green spot at the base, color until maturity – very light, at maturity – red. The fruits contain 6,5-8,0% of dry matter, 4,6...5,0% – sugars, 20,5...30,0 mg/% – vitamin C, 0.40...0.50% – acidity. The variety is early, vegetation period is 103 days. In the transplant culture, the variety ensures a yield of 30,0...53,6 t/ha, while the standard fruit yield is high (91,0...96,0%).

Advantages: The variety *Dargen* harmoniously combines high productivity, good tasting qualities with the resistance to fusarium and alternariosis, positive low temperatures, medium resistant to high temperatures. The productivity is high at cultivation through both seeds and seedling transplants.

SYNTHESIS AND BIOLOGICAL ACTIVITY OF MONASTROLL

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Abstracts. Dihydropyrimidine-5-carboxylates are known to possess anti-hypertensive, anti-viral, anti-tumor, anti-staphylococcal, anti-cancer, etc. biological activity. The structure of dihydropyrimidines is of interest for studying the reactivity of a molecule and preparing new derivatives. In the specialized literature, a large

number of different derivatives of dihydropyrimidine-5-carboxylates are described, however, most of them are obtained from the condensations of 1,3-dicarbonyl bonds with various aldehydes, urea or thiourea, catalyzed by different catalysts through different schemes of synthesis, which damages the finite yield.

Introduction. The reaction products are easily accessible in large quantities and are used in the pharmaceutical industry as active substances or as precursors in their synthesis. Due to the importance of dihydropyrimidines, several new methodologies have recently been developed for the synthesis of monastrol and its derivatives. Chemical transformation of dihydropyrimidines by introducing specific pharmacophore groups into their structure is considered one of the promising methods for obtaining new classes of compounds with various biological properties. Attention is drawn to the presence of nucleophilic centers that allow a variety of mono- and dialkylations, as well as very promising cyclization reactions based on them. Some of them, depending on the substituted groups, possess the corresponding anti-hypertensive, anti-viral, anti-rumoral, anti-staphylococcal, anti-cancer biological activity. This reaction has been known for more than a century, but it is ambiguous. The literature describes the mechanisms of this reaction, which proceeds in more than five directions, with the formation of various intermediate products . The synthesis is catalyzed by inorganic acids or under microwave or infrared radiation. The synthesis is catalyzed by inorganic acids or under microwave or infrared radiation. The most useful and elegant methodology currently used to synthesize dihydropyrimidines is the Biginelli reaction. The Biginelli reaction is a multicomponent chemical reaction that gives 3,4-dihydropyrimidin-2(1H)-one(thione). The hydrogen atoms of the $CH_{3\ group}$ in position 6 of the 4-(4-methoxyphenyl)-6-methyl-2-thioxo-1,2,3,4-tetrahydropyrimidine-5-carboxylate molecule have sufficient mobility for condensation reactions.

In recent years, efforts have been aimed at developing green solvents, called «eutectic solvents», derived from renewable and biodegradable components. They play an important role in human activities, and their use in research drugs has stimulated the development of a wide spectrum of synthetic methods for their preparation, preparative accessibility and chemical transformations, such as modulators of calcium channel antagonists, adrenergic receptors, antibacterial agents of the α1 receptor series, mitotic inhibitors, kinesin (family of motor proteins of eukaryotic cells, these are tubulin-dependent ATPases), anticancer, antihypertensive activity, antiviral agents and others, which makes further searches among them very promising [3].

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In the synthesis of dihydropyrimidines, the target is the selection of reagents and the testing of various catalysts and conditions, especially in the development of strategies that enable the approach of environmentally friendly catalytic conditions for further use in the work. Eutectic alloys, natural polysaccharides can serve as an environmentally friendly and financially attractive alternative to toxic and expensive catalysts. During experiments, catalysis and its role, their environmental characteristics, environmental pollution, waste and costs, as well as the application of these concepts to the synthesis of the biologically important structure of the bioactive derivative of 3,4-dihydropyrimidine-2(1H)-thione, known as its common name - Monastrol.

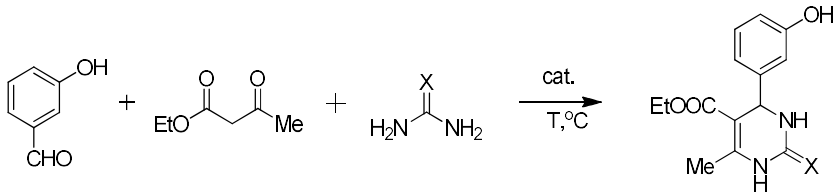

Fig.1. Biginelli reaction : monoreactive three-component synthesis of monastrol based on acetoacetic ester, thiourea or urea and 3-hydroxybenzaldehyde with the formation of monastrol and oxymonastrol (ethyl 6-methyl-4-(3-hydroxyphenyl)-2-(thi)oxo-1,2, 3,4-tetrahydropyrimidine-5 carboxy)

Monastrol synthesized in the one-step, multicomponent Biginelli reaction in the presence of various bioavailable and biodegradable catalysts is of interest in its cell permeability as a molecular inhibitor small protein belonging to the Kinesin-5 protein family, protein for the bipolar motor. These mitotic blocking agents may be useful in the treatment of cancer. Monastrol and related compounds that bind proteins other than tubulin may have less toxicity and fewer side effects than currently used tubulin-binding agents. The above properties are typical for racemic monastrol [3].

The target of monastrol synthesis is reagent selection. To increase the yield, selectivity, reduced reaction time and minimization of excess reagent, formation of side products, high temperatures, pollution, waste and costs in the synthesis of Biginelli catalysis have emerged unequaled especially in the development of strategies that allow to address the ecological catalytic conditions for further use of the works. Monastrol syntheses were performed with various catalysts and in various ratios, the results of which are presented in the corresponding reports [1]. The accessibility, the high efficiency, the mild reaction conditions, the ease of separation of the catalyst after the completion of the synthesis, the more directed progress of

the reaction allow us to conclude in their favor. Therefore, the improvement of the asymmetric synthesis of S-monastrol (enantiomer with higher biological activity) represents a current topic. In the search for low molecular weight compounds that could interfere with mitosis, monastrol, a compound that blocks the motor activity of specific kinesins whose functions are restricted to the mitotic spindle, was proposed. Together with the role played by microtubules in disease pathogenesis, these cytoskeletal elements may be targets for new drugs. These mitotic blocking agents may be useful in the treatment of cancer, namely, it is currently proven, breast cancer. Monastrol and related compounds that bind proteins other than tubulin may have less toxicity and fewer side effects than currently used tubulin-binding substances. Monastrol has been shown to inhibit kinesin-5, a motor protein important for spindle bipolarity. A high molecular weight, cell-permeable, potent inhibitor of mitosis that does not interact with tubulin. It arrests cells in mitosis and specifically inhibits the mobility of mitotic kinesin Eg5, the motor protein required for the formation and maintenance of the mitotic spindle. Among the dihydropyrimidines, monastrol ranks prominently. Of considerable interest is cell permeability as a small molecule inhibitor of the spindle protein kinesin-5, as a motor protein for spindle bipolarity.

Monastrol, as an antiprotozoal drug, is used to treat and prevent infections caused by protozoan parasites belonging to the genus Leishmania, affects the activity of urease, etc. Monastrol and its analogues oxymonastrol differ from each other by replacing the sulfur atom present in monastrol with an oxygen atom in oxymonastrol. Oxymonastrol induced DNA damage , reduced cell proliferation, and increased the mRNA level of a member of the Kinesin subfamily of the cytochrome P-450 family. However, oxymonastrol was cytotoxic only at the highest concentrations used, without compromising cell proliferation and viability. Moreover, no genotoxic damage or changes in mRNA level were detected. Monastrol has greater antiproliferative activity compared to oxymonastrol, and this effect is probably associated with DNA damage caused by monastrol and its possible bioactivation, demonstrated by increased mRNA expression. In addition, these effects are apparently associated with the presence of a sulfur atom in its structure [2] . The general and specific objectives of the given theme are: the development of methods for the synthesis of substituted dihydropyrimidine-5-carboxylates and their use for obtaining biologically active polyfunctional organic compounds. The synthesis of substituted dihydropyrimidine-5-carboxylates consists in the variation of the substituents in the initial aldehyde, urea, thiourea, aceto-acetic acid ethers. Substituted dihydropyrimidine-5-carboxylates can be converted to the desired product by reaction with a suitable nucleophile. Obtaining "eutectic solvents" based

on native components (tartaric acid, choline chloride, dihydroabietic acid, urea, pectin, etc.) and researching the catalytic properties of "eutectic solvents" in order to obtain substituted dihydropyrimidine-5-carboxylates. Obtaining and researching the catalytic properties of materials made using 3D printing technology based on local minerals (from the region of Naslavcea village, etc.) and insoluble polymers

Key words.

Biginelli reaction, monastrol, dihydropyrimidine, eutectic solvents.

Relevance and purpose.

In the synthesis of monastrol, the objective is to select reagents and test various biodegradable and bioavailable catalysts to achieve maximum product yield. Eutectic alloys can serve as straight environmentally friendly alternative from a financial point of view and the toxicity of catalysts in the synthesis of monostrol.

Materials .

To confirm the structure of the synthesized compounds, analyzes were performed using the following tools:

1 . IR-spectrum recorded in the database by Perkin Elmer. Spectrum 100FT-IR with a range of 3600-650 cm $^{-1.}$

2. NMR spectra were recorded in DMSO-d6 with 1% TMS on a Bruker-Avance III spectrometer (400.13 and 100.61 MHz).

Commercially available reagents, biodegradable catalysts, with permitted toxicity, were used as initial compounds. Solvents were used after prior distillation.

The results.

During the experiments, catalysis and its role, the importance of multicomponent reactions and their ecological, biodegradable and bioavailable characteristics, as well as the application of these concepts to the synthesis of the important biological structure of monastrol (1,2,3,4-tetrahydro-4-(3 - hydroxyphenyl)-6 methyl-2-thioxo-5-pyrimidinecarboxylic). To increase yield, selectivity, reduce reaction time, and minimize excess reactants, side products, high temperatures, pollution, waste, and costs in Biginelli synthesis, catalysis has emerged unparalleled, especially in the development of strategies, which favors the achievement of eco-friendly catalytic conditions for its continued use in the chemical field. The syntheses of monastrol were carried out with different catalysts and in various ratios.

Conclusion.

Syntheses of monastrol were carried out with the participation of different catalysts and in different ratios. The availability of eutectic solvents, waste and by-products from the food industry as catalysts in the Biginelli reaction, high efficiency, mild reaction conditions, ease of separation of the catalyst after finishing the

synthesis, more targeted reaction, allows to we conclude in favor of eutectic or green solvents, and secondary products of the food industry, which allows us to bear minimal losses in the food industry. The linear nature of the dependences of the course of reactions on the corresponding catalysts was presented as the result of the conducted research .

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BIOACTIVITY OF 3,4-DIHYDROPYRIMIDINE-2-(TI)S

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Due to the importance of dihydropyrimidines, several new methodologies have recently been developed for the synthesis of monastrol and its derivatives. The most useful and elegant method currently in use is the multicomponent Biginelli reaction. Catalysis plays a fundamental role in the Biginelli synthesis. Monastrol and oxymonastrol differ from each other by the replacement of the sulfur atom present in monastrol with an oxygen atom in oxymonastrol. The synthesis methods used in these studies are the Biginelli cyclization method. The methods for detecting the final substances are: melting point, thin-layer and column chromatography, spectral methods: NMR, IR.

From the point of view of “green chemistry”, the most waste-free and environmentally friendly, it is of interest to obtain ionic liquids containing various active groups, for example, cyanoethyl, carboxyl, and on their basis to obtain eutectic mixtures and study their catalytic properties in the synthesis of monastrol.

The biological role of monastrol and its derivatives has led to considerable interest in its synthesis and is a three-component one-pot synthesis based on the interaction of acetoacetic ester, thiourea and 3-hydroxybenzaldehyde, which avoids waste from multi-stage purification and the formation of residues while maintaining environmentally friendly conditions. As an antiprotozoal agent, it is used in preparations for the treatment and prevention of infections caused by protozoan parasites belonging to the genus leishmaniasis, affects the activity of urease, etc.

Alkyl-substituted 3,4 dihydropyrimidin-2(1H)-ones (thiones) are extremely attractive substances with various design possibilities: the presence of an alkyl substituent significantly increases the solubility, activity, allows for the targeted action of various compounds and provides a low molecular weight of target compounds. At present, we have obtained specific compounds by condensation of (thio)urea with a number of aliphatic aldehydes and various dicarbonyl compounds in ethyl acetate solution. The reaction proceeds in most cases unambiguously and without the formation of by-products, and optimization of the reaction conditions has allowed us to increase the yields of a number of target compounds up to 88%.

New strategies for creating environmentally friendly catalytic conditions to increase yield, reaction time, selectivity and minimize excess reactants, by-product formation, high temperatures, environmental pollution, waste and cost in Biginelli synthesis were explored for further use in renewable chemicals industry.

INTERACTIVE-CREATIVE EDUCATIONAL EDITION FOR CHILDREN AGED 2-5 YEARS, BASED ON THE STORY „PUNGUȚA CU DOI BANI", INTEGRATED WITH THE TANGRAM GAME SCENARIO

Nicoleta VASILIEV, Viorica CAZAC

Technical University of Moldova, Republic of Moldova

Aim and Objectives of the Project. This project aims to develop an interactive and creative educational edition designed for children aged 2 to 5 years, fostering their cognitive, aesthetic, creative, and organizational skills. The edition offers young readers the opportunity to explore the world of Ion Creangă's characters in a creative way, gain knowledge and appreciation of his work, define case situations, and understand causal relationships within the daily events of the story.

Additionally, it encourages children to recognize the peculiarities of human personality and its interactions with the environment. It also allows them to reconstruct the story's characters using geometric wooden pieces, engaging in a creative process by associating character shapes and scenes with the geometric elements from the set. The edition promotes chromatic association with personality traits and color coordination between elements. Interaction with sustainable wooden pieces, developed based on Tangram game principles, further enhances the learning experience.

Beyond creativity, children will also develop logical thinking, hand-eye coordination, and associative skills.

Novelty and Educational Value. The project introduces an innovative concept by combining a traditional story with an interactive game. The book includes a Tangram set - comprising a square, a parallelogram, and five triangles - which allows children to reconstruct the characters from „Punguța cu doi bani" as they imagine them. Initially, the reconstruction challenges are simple, focusing on the characters. As the story progresses, the complexity of the game increases, providing progressive challenges that stimulate memory, attention, and fine motor skills.

The carefully chosen colors in the book help children correctly identify and combine elements while encouraging them to associate and merge them creatively.

Description of the Educational Edition. The edition is designed as a set resembling a book, complete with a cover and an integrated magnetic flap for easy opening and closing. Upon opening the cover, children will find both the book containing the story and the Tangram set. Each page is dedicated to a specific character from the story.

Through the Tangram game scenario, children engage directly with the text, learning about the characters' physical, personality, and behavioral traits while actively reconstructing them using colored wooden geometric pieces. This method transforms reading into a hands-on, engaging, educational, creative, and memorable experience.

Impact and Benefits. This interactive edition supports the development of strategic thinking, logic, creativity, and communication skills, as well as problem-solving abilities in various real-life contexts. It also contributes to personality development, aesthetic education, and cultural appreciation.

Moreover, the project promotes and preserves national cultural heritage, fostering cultural unity through diversity. By constructing characters, children explore their environment through the lens of traditional national values. The book serves as a modern learning tool that effectively integrates reading, play, and essential skill development in an engaging and meaningful way.

PROCEDURE FOR MAKING GEOPOLIMERS BASED ON RED MUD, FLY ASH AND POWER PLANT DESULPHURATION PRODUCT FOR APPLICATIONS IN THE FIELD OF CONSTRUCTION

Dumitru-Doru BURDUHOS-NERGIS, Andrei Victor SANDU, Mădălina Simona BĂLȚATU, Dragos-Cristian ACHITEI, Manuela-Cristina PERJU, Diana Petronela BURDUHOS-NERGIS, Andriana SURLEVA, Petrica VIZUREANU

"Gheorghe Asachi" Technical University of Iasi, Romania

The invention refers to a Process for making geopolymers based on red mud, fly ash and power plant desulfurization product by alkaline activation that have the ability to harden quickly at room temperature. The process according to the invention for making the ecological geopolymer consists of mixing two components, one solid and one liquid, whose composition is as follows: the solid component consists of 30-35% class F fly ash, 10-15% thermal power plant desulfurization product, 45-50% red mud, and the liquid component consists of Na2SiO3 solution and NaOH solution in a mass ratio between 1.25 and 1.5; the mass ratio between the liquid and solid components is between 0.65 and 0.75, and the concentration of the NaOH solution is 10M or 3M.

JACUZZI SYSTEM FOR THERMALISM WITH HYDRO-/AIR-MASSAGE AND HALOCHAMBER TREATMENTS WITH SOLIONS

Ioan Gabriel SANDU, Andrei Victor SANDU, Ion SANDU, Kamel EARAR, Viorica VASILACHE, Cătălina Mihaela ȘTIRBU, Radu Adrian CRIȘAN DABIJA, Marin CHIRAZI, Alina VLADESCU, Mihai Cosmin COTRUT, Maria Diana VRÂNCEANU

"Gheorghe Asachi" Technical University of Iasi, Romania

The invention relates to a jacuzzi system for thermalism with hydro-/air-massage and halochamber treatments with solions, to be used for the prevention and treatment of cardio-respiratory, osteo-muscular and neuro-motor diseases as well as for improving performance in children, elderly and sportsmen or persons performing intense physical activity. The system consists of a parallelepipedal or circular tight chamber, with ionized windows, with UV filters, having, in central position, a round-, oval- or lagune-shaped basin made of glass fibers and photo-thermal resistive

polymer, an aerosol-generating bubbling device with concentrated solution of NaCl, KCl, CaCl, MgCland KI in a mass ratio equal to 7.95 : 1,0 : 0.5 : 0.5 : 0.05, where, through the frits from the bottom side, overheated water vapours are purged to reach the preset levels of solions, the bubbling device being placed in a niche next to the entrance door, where for the control, in real time, of the working parameters, there are used devices with specific sensors coupled to a microcomputer, which also enables modification of the water vapour flow-rate for bubbling, the basin volume is correlated with the halochamber volume and it ranges between 1000 and 10000 liters, with a depth of 0.5...1.5 m, and the working temperature ranges between 35...40°C.

NOZZLE SYSTEM USED FOR THERMAL SPRAYING IN ELECTRIC ARC

Ștefan Lucian TOMA, Gabi SAVIN, Bogdan Florin TOMA, Costică BEJINARIU, Iulian IONIȚĂ, Petrică VIZUREANU, Gheorghe BĂDĂRĂU, Andrei Victor SANDU, Alin CAZAC, Diana – Petronela BURDUHOS – NERGIȘ

"Gheorghe Asachi" Technical University of Iasi, Romania

The invention belongs to the field of Thermal spraying in electric arc of wire drawn metallic materials. The technical problem that is solved by the invention is the directed constrain of the electric arc without modifying the velocity and the flow of the compressed air that divides the droplets of molten metal into fine particles in order to increase the temperature and the velocity of the sprayed particles. The technical solution to solve this problem consists in the creating a compressed air circuit through a concentric nozzle system composed of a body, a cap, a conical nozzle, a conical nozzle and a constraint frontal nozzle.

PROSTHETIC MASTER-SLAVE SYSTEM FOR AUTOMATIC COMPENSATION OF LEG LENGTH DISCREPANCY

Dimitrie-Cristian FODOR, Cristian AGHION, Neculai-Eugen SEGHEDIN

"Gheorghe Asachi" Technical University of Iasi, Romania

The prosthetic system is composed of two components: a primary component (Master) affixed to a rigid bar positioned over the suprapatellar regions of the unilaterally transtibial amputee, and a secondary component (Slave) that is mechanically linked to a motorized, extendable prosthetic module housed within a transtibial prosthesis. This prosthesis can feature either a passive or active ankle joint. The Master component is responsible for evaluating the leg length discrepancy. The prosthetic limb is designed to transmit wireless commands to the Slave component, which, in turn, activates the extendable module until the prosthetic limb is equalized with the intact contralateral limb.

The developed concept offers several key advantages, including the reduction of prosthetist subjectivity during manual adjustment using traditional tools for determining leg length discrepancy. Additionally, it facilitates automatic adjustment of the transtibial prosthesis length to maintain body symmetry and decreases the frequency of visits to specialized clinics for prosthesis length adjustment.

HIGH PERFORMANCE DESIGNED PROTOTYPE OF A SMALL DRONE TRACKING SYSTEM

Mihai-Andrei GHEORGHE, Alexandru ȘCERBATII, Marian POBORONIUC

"Gheorghe Asachi" Technical University of Iasi, Romania

The proposed system is a Proof-of-Concept of a short range point-defense system designed for the detection and tracking of small form-factor UAVs (Unmanned Aerial Vehicles).

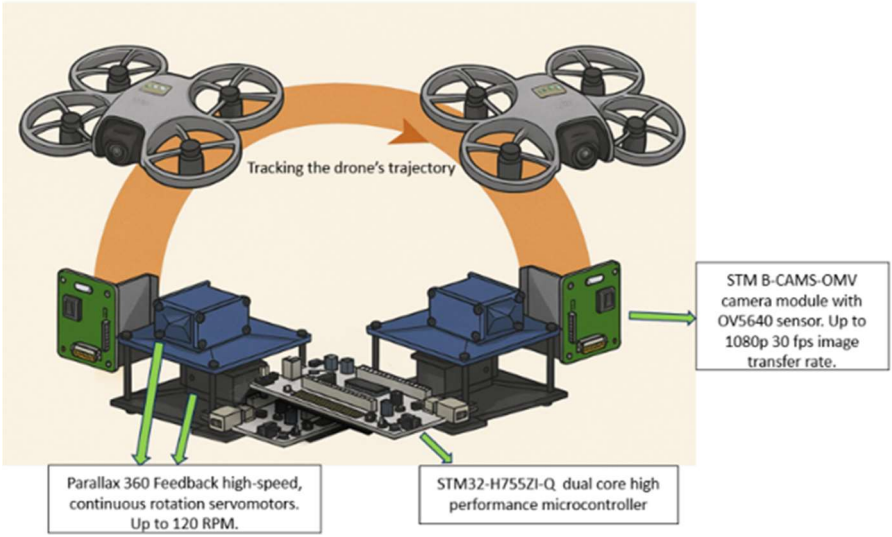


Fig. 1

The applications of such a system range from warfare to civilian environments, some examples including the monitoring of no-fly zones near airports for safety reasons, or monitoring of private property for privacy reasons. Using a pan-tilt mechanism, the system can surveil a semi-spherical area and features real-time video streaming to a smartphone via a mounted camera.

The drone detection algorithm uses a TDOA (Time Difference of Arrival) approach based on identifying the high-frequency sounds generated by the propellers of UAVs. All structural elements have been 3D-printed. Further improvements may include the integration of additional sensing methods for improved detection accuracy, remote control of the system via a smartphone app and the optimization of the physical design for higher durability and improved performance through the usage of higher-quality materials.

INTUITIVE HUMAN-ROBOT INTERACTION VIA HAPTIC CONTROL

Alexandru SCERBATII, Mihai-Andrei GHEORGHE, Marian POBORONIUC

"Gheorghe Asachi" Technical University of Iași, Romania

Conventional robotic arm control systems often struggle with inherent latency, limited feedback mechanisms, and an inability to adapt dynamically to complex environments. These constraints hinder their application in high-stakes fields such as minimally invasive surgery, automated manufacturing, and remote scientific exploration—where both precision and responsiveness are critical. Existing solutions, while technologically advanced, are often expensive, proprietary, and inaccessible to many educational or low-budget research institutions. To address these challenges, we propose a novel real-time haptic control framework designed to provide a more natural and intuitive interaction between the human operator and the robotic system. By leveraging real-time programming principles, the system minimizes communication delays and synchronizes input with physical motion, ensuring near-instantaneous response from the robotic arm. The integration of tactile feedback allows users to not only control the robot but also perceive physical interactions—such as resistance, contact, or texture—making manipulation tasks more accurate and inherently safer. A key innovation of our approach is its emphasis on affordability and accessibility. Instead of relying on high-end, commercially available haptic interfaces, we designed a cost-effective alternative using off-the-shelf components and open-source platforms. This makes the system highly adaptable and replicable in various settings, including university laboratories, technical schools, and DIY (Do It Yourself) communities where resources are limited but innovation thrives. The modular architecture supports a range of hardware configurations and feedback types, allowing for scalable implementation based on specific application needs.

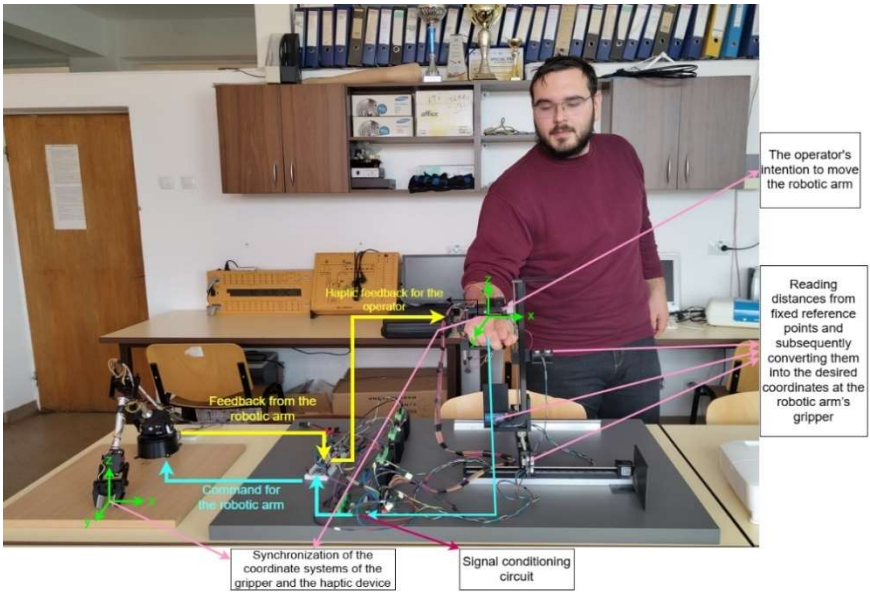


Fig. 1: Interactive Control Loop Between Human Operator and Robotic Arm via Haptic Interface

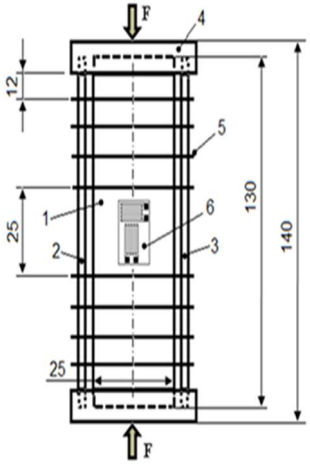
TEST SPECIMEN FOR COMPRESSION TESTING OF SAMPLES TAKEN FROM THIN FLAT

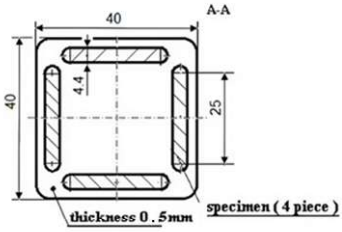
Ciprian Ionut MORARAȘ, Ionut MITITELU

"Gheorghe Asachi" Technical University of Iasi, Romania

The invention relates to a specimen for compressive testing of samples taken from thin flat semi-finished flat products. Static compression testing is especially necessary for materials with brittle behavior, such as composites. Several methods are known for the compression testing of composites, the most widely used being: IITRI (ASTM D3410); Celanese; ASTM D6641M (mixed loading mode);

ASTM D695 modified by Boeing 9 . All these methods have the following disadvantages: the effect of stress concentration cannot be avoided, due to the proximity of the "calibrated" area to the trays or to the pads (beads) that reinforce the gripping part of the specimen; special devices are used for gripping and guiding the specimen, which are expensive and are not included in the equipment of universal testing machines. The technical problem which the invention solves is to design a thin flat specimen which does not require special gripping and guiding devices for compression testing and which allows easy access for strain gauges. A special device has been developed in which four identical rectangular specimens, inserted with a sliding fit or lightly pressed into the pierced grooves and arranged on the sides of a square, are tested. The device groups four samples of Lxl = 130×25mm, taken from a 4.4 mm thick GFRP plate, having at each end an aluminium alloy cap and eight 0.5 mm thick aluminium sheet spacers, where 1-front sample; 2-left sample; 3-right sample; 4-Al alloy cap; 5-Al sheet spacer; 6-T-type rosette. The invention has the following advantages: it decreases the possibility of buckling by increasing the moment of inertia of the cross-section (due to the arrangement of the samples in a square) and decreasing the buckling length (due to the guiding of the samples passing through the intermediate disks); facilitates the use of extensometers and strain gauges due to the increased length of the active part of the specimen; minimizes the stress concentration effect; it does not require special devices for gripping and guiding the specimen, nor for avoiding bending in the specimen samples (in the latter case, existing devices such as spherical joints are used in the testing machines);when bonding the specimens in the grooves in the end disks, a mixed mode of loading (compression applied on the end of the specimens and shearing in the adhesive start) is performed, as in the ASTM D6641M device, thus avoiding crushing of the specimens in the loading areas. The above sample also allows the use of high-performance optical methods for monitoring strain and stress state in GFRP samples, such as Digital Image Correlation (DIC). The other standard methods for compression testing (ASTM





D695-15, D 3410/3410M-03, D6641/6641M-09) do not allow the use of DIC, for design reasons.

MODULAR MECANUM WHEEL ASSEMBLY OPTIMIZED FOR TRACTION ON SANDY AND UNSTABLE SURFACES

Aurel Mihail ȚÎȚU, Daniel BÂLC, Emanuel BÂLC

"Lucian Blaga" University of Sibiu, Romania

This modular Mecanum wheel is specifically designed to ensure advanced mobility on low-traction surfaces or terrains that are traditionally challenging for this type of wheels, such as sand, gravel, or soft surfaces. Its modular design allows for rapid configuration and adaptation of individual components, providing a flexible solution for off-road applications or operations in difficult environments. Each roller is built using materials optimized for effective contact with sandy surfaces, featuring a profile that maximizes the contact area while minimizing sinking.

MECANUM WHEEL WITH INDIVIDUAL FLEXRING-EQUIPPED ROLLERS FOR VIBRATION DAMPING AND ENHANCED STABILITY

Daniel BÂLC, Aurel Mihail ȚÎȚU, Emanuel BÂLC

"Lucian Blaga" University of Sibiu, Romania

This Mecanum wheel incorporates a damping component, based on the use of flexrings mounted on each individual roller. Flexrings are flexible structures that absorb vibrations generated by the rollers' contact with the rolling surface. This adaptation brings multiple benefits, especially for precision applications such as industrial robots or autonomous vehicles operating in vibration-prone environments or on uneven surfaces.

HYBRID-ARCHITECTURE MECANUM WHEEL WITH INDEPENDENTLY ACTUATED ROLLERS

Emanuel BÂLC, Aurel Mihail ȚÎȚU, Daniel BÂLC

"Lucian Blaga" University of Sibiu, Romania

This Mecanum wheel represents a significant technological advancement by integrating an independent actuation system for the peripheral rollers. In traditional configurations, Mecanum wheel rollers are passive, rotating freely as the main wheel spins. In this hybrid wheel, each roller is equipped with its own actuation system, powered by a dedicated DC micro-motor capable of independently controlling the roller's speed and direction of rotation.

DEVELOPMENT OF A SUSTAINABLE TOURIST SITE MODEL

Elena Andreea BUCA, Rahela BARAC, Mihai Victor ZERBES, Alexandru OLTEANU, Laura-Maria FUMUREANU, Liliana Georgeta POPESCU, Sorin SOARE

"Lucian Blaga" University of Sibiu, National Research and Development Institute for Cryogenic and Isotopic Technologies Râmnicu Vâlcea, Sibiu Students' Cultural House, Romania

The paper presents an innovative project carried out by a multidisciplinary team formed by: 2 students and 2 teaching staff of the Faculty of Engineering of the "Lucian Blaga" University of Sibiu, 1 research assistant from the Institutul Național de Cercetare-Dezvoltare pentru Tehnologii Criogenice și Izotopice Râmnicu Vâlcea and 1 young engineer affiliated with the Student Culture House of Sibiu. The main objective of the paper was to develop a model of a sustainable tourist site, suggestively named "S.M.A.R.T. Village". This initiative is part of the current trends of sustainable development and aims to offer an ecological, viable and educational alternative in the field of tourism and construction. The project combines environmental concerns with the need to educate society in the spirit of sustainability and the intelligent use of natural resources.

The project starts from a clear motivation: the need to reduce the negative impact of human activities on the environment, by promoting a responsible lifestyle,

inspired by the principles of LOHAS ("Lifestyle Of Health And Sustainability"). S.M.A.R.T. Village proposes an integrated approach, combining green technologies, sustainable architecture, organic agriculture and the valorization of local traditions. At the same time, the aim is to create a self-sufficient community, based on collaboration, continuous education and respect for natural and cultural heritage.

The area chosen for the creation of this ecological village is located in Brașov County, between the Țagla and Piatra Craiului Mountains, a place with a special natural and climatic potential. Here, the favorable conditions for the production of wind, solar and hydropower energy are exploited by integrating alternative energy production systems: wind turbines, solar panels and composting systems for the recovery of organic waste. The varied relief and the proximity to protected natural areas also provide an ideal setting for the development of ecotourism and outdoor activities.

The proposed constructions are made of recycled materials, such as PETs, pallets, PFL boards or other recovered resources. These are designed not only as homes or accommodation, but also as functional areas – restaurants, conference rooms, creative workshops, wellness centers and charging stations for electric vehicles. Architectural and technological solutions ensure energy autonomy and comfort, while maintaining a minimal impact on the environment. Each building is designed modularly, with the possibility of expansion and adaptation according to the needs of the community and visitors.

The project also includes a bio agro-zootechnical microfarm, where sustainable cultivation methods such as aquaponics, permaculture or vegetable cultivation in composted containers are practiced. Also included are organic farms for goats, pigs, poultry and fish, designed to avoid any contamination of the soil and water. These units not only provide local, healthy and pesticide-free food, but also offer an educational setting for tourists and students, promoting traditional and modern agricultural practices, without negative impact on the environment.

The recreational area is well-designed, with sports fields for football, tennis, horse riding, mini golf, as well as playgrounds, barbecues and spaces for camps or educational and recreational activities. Team building activities, craft workshops and cultural events are also regularly organized that actively involve the local community. These facilities transform the village into a dynamic space, intended for all age groups, where education, relaxation and nature coexist in harmony.

S.M.A.R.T. Village is more than an academic exercise – it is a practical demonstration of how technical knowledge can be used to create a sustainable, functional and harmonious community. It is a proposal for the future of tourism and living in harmony with nature.

In addition, the project opens up real prospects for replication in other rural or mountainous areas in Romania, being a feasible model of sustainable local development, with a positive impact on both the environment and the quality of life.

BUILDING A GREEN CAMPUS: A MODEL FOR ENHANCING ENGAGEMENT AND PROMOTING ENERGY SUSTAINABILITY

Alexandru OLTEANU, Laura-Maria FUMUREANU, Mihai Victor ZERBES, Liliana Georgeta POPESCU, Sorin SOARE

"Lucian Blaga" University of Sibiu, National Research and Development Institute for Cryogenic and Isotopic Technologies Râmnicu Vâlcea, Sibiu Students' Cultural House, Romania

Introduction

This project presents a conceptual model that connects university strategic objectives with concrete actions to foster a sustainable culture, focused on energy efficiency, environmental impact reduction, and stakeholder engagement. Developed through a logical framework and a student-targeted study, the model is supported by quantitative statistical analysis. The outcome is a strategic tool designed to enhance the integration of sustainability into institutional practice through active stakeholder involvement.

Methodology

The proposed model was validated through a quantitative study based on a questionnaire administered to students, built around statements aligned with the stages of a sustainable culture. The questionnaire was completed by 322 respondents, selected through hybrid sampling proportional to fields of study and years of education.

Data were statistically analysed using SPSS, with Cronbach's Alpha for internal consistency, Spearman and Kendall correlation tests, and Multiple Linear Regression to confirm theoretical relationships. The results demonstrated the model's validity and the predictive relevance of the analysed variables, supported by normality tests and residuals' graphical analysis.

Results

A total of 322 valid responses were collected. The internal consistency of the questionnaire was excellent ($\alpha = 0.910$). Spearman and Kendall correlations confirmed significant relationships between knowledge, motivation, and sustainable behaviour, with the highest values for knowledge about renewable energy ($\rho = 0.432$), energy production ($\rho = 0.418$), and energy storage ($\rho = 0.417$). The regression model was significant ($F = 89.162$, $p < 0.001$), showing a strong

correlation between variables (R = 0.676) and solid explanatory power ($R^2 = 0.457$, adjusted $R^2 = 0.452$). The three independent variables – knowledge about energy (B = 0.412), motivation provided by the university (B = 0.321), and transparent communication (B = 0.116) – significantly contributed to explaining responsible behaviour. Enhancing all three factors from moderate to high levels resulted in an estimated increase in engagement score of nearly 30%.

Conclusions and Discussions

The proposed model for supporting a sustainable culture in universities was statistically validated through a rigorous quantitative study conducted on a sample of 322 respondents, demonstrating high internal consistency ($\alpha = 0.910$). Validation was achieved through significant correlations and multiple linear regression, confirming the relevance of three fundamental dimensions, knowledge, communication, and motivation, which together explain 45.7% of the variance in responsible behavior (adjusted $R^2 = 0.452$). Although seemingly moderate, this percentage is notable in the context of human behavior analysis, where high variability and multiple external influences set it apart from the exact sciences.

Therefore, the model shows that students' sustainable engagement depends on access to information, knowledge, and institutional support, providing a practical tool for concrete changes in university policies and culture.

OPTIMIZATION OF A PNEUMATIC SHUTTER SYSTEM FOR THOMSON SCATTERING PLASMA DIAGNOSTICS

Sorin SOARE, Alexandru OLTEANU, Mihai Victor ZERBES

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Introduction

Nuclear fusion presents a promising solution for sustainable, carbon-free energy with minimal radioactive waste and enhanced safety compared to fission. Magnetic confined plasma experiments (fusion reactors) are developing advanced plasma diagnostic among others. Plasma monitoring plays a key role in the safe exploitation of long pulse discharges. These systems rely on electromagnetic radiation capturing and therefore they require a clear view path which in turn imposes vacuum vessel interruption of the all-metal wall to allow the use of materials transparent to this radiation. These penetrating systems will be subjected to the conditions existent in the vacuum chamber (inside the reactor) during baking and operation scenarios, i.e. vacuum, radiation, thermal gradient, magnetic field variations.

The data acquisition systems (DAQ) usually consist of window (optical typically), a supporting structure (penetrating into the reactor chamber) and some protection for the window (double windows, metallic shutter) against flying debris, unwanted film depositions and thermal protection. Behind the window usually the actual DAQ is located and continued with electromagnetic transportation to the data analysis systems. This shutter protects the windows when the system is not in use, providing thermal and mechanical shielding as well as reducing the neutron flux. Given the harsh reactor environment, the Port Plug and shutter mechanism must be highly reliable.

This study evaluates and optimizes the shutter actuation system and Port Plug structure, combining kinematic modeling, force analysis, and a comparison of two actuation solutions: spring-damped versus high-force pneumatic actuation. Finite element analyses (FEA) were performed under static and transient load conditions, including pressure, torque, and multi-axis acceleration, to validate the design's structural integrity. The results confirm an optimized configuration for safe, precise, and durable operation within fusion reactor.

Methodology

The analysis focused on two key areas: the cinematic study of the closure mechanism and the structural evaluation of the Port Plug.

Cinematic Modeling and Force Evaluation – An analytical model of the closure mechanism was developed, analyzing forces and moments with and without a damping system.

Structural Analysis (FEA) – The Port Plug's geometry was modeled and subjected to real-world loading conditions to assess its behavior under static and dynamic conditions using ANSYS.

Actuation Solutions Comparison – Two pneumatic actuators were compared: a standard version and a more robust one, with and without damping.

Model Validation – The analytical models were validated against FEA simulations to ensure consistency and accuracy.

Results

In the shutter system force analysis, the cinematic behavior was evaluated using a pneumatic actuator with a stroke of 46–96 mm and a maximum force of 100 N. Simulations showed that 61.8 N is required to maintain the fully closed position, and -97.65 N is needed for balance in the fully open position. A helical spring solution was discarded due to neglecting shaft mass and internal friction. The final solution uses a 50 mm pneumatic actuator, operating at 0.6 MPa and generating up to 1178 N, with Igus X bushings ensuring precise guidance and resistance to extreme temperatures and loads in the nuclear environment.

The structural analyses of the Port Plug focused on both static and transient behavior. In the static regime, applying a 40 kNm torque to the side walls resulted in a deformation of 2.08 mm and an equivalent stress of 3.4e8 Pa, with a safety factor of 0.7, indicating a risk of plasticization. Applying the same torque to the plasma flange reduced the deformation to 1.5 mm and the stress to 2.8e8 Pa, with an

improved safety factor of 0.88. In the transient analysis, with the torque reduced to 30 kNm and a duration of 30 seconds, stable results were obtained: maximum deformation of 1.18 mm, stress of 1.59e8 Pa, strain of 8.946e-4 m/m, and a safety factor of 1.56, validating the optimal geometry (10 mm wall) and structural configuration for real operating conditions.

Conclusions and Discussions

The optimal solution for the shutter system is a high-capacity pneumatic actuator (1178 N), ensuring safe operation without extra damping. Structural analysis confirmed its compatibility with the reactor environment and validated the design. Applying torque to the side walls risks plastic deformation, while applying it to the plasma flange reduces stresses but remains critical. The safe configuration, with reduced torque (30 kNm), keeps stresses and deformations within the elastic range. The 10 mm thick wall geometry and force application to the plasma flange are validated as the optimal solution.

SHM OF CRITICAL AREA OF SCALABLE WIND TURBINE BLADE AFTER SELF-HEALING

Ionut MITITELU, Ciprian Ionut MORARAȘ, Gabriel Silviu DOBRESCU
Mentor Adriana SAVIN

National Institute of R&D for Technical Physics, Iasi, Romania

The main objective of non-destructive testing of scalable wind turbine blades (WTB) after the self-healing (SH) process is to monitor the structural integrity and increase the service life until the first in-service inspection. The tests were performed on five WTB GE 1.5sle scalable model specimens (in our case a 1750 mm long blade).

The test results were recorded in a database regarding the effectiveness of the applied methods. For the SH process, polyetherimide hollow fibers (PHF) with SH polymers polydimethylsiloxane (a-PDMS) were used/tested. The distribution of SH agents was ideally embedded with minimal disruption to the surrounding layers. (Fig 1d for five interfaces). Local detection systems were Crack PHF is detected with passive wireless sensors, array of fiber Bragg grating-FBG, triaxial accelerometers and strain sensors mounted on the surface of the WTB.

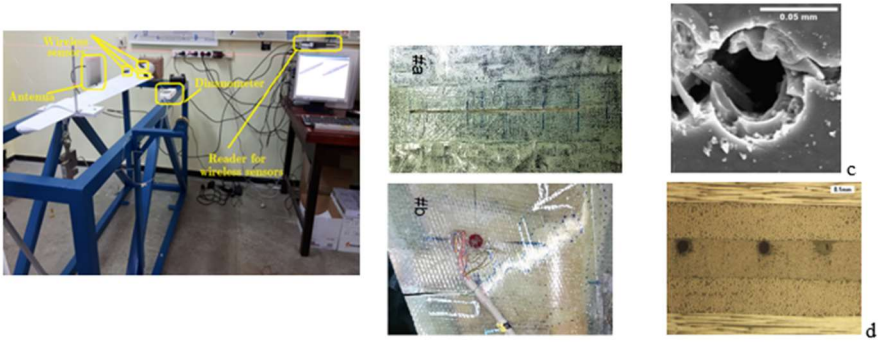

Fig. 1 Investigated damage cases #a Lateral transverse crack manually induced [length27mm]; #b Transverse crack in the network start [length 15mm]; SEM image crack passing directly through; distribution (PHF a-PDMS)

The crack propagation in PHF depends on HF and the fiber/matrix interface. The PHF stores repair agents during passive states and provides a mechanical trigger for the self-repair process when damage to the host material occurs (Figure 1a crack passing directly through the PHF). The FEM analysis identified three areas of interest corresponding to areas with high risk of damage, as both aerodynamic/static loads overlap. The results of bending tests in a loading-unloading cycle after the SH are presented in Fig. 2a and b.

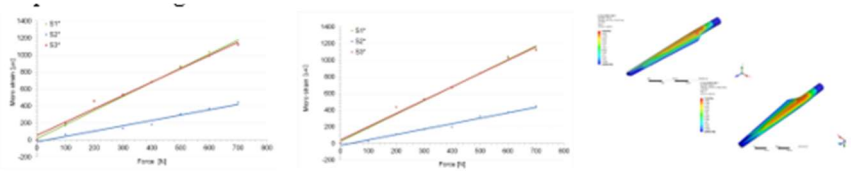

Fig. 2 Signal delivered by the three WRS placed in different critical regions of WTB: a) loading; b) unloading c) FEM analysis

Comparing loading/unloading data at 500N with the simulated ones, a good correlation of the displacement can be observed, experimentally being determined as 37 mm. Using the FBG sensor (DTG S-01 type, with a center wavelength of 1535 nm), the strain-load dependency of the WTB was tested in a loading-unloading cycle.The results present same dependency strain-load. The FBG sensor test, in addition, shows the existence of a residual stress upon removal of the force, which corresponds to an accumulation of energy in the WTB composite structure, predominantly in the resin.

FORMALDEHYDE RESISTIVE SENSOR

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Field of invention

Formaldehyde (CH_2O) is a flammable, colorless, volatile organic compound (VOC) with a strong odor, widely used in the chemical and light industries. It originates from sources like forest fires, exhaust gases, and cigarette smoke and poses health risks such as eye and throat irritation, nausea, and breathing difficulties. Classified as a human carcinogen by the International Agency for Research on Cancer (IARC), formaldehyde is also a major contributor to sick building syndrome (SBS). Its toxicity and widespread presence have driven growing interest in developing CH_2O sensors.

Original approach

The sensitive film described in this invention, which is used to obtain resistive CH_2O sensors, is a binary nanohybrid of the nitrogen-doped carbon nanohorns (N-CNHs) / copper oxide (CuO) type. The mass percentage of nanocarbon material varies between 70 and 90%. The sensitive layer's resistance increases with CH_2O concentration as formaldehyde donates electrons, reducing hole concentration and conductivity.

Sensing structure

The sensor substrate, made of Si/SiO_2 with a size of 5 mm, features gold electrodes with a width of approximately 200 microns and a separation of 6 mm. CH_2O monitoring is conducted by applying a constant current between the electrodes and measuring the voltage at varying CH_2O concentrations.

Sensor manufacturing

The raw materials required for the synthesis of the CuO / N-CNHs sensitive film are: $Cu(CH_3COO)_2 \cdot 2H_2O$, mixture of isopropanol (solvent) and diethanolamine (stabilizer), and carbon nanohorns doped with nitrogen N-CNHs. The molar ratio $Cu(CH_3COO)_2 \cdot 2H_2O$: isopropanol is 1:3, while the mass ratio of acetate/stabilizer is 1/1. The raw materials are mixed by magnetic stirring, done sequentially, in two stages: (I) at a temperature of 60 ºC, for 1 hour; (II) at a temperature of 70 ºC, for 2 hours. Nitrogen-doped carbon nanohorns N-CNHs are added in the second stage of

magnetic stirring. The obtained dispersion is subjected to magnetic stirring for three hours, at room temperature, and deposited by the drop-casting method on a Si/SiO_2 substrate with linear electrodes or interdigitated electrodes. The densification of the sensitive layer is carried out sequentially, in two stages, by thermal treatment, as follows: (I) nitrogen atmosphere, for 10 minutes, at a temperature of 300 ºC, and (II) nitrogen atmosphere, for 1 h, at a temperature of 400 ºC.

Advantages of the proposed sensing area

- N-CNHs give a high specific surface/volume ratio, affinity for CH_2O molecules, as well as a variation in the resistance of the sensitive layer upon contact with the CH_2O molecules;

- CuO is a p-type semiconductor and has a synergistic effect with nitrogen-doped carbon nanohorns, also p-type semiconductors, when in contact with CH_2O molecules;

- CuO changes the distribution of pores at the interface with carbon nanohorns doped with nitrogen, increasing their specific surface area.

QUATERNARY OXIDIZED CARBON NANOHORNS-BASED NANOHYBRID FOR RESISTIVE HUMIDITY SENSOR

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Field of invention

The present invention relates to the RH sensing response of a resistive sensor employing a sensing layer based on quaternary nanohybrid composition comprising or consisting of $CNH_{OX}/SnO_2/ZnO/PVP$ at a 1.5/1/1/1 w/w ratio to 3/1/1/1 w/w ratio.

Materials, method, results

The interdigitated (IDT) sensing structure can be fabricated on substrates like Lexan, Kapton, or glass, with a dielectric thickness ranging from 5 to 50 μm. The electrodes, made from conductive materials such as gold or chromium, can either be of the same or different materials. A nanohybrid sensing layer dispersion in isopropyl alcohol, prepared at various w/w ratios, was deposited onto the IDT

structure using the drop-casting method. The RH sensing capability was evaluated by applying a current between the electrodes and measuring the voltage at different RH levels in humid nitrogen at room temperature. The results were compared to a commercial capacitive RH humidity sensor.

Advantages of the proposed solution

New RH sensing layers, these quaternary nanohybrid compositions exhibit several advantages:

- Oxidized carbon nanohorns (CNH_{OX}) have high specific surface area/volume ratio, water molecule affinity, and show rapid electrical resistance variation when RH varies from 0% to 90%.
- The nano-sized tin (IV) oxide (SnO_2) exhibits good RH sensitivity. CNH_{OX} have p-type electrical conduction (through holes), while SnO_2 is a n-type metallic oxide semiconductor (through electrons). By adding SnO_2 to CNH_{OX}, one will obtain islands of p-n semiconductor heterojunctions embedded in PVP (a dielectric material) that increase the sensitivity of the sensitive layer.
- Zinc oxide (ZnO) nanopowder exhibits good RH sensitivity. Both ZnO and SnO_2 are n-type electrical conductors. The ZnO – SnO_2 nanocomposite has sensing properties superior to each of the single oxides, because each of the oxides interacts differently with the oxidized carbon nanohorn material, leading to alterations in the pore distribution, which increase the specific surface area;
- Polyvinylpyrrolidone (PVP) is a hydrophilic polymer with excellent binding properties, which enables its employment in sensing structures with either flexible or rigid substrate;
- Detection at room temperature, low response time, low cost, small size, simplicity in manufacture.

Acknowledgment

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MATRIX NANOCOMPOSITE FOR SURFACE ACOUSTIC WAVES NO2 SENSOR

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Field of invention

Nitrogen dioxide (NO_2) is a harmful air pollutant primarily produced by combustion in vehicles, power plants, and industries. Prolonged exposure, even at low levels, can cause respiratory issues like bronchitis, asthma exacerbation, and reduced lung function. NO_2 also contributes to environmental problems, including ground-level ozone formation and climate change. Reducing NO_2 emissions is crucial for protecting public health and the environment.

Original approach

The devices described in this invention consist of new sensitive layers for the detection of NO_2. The sensitive films are used in the design of a surface acoustic wave (SAW) sensor. A surface acoustic wave device is composed of a piezoelectric substrate, a pair of interdigital transducers, and a sensitive layer for the analyzed gas. The proposed sensitive layers are made of new binary nanocomposite with reduced graphene oxide (rGO), boron-doped (rGO-B), and oxidized carbon nanohorns (CNHox).

Sensing structure

The sensitive layers made of rGO-B / CNHox are deposited on the piezoelectric quartz substrate by the drop-casting method or by the spin-coating method.

Sensor manufacturing

- graphene oxide dispersion in water is subjected to ultrasound for two hours;
- a stoichiometric amount of boric acid (H_3BO_3) is added to the obtained dispersion and subjected to ultrasound for 60 minutes.
- the resulting dispersion is placed in an oven and heated at 100 ºC to evaporate the liquid phase. The solid phase obtained is ground, placed in an alumina crucible, and heated in a tube furnace, in N_2 atmosphere, at 500 ºC. Subsequently, the resulting product is dissolved in water and ultrasonicated. HCl (1 M) is added to the resulting dispersion and stirred magnetically for

24 hours. The obtained dispersion is centrifuged and washed with distilled water. Afterward, oxidized carbon nanohorns is added to the previously prepared dispersion and the magnetic stirring at room temperature. Finaly, the obtained dispersion is deposited on the SiO_2 substrate. The sensitive layer obtained is subjected to a thermal treatment at 90 ºC, in a vacuum.

Advantages of the proposed sensing layer

Reduced graphene oxide, doped with boron, has a higher affinity for NO_2 molecules compared to reduced graphene oxide, and π-π type interactions between reduced graphene oxide, doped with boron, and oxidized carbon nanohorns ensure mutual homogeneous distribution in the sensitive layer

CHEMIRESISTIVE ETHANOL SENSOR BASED ON GRAPHENE AND METAL OXIDE NANOCOMPOSITES AND PROCESS FOR OBTAINING IT

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Original approach

The invention introduces a chemiresistive ethanol (EtOH) sensor and a novel manufacturing process utilizing zinc oxide (ZnO) and graphene (Gr) nanocomposite sensitive layers. A key innovation is the use of sodium hydroxide (NaOH) as both a reducing agent for forming ZnO from zinc nitrate ($Zn(NO_3)_2$) and as an initiator for nanostructuring, producing hierarchically organized ZnO-Gr nano-flower powders with high porosity at pH 14. The sensitive layer is created by depositing ZnO-Gr paste onto a dielectric substrate using drop casting, followed by heat treatment for thermal consolidation. The structure includes an electrical heating resistor on the opposite side of the substrate. Functionalizing ZnO with Gr enhances sensitivity and reduces the sensitive layer's electrical resistance, improving the sensor's performance. The sensor substrate, made of Si/SiO_2, measures 5 mm, with gold electrodes in either linear or interdigitated configurations. Ethanol detection is performed by applying a constant current between the electrodes and measuring voltage changes at varying ethanol concentrations.

Sensor manufacturing

Zn $(NO_3)_2.6H_2O$ was weighed with a microbalance to obtain the amount of 0.8940 g and then the measured amount was dissolved in 5 ml deionized water; sodium hydroxide (NaOH) 1.59 g was weighed and was dissolved in 4 mL H_2O; the Zn salt solution was gradually poured into the measured aqueous Gr solution (0.05 mg/mL) to obtain 0.4 wt% Gr in the ZnO/Gr mixture; drops of the basic NaOH solution were gradually poured into the synthesis beaker, stirring continuously; the pH of the solution was measured with litmus paper after each small addition of NaOH solution until reaching pH=14; the ultrasound head (sonotrode) was inserted into the beaker with the ZnO + Gr solution and the ultrasound was started, the solution temperature was maintained in the range (64-67) ºC throughout the ultrasound; The acoustic power density applied to the solution was 2.5 W/mL of solution; the pH was maintained at 14. The solution was kept in the refrigerator for sedimentation for 24 h, and after that, the supernatant was replaced with water, and the pH was adjusted to pH=7. The powder was dried in a microwave oven.

ACKNOWDLEGMENT

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QUATERNARY HYDROPHILIC NANOHYBRID COMPOSITION FOR RESISTIVE HUMIDITY SENSORS

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Original approach

Many principles and methods were described in the literature for measuring relative humidity (RH) and several types of materials were employed as RH sensing layers. The present invention relates to the RH sensing response of a resistive sensor employing a sensing layer based on a quaternary nanohybrid composition comprising or consisting of CNHOX/GO/SnO_2/PVP at 1/1/1/1 to 0.75/0.75/1/1 w/w

ratio. The quaternary hydrophilic nanohybrid compositions exhibit several significant advantages, when employed\

Sensor manufacturing

The interdigitated (IDT) sensing structure was manufactured on a Si substrate (470 μm thickness), covered by a SiO_2 layer (1 μm thickness). The metal stripes of IDT comprised a Cr (10 nm thickness) and Au (100 nm thickness) stack, having 200 μm width. A dispersion formed in isopropyl alcohol of a quaternary nanohybrid composition described above, at different ratios, was deposited on the IDT structure using the drop-casting method.

- The RH monitoring capability of the sensitive layers was investigated by applying a current between the two electrodes and measuring the voltage at different RH values
- Measurements were performed in humid nitrogen, at room temperature, and compared with the response of a commercial, industrial grade, capacitive RH sensor, provided with signal-processing and signal-amplifying electronics.
- It was demonstrated that the resistance of the sensitive layer varies with RH.

Advantages of the proposed solution

- The quaternary hydrophilic nanohybrid compositions exhibit several significant advantages, when employed as RH sensitive layers:
- both oxidized carbon nanohorns (CNHOX) and graphene oxide (GO) are nanocarbon materials with high specific surface area/volume ratio, affinity for water molecules, and exhibit rapid variation of the electrical resistance in contact with H_2O molecules, when RH varies from 0% to 90%;
- nano-sized tin (IV) oxide (SnO_2) powder exhibits good RH sensitivity;
- PVP is a hydrophilic polymer with excellent binding properties;
- detection at room temperature and low response time.

Acknowdlegment

- This work was funded by the Romanian Ministry for Research and Innovation, through the PN 1916/2019 - MICRO-NANO-SIS PLUS / 08.02.2019 Program.

SYSTEM FOR MONITORING AND ADJUSTING THE POWER DISSIPATED IN THE FINAL STAGE OF A HIGH POWER AMPLIFIER IN AUDIO FREQUENCY

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The invention relates to a monitoring and adjusting system that uses a well-controlled voltage reference with voltage variations, for controlling the power dissipated on the final stage of a high-power amplifier in audio frequency, by determining with a small hysteresis the voltage drop of on this final floor and transmitting this information in order to charge a storage element with energy.

METHOD OF COMPOSITE POWDER MATERIALS WITH A (COCRNIVCU) HIGH-ENTROPY ALLOY (HEA) MATRIX REINFORCED WITH CARBIDE CERAMIC PARTICLES FOR PLASMA SPRAYING AND THE RESULTING POWDERS

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The invention relates to a method for synthesizing composite powder materials comprising a (CoCrNiVCu) high-entropy alloy (HEA) matrix with a single FCC (face-centered cubic) crystallographic phase, reinforced with carbide ceramic particles (e.g., TiC, SiC, VC, WC, Co-WC). These powders are specifically engineered for thermal spray coatings in demanding applications requiring superior mechanical, chemical, and tribological properties, particularly in the automotive and aerospace industries. Key applications include coatings of friction components such as clutch disks and brake disks, where a high coefficient of friction and low wear rate are critical.

The synthesis method employs mechanical alloying and sintering techniques, offering a simple, efficient, low-cost, and environmentally friendly (low- or zero-emission) production process. Additionally, this approach is scalable to industrial levels, making it suitable for large-scale manufacturing of advanced HEA-based composite materials.

MULTILAYER STRUCTURES BASED ON THIN LAYERS COPPER AND SILICON CARBIDES, NITRIDES, AND CARBONITRIDES, WITH HIGH TRANSPARENCY AND HEAT-REFLECTING PROPERTIES

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The invention relates to a multilayer structure that is transparent to radiation in the visible spectral range, with wavelengths around λ=632.8 nm, and exhibits high reflection in the infrared spectral range, as well as the technology for obtaining this structure. The multilayer structures are obtained through physical vapor deposition methods (magnetron sputtering), comprising insulating materials formed in a plasma containing silicon, argon, nitrogen, and carbon atoms and ions in varying proportions, along with a metallic material obtained in a plasma containing copper and argon atoms and ions. The multilayer structures consist of three individual thin layers as follows: a first insulating layer of (SiCxNy) type, deposited directly on a transparent glass substrate; the second layer is a continuous metallic copper layer; and the third layer is an insulating layer of (SiCxNy) type, which may be identical to the first or different in terms of composition. The multilayer materials have a total thickness ranging between 85 and 150 nanometers, with optical properties that remain stable over time at ambient temperature and exposure to the atmosphere

NEAR FIELD TELESCOPE FOR OPTIMISATION OF SOUNDING DISTANCE OF LIDAR SYSTEMS

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Improving Near-Surface Detection in Lidar Systems

This work presents a novel prototype telescope designed to enhance lidar system capabilities by significantly reducing the incomplete overlap distance. Traditional tropospheric lidar systems begin accurate detection at around 800 meters altitude; this telescope reduces that limit to just 150 meters. As a result, it becomes possible to measure aerosol properties, monitor fog and turbulence, and track boundary layer dynamics closer to the ground—without sacrificing data quality from higher altitudes.

Designing a Cost-Effective and Compact Optical System

The optical design incorporates high-performance UV-VIS coated achromatic lenses. A large 75 mm lens with a 141 mm focal length serves as the primary collector, followed by a 12.5 mm, 30 mm EFL secondary lens. Additional correction is handled by two 125 mm plano-convex collector lenses and a 40 mm collimating lens made of UV fused silica.
The field of view, between 1 and 3 mRad, is achieved with an aperture diameter of just 0.8 to 1.6 mm, enabling precision alignment and compact system integration. This makes the system suitable for mobile and airborne use, where size and weight are critical constraints.

Building a Modular and Lightweight Mechanical Structure

The mechanical configuration is based on modular tubes and threaded aluminum components. The telescope consists of several 3-inch tubes and one reducer that narrows to 1 inch, accommodating variable apertures and sensor modules. All components are fixed with duralumin rings, painted matte black to eliminate reflections.
The modular approach simplifies maintenance and allows for fast alignment and reconfiguration. Photomultiplier detectors at the end of the optical path ensure accurate data collection across various channels and wavelengths.

Maximizing Functionality Through Versatile Design Choices

- Reduces detection threshold to 150 meters while preserving a 13 km range
- Supports multi-channel configurations for simultaneous multi-wavelength measurements
- Enables fast, precise alignment through a narrow and adjustable field of view
- Minimizes cost through the use of commercially available optics and mechanical components
- Provides robust optical stability, even in variable field conditions Integrates easily into existing lidar infrastructures with no major modifications

Extending Applications in Atmospheric Sensing

The telescope is particularly valuable in atmospheric research, supporting real-time monitoring of surface-level phenomena such as particulate matter behavior, fog development, and turbulence mixing. Its compact and lightweight structure makes it ideal for mobile lidar platforms and aircraft-based measurement campaigns.

Enhancing Lidar Systems Through Scalable Innovation

This invention demonstrates how affordable and scalable solutions can dramatically improve lidar system performance. By addressing one of the major limitations of conventional designs—high minimum overlap distance—the near-field telescope prototype opens new paths for research and operational applications in meteorology, air quality assessment, and environmental science.

LASER EMISSION STABILIZATION TECHNIQUE FOR DETECTION BY HIGH SPECTRAL RESOLUTION LIDAR

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Introducing a Novel Technique for Laser Emission Stabilization

This patent proposal presents an innovative approach to laser emission stabilization designed for high spectral resolution lidar (Light Detection And

Ranging) systems. The method involves a novel integration of 73ptica land electronic components to ensure real-time frequency control of the laser source, thus enhancing measurement accuracy and system reliability.

Combining Acousto-Optic Modulation with Real-Time Processing

The proposed system relies on an acousto-optic modulator (AOM) to split the laser emission into multiple diffraction orders. A Raspberry Pi 5 module, paired with two Raspberry cameras, monitors the laser's spectral stability by observing the behavior of these orders in relation to an iodine reference cell. Specifically, the ±1 diffraction orders are compared to determine shifts in the primary emission wavelength (order 0), allowing for real-time correction of the laser's frequency based on intensity measurements.

Ensuring Efficient and Cost-Effective Control

This technique stands out for its simplicity, low cost, and ease of implementation. Using off-the-shelf hardware like Raspberry Pi modules enables automatic feedback control without the need for expensive or complex instrumentation. The device monitors the emission in real time and applies adjustments instantly, ensuring optimal performance of the lidar system.

Benefits of the Proposed Stabilization Method

- Low implementation cost due to use of affordable components
- High stability of laser emission through continuous monitoring
- Fast response time for real-time adjustments
- Easy deployment in existing lidar systems
- Fully automatic emission control, reducing the need for manual calibration

Applications in Advanced Lidar Systems

This stabilization method is ideal for enhancing high spectral resolution lidar systems used in atmospheric sensing, environmental monitoring, and remote detection. By maintaining laser frequency stability, it supports precise measurements necessary for advanced optical diagnostics.

COMPOSITIONAL GRADIENT STRUCTURES FOR PROTECTIVE COATINGS OF CUTTING TOOLS USED IN THE WOODWORKING INDUSTRY

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The invention relates to obtain the compositional gradient structures formed by alternating layers of metal, nitrides and carbonitrides of transition metals (Ti, Cr), to be used as protective coatings of cutting tools such as milling cutters, knives, circular cutting discs and other critical equipment for woodworking subjected to a severe wear regime.

FOUR-TERMINAL SOLAR CELL WITH HETEROJUNCTION STRUCTURE BASED ON NON-TOXIC METAL OXIDES

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The invention relates to a four-terminal solar cell with a heterojunction structure based on non-toxic metal oxides and to a process for obtaining it, the cell being used for the production of advanced solar cells and photovoltaic panels. The solar cell according to the invention consists of two solar cells: a frontal subcell (SF) consisting of the layers (L2) as n-type emitter and the buffer layer (L3), over which is the quartz layer (L1), the p-type absorbent layer (L4) of Cu2O, the layer (L5) of the p 'type of Cu2O doped with N and the layer (L6) of optically transparent material, and the posterior subcell (SP) formed by the layers (L9) as n-type emitter of c - Si, the layer (L10) as p-type base (c - Si) of Cu2O absorbent material and the layer (L11)

of c-Si material type p', the two subcells being separated by a layer (L7) of the encapsulation interface and a layer (L8) of SiNx, and the layer (I2) is a metallic contact layer of Al provided with four output terminals (T1 … T4) which ensures the external contact connections. The process according to the invention is described by the following steps: making the cut plates type p, 1… 3 Ohm cm, 100 μm, 6 inches; printing (KOH) and texturing of the front surface; phosphorus emitter diffusion; elimination of phosphosilicate glass (PSG), SiNx deposition by plasma-based chemical vapor deposition (PECV); silkscreen of Ag front and Al rear; laser processing; heating contacts; welding of layers, making frontal contacts and laminating the subcell (SF) on the subcell (SP).

E-TONGUE LIKE SENSOR FOR FOOD SAFETY (FOODESENSE) – PD87/2020

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The proposal is based on the development of an electronic tongue-like sensor for the evaluation of histamine in food products (the focus is on meat products, as they are most often subject to poor hygiene during production, processing and transport). Using a single ultra-sensitive electrochemical sensor, it is possible to measure the concentration of histamine, a representative compound for assessing the level of freshness (the caution level for histamine is 50 ppm, while the maximum allowed levels vary from 200 ppm to 500 ppm). This electronic language will ensure on-site quality control of food products, from producer to seller and to consumer, providing information on the condition of food along the distribution chain. To validate the sensor, tests were undertaken on real samples, purchased from commercial stores. 7 samples of different types of meat were tested: 1 fresh chicken sample, 1 fresh pork sample, 1 fresh beef sample, 1 pork and beef minced meat sample, 1 fresh pork sausage sample, 1 fresh pork sample smoked chicken and 1 sample of altered pork. The most important result obtained is the development of the sensor based on non-specific molecular imprinting, with graphene and thiophene

electropolymerized onto Au support. This sensor represents an extension of the research project towards the "lab-on-a-chip" field. Even if the detection limit for histamine is relatively high (around 80 ppm), the manufacturing technique allows the immobilization of several distinct molecules on a small area of sensorial support.

ULTRASENSITIVE GAS SENSOR ARRAY FOR GREENHOUSE ENVIRONMENT ASSESSMENT (GreHSen) - PED393/02.11.2020

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The efficient use of water and other resources as well as the development of an automated monitoring system are key issues in agriculture. The project – Ultrasensitive gas sensor array for greenhouse environment assessment (GreHSEN) – developed a monitoring sensor array which can specifically evaluate the level of dangerous gases produced inside of greenhouses (CO2, NH3). The demonstration model is an experimental model consisting in an integrated gas sensors array and an appropriate data acquisition system. The integrated gas sensors array is based on functionalized graphenes, which allows amplification of detected electrical signals. The detection mechanism is based on the variation of resistivity/conductivity and interfacial properties of the active semiconductor layer (in our case the semiconductive polymer-modified graphene layer) when exposed to different gases. The typical sensing mechanism is as follows: first, the target analyte comes into contact with the sensing layer; the analyte affects the semiconductor layer with various molecular interactions, changing the distribution of the charge carrier density; this change in the charge carrier density results in a change in the resistivity of the sensors. We synthesized by electropolymerization and magnetron sputtering thin layers of graphene –polyaniline and graphene-polypyrrole and tested them to CO2 and NH3. The sensor array showed a good response to the gases and fast recovery. The most important result obtained during the implementation of the project was the integration of the sensor array with the data acquisition system, that can actively monitor and transmit data in real-time.

AMPLIFIER CONTROLLED BY THE INPUT SIGNAL LEVEL FOR A CHERENKOV DETECTOR IN SALINE ENVIRONMENT

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The invention refers to an amplifier used for a Cherenkov detector in order to obtain the most accurate information about the phenomena in the Universe. The amplifier according to the invention comprises three stages of amplification, mounted in cascade, each having a delay circuit, a comparator, an amplifier and a semi-adjustable resistor. The input signal coming from an electromagnetic sensor and formed following the interaction of a cosmic radiation neutrino with a saline environment, commands the amplifier to obtain an optimal amplification in order to determine the Cherenkov cone.

PLANAR SURFACE PLASMON RESONANCE STRUCTURE WITH RELIEF DIFFRACTION GRATING AND PROCESS FOR MAKING THIS STRUCTURE

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The invention was concerned with surface plasmon resonance structures for optical sensors. The invention consists in the use of the relief diffraction grating that works in transmission. The diffraction grating coupling allows the structure to be planar. The SPR structure consists of a thin metal film deposited on one side of the substrate and on the other side a relief diffraction grating realised in a film which have properties of photoresist. This one is illuminated throu metallic mask and subsequently etched, a process known and used in nano-photolotography.The flatness of the structure is an important achievement as it reduces manufacturing costs, reduces the size of sensors and allows the creation of portable devices.

PROCEDURE FOR REMOVING CONSOLIDANTS AND ORGANIC DEPOSITS FROM THE SURFACE OF MURAL PAINTINGS USING BACTERIAL ESTERASES IMMOBILIZED IN POLYSACCHARIDES-BASED GEL

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The invention presents a process for removing consolidants and organic deposits from the surface of mural paintings, using bacterial esterases immobilized in gel. The process consists in preparation of enzyme solution (esterases) from acetone powder in potassium phosphate buffer (pH 7.5), followed by preparation of the gel based on polysaccharides extracted from Rhodophyceae family' algae (Agarart) or from Xanthomonas campestris bacteria (Vanzan), with immobilized esterases (1:1), then adjusting the gel size to the surface to be treated. After applying it to the surface and a period of incubation, the gel is removed, the surface is cleaned and dried. Finally, the efficiency of the process is evaluated by complementary techniques (direct analysis, optical microscopy, electron microscopy, colorimetry, FTIR, hyperspectral imaging).

HYBRID EQUIPMENT FOR STRATIGRAPHIC CHARACTERIZATION OF CULTURAL HERITAGE OBJECTS

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The present invention consists of a hybrid equipment that incorporates three major laser spectroscopy techniques: Laser Induced Break-Down Spectroscopy, Laser Induced Fluorescence and Raman Spectroscopy delivering an important tool for the field of cultural heritage applications: the stratigraphic characterization of cultural heritage objects, in situ, without sampling. The hybrid equipment is

configured to collect LIF and RAMAN data from the stratigraphy of materials using the micro-destructive component: LIBS. The proposed equipment can be operated in lab or in situ, providing a complex characterization of the investigated surfaces, at the ionic, atomic and molecular level, in real time.

INTELLIGENT ADVANCED PHOTONICS TOOLS FOR REMOTE AND/OR ON-SITE MONITORING OF CULTURAL HERITAGE MONUMENTS AND ARTEFACTS – RESEARCH AND INNOVATION ON CULTURAL HERITAGE AND CCIs-2023, HORIZON-RIA No. 101132448

Monica DINU, Roxana RADVAN, Luminița GHERVASE, Lucian RATOIU, Andreea PATRASCU, Vlad CRISTEA, Marilena STANCU

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iPhotoCult is a HORIZON Europe project aiming to design, develop, demonstrate, and validate innovative and intelligent new environmentally friendly and green solutions for safeguarding Cultural Heritage (CH) monuments and artefacts.The iPhotoCult solutions, which can be applied remotely and on-site, consist of:a suite of advanced diagnostic and monitoring Tools along with Methodologies for their effective and optimum use. Tools providing physical, chemical, and structural information, referenced to high-resolution 3D digital models of the Cultural Heritage buildings, monuments, and artefacts, thus allowing for accurate and reliable monitoring and analysis of critical changes over time, integrated with data acquisition and, where applicable, remote operation software; a cloud-based Software Services Platform (iSSP) providing services for (i) data processing, management and visualization, (ii) Artificial Intelligence (AI) supported prediction for degradation and deterioration of Cultural Heritage buildings, monuments and artefacts, and (iii) analytical Cultural Heritage methodologies and protocols, in the form of digital “workflows & flowcharts & process-diagrams”, for documenting conservation interventions and for consistency as well as for the standardization of risk assessment protocols, conservation strategies, and conservation materials selection processes.

GELLED FERROFLUID FOR ACTIVE MILITARY CAMOUFLAGE – AN INNOVATIVE APPROACH TO REDUCING ELECTROMAGNETIC AND ACCOUSTIC SIGNATURE

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Abstract

The ferrofluid, a colloidal liquid composed of magnetic nanoparticles suspended in a carrier fluid, exhibits unique magneto-rheological properties that can be innovatively exploited in the field of military camouflage. This innovative paper investigates the applicability of ferrofluids in reducing electromagnetic and acoustic signatures, proposing a flexible and adaptable solution that surpasses the limitations of traditional rigid materials used in active camouflage. [2] The main innovation lies in the theoretical analysis of the interaction between ferrofluids and external fields, focusing on the mechanisms of energy absorption and dissipation an area of research that has been relatively unexplored until now. The study employs numerical simulations to model the magnetic and acoustic properties of the ferrofluid and analyzes the optimal conditions for application on conventional substrates, proposing a strategic direction for the development of adaptable active camouflage technologies.

Current art of state

Currently, military camouflage primarily relies on radar-absorbing materials (RAM) and anechoic coatings to reduce radar and sonar signatures. [3] Although effective under certain conditions, these materials are rigid, difficult to adapt, and hard to repair in the field. In contrast, the use of gelled ferrofluid introduces an innovative concept: a flexible, self-healing, and adaptable layer capable of absorbing both electromagnetic radiation and acoustic waves, opening the possibility for the development of dynamic and real-time reconfigurable camouflage. [1]

Scientific research methodology

Gelled ferrofluid is obtained by dispersing magnetite (Fe_3O_4) nanoparticles into a carrier liquid, followed by the gelation of the suspension using agents such as carbopol or sodium alginate. The controlled particle size (10–100 nm) and the addition of surfactants ensure a stable and uniform dispersion. Gelation provides the

necessary viscosity (500–2000 cP) to maintain stability without spontaneous flow, thus creating a material compatible with active camouflage applications.

Application of ferrofluid solution

The ferrofluid is applied onto anodized aluminum substrates to maximize mechanical adhesion. The stabilization of the layer is facilitated by a magnetic field generated by a layer of ferromagnetic material mounted on the reverse side. [4] Techniques such as spin-coating allow the formation of a thin layer (~1 mm), and the application of an additional magnetic field (100–200 Gauss) optimizes the distribution of magnetic particles, thereby enhancing the electromagnetic and acoustic absorption properties.

Experimental data

Radar frequency: 10 GHz, f= 10 GHz; Relative permittivity: εr = 10 μ; Relative permeability: μr = 5; Conductivity: σ = 5 s/m; Layer thickness: d = 1 mm; Substrate: $r_{12} \approx -1$.

Calculation relationships

Impedance of the Ferrofluid Layer: [1]

$$\boldsymbol{Z}_{\text{ff}} = \boldsymbol{Z_0}\sqrt{\frac{\mu_r}{\varepsilon_r}}, \text{ where: } \boldsymbol{Z}_{\text{ff}} \approx 266.6\ \Omega. \quad (1)$$

Attenuation in the Layer: [2]

$$\boldsymbol{\gamma} = \sqrt{\boldsymbol{j\omega\mu(\sigma + j\omega\varepsilon)}}. \quad (2)$$

Attenuation Factor for a Layer of Thickness is:

d = 1mm and $\mathbf{exp(-2\gamma d)} \approx 0.0435$.

c.1. Reflection Coefficient at the Air-Ferrofluid Interface:

R 01 = -0.1716.

c.2. Reflection Coefficient at the Ferrofluid-Aluminum Interface:

$\boldsymbol{r_{12} \approx -1}$.

The total reflectivity of the ferrofluid layer is calculated as follows: [3]

$$\boldsymbol{R} = \left|\frac{r_{01}+r_{12}\exp(-2\gamma d)}{1+r_{01}r_{12}\exp(-2\gamma d)}\right|^2, \text{ R} \approx 3.36\ \% \quad (3)$$

The application of a 1 mm thin layer of ferrofluid significantly reduces the radar signature, with a reflectivity of approximately 3.36%.

Conclusions

This paper proposes an innovative technology for flexible and adaptable military camouflage based on gelled ferrofluids, capable of reducing radar and sonar signatures. The use of these materials opens new avenues for optimizing equipment protection by integrating advanced nanoparticles and enabling real-time adaptation to operational conditions. Preliminary results indicate significant potential for application in the development of next-generation dynamic camouflage systems.

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ALUMINUM ALLOYS FOR CAR RIMS

Doru SAPTA
Mentors: Ana SOCALICI, Corneliu BIRTOK BANEASA, Vasile PUTAN

Politehnica University of Timisoara, CITT Politehnica 2020, Timisoara, Romania

Aluminum alloy 6082 is used in various applications in the automotive industry, construction, and the transportation sector. It is widely used and has replaced alloy 6061 in many applications. It has high corrosion resistance and high hardness. It is very difficult to achieve fine-grained structures in aluminum alloys through various processes. In the case of aluminum alloy 6082, the hardening phase is Mg2Si. Its size is determined by the presence of iron and silicon. These alloys use magnesium and silicon in their composition, can be heat-treated, have good forgeability, and high corrosion resistance. Globally, the manufacturing of automotive wheels is carried out using aluminum alloys through casting and/or plastic deformation.

The experimental data were collected and processed statistically. The goal was to establish correlations between grain size (considered a dependent parameter) and the chemical composition elements that influence grain refinement. It is observed that the alloying elements Si, Mg, Mn, as well as Ti, used for grain refinement, positively influence the mechanical properties within the limits of these elements. Specifically, an increase in Ti leads to finer grain size, which also results in higher values for mechanical characteristics. Using high-quality charge materials leads to minimal variations in the chemical composition elements, and following

alloying, only small differences in chemical composition are observed from one batch to another. The narrow variation limits for chemical elements resulted in acceptable variations in the alloy's qualitative characteristics.

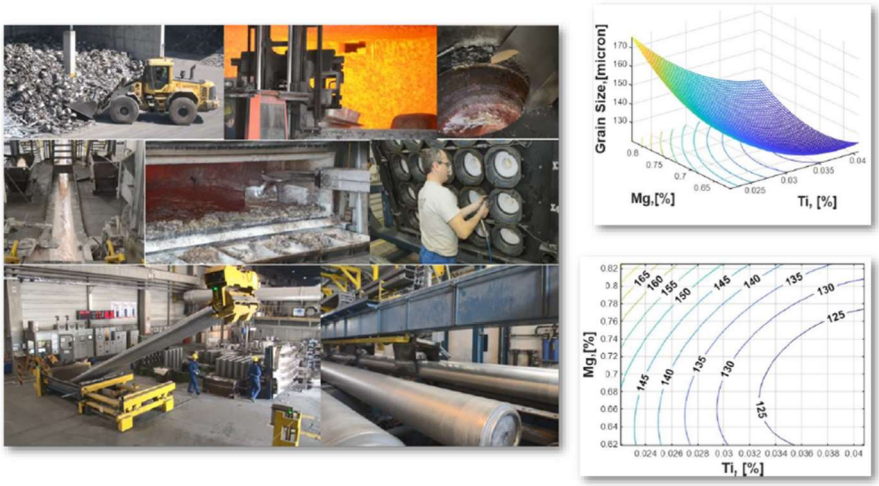

Fig 1. Study cases thermal imaging views

A-S-F SUPER-ASPIRATED AIR FILTER

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This study presents a method for optimizing the intake system in the case of the internal combustion engine by implementing an axial super-aspirated air filter with special functions.

The axial super-aspirated air filter has the following functions: capture, recovery, increasing the air speed and reducing the temperature. The advantages are the reduction of fuel consumption and polluting emissions.

This study is based on several patents related to the super-aspirated air filters as follows:

Filtru de aer supraaspirant, 126019, 2012;

Filtru supraaspirant inversat, 125034, 2013;

Air Filter for IC Engines, US14/121,674, 2016.

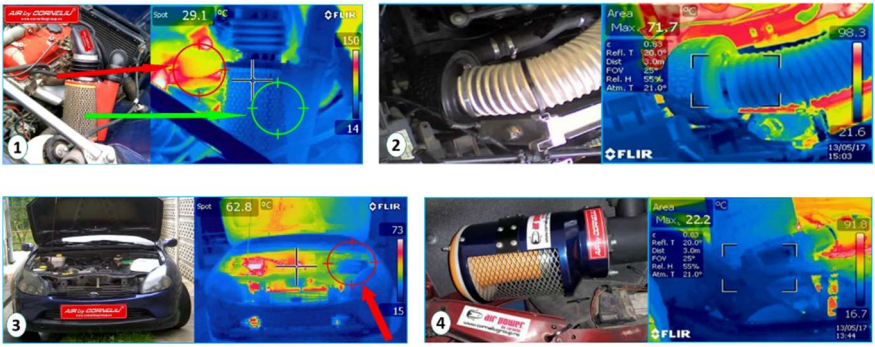

Fig. 1. Study cases thermal imaging views

In general the relatively high values of the temperature recorded on the intake system is due to the organization of the propulsion group, the air filter location and the lack of protection in the filter area.

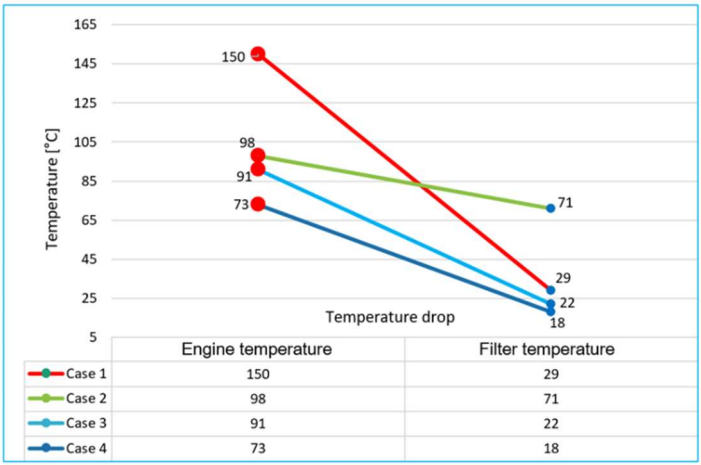

Fig. 2. Comparative temperature values in the studied cases

A solution in order to reduce the temperature on the intake system consists in the implementation of an Air by Corneliu system composed of the super-aspiring air filter, dynamic system of air transfer (STDA) and integrated thermal deflector.

The researches has shown that temperatures have been reduced by up to 50%.

Acknowledgement: This research project was financially supported by the Project "Network of excellence in applied research and innovation for doctoral and postdoctoral programs / InoHubDoc", project co-funded by the European Social Fund financing agreement no. POCU/993/6/13/153437

ASSISTIVE EXOSKELETON FOR PEDIATRIC PARALYSIS REHABILITATION

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The integration of the exoskeleton in pediatric rehabilitation represents an important step in modern medicine, offering children with paraplegia a new perspective on mobility. This technology not only facilitates the recovery of neuromuscular functions but also stimulates neuroplasticity, an essential process in the development of the nervous system. The pediatric exoskeleton assists the movements of the hip, knee, and ankle through mechatronic actuators. The design of the exoskeleton began with an analysis of the biomechanics of pediatric gait, focusing on the movements of the hip, knee, and ankle joints. Fusion 360 was used to create a precise 3D model of the exoskeleton, considering the anthropometric dimensions of children. The exoskeleton is designed to provide support, stability, and increased mobility to users, having a robust belt-type system that supports the user's trunk, distributing the weight of the exoskeleton on the body and reducing pressure on certain areas. The structural frame supports the weight of the exoskeleton and provides stability, and the adjustable straps securely fix the exoskeleton on the body, allowing adjustment for different sizes and ensuring a comfortable and secure fit.

The core of this system are six actuators, three for each lower limb, chosen for their robust torque and compact dimensions. These motors, strategically positioned near the hip, knee, and ankle joints, are responsible for generating the complex movements necessary for walking and other activities.

Precise motion control is ensured by drivers, with each motor being controlled independently. The central processing unit of the exoskeleton is an Arduino Mega 2560 microcontroller, responsible for coordinating the movements of the motors. The code implements an adaptive control system for a six-motor pediatric exoskeleton, facilitating locomotor rehabilitation for children with paraplegia by generating personalized lower limb movements, simulated based on the human gait pattern.

The final model of the pediatric exoskeleton was designed in detail in Fusion 360. The electronic control system, based on a microcontroller, was designed to generate coordinated movements of the lower limbs. The implemented electronic circuit provides the interface with the actuation elements. The physical prototype of the exoskeleton was created using additive manufacturing techniques, and the electronic components were integrated into the printed structure. The final assembly demonstrated the basic functionality of the system, successfully simulating controlled flexion and extension movements of the lower limb joints. The results obtained validate the concept of a functional pediatric exoskeleton, realized through modern design and manufacturing techniques. To improve performance and expand the system's capabilities, the integration of sensors is proposed.

The results of the initial tests demonstrate the feasibility of the concept, with the ability to generate controlled movements of the lower limbs, simulating human gait. However, this project not only offers a technical solution for mobilizing children with paraplegia, but also contributes to improving their quality of life.

EMBEDDED SYSTEM FOR PRECISE HAND MOTION ANALYSIS AND REHABILITATION SUPPORT

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As a result of neurological evolution, physiological maturation, and the functional development of learned movement patterns, the hand becomes a key component in an individual's interaction with the environment. Conditions such as upper limb hemiparesis, strokes, or traumatic injuries can severely compromise this

functionality, significantly affecting the degree of personal autonomy. In this context, the recovery of fine hand movements becomes vital for the patient's quality of life, and our proposed device addresses this need by providing a precise evaluation method and a motivating support system for the patient. The prototype was developed using an Arduino Mega 2560 development board, chosen for its ability to manage multiple communication ports (SDA, SCL) and its extended memory. In the middle of the system are MPU6050 sensors, which integrate an accelerometer and a gyroscope, allowing real-time monitoring of movements. This sensor is essential for determining orientation angles and the spatial position of an object, providing relevant information for mobility assessment during medical rehabilitation.

For data transmission, the HC-05 Bluetooth module was used to facilitate communication between the Arduino board and the mobile application named iMOB - one of the two software components developed by the team, alongside a graphical interface created in Processing. The data collected is analyzed and displayed in real time, offering both numerical interpretation (expressed as mobility percentages) and visual feedback through LED indicators.

The proposed rehabilitation process is structured into two distinct stages: functional evaluation and actual rehabilitation, both supported by a shared calibration component that ensures measurement accuracy. This staging enables a more structured approach to follow patient progress and a more efficient adaptation of interventions.

Regarding user interaction, the application developed on the MIT App Inventor platform was designed to be intuitive and easy to use. It guides the patient through the evaluation of their current mobility using representative animations for each analyzed movement. This visual component enhances the understanding of the required steps and improves the user's active engagement in their own rehabilitation. An innovative element of the project is the playful component integrated into the rehabilitation process. An interactive game was developed based on the classic Snake game mechanics, in which the snake’s movement directions are controlled in real time by the patient’s finger movements, captured by the MPU6050 sensor. As the game progresses, the difficulty increases with the snake’s size and speed, offering an additional stimulus for active involvement in the rehabilitation process.

Considering the above statements, it can be concluded that by integrating a precise monitoring system, visual feedback, an intuitive application and an interactive game, the team proposes an effective and motivating solution for patients undergoing upper limb rehabilitation.

ENHANCING POST-STROKE MOTOR REHABILITATION THROUGH GAME-BASED INTERACTIVE THERAPY

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The recovery of motor functions affected following a stroke, especially in cases involving hemiplegia, is a complex and extended process that demands repetitive physical training and sustained patient engagement. Integrating game elements into rehabilitation programs has shown strong potential to improve therapy by enhancing both effectiveness and user motivation. This project introduces an interactive rehabilitation system designed to support motor control recovery through game-based activities. Using an intuitive interface, patients are encouraged to perform specific hand movements that are embedded into playful tasks with real-time feedback. This transforms repetitive motions, often perceived as tedious in traditional settings, into engaging and goal-oriented exercises that patients are more willing to repeat. The system includes sensors that detect finger flexion and grip strength. These sensors are embedded into a wearable interface and send data to a microcontroller, which interprets the input and feeds it into a specialized program. This software component manages game logic and can optionally trigger a TENS unit to aid muscle contraction in users who have limited voluntary movement. While electrical stimulation is available as a supporting feature, the main focus is on active participation through physical motion. An LCD screen displays the game interface, showing visual progress and encouraging interaction. The system adapts to each user's capabilities through customizable difficulty levels and movement sensitivity, allowing for personalized therapy progression. Movements such as gripping or finger extension are mapped to game mechanics that require precision and timing, helping to reinforce neuromuscular coordination. Preliminary results suggest that this gamified approach increases patient motivation and consistency while supporting measurable improvements in motor function. Participants responded positively to the interactive format, highlighting its potential as a long-term therapeutic tool.

In conclusion, the system provides a compact and adaptable solution that combines technology, gameplay, and physical therapy in a cohesive and accessible format. It offers a promising alternative to conventional rehabilitation by turning

therapy into a more engaging and personalized experience for individuals recovering from stroke.

MULTILEVEL DIGITAL THERAPY SYSTEM FOR ENHANCING BALANCE IN PATIENTS WITH MOTOR IMPAIRMENTS

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Body balance plays a crucial role in maintaining physical health, relying on the integration of sensory input and motor control. Neurological and musculoskeletal conditions—such as stroke, fractures, or Parkinson's disease—can impair balance by affecting joint mobility, muscle strength, and proprioceptive feedback. In response, this research introduces a novel rehabilitation device that merges weight-sensing technology with interactive gameplay.

The system features a pressure-sensitive platform equipped with four load sensors, connected via HX711 amplifiers to an Arduino Uno board. Real-time data is transmitted to a Unity-based application that translates pressure shifts in four directions to various rehabilitation applications, where pressure shifts in four directions are interpreted as interactive commands. Personalized calibration enhances accuracy and user adaptability. The software component of the project serves as the interactive core of the rehabilitation system. The experience is structured across three levels of difficulty, which can be adapted based on the patient's mobility, reaction speed, age, and cognitive abilities.

Preliminary results demonstrate the device's ability to accurately capture changes in weight distribution and convert them into meaningful interactions, encouraging active participation and enhancing patient motivation. This, in turn, supports functional recovery and neuroplasticity.

The innovation lies in combining low-cost sensor technology with engaging digital environments to create an accessible, adaptable tool for balance and proprioception training. Ultimately, the system holds strong potential to improve the quality of life for individuals affected by motor and neurological impairments.

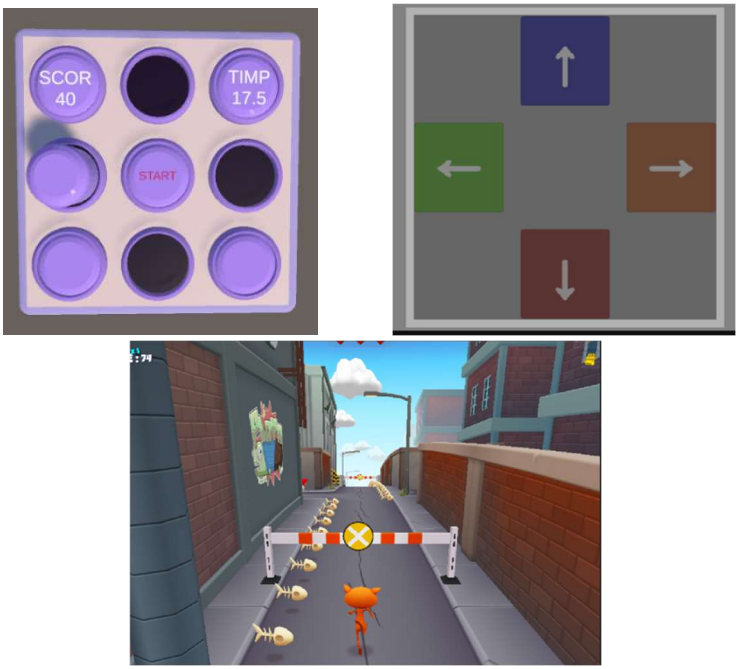

Fig.1. The software component in Unity

THE CORRELATION BETWEEN ACADEMIC STRESS AND HEART RATE VARIATIONS: A PSYCHOPHYSIOLOGICAL PERSPECTIVE

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This study explores the relationship between stress and heart rate, examining how academic stress affects physiological responses. Heart rate data were collected using a pulse sensor connected to an Arduino board, integrated into a glove, while psychological stress levels were assessed through standardized stress questionnaires completed by participants both before and after the exam session. The analysis aims to identify correlations between self-reported stress and heart rate variations, providing insights into the physiological effects of stress. The findings

may contribute to a better understanding of stress monitoring and management, particularly in academic settings.

In this study, we aim to explore the relationship between stress and heart rate, examining how academic stress affects physiological responses using a psychophysiological perspective.

In order to explore the physiological aspect, we aimed to develop a device for recording heart rate.

The device consists of an Arduino UNO development board, which uses an ATmega328 microcontroller, an XD-58C pulse sensor, a MICRO SD (TF) module, a MICRO SD card and a 9V battery to power the board. All components were incorporated into a glove, as can be seen in the figure. We kept the palm of the glove with a single finger on which we placed the pulse sensor, and at the wrist level we fixed the development board with the rest of the mounted components, so that the assembly is compact and provides comfort to the user.

In addition to the study on the psychological influence of parameters that influence heart rate, we developed a questionnaire to assess the level of stress. The questionnaire was distributed to students at the University of Medicine and Pharmacy "Grigore T. Popa" Iași to examine the degree of stress. It includes 25 questions that highlight the determination of academic stress, the triggering factors and the elements that influence the lifestyle of the participants.

After the initial application of the questionnaire on a larger group of participants, the experimental part was carried out on a number of 6 students from different specializations and different years of study, who agreed to be tested. The period selected for testing was the winter session (January-February 2025), in which we found an increase in the level of stress due to the large volume of study material reported in a limited time frame. The target group was tested both before and after taking an exam to compare the pulse values recorded by the prototype. In the Arduino application, we developed and implemented a code on the board, which takes the analog signal generated by the pulse sensor and converts it into values expressed in beats per minute (bpm).

Correlating the physiological data obtained with the answers to specific questionnaires to assess the level of stress, makes the data obtained easy to correlate with the student's state during the exam session. Due to the slightly chaotic lifestyle of students, it is not enough to monitor physiological signals alone to be able to assess the state of academic stress.

Effective stress management is essential for maintaining health and academic performance, which is why identifying moments of stress intensification and adopting appropriate management strategies are particularly important aspects.

RESISTIVE HUMIDITY SENSOR

Bogdan- Catalin SERBAN, Octavian BUIU, Marius BUMBAC, Cristina NICOLESCU

Valahia Univeristy of Targoviste, Romania

Field of invention:

The technical problem solved by the invention consists in the synthesis of new conductive polyanilines, in the form of nanofibers, sensitive to the variation of the relative humidity value, by doping emeraldine (insulating polyaniline) with oxysulfonated carbon nanohorns (ox-CNHs-SO3H,) and oxysulfonated onion-type carbon nanomaterials (ox-CNOs-SO3H).

The synthesis of ox-CNHs-SO3H and ox-CNOs-SO3H is achieved by treating simple carbon nanohorns, as well as onion-type carbon materials in Ar-O2 plasma and subsequent sulfonation.

The sensor substrate is made of PET and has a size of 5 mm, the electrodes being made of gold. The width of the electrodes is approximately 200 microns, with a separation of 6 mm between them. They can be linear or have an interdigitated configuration. The relative humidity monitoring capacity is investigated by applying a constant current between the two electrodes and measuring the voltage at different values of the relative humidity level to which the sensitive layer is exposed.

Manufacturing of the sensitive layer based on conductive polyanilines

The appropriate solution is subjected to electrospinning, using as collectors the PET substrate with linear electrodes or the one with interdigitated electrodes. Previously, a protective layer (using, for example, photoresist) will be applied to the electrodes (on each of the linear electrodes or at each end of the interdigitated electrodes), on a region delimited by a mechanical mask, to keep an area free of the sensitive layer, which will later be used for electrical contacting. The photoresist layer will be removed after the deposition of the sensitive materials. The sensitive layer of conductive polyaniline nanofibers deposited on the substrate is dried in an oven at 90ºC for 40 minutes.

Advantages

- the presence of oxygenated functions ensures the degree of hydrophilicity necessary for interaction with water;

- ox-CNHs-SO3H and ox-CNOs-SO3H contain carboxylic and sulfonic groups that can protonate the iminic nitrogen atoms in the emeraldine structure, with the formation of conductive and stable polyanilines.

- due to the large counterion, conductive polyanilines synthesized by doping emeraldine with ox-CNHs-SO3H and ox-CNOs-SO3H are less susceptible to the dedoping phenomenon;

- chemical and thermal stability;

- superior mechanical properties;

- detection at room temperature.

SURFACE ACOUSTIC WAVE SENSOR FOR RELATIVE HUMIDITY MONITORING

Bogdan- Catalin SERBAN, Octavian BUIU, Marius BUMBAC, Cristina NICOLESCU

Valahia Univeristy of Targoviste, Romania

Field of invention:

The present invention relates to the RH sensing response of a surface acoustic wave sensor employing a sensing layer based on new ternary nanocomposite matrices of the polyvinylpyrrolidone type / oxysulfonated onion-type nanocarbon materials (ox-CNOs-SO3H)-carbon black. The oxysulfonated onion-type nanocarbon materials used are found in the ternary nanocomposite in a mass percentage ranging between 60-70%, while carbon black is found in a mass percentage ranging between 5-10%.

The sensor used is of the "delay line" type, dual, made on a piezoelectric quartz substrate. The sensor has a double delay line to compensate for thermal drift. Thus, one delay line is covered with the ternary nanocomposite sensitive to RH variation, the second delay line being the piezoelectric substrate without a sensitive layer. The sensitive films are deposited on the piezoelectric quartz substrate by the "spin coating" method.

Sensitive layer preparation

The quartz substrate is cleaned for 10 minutes in an ultrasonic bath using equal volumes of ethanol and demineralized water sequentially; 3 mg of polyvinylpyrrolidone is added to 15 mL of deionized water, under magnetic stirring,

for 20 minutes, at room temperature; subsequently, 6 mg of ox-CNOs-SO3H is added to the previously prepared solution and magnetic stirring is continued for 90 minutes, at room temperature; 1 mL of aqueous carbon black dispersion (10% concentration) is added to the dispersion prepared in item 3 and magnetic stirring is continued for 180 minutes, at room temperature; the obtained dispersion is deposited by the "spin coating" method, using a quartz substrate (3000 rpm, for 40 s); the obtained film is subjected to heating at 100ºC for 60 minutes; the obtained film is subjected to a final heat treatment at 200ºC for 30 minutes; the obtained sensitive layer, deposited on the substrate, is dried in an oven at 50ºC, in vacuum, for 24 hours.

Advantages

- The use of the previously described ternary nanocomposite presents several notable advantages:
- the presence of ox-CNOs-SO3H confers a high specific surface area/volume ratio, affinity for water molecules ("mass loading"), as well as a variation in the resistance of the sensitive layer upon contact with them ("electric loading");
- the hydrophilic character of PVP and ox-CNOs-SO3H facilitates water molecules interaction;
- carbon black improves the dispersion of ox-CNOs-SO3H in the polymer matrix and modulates the conductivity of the moisture-sensitive layer, being an excellent filler.
- rapid response of the sensor to variations in RH levels, excellent mechanical properties, detection over a wide temperature range, reversibility.

PROPANOL RESISTIVE SENSOR

Bogdan- Catalin SERBAN, Octavian BUIU, Marius BUMBAC, Cristina NICOLESCU

Valahia Univeristy of Targoviste, Romania

Field of invention

The technical problem solved by the present invention consists of obtaining new layers sensitive to the variation of the n-propanol concentration, used in the design of resistive sensors. The sensitive film described in this invention, which is

used to obtain resistive n-propanol sensors, is a binary nanohybrid of the fluorinated carbon nanohorns(F-CNHs)/Cu2O at 1/1 w/w ratio. From the point of view of the detection principle, the resistance of the sensitive film increases with the level of the n-propanol concentration. The decrease in conductivity is explained by the fact that n-propanol donates electrons to the sensitive layer, decreasing the concentration of holes. The sensor substrate is made of Si/SiO2 and has a size of 5 mm, with the electrodes made of gold. The width of the electrodes is approximately 200 microns, with a separation of 6 mm between them. They can be linear or have an interdigitated configuration.

Sensitive layer preparation

The dispersion of fluorinated carbon nanohorns is prepared by dissolving 1 mg of CNHs-F in 5 mL of ethanol, under magnetic stirring for five hours, at room temperature.

1 mg of Cu2O nanocubes is added to the dispersion of fluorinated carbon nanohorns in ethanol (1mg to 5 mL ethanol).

The obtained dispersion is deposited by the "drop casting" method using a Si/SiO2 substrate with linear electrodes or interdigitated electrodes (after previously masking the contact area).

Densification of the sensitive layer is carried out in a nitrogen atmosphere, for 60 minutes, at a temperature of 125ºC.

Advantages

- F-CNHs provide a high specific surface/volume ratio, affinity for n-propanol molecules as well as a significant percentage variation in the resistance of the sensitive layer upon contact with them;
- The presence of fluorine atoms reduces the hysteresis through their hydrophobic effect;
- Copper (I) oxide is a p-type semiconductor and exhibits a synergistic effect with fluorinated carbon nanohorns, also p-type semiconductors, upon contact with n-propanol molecules;
- Cu2O changes the pore distribution at the interface with the F-CNHs, increasing their specific surface area.

CHEMIRESISTIVE ETHANOL SENSOR

Bogdan- Catalin SERBAN, Octavian BUIU, Marius BUMBAC, Cristina NICOLESCU

Valahia Univeristy of Targoviste, Romania

Field of invention

The sensitive films described in this invention, which are used to obtain resistive ethanol sensors, are binary nanohybrids of the type of onion-type nanocarbon (CNO) materials functionalized with trifluoromethyl groups (CNO-CF3) - Ni oxide (NiO) and carbon nanohorns (CNH) functionalized with trifluoromethyl groups (CNH-CF3) - NiO. The conductivity of the sensitive layer decreases with the level of ethanol concentration.

Sensor manufacturing

The CNO-CF3 dispersion is prepared by dissolving 1 mg of CNOs-CF3 in 5 mL of isopropyl alcohol, under magnetic stirring for five hours, at room temperature.

The synthesis of NiO nanopowder involves the reaction of 0.237 g (1.0 mmol) of NiCl2·6H2O and 0.06 g of Na2C2O4 are dissolved under magnetic stirring in 15 mL of H2O and 2.0 mL of ethylene glycol. The obtained solution is transferred to a stainless steel autoclave and heated at 200 ºC for 12 hours. The solid product is separated by centrifugation, washed with deionized water, respectively ethanol, then dried in air; the solid product is gradually heated to 300ºC (3 degrees/min), maintained for one hour at this temperature, then gradually cooled to room temperature.

To the CNO-CF3 dispersion, 1 mg of NiO nanopowder is added. The obtained dispersion is deposited by the "drop casting" method using a Kapton substrate with linear electrodes or interdigitated electrodes (after previously masking the contact area). Densification of the sensitive layer is carried out in a nitrogen atmosphere, for 120 minutes, at a temperature of 100 ºC.

Advantages

- nanocarbon materials functionalized with trifluoromethyl groups present a high specific surface/volume ratio, affinity for ethanol molecules (by forming hydrogen bonds), as well as a variation in the resistance of the sensitive film upon contact with them;

- NiO nanopowder is a p-type semiconductor with a wide conduction band, large specific surface area. It presents a synergistic effect with oxidized nanocarbon materials such as CNO-CF3 and CNH-CF3, also p-type semiconductors, upon contact with ethanol molecules;

- The metal oxide modifies the pore distribution at the interface with the oxidized onion-type nanocarbon materials, increasing their specific surface area;

- Trifluoromethyl groups, through their marked electron-withdrawing effect, increase the number of carriers in CNO-CF3 and CNH-CF3. Conduction is achieved by holes (p-type carriers), the sensitivity of the material for ethanol molecules increases;

TRIMETHYLAMINE RESISTIVE SENSOR

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Valahia Univeristy of Targoviste, Romania

Field of invention

The sensitive film described in this invention, which is used to obtain resistive trimethylamine sensors, is a binary nanohybrid of the type of oxidized onion-type nanocarbon materials functionalized with trifluoromethyl groups /CuO. From the point of view of the detection principle, the resistance of the sensitive film increases with the level of trimethylamine concentration. The increase in resistance is explained by the fact that trimethylamine donates electrons to the sensitive layer, decreasing the concentration of holes. The sensor substrate is made of Si/SiO2 and has a size of 5 mm, with the electrodes being made of gold. They can be linear or have an interdigitated configuration. The monitoring capacity of trimethylamine is investigated by applying a constant current between the two electrodes and measuring the voltage at different values of the trimethylamine concentration to which the sensitive layer is exposed.

Sensor manufacturing

The raw materials required for the synthesis of the sol are: the precursor-Cu(CH3COO)2 ·2H2O, the solvent (mixture of ethanol and ethanolamine), the stabilizer (polyethylene glycol with molecular weight M=5,000), ox-CNO-CF3. The molar ratio of Cu(CH3COO)2 · 2H2O - ethanol is 1: 4. Magnetic stirring is performed sequentially, in two stages: at 50ºC, for 2h, and at 70ºC, for 2h. In the

second stage of magnetic stirring, obtained ox-CNO-CF3 is added. The solution is stabilized at room temperature for 12h. The deposition of the formed solution is carried out by the drop casting method, after previously masking the contact area. The densification of the sensitive layer is carried out sequentially, in two stages, by thermal treatment, as follows: 10 minutes, at a temperature of 300ºC, and 1 h, at a temperature of 400ºC (in air).

Advantages

- onion-type oxidized nanocarbon materials functionalized with trifluoromethyl groups provide a high specific surface/volume ratio, affinity for trimethylamine molecules as well as a significant percentage variation in the resistance of the sensitive layer upon contact with them;
- trifluoromethyl groups, through their marked electron-attracting effect, increase the number of carriers in nanocarbon materials.
- the presence of fluorine atoms reduces the affinity for H2O due to the hydrophobic effect,
- CuO changes the pore distribution at the interface with oxidized onion-type nanocarbon materials functionalized with trifluoromethyl groups, increasing their specific surface area;
- room temperature detection; reversibility; fast response.

DYE-SENSITISED SOLAR CELLS

Rodica Mariana ION, Liviu OLTEANU, Laura Monica GORGHIU, Nelu ION, Andrei MILITARU

Valahia Univeristy of Targoviste, Romania

The invention relates to a dye-photosensitized solar cell having high absorption coefficient at high wavelengths, good conversion efficiency and operating safety. According to the invention, the solar cell consists of an anode made of conductive glass, e.g. indium-doped tin oxide (ITO) or fluorine-doped tin oxide (FTO) or an ITO-PET polymer to be coated with an n-type semiconductor, i.e. TiO2 paste, and then with the photosensitizing dye based on 5,10,15,20-tetra-p-phenyl-porphyrin tungsten chloride (WCl4-TPP), an electrolyte based on potassium iodide and a cathode made of ITO or FTO glass or of ITO-PET polymer with a TiO2 coat on which a graphite catalyst is applied. A DSSC cell consists of: a

photoelectrode, a dye, electrolyte, counter-electrode. In the manufacture of dye-sensitized photovoltaic cells - DSSC, one of the most important aspects is the choice of the right material for the manufacture of the photoelectrode. This component must have a conduction band, high electron density to avoid their recombination, a large surface area and be a semiconductor. Thus, maximum light absorption by the dye molecules is ensured, without affecting the electrical properties of the substrate.

Frequently, semiconducting metal oxides used as photoelectrode materials are oxide materials such as titanium dioxide (TiO2), zinc oxide (ZnO), tin dioxide (SnO2), niobium pentoxide (Nb2O5) or strontium titanate (SrTiO3). Among these, the photoelectrode based on TiO2 or ZnO nanoparticles is commonly used to obtain DSSC cells. Generally, in photovoltaic cells sensitized with organic structures, TiO2 in the form of anatase is used, because it has high stability and a large band gap. Nanometric TiO2 particles have the property of filtering sunlight, absorbing mainly the UV component of the radiation coming from the sun, being transparent to visible light. In the case of DSSC cells, p-type semiconductor materials are the photoactive sensitizers (dyes). The transmittance and conductivity of these are equally important. The most common conductive glasses are indium-doped tin oxide (ITO), fluorine-doped tin oxide (FTO), aluminum-doped zinc oxide (AZO), antimony-doped tin oxide (ATO), etc. Among them, ITO and FTO are the most widely used in DSSCs. ITO glass exhibits high transparency and high electrical conductivity at room temperature, which makes it an important candidate for electrode substrates in DSSCs. When ITO glass is heated to temperatures above 300°C, its electrical resistance increases by more than three times, which reduces the electron supply and conductivity of substrates. The porphyrin photosensitizing dye WCl 4-TPP, of the present invention, exhibits absorption at a longer wavelength and a higher absorption coefficient in the visible region (λ max/nm (Absorption Coefficient ε/103M - 1 · cm-1) for WCl 4-TPP is: 448 (194), 609 (8.3), 660 (29.7) and is particularly applicable to indoor (artificial) light sources.

Advantages of photovoltaic cells with photosensitizing dye based on tungsten -5,10, 15,20-tetra-p-phenyl-porphyrin (WCl 4-TPP):

• The dye has a broad absorption spectrum, preferably in the near IR region to collect as many photons as possible;

• The high extinction coefficient allows the dye to be used in very thin semiconductor films;• The energy levels match the conduction band of the semiconductor and the redox potential of the hole conductor;

• The synthesis of these compounds is easy to achieve for large-scale production; • Low toxicity and the possibility of recycling;

• Very high photostability to be used for at least 20 years;

• Obtaining a long lifetime of the injected electrons by blocking the recombination mechanisms.

ELECTRONIC DEVICE FOR OVER-TEMPERATURE PROTECTION IN CONDUCTORS AND DATA RECORDING RELATED TO TEMPERATURE EVOLUTION AND OTHER OPERATIONAL PARAMETERS – METHOD OF MANUFACTURE AND USE

Mihăiţă Nicolae ARDELANU, Emanuel - Valentin BUICĂ, Liviu OLTEANU, Andrei MILITARU, Isabela Elena BĂNESCU

Valahia Univeristy of Targoviste, Romania

The invention relates to an electronic device for over-temperature protection in conductors or within the assembly of electronic/electrical circuits, recording data related to the temperature evolution and other operational parameters of working devices in continuous flow or extended operation periods that could lead to overheating and, consequently, to the release of toxic smoke and fire, with the aim of protecting the environment, buildings, and human factors. When an electric current passes through connectors, due to imperfect contact and the resistance of the metal from which their pins are made, they dissipate energy through the Joule effect. If the maximum current is exceeded for an extended period, for which the connectors are designed to withstand, they may heat up sufficiently to cause a fire.

The technical problem addressed by the invention consists of over-temperature protection in conductors and the recording of data related to the temperature evolution and other operational parameters for various electrical/electronic devices/appliances. The solution to this problem involves the creation of an electronic device that provides over-temperature protection in conductors and records data related to the evolution of temperature and other operational parameters. Our device consists of programming the technological operating parameters of various electronic/electrical devices, interrupting the power supply, recording these parameters in databases, and using them to improve the operational properties of the circuit components of these devices. The solution involves creating a device using electronic circuits and a variety of passive and active components.

The electronic schematic comprises the main components: the microcontroller and the power supply. The AtTiny85 microcontroller serves the purpose of receiving the electrical signal from the two NTC thermistors and converting it into a numerical value representing the temperature. Depending on the temperature near the connector pins, upon reaching the threshold set in the software, the microcontroller commands the drain of the two MOSFET transistors connected in parallel to double the drain current.

The power supply is connected to Connector 1, and the device to be powered (the load) is connected to Connector 2. The source of the two transistors is connected to the negative terminal of the power supply connector, while their drains are connected to the negative terminal of the output connector.

When the temperature read by the two sensors falls within the set parameters, the transistors allow current to flow to the load. However, when the sensors measure a temperature higher than the critical set threshold, the transistors block the current flow to the load. The device is equipped with a visual indicator that will signal when the over-temperature protection is activated by intermittently alternating the indicator's on and off states.

The microcontroller is programmed, and data communication with it is achieved via the dedicated connector. Programming is done using the SPI communication protocol, while data communication is performed via the I2C or UART protocols.

DEVICE FOR MEASURING THE REACTION SPEED - RESPONSE

Albert-Sebastian CÎRDEI, Florin-Valentin LEUCIUC, Virgil-Adrian MOROȘAN-LARIONESCU

Stefan cel Mare University of Suceava, Romania

The invention relates to an apparatus for measuring reaction speed, which can be used by persons of different ages for the purpose of testing this form of speed.

Devices are known which are designed to test and improve reaction speed by consisting of a circuit board interfaced to a computer system and which, by means of a software program, requires the performer to respond to a visual stimulus, for example: (CN103371834 (A) - 2013-10-30), (US201202021872 A1-2012-01-26), but which are defective in that the illumination of the light signals causes the subject

to react and move his hands to touch the buttons corresponding to the illuminated lights, the apparatus has devices to measure the time elapsed from the light bulb turning on until the corresponding switch is reached, except that in this case the reaction speed is not precisely measured, and there is also a displacement of the body segments, which relates to the execution speed.

The technical problem that the invention solves is to realize an apparatus that accurately assesses the reaction speed, causing the test subject to act with simple motor gestures such as making a fist or moving a joystick in response to a visual stimulus, represented by a ball or other object.

The "reaction speed measuring apparatus", RESPONSE, according to the invention, eliminates the disadvantages of known devices by the fact that it is composed of a supporting frame which can be fixed to the backboard, to the handball or football goal or to the basketball backboard and which allows, by means of three motors, a movement of a central supporting element on the three axes x, y and z. A ball or other object is fixed to the supporting element, which moves in a random direction following a command generated by a controller. The test subject stands at a distance of several meters from the frame and holds a joystick-type device in his hand, which he has to operate according to the direction of the ball.

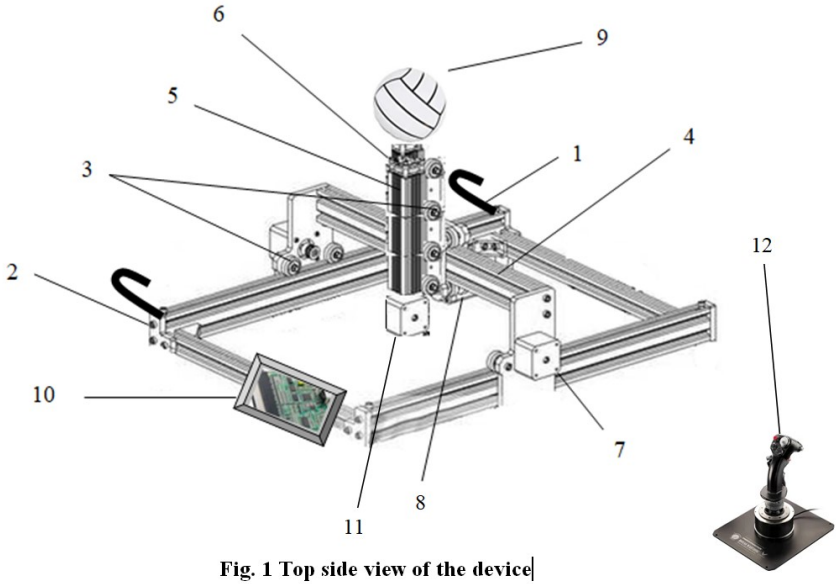


Fig. 1 Top side view of the device

DEVICE FOR TACTICAL TRAINING IN VOLLEYBALL – CHROMOS

Virgil LARIONESCU, Miriam-Denisa COZMEI

Stefan cel Mare University of Suceava, Romania

The invention relates to an apparatus for developing the reaction and decision making speed of a volleyball player in the situation of passing or attacking the ball to the net, depending on the game situation, which can be used both in sports halls and on outdoor courts. The technical problem that the invention solves is to realize an apparatus that signals to the athlete in the action of playing the ball the place where he must pass or place the ball when he is in the air or in the action of transmitting the ball by pass or attack.

The "device for tactical training in the game of volleyball - Chromos", according to the invention, eliminates the disadvantages of the known apparatuses in that it consists of a box fixed by means of cables or rods to the posts of the volleyball net, which can be moved manually or by means of an electric motor to any desired position, having the purpose of signaling technical-tactical actions desired by the coach by means of paddles of different colors, each indicating a specific task. The paddles are actuated by linear actuators that move the rotating mobile supports by means of a wireless control, causing the paddle to move down and become visible to the players.

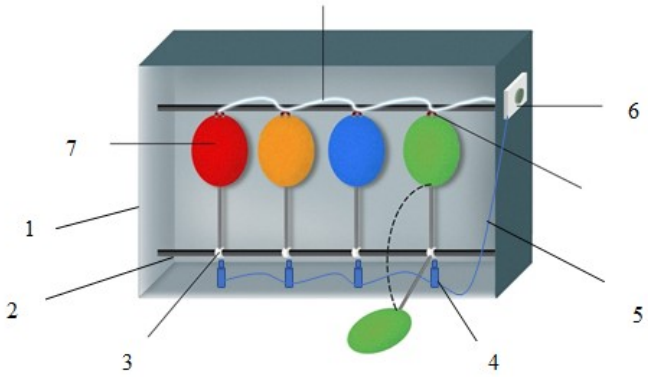


Fig.1 Front view of the tactical training device

MULTIFUNCTIONAL DEVICE FOR ANTHROPOMETRIC MEASUREMENTS – MORFIC

David PÎȚU, Virgil LARIONESCU

Stefan cel Mare University of Suceava, Romania

The invention relates to a device intended for measuring anthropometric indices: waist, height, wingspan, arm span, etc., which can be used by people of different ages.

Devices are known that measure certain somatic indices in that they are made up of an orthogonal frame that includes pillars that fix a horizontal bar that contains vertical and horizontal devices for measuring the spatial relationships of the various bone points on the subject's body - CA2307063A1 2001-10-28, but which have shortcomings in that it is a fixed, massive construction, adjustments must be made to each subject depending on their height and cannot electronically transmit the result of the measurements in order to compile a database.

The anthropometric measurement device, according to the invention (figure 1), comprises a glove-shaped housing 1 that can be made of plastic or textile material, which is fixed to the subject's forearm with a strap 2, having in its composition a roller 3 provided with a spring on which a textile thread 4 is wound, which is passed behind two pressure wheels 5 and is also in contact with a rotary encoder 6 that is activated when a pulling action is performed. By means of cables 7, the encoder communicates by electrical pulses with a data acquisition board 9, which wirelessly transmits the data to a computing system located in the immediate vicinity and to an LCD screen 12 located on the housing 1. The subject inserts his left hand into the housing 1, the middle finger reaching its end into an inner thimble 13, being fixed by the strap 2, and the middle finger of the other hand into the thimble 8, fixed in the distal part of the wire 4. By stretching the hands to the side, the wire 4 determines the rotation of the encoder 6 and the recording of the distance traveled by the wire, thus determining the value of the user's span. Having reached the maximum point of the arms' separation in the lateral plane, the subject activates the button 11, which leads to the increment of the obtained values and their display on the LCD screen, as well as their recording in a database.

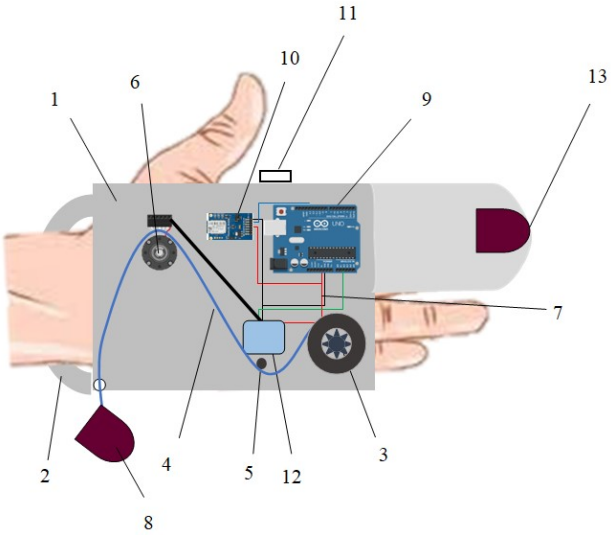


Fig. 1 Frontal sectional view of the device fixed on the subject's hand

CONTACTSAFE

Daniel Iulian FLUTUR, Florin George BACIU, Gabriel Gheorghe CIUCIUDAU

Stefan cel Mare University of Suceava, Romania

ContactSafe is an intelligent contact monitoring system that continuously checks the state of vital electrical contacts in order to identify and stop electrical problems. In order to deliver real-time diagnostics of contact performance, our prototype monitors either the contact resistance or the torque using strain gauges.

Contact resistance monitoring.

To measure the electrical resistance, sensors are placed upstream and downstream of an electrical contact. A baseline resistance is created once the contact has been tightened to the torque advised by the manufacturer. Users can identify loosening or degradation early on by receiving notifications if this range is deviated from.

Monitoring torque with strain gauges

After the initial tightening, torque variations are detected by a strain gauge that is integrated into the contact. The system notifies the user if the torque rises or falls below safe limits. Unusual heating brought on by torque loss or excess might raise the possibility of failure or fire. In order to create a reliable, predictive monitoring solution for electrical systems, we are confirming both approaches through laboratory testing.

ELECTROCARDIOGRAM MONITORING AND IMPLEMENTATION OF AN ELECTROCARDIOGRAPHIC SIGNAL SIMULATOR

Octavian LEUCĂ

Stefan cel Mare University of Suceava, Romania

The simulator generates a signal that accurately reproduces the shape of the ECG waveform, with the option to switch between two heart rates: 60 bpm (normal rhythm) and 120 bpm (tachycardia), via a hardware switch. The circuit was designed and adapted using the EasyEDA environment and is powered separately by a 9V battery. The integrated circuits are responsible for performing frequency division and decoding operations, thus providing an efficient solution for managing signals within the circuit.

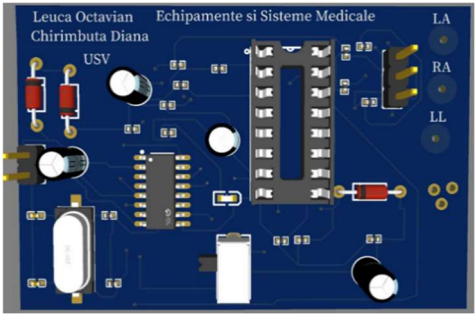


Fig. 1

In the second stage of the project, the STM32F407VG-DISC1 development board was used because it features a high-resolution analog-to-digital converter and

offers good compatibility with most displays on the market. The user interface was built using STMicroelectronics' TouchGFX development environment.

For source code development, the CubeMX code generator was used, allowing for pin configuration and control of communication speeds for SPI interfaces and the analog-to-digital converter. After generating the base code in CubeMX, the software was developed using the IAR Embedded Workbench for Arm programming environment, as it integrates very well with ARM-based microcontrollers and the compiled code size is significantly smaller compared to programming the STM32F407VG using the Arduino IDE.

For ECG signal acquisition, the AD8232 sensor was used and connected to pin PA2. To manage the data, a circular transfer mechanism was implemented using DMA (Direct Memory Access), which is triggered and synchronized by a timer. To optimize the transmitted data, the analog-to-digital converter was configured to an 8-bit resolution, and the conversion mode was set via a timer with a prescaler of 320 and an ARR register value of 100.

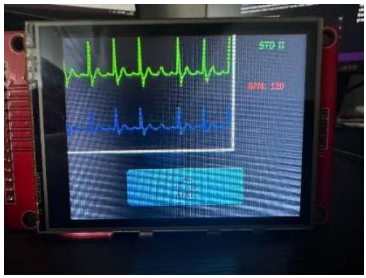


Fig. 2

HYBRID SOLAR SYSTEM WITH AUTOMATIC ADJUSTMENT

Visarion-Cătălin IFRIM, Ciprian BEJENAR,
Constantin UNGUREANU, Laurențiu-Dan MILICI,
Pavel ATĂNĂSOAE

Stefan cel Mare University of Suceava, Romania

Hybrid solar system with automatic adjustment, according to the invention, features an assembly consisting of solar panels intended for the production of electricity and heat, joined through thermo-mechanical actuators and elastic parts,

which is why, the system supports the adaptive modification of the shape and operating regime, without external intervention, so that, in summer the production of electrical energy is facilitated, in winter the production of thermal energy is facilitated, and in spring and autumn it allows the simultaneous production of electricity and heat.

METHOD AND SYSTEM FOR INCREASING HEATING POWER

Ciprian BEJENAR, Marian BEJENAR,
Andrei-Dumitru NAȘCU, Daniel HRIȚCAN, Vasile-Eusebiu TOADER,
Laurențiu-Dan MILICI

Stefan cel Mare University of Suceava, Romania

Method and system for increasing heating power, according to the invention, features a strategy and a digital command/control path, of the direct current passed through non-ideal heating elements, of the resistive-inductive (RL) type, based on a pulse modulation technique, to modify the effective value of the electric current without varying the amplitude of the electric voltage, which improves the regulation linearity of the systems that implement it.

SYSTEM FOR SAVING LOW-BEAM LIGHT SOURCES AND METHOD FOR ADJUSTMENT

Gheorghiță-Stelian MIHĂILESCU, Ciprian BEJENAR,
Laurențiu-Dan MILICI, Ștefan-Bogdan DULGHERU,
Radu-Dumitru PENTIUC, Pavel ATĂNĂSOAE

Stefan cel Mare University of Suceava, Romania

System for saving low-beam light sources and method for adjustment, according to the invention, features the completion of the electrical circuit for powering adjustable low-beam lamps, so that it allows for fine and precise limitation of the electrical power supply depending on the external light, to extend the life of existing light sources and eliminate daytime running lights, while ensuring

maximum visibility among traffic participants, in any driving condition that requires the use of the low-beam of equipped vehicles.

DYNAMICALLY ADJUSTABLE SUNSHADE SYSTEM FOR VEHICLE WINDSHIELDS

Ciprian BEJENAR, Alexandru LEONTE, Laurentiu Dan MILICI, Andrei Emanuel PASCAN, Mihai DIMIAN, Daniela IRIMIA, Constantin UNGUREANU, Ciprian AFANASOV

Stefan cel Mare University of Suceava, Romania

The sunshade system with dynamic adjustment for vehicle windshields involves gradually controlled shading, in the vertical plane of the windshield, by progressively powering the elements arranged in layers in a package of films, transparent when not powered and opaque when powered, both manually, depending on the user's wishes, and automatically, depending on the elevation angle of the sun and the vehicle relative to the horizontal plane, so as to provide a distinct alternative for creating sunshades next to the vehicle windshield.

SYSTEM FOR AIRING AND VENTILATION

Marian BEJENAR, Ciprian BEJENAR, Oana-Vasilica GROSU, Visarion-Cătălin IFRIM, Mihaela PAVĂL, Laurențiu-Dan MILICI, Eugen IAVORSCHI, Daniel-Sebastian SOLOVĂSTRU

Stefan cel Mare University of Suceava, Romania

System for airing and ventilation, according to the invention, features a disc/propeller with flaps/blades made partly of an intelligent material of metallic nature, with the property of two-way shape memory, with variable geometry, automatically depending on the temperature of the blocked or circulated air flow, while the constructive shape of the disc/propeller ensures the modification of the incidence angles or the stabilization of the angular momentum.

Advantages:

- The system introduces new possibilities for the realization of air/ventilation flaps/propellers, with variable geometry and hybrid destination;

- The system achieves a variable geometry that allows the blocking, circulation and forcing of the air flow, for the purpose of airing or ventilation;

- The system involves a disc with flaps, which transforms into a propeller with blades, depending on the air temperature, without additional power supply;

- The system eliminates the incidence angles of the flaps in the airing configuration, while stabilizing the angular momentum in the ventilation configuration.

REACTION RECORDING DEVICE FOR INDIVIDUALS WITH AUTISM SPECTRUM DISORDER (ASD)

Natanael CODĂU

Stefan cel Mare University of Suceava, Romania

This project develops a low-cost, embedded system to assess and track the behavioral and sensory responses of children with Autism Spectrum Disorder (ASD) to environmental stimuli. The system is intended to support therapeutic methods like Applied Behavior Analysis (ABA), neurofeedback, and sensory integration therapy, where precise, real-time monitoring is crucial.

Hardware architecture and components:

The system is based on the STM32F4 Discovery development board, featuring the ARM Cortex-M4 microcontroller, which supports real-time processing and sensor interfacing. Key components include:

- STM32F407VG microcontroller: a 32-bit core at 168 MHz, ideal for ADC, interrupts, and communication.
- LIS3DSH accelerometer: detects motion via SPI, useful for capturing physical reactions.
- Analog microphone module: captures acoustic responses through an ADC channel.
- Digital push button: allows manual annotation of stimulus events.
- LED indicator: provides visual feedback during data recording.
- Optional Storage: EEPROM or microSD for offline storage, or data transmission via UART.

Functional block diagram

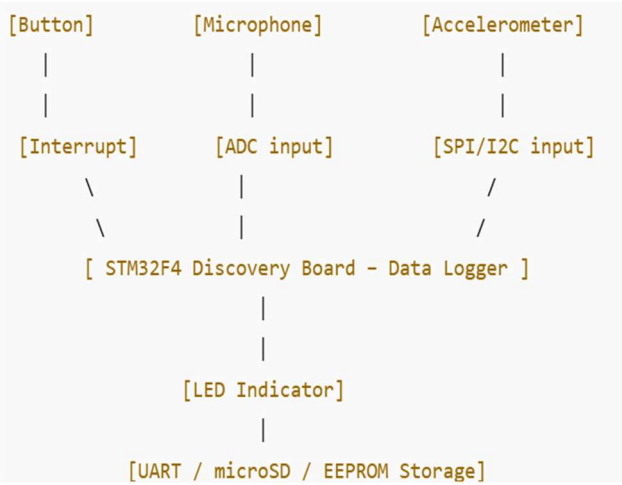


Fig. 1

Functional and therapeutic objectives:

The device enables objective tracking of responses to sensory stimuli. When the button is pressed (synchronized with a stimulus), the system collects: accelerometric data to track movements, acoustic signals for vocal responses or noise changes, a time stamp for response correlation.

This allows for both qualitative and quantitative analysis, helping therapists personalize and monitor interventions.

System workflow:

- Stimulus event: the therapist administers a stimulus (e.g., sound or light).
- Data acquisition: the LED lights up, and data collection starts via the accelerometer and microphone.
- Logging: data is stored locally (EEPROM/microSD) or sent via UART to a processing unit.
- End of recording: the LED turns off, signaling the system's return to standby mode.

Use cases and applications:

- Therapeutic monitoring: offers objective documentation of behavioral responses, reducing subjective notes.
- Sensory profile assessment: identifies hypersensitivities by correlating stimuli with responses.

- Progress tracking: tracks responsiveness and desensitization trends over time.
- Experimental research: a cost-effective tool for developmental psychology and biomedical studies.

Conclusion:

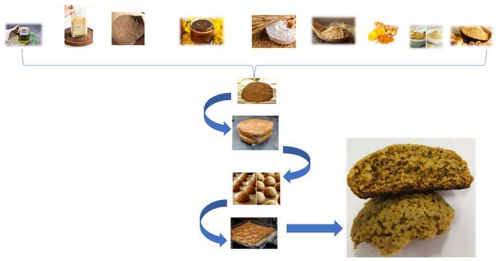
The STM32F4 platform and sensor integration provide a flexible solution for ASD behavioral monitoring. Future enhancements could include wireless communication, better synchronization, or machine learning for pattern recognition.

NUTRITIONALLY ENRICHED GINGERBREAD AND PROCEDURE FOR OBTAINING IT

Adriana DABIJA, Ancuța CHETRARIU

Ștefan cel Mare University of Suceava

The invention relates to an assortment nutritionally enriched gingerbread with a high protein and fiber content, intended for all categories of consumers. The nutritionally enriched gingerbread, according to the invention, are obtained from the following ingredients: wheat flour, millet flour, spent grain flour and dandelion syrup, being intended for people who want to have a healthy diet. In recent years the sustainable use of organic waste and agri-food by-products has become one of the main principles of the circular economy and one of the most important challenges of food engineering.



Gingerbread falls into the category of flour products, being known in a wide variety of assortments obtained from hard doughs mixed with chemical loosening agents, syrups, fats and other improvers of food taste and value, with porous structure. The technical problem that the invention solves consists in obtaining a product with sensory characteristics and improved nutritional value,

with a high content of proteins and fiber. The finished product has a nadvantages: obtaining an assortment of gingerbread with the role of functional food due to the ingredients in the manufacturing recipe.

DEPROTEINIZED WHEY IN BREWING

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The New Waste Framework Directive (Directive 2008/98/EC) prioritises preventing waste generation, with less focus on disposal and more on processing for recovery, recycling, and reuse (valorisation). Similarly, to improve the management of biological resources, develop new markets for food and biobased products, and protect the environment, the European Union's bio-economy policy must be put into practice. Dairy processors must consequently develop profitable and effective ways to handle whey waste, particularly in light of the high cost of the waste treatments currently in use. Recycling and reusing food and agricultural industry by-products is gaining popularity among consumers, businesses, and the scientific community. Although there is still debate on a universal definition of the circular bioeconomy, one of its fundamental tenets is the extraction of value from otherwise wasted food production outputs. Whey, a nutrient-dense by-product produced during the production of cheese and casein-based dairy products, finds numerous commercial applications. With the aid of advanced technologies, this by-product can be utilised in a variety of products with added value. The acquisition of whey beverages is a practical valorisation method that our nation's cheese producers may use. In order to produce whey beer, our project suggested valorising deproteinized whey. In addition to increasing the amount of mineral elements and partially replacing the water used in the beer-making process, whey can also include fermentable or non-fermentable carbohydrates. Regarding the innovative aspects of this beverage, our project proposes the use, as an absolute novelty at national and even global level, of the combination of the three ingredients in the manufacturing recipe: barley malt, deproteinized whey and fir bud syrup. The sample with 30% deproteinized whey was the one that was unanimously praised among the suggested products. It was discovered that the ingredient with the largest whey content, lactose, had no effect on the finished product's flavour. Whey beer, the final result, has characteristics comparable to those of beer, including a nice, distinctive smell, a hop aroma, and a

pleasant, bittersweet taste. From a sensory point of view, the absolute novelty is the taste, but also the surprising color: the unmistakable green of fir buds. In conclusion, the project proposes obtaining a non-distilled low-alcoholic beer-type beverage that can be easily reproduced on an industrial scale, from micro-factories to large-capacity production companies, through a simple process, in accordance with the provisions of the regulations in force, under food safety conditions.