Co-funded by the European Union

Deep Tech Teaching Factories 2023 Competition

2023 CHALLENGES

Updated: 04.10.2023

2023

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CHALLENGE: QAI Check (Concerning ML/AI)

Company: Katty fashion

Country: Romania

Website: https://katty-fashion.com/

1. About the company's business

Katty Fashion is an innovative SME founded in 2003 in the North-East of Romania, offering bespoke services of collaborative design, product development and garment manufacturing for all categories of womenswear. With over 50 EU brands relying on our services, we have made a commitment to become the next Factory of the Future and help bring more innovative and sustainable services to consumers and clients. Katty Fashion also won the C-Voucher Competition and BoostUP Transform CLC EAST EITM in 2020 as we progressed with our transformation roadmap. We are currently focusing on a bottom-up approach in the development of viable and efficient zero pre-consumer waste services through various projects.

2. Industrial process covered by the Challenge

Katty Fashion is currently pursuing the digitalization of its sampling and production services, however the reception area, which is the starting point of our physical development process, is still characterized by manual low-tech labor. Shipments that arrive at the reception area can be posted by either our clients with or without guidance or by Katty Fashion team members on behalf of our clients. The reception zone receives all materials and accessories necessary for all categories of womenswear. It also acts as an inventory space, where goods are stored until the required materials are necessary. From the reception area, fabrics travel to the cutting area, followed by stitching, fusing, finishing and non-manufacturing operations such as quality control and intra-logistics steps. Currently, the reception of goods is mainly using package and supplier information in order to assess the state of the fabric. The reception area only verifies that the shipment is in line with the client order. The material it is stored until it is scheduled to be used, then transferred to the cutting area, where the state of the material is assessed. At this point, any defects create a significant delay in the production which can affect the market entry for the collection. For any significant defects that result in order alteration the client must be informed, and additional resources are required in order to successfully complete the order.

3. Description of the challenge

The textile manufacturing industry is one of the largest polluters globally, according to studies conducted by the EU. Textile production alone accounts for the pollution of approximately 20% of global clean water. The fashion industry is estimated to be responsible for over 10% of global carbon emissions. Despite the recent challenges posed by COVID-19, the industry is still expected to grow at a CAGR of 3.52% during the 2023 to 2028 period. This, coupled with the commitment the EU has towards waste reduction, sustainability, and circularity, highlights the importance of developing and implementing innovative solutions in our industry, in order to achieve said goals. Our industry, especially, is one characterized by manual repetitive labour that generates high levels of waste, from both a physical, human resource and performance point of view. The reception of fabrics is no exception. Currently, in most cases, and especially in Romania, fabric reception from customers is a manual process. The activity of a fashion garment manufacturer involves diversified client portfolios, with varied order quantities and complexity. This generates a high volume of materials and accessories received at any point in time, that can be rotated numerous times throughout the production process, over the course of several seasons, based on client demands. Moreover, the quantity of materials is closely tied to the order amount, and any shortcomings in the stocked materials can cascade to create significant production bottlenecks, leading to loss of revenues and increased waste and resource consumption for both clients and manufacturers. However, currently, there is no check for material quality until the material reaches the cutting area. This process flow creates significant risks of delayed production, and additional resource consumption should the fabric be defective. These material defects can also be easily missed in the cutting stage due to human error, which leads all organizational resources used in the production stages of the product, up until the defect identification to become defect waste. The current tools available, however, are insufficient for optimizing the production process, given the time, human resource, and operational constraints. Therefore, we need an ML/AI algorithm that can do automated quality checking for rolls of fabrics at the reception stage, instead of during the production stages. The most common fabric defects are currently well-documented depending on the process during which the defects took place, but a solution to identify them using AI/ML applicable to the SME garment manufacturing process is not readily available. Aforementioned fabric defects include, but are not limited to knots, thick/thin yarn, running shade variation, color yarn, holes, uneven dye, uneven print, crease marks, fabric skew, fabric browning, stain/spot/dirt, broken yarn, stop mark and more.

4. Expected outcomes from Solver Teams

At the end of the collaboration, we expect to have a prototype that works with a given set of images or videos and displays the analysis results in a manner easily understandable by the targeted users. We also expect to continue collaborating in the long term for the development of innovative machines for the fashion industry.

CHALLENGE: Eddy Current Probe Design (ECPD)

Company: Aleistyn LLC

Country: Ukraine

Website: https://www.linkedin.com/company/structurescope-eg/

1. About the company's business

According to the NACE CODE, Aleistyn LLC is classified under p. 26.51 Manufacture of instruments and appliances for measuring, testing and navigation. The sector of application of company's products is Fabricated Metal Products (FMP), NACE CODES 24, 25, 28, 29, 30. Aleistyn is a high-tech, science-intensive manufacturer of the Structurescope EG+AI (SSEGAI) device and its software for determining the chemical-physical and mechanical properties of metal alloys by the eddy current (EC) method of non-destructive testing (NDT). SSEGAI allows to conduct the measurement and receive the final result within 30 seconds, and it replaces up to 80% of various metallurgical tests (MT). The current business model involves production and sale of the device, configuration, and system support by the customer's side. The SSEGAI is equipped with the integrated artificial intelligence (AI) to interpret the properties of metal alloys, and we plan to move to a software-as-a-service (SAAS) business model.

2. Industrial process covered by the Challenge

Aleistyn LLC has the following Deep Tech (DT) industrial process that require constant interaction between the factory and the classroom. Eddy current probe (ECP) design is one of the key processes in the business. The informativeness of the electromagnetic field of the object under control (OC) is a basic element of our technology (Patent US 20200278308 A1 SYSTEM AND METHOD FOR NON-IONIZING NON-DESTRUCTIVE DETECTION OF STRUCTURAL DEFECTS IN MATERIALS) and depends on the structural and parametric characteristics of the EDP. The design of the ECP depends on the specific parameters of the OC: type of material, geometric shape, purpose of testing. Designing the ECP is the most time-consuming and expensive process, which lasts from three to five weeks, because the parameters of the OC determine the choice of the device mode of operation in interaction with the ECP, based on the nature of the electromagnetic interaction with the structure of the OC material. The device operation modes are set by programming, and for the ECP its structural and parametric synthesis is performed. Structural synthesis involves the design of inductors and their best combination, the use of magnetically conductive materials, screens, etc. The optimal parametric synthesis provides the imposed parameters of the eddy currents density in the OC.

3. Description of the challenge

We are positioning the SSEGAI as an EC NDT technology that can be used to determine the chemical-physical and mechanical properties of conductive and semiconductor materials. SSEGAI is based on our patented method of determining the structure of the material (Patent US 20200278308 A1). This method, for certain cases, determines the distribution of electrons in real space and at different energy levels that form the electronic structure of materials. The latter is conditioned by the nanostructure boundaries that form a geometric “shape” of the structure external geometry such as surfaces (interfaces), edges and vertices (films, rods, wires, tubes and points), and the “under structure” (internal geometry), that is defects (atomiclevel imperfection grain boundaries, dislocations, vacancies, and their networks). The complex interaction of the atomic nucleus and electrons determines all the physical and chemical properties of materials, whereas the interaction of geometric factors at the nanostructure level affects the mechanical characteristics of materials. The measurement is carried out by our specially created automated system, which synthesizes the excitation signal with a given amplitude and frequency and online determines the amplitudes and phases of the poly-harmonic response signal with ultra-high accuracy (without applying Fourier transformation). So, the value of the harmonic amplitude is determined with an accuracy of 10 µV, a phase of 0.01 degrees. Thus, based on the measurement results, we obtain the amplitude-phase-amplitude characteristics (APAC) of the harmonics of the response signal. Such measurement technology is patented by us in Ukraine: 125413 Method and system of automated determination of object material structure, 125416 Digital method and system for determining the structure of material of the object. We interpret the measured APAC with the help of AI, when the measurement results are presented in other quantities that characterize the properties of the material, for example, the hardness, the type of microstructure, the work of destruction of the sample, the content of a chemical element, and so on. Also, when using robotic movement of the ECP, we can make a 3D reconstruction of certain areas of the OC. For a single point on the OC, the APAC measurement and interpretation is fully automated and are performed within 24 seconds. The maximum efficiency of these three components of our technology is achieved due to the homogeneity of the ECP sensitivity in the zone of interaction with the OC. This is achieved by creating an optimal electromagnetic field of the OC excitation, which makes it possible to improve the informativeness of the response signal. A criterion for the optimal field is the state of uniformly distributed eddy current density (ECD) in the zone of interaction with the OC (parametric characteristics of the OC), which is determined by the type of the OC material, diameter of the wire, number of turns and the order of their laying, length, diameter, relative location of the excitation coils and the measurement, ferromagnetic core (electrical steel, ferrite, permalloy) and its shape (U-shaped, cylindrical, pot, other similar, geometric dimensions), i.e. choosing structural characteristics. The problem we face is inefficiency of the ECP structural and parametric synthesis process for a new task of determining the properties of materials. The synthesis takes place in at least several iterations, when we create the first version of the ECP, test it, evaluate the test results, adjust the structural characteristics, and so on until we reach the ECD optimal distribution uniformity. Given the variety of materials and technologies for their manufacture, processing and operation, as well as the potential market only in Europe, where 518.1 thousand enterprises conduct business in the FMP sector, this model of the ECP synthesis process has a critical limitation.

4. Expected outcomes from Solver Teams

We expect to receive a setting of the COMSOL Multiphysics software that allows us to model the electromagnetic field and eddy currents of the ECP as its parametric characteristics depending on its structural characteristics and the OC material in combination with the neural network setting to evaluate the overall performance of the SSEGAI, or in other words, to solve the optimization problem of the ECP parametric characteristics. Thus, we have to create the methodology of the digital twin of the ECP and the elements of the automated process of the ECP parametric and structural synthesis.

prostoria

CHALLENGE: Sustainable Textile Waste Management Solution

Company: Prostoria

Country: Croatia

Website: https://www.prostoria.eu/

1. About the company's business

Prostoria primarily operates in the furniture and interior design sector. The furniture industry, in which we design, manufacture, and market a range of contemporary and design-focused furniture products, includes us having to handle a lot of textile material. The production phase includes various types of textile management and operations, such as procurement of raw materials, the treatment and care, processing, and properly handling the waste generated, among else. Thus, we're also very much considered to be a part of the textile industry's eco-system in Croatia. We are known for our innovativeness and eco-approach to styling furniture designs, as we put a lot of effort into collaborating with designers and craftsmen to create products that cater to modern green and sustainable living practices. Our products are characterized by clean lines, modern aesthetics, a strong focus on
functionality and sustainability, and the facilitation of recycling.

2. Industrial process covered by the Challenge

Product Design and Conceptualization: During the initial stage, we engage in ideation, sketching, and the development of product design prototypes. We recognize significant potential in the presented challenge as a mean of incorporating AI-generated eco-design principles into our daily operations, aligning with practices involving de- and re-manufacturing, zero-waste criteria, and a closed loop framework.

Digital Markup and Cutting Optimization and Quality Control: Before cutting the textiles, digital markup files are prepared. They contain precise instructions for the computer-controlled cutting process, ensuring accurate and efficient cutting of fabrics. We see this process as ideal for the students to direct their efforts in trying to come up with solutions on optimizing the cutting patterns, minimizing waste and energy consumption. (cross-referencing work orders within the temporal/spatial dimension)

Textile Cutting and Sewing: Prior to upholstery, textiles, including fabrics and leather, are cut and sewn to create the necessary coverings and padding for the furniture. Students are stimulated to inspect the process in order to better understand the aforesaid process.

Upholstery: Following the preparation of the structural pieces, the furniture moves into the upholstery phase, where the previously cut and sewn fabrics are attached to the frame or padded. Students are stimulated to inspect the process.

3. Description of the challenge

Summary of the industry phenomena:

1) Pre-production scraps: Furniture manufacturing involves textile shaping and cutting processes to transform the raw textile materials into finished furniture products. These processes often generate substantial amounts of production waste; off-cuts, remnants, trimmings, and imperfect pieces. The textile scraps are considered unusable and contribute to the waste footprint of the process.
2) Defective products: Manufacturing defects, quality control failures, and deviations from initial product specifications can result in proclaiming textiles defective. The defective items are then discarded, contributing to the waste volumes of production.
3) Unsold inventory: The industry's linear model often leads to overproduction, product series manufactured in excess to the demand, becoming obsolete, eventually harming both the budget and the environment at the end.
4) Consumer disposal: Once products reach their lifecycle's end, consumers are left to dispose of products themselves - alone, leading to recycling/repairing missed opportunities.

Textile waste in the furniture industry represents an opportunity missed for resource recovery. Much of the pre-production textile scrap material can indeed be reused/repurposed to create new products. Textile leftover scraps can be used for padding, insulation, can even be turned into new fabrics through recycling processes, or even be termovalorised/generate energy. Failing to capture the textile's potential while still inside the facility squanders valuable human, financial, and material resources and takes us farther away from the closed loop production system and the EUGD 2050 objectives.

Problems we would like solved:

1) Complexity of Disposal Tracking: Managing production scraps is logistically complex. The company would like to establish a digital waste management solution, ensuring compliance with waste disposal regulations. We seek a better solution to our current technology stack, ideally a single MES system, encircling all the functionalities.

2) Complexity of Eco-Design (Circular Design): Designing textile products with longevity, recyclability and secondary purpose in mind can reduce waste significantly. We envision having our eco-design practices optimized using the industry standards regarding de- and re-manufacturing, zero waste manufacturing and closed loop manufacturing. We suggest using the "big-data" approach to map the company's inventory potential and work-orders schedule to propose new ways of implementing material efficacy, with it minimizing waste.

Some keywords to solving the problem:

Optimized cutting patterns, product lifecycle thinking, lean design, design collaboration.

4. Expected outcomes from Solver Teams

Outputs we're asking for are of software nature. A mock-up of a tool should have functionalities of (neither rules out any other, the more functionalities the better):

1. Waste Identification: System identifies and categorizes different types of textile waste generated in the production process.
2. Waste Mapping: System effectively collects textile waste data within a manufacturing facility.
3. Waste Recycling: System proposes opportunities for textile waste reuse.
4. Reporting: System generates reports about products' sustainability, eco-design compatibility, company's sustainability coefficient, overall CSR reporting.

Deliverables:

1. Documentation outlining the approach/methodology on solving the company's textile waste accumulation problem.
2. A presentation summarizing the findings and the proposal. Using data/visuals to convey the idea.
3. A mock-up prototype tool demonstrating the practical implementation of the solution using test data that is to be provided.

CHALLENGE: Automation of complex positioning and assembly processes in the manufacturing of refrigeration systems

Company: Consorzio Intellimech

Country: Italy

Website: https://www.intellimech.it/en/

1. About the company's business

Consorzio Intellimech was founded in Bergamo in 2007 to fill the gap between the research and the industrial sector, promoting the collaboration of companies of different sizes and from various industrial domains. The consortium currently involves 51 high-tech enterprises, making it one of the most important Italian private initiatives in this field. Intellimech research activity is primarily focused on the Smart Factory field, which includes advanced electronics, Data Analytics, AI, ICT systems and robotics for applications in a wide range of industrial areas. Intellimech manages applied R&D and interdisciplinary experimental activities into precompetitive technological platforms and prototypes production for innovative infra-sectorial applications to serve the partners. Moreover, Intellimech has experience implementing products and services relying on the outcomes from shared research activities and concretized through vertical projects tailored for specific partners.

2. Industrial process covered by the Challenge

The challenge refers to the Intellimech partner Vin Service. Founded in 1976 in the province of Bergamo, Vin Service is an Italian SME that is a world leader in the design, production and worldwide distribution of tapping equipment and refrigeration systems for alcoholic and non-alcoholic beverages. The company became part of a well-known multinational group in November 2016, intending to grow further worldwide by offering highly innovative products. In fact, innovation has always characterized Vin Service's growth path, both concerning the renewal of its products and rethinking and improvement in the management of production processes. In this regard, starting in 2011, in order to maintain its global competitiveness by avoiding the relocation of activities, the company radically transformed its production organization by introducing a multi-year Lean Production program and investing in process digitization to promote efficiency, flexibility, and production quality. Despite the excellent results achieved in standard processes, several limitations have not yet been fully addressed in areas dedicated to the assembly of products characterized by variable configurations and significant manual labour. The challenge refers to one of these processes, which transversely impacts several products. In particular, the objective is to automate the insertion of spacers among the refrigeration coils, a process which is currently fully manual and features high occurrences of errors.

3. Description of the challenge

The proposed challenge centres on improving the assembly process of refrigeration systems commonly used in beverage tanks. The primary goal is to automate the placement of spacers around the coil windings that make up these systems. Refrigeration coils are typically made of high-quality materials, such as aluminium, to ensure excellent heat conductivity and resistance to corrosion, which are essential properties for efficient heat transfer and long-term durability. The refrigeration coils are often composed of multiple windings or tubes. These windings provide a large surface area for heat exchange, allowing for efficient cooling or refrigeration. Refrigeration coils may feature different shapes. In this specific case, rectangular helix coils should be considered. The assembly process considered in this challenge takes place after the bending machine has bent straight tubes to create the refrigeration coils. Indeed, the coil structure resulting from this procedure is not stable, and the coils tend to become misaligned. Consequently, the insertion of spacers becomes necessary to maintain their intended shapes. These spacers are linear plastic structures with slots designed to accommodate the coils. Typically, four spacers are needed for each product, one for each side of the rectangular shape. Images of the described coils and spacers are reported in the attached file. Currently, this spacer insertion task is carried out manually by a dedicated operator. This manual operation is not only repetitive but can also pose safety risks, as the operator is required to manually hold the coils in the correct position and insert the spacers, often needing to use a hammer. The challenges in automating this process stem from the varying characteristics of the coils. These coils can differ in geometric terms, including square and rectangular shapes, with dimensions ranging from 6cm to 18cm. Additionally, the coils may need to be inserted into the spacers in different patterns. Indeed, although the spacers provide a fixed pitch between winding seats, certain types of coils require skipping specific seats, as defined in the processing order. Hence, any automation system must be flexible enough to accommodate these variations. Moreover, care must be taken during spacer insertion to prevent damage to the coil spirals. So far, no suitable solution for this specific need has been identified in the market. However, several advanced technologies could be used to address this challenge. For instance, collaborative robotic cells may support the human operator in the positioning and assembly tasks. In this case, AI models and computer vision algorithms should be exploited to make the cobot aware of the context and enable human behaviour interpretation and cobot adaptation.

4. Expected outcomes from Solver Teams

Intellimech expects from the solver team:

- An analysis of the state-of-the-art concerning advanced solutions for complex positioning and assembly processes.
- An analysis of eventual commercialized solutions.
- Development of a bench test to demonstrate the effectiveness of the most promising identified solution.

Moreover, besides enhanced know-how on the process at issue, Intellimech is willing to take advantage of this opportunity to build a new partnership with the research department/university involved.

CHALLENGE: Develop a machine vision solution for product classification with AI

Company: Pannon Business Network Association

Country: Hungary

Website: https://www.pbn.hu/

1. About the company's business

Pannon Business Network is the center for applied research and training to catalyze added value manufacturing connected both to industry and academia, enabling digital, sustainable, resilient business transformation. PBN aims at effective implementation of knowledge transfer catalysed by international projects (nearly 100 projects since 2006) and an extensive international partnership pool.

2. Industrial process covered by the Challenge

The SIF-400 Teaching and Learning factory is a 5 modules assembly line of Industry 4.0 technology. The whole system is connected through ethernet network, and the communication of the work processes are controlled by a MES (Manufacturing Execution System). At the end of the production the system should hand the finished products to an external module this is the task for the challenge, to recognize, sort, pick and place the different kind of products.

3. Description of the challenge

The problem is very complex. At first the finished products are now laying on a ramp, but in the future, this will be changed. The products will be "in bulk", so the robot could reach and pick them. But the robot does not have the exact solution to detect the position and the orientation of the products so an additional camera will be necessary. Meanwhile the finished products could be in 2 different kinds of canisters: square and round. The system must be able to identify at least the shape of the canister. (The canisters are filled with wide variety of small sized coloured balls and the walls of these canisters are transparent, that could also cause difficulties.) If a product is recognized, then the robot should get to the right position with good orientation and pick up the product. After that the product should be handed over to an external system for further work processes. In summary the current situation needs a kind of machine vision solution for product classification with AI.

4. Expected outcomes from Solver Teams

The most usable output could be some coordinates to the robot, for example: there is a box of products, the height is given, but the missing 2 coordinates of a 3D system is calculated from the picture of the camera and the position of the robot and the type of the product (in order to position the gripper). We would also like to understand the solution's methodology, we would not like to use it as a "blackbox".

CHALLENGE: Is CLEAN AIR's Sustainable natural resource management challenge

Company: Is CLEAN AIR Italia S.r.l.

Country: Italy

Website: https://www.iscleanair.com/wp/en/

1. About the company's business

Is CLEAN AIR Italia S.r.l. is an innovative advanced technology company, strongly driven by research and development, that has been involved in the development, industrialization and commercialisation of APA (Air Pollution Abatement) technology and related clean air services and solutions on a global scale since 2017. APA is the first filter-less solution for the air cleaning and environmental remediation at the surface level. It is a patented, smart, modular, and flexible multiservice platform integrated with monitoring features, IoT, based on energy efficiency and circular economy philosophy for a social, ecological and economic sustainability. In recent years APA has been awarded and received multiple recognition for its uniqueness and sustainability since using only water reduces resource consumption and waste. Applied already in many (over 150 installations) industrial and urban settings, is looking at next phase of enhancements of its products.

2. Industrial process covered by the Challenge

At the heart of our challenge lies a key and important industrial concept: the meticulous management of resources. Within the Teaching Factory initiative, we are presenting a formidable challenge that lies at the intersection of resource management, sustainability, and ingenuity. Our mission is to unlock the untapped potential of cleaning the air we breathe using natural resources and whilst doing it, reimagine water resource utilization, which is the only element our system uses. The crux of our challenge is to engineer an intuitive process that can be embedded and industrialized together with the well-developed (TRL8-9) proprietary purification system, seamlessly absorbs water particles present in the air (as Humidity) and channels them back into our water tank. But here's the twist: efficiency is only part of the puzzle. We invite you to envision a solution that orchestrates this feat without burdening our energy consumption and enhance the nature-based approach of our solutions. It's an innovation that doesn't just streamline resource management but nurtures the delicate balance of our ecosystems. Furthermore, taking into account that the materials intended for absorption should prioritize environmental friendliness, our entire challenge holds the potential to yield a product that not only excels in sustainability but also champions eco-friendliness.

3. Description of the challenge

Our focal intention revolves around attaining an elevated level of control over a prevalent industrial phenomenon or addressing a specific challenge. Our aim is to identify and verify a water-absorbent substance capable of capturing evaporated water from our storage tank during the air cleaning processes, and simultaneously, facilitating a simplified process for transferring the trapped evaporated water back into the tank. An essential criterion for this material is its efficiency in absorbing water vapor while enabling easy conveyance. A distinctive feature will have to be its ability to execute these functions without any consumption of power or electricity. This innovation not only will contribute to resolving the challenge but also increase the sustainability of the purification process and bolsters overall resource management. A profound industrial concept remains at the core of our formidable challenge: the intricate management of resource utilization. Our proposition embodies a substantial challenge that finds its essence at the convergence of resource management, sustainability, and ingenious thinking. Our overarching objective is to unearth the latent possibilities within the air we inhale, thus catalyzing a paradigm shift in our perception of water resource utilization. The core of our challenge is based on engineering an instinctive process that effortlessly assimilates the suspended water particles in the air (which are usually measured as Relative Humidity) and seamlessly redirects them into our water storage unit. However, an intriguing facet complicates this pursuit: the emphasis on efficiency merely constitutes one piece of a multidimensional puzzle. In fact, we extend a warm invitation for you to envision a solution that accomplishes this remarkable feat with elegance, all while circumventing any undue strain on our energy resources. The innovation we seek transcends the boundaries of traditional resource management, maintaining an equilibrium into our indoor ecosystems. Furthermore, it is paramount to acknowledge that the materials chosen for absorption must inherently prioritize environmental compatibility. Embedded within the comprehensive scope of our challenge lies the potential to yield a product that not only excels in sustainability but also serves as a vanguard of ecological harmony.

4. Expected outcomes from Solver Teams

We anticipate the solver teams to provide deliverables in the form of a technical report. This report should encompass the outcomes from state of art review, originality element, initial tests, experimental results simulation-based findings based on a coherent methodology, and followed by analytical and clear results, and also some recommendation for industrial implementation.

CHALLENGE: Modular air quality sensor

Company: Istya

Country: France

Website: https://istya.co

1. About the company's business

Istya is a pioneering startup operating in the smart building technology sector, with a focus on transforming indoor air quality and energy efficiency. Leveraging cutting-edge technologies such as Internet of Things (IoT), generative AI algorithms, and Heating, Ventilation, and Air Conditioning (HVAC) systems, we aim to create healthier and sustainable indoor environments. One of our standout features is a modular sensor system that offers unparalleled flexibility and effectiveness by allowing customization of sensor arrays to meet the unique needs of various indoor spaces. Our Software-as-a-Service (SaaS) platform enhances user experience by enabling natural interactions with our system. Beyond mere energy savings, our vision encompasses improving the overall well-being and health of building occupants. As we expand our global footprint, Istya is open to collaborations that align with our mission to deliver impactful and scalable solutions for a more sustainable future.

2. Industrial process covered by the Challenge

Modular Hardware: Istya's sensor system is built on the principle of modularity, offering unparalleled adaptability for various environments— from offices to factories. This core feature allows for infinite repairability, significantly reducing e-waste and contributing to a more sustainable industrial ecosystem. The modularity not only meets but anticipates customer demands, allowing for real-time customization based on specific air quality monitoring needs. This adaptable framework promotes circularity by enabling easy updates or replacements of individual components rather than discarding entire units. Clients can even personalize the sensor systems, selecting from a wide range of sensor types and configurations to get the most accurate and relevant air quality data for their specific context.

3. Description of the challenge

Why is this critical issue?

Adaptability: Traditional air quality monitoring systems are often rigid and unable to adapt to the varied needs of different industrial processes. This one-size-fits-all approach leaves gaps in monitoring and efficiency.

Sustainability: Most existing systems don't consider sustainability, often requiring full unit replacements even when only one component may be faulty or outdated. This leads to increased e-waste and costs.

Customization: Industries often have unique requirements based on the specifics of their manufacturing processes. The inability to customize existing solutions to meet these unique needs leads to inefficiencies and can compromise the quality of data collected.

Circular Economy: Traditional sensors often don't adhere to the principles of a circular economy, thereby missing an opportunity to contribute to sustainable industrial practices.

Our modular sensor system aims to solve these issues by allowing for unprecedented adaptability, customization, and sustainability. The modularity enables the sensor to be tailored to any environment, be it an office or a factory, and to meet client-specific requirements. It also supports sustainability and circular economy principles by being infinitely repairable and upgradable, reducing e-waste and long-term costs for businesses. This innovative approach directly addresses the shortcomings of existing systems, making it a highly relevant and impactful solution for the challenge.

4. Expected outcomes from Solver Teams

- Technical Blueprint: A detailed schematic of the modular sensor design that addresses the challenges of cost-efficiency and easy installation. This blueprint should also consider scalability for mass production.
- Feasibility Report: An analytical document assessing the practicality of the proposed solution, including aspects like material requirements, production costs, and potential ROI.
- Prototype or MVP: If possible, a working prototype demonstrating the effectiveness of the sensor system in a controlled environment.
- Cost Analysis: A detailed breakdown of the manufacturing, operational, and maintenance costs associated with the proposed sensor system. This should identify areas for cost-saving and economies of scale.
- Implementation Timeline: A realistic project timeline outlining key milestones for development, testing, and potential market launch.
- Sustainability Assessment: An evaluation of how the proposed solution aligns with sustainability goals, such as reducing waste or energy use.