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ROME TECHNOPOLE

PROTOTYPES IN THE ROME TECHNOPOLE INNOVATION ECOSYSTEM

Spoke 2 / Rome Technopole

Rome, 25 October 2024

Introduction by Prof. Renato Baciocchi

Spoke 2 aims to develop and fine-tune a series of tools and services to support technology transfer. Their sustainability, even at the end of the project funded by the PNRR, passes through the systematization of the initiatives born or strengthened as part of the Rome Technopole: SARIC, a Support service for spin-off companies and start-ups of the Rome Technopole ecosystem involved in digital transition projects and enhancement of industrial outcomes carried out by public research; START-CUP, the competition open to research groups of the Lazio Region and other initiatives to support the establishment and structuring of start-ups and spin-offs; TECHNE, the Rome Technopole accelerator program; BRICK, the platform dedicated to promoting the technologies, patents and start-ups of the Lazio Region's Innovation Ecosystem; the joint university-enterprises training program on technology transfer.

But the first element in assessing the effectiveness of the actions implemented in Spoke 2 on technology transfer is certainly the ability to transfer research results from the laboratory (TRL 4) to a real environment (TRL 5-6 or greater). In this sense, in the Rome Technopole project, well over 60 internal projects and 13 projects funded through cascading calls for prototypes or proof-of-concepts within the three pillars of the project, namely digital transition, energy transition, health and bio-pharma, have been initiated and are nearing completion.

This catalog includes some of these projects, for each of which a descriptive fact sheet is given. Without going into the merits of the individual projects, keywords such as Digital Twin, Building Information Modelling-BIM, Internet-of-Things-IoT (such as wearable sensors for health and other applications), artificial intelligence-AI, are those most frequently found in these projects. This confirms the highly innovative nature of the projects, which often fall in more than one of the project pillars.

The fact sheets report the name of the prototype, the working group, the Rome Technopole pillar of reference, the description and classification of the prototype, and any type of collaboration/involvement required for further development of the project idea at higher TRLs.

I hope that this catalogue and the information in the fact sheets can help to disseminate the results of the Rome Technopole project and make them available to a wide range of stakeholders, thereby fostering new opportunities for collaboration between the world of research and the world of production. The future and sustainability of Rome Technopole's technology transfer depend on the quality of the project ideas, but above all on the ability of the Ecosystem to support them, enhance them and grow them, setting them on the road to full-scale commercial application.

The online version of the Prototype Catalogue will soon be available on the website of the Joint Laboratories and Relationships with Companies Office (https://web.uniroma2.it/it/ percorso/laureati_e_imprese/sezione/laboratori-congiunti-e-rapporti-con-le-imprese) and on the Rome Technopole Foundation website (https://www.rometechnopole.it/). Visiting the web sites you can also find the Technology transfer products' catalogue.

As Spoke 2 leader, I hope that this catalogue can be of interest to stakeholders, in particular investors and corporates, and that it can constitute a useful tool to encourage the further development of the entrepreneurial ideas underlying the projects presented, enhancing interest in services to support entrepreneurship.

This prototypes catalogue, presented during the Tech Transfer Day, held on 14th October 2024, has been collected and edited by the Tor Vergata Task Force of the Rome Technopole project, composed of:

- **Anna Rita Longhi**
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  Scientific Director of the Tor Vergata Rome Technopole Project, University of Rome Tor Vergata

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PROTOTYPES IN THE ECOSYSTEM

Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Microfluidic platforms for organ-on-chip application in oncoimmunology – **OOC platform for oncoimmunology**

Working group (reserchers/enterprise)

Luca Businaro, spoke 1; Annamaria Gerardino, spoke 2; Adele De Ninno, spoke 6; Farnaz Dabbagh Moghaddam, recruited personnel spoke 3.

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

BioPharma&Health; FP7

Description of the prototype

Organ-on-Chip platform consisting in an integrated microfluidic system, biological cell co-culture protocols and data acquisition based on microscopy and -omics approach.

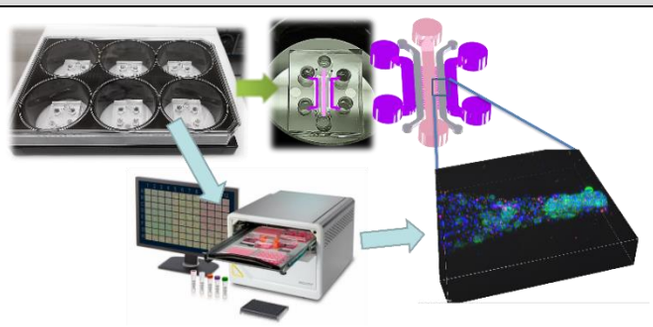

Figure 1 -Organ-on-Chip platform

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
4/6	Prototype	Further experimental development	Product & protocol

Type of collaboration / engagement needed

Industrialisation of microfluidic thermoplastic moulding systems;
Realisation of dedicated platforms through integration of chip-microscopes high-content and/or high-throughput dedicated microscopy systems;
Dedicated data analysis AI-based biological image analysis platforms;
Digital Twins Algorithms for simulation of complex systems

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

BP- CNR- 3: The prototype is a product of the project “Organs-on-chip for onco-immunology”

Contacts

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Wearable Systems based on nanomaterials for Health and Safety

Working group (reserchers/enterprise)

Prof. Maria Sabrina Sarto; Prof. Alessio Tamburrano; Prof. Alessandro Giuseppe D'Aloia; Researcher Fabrizio Marra; Researcher Hossein Cheraghi Bidsorkhi; Researcher Marco Fortunato

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

The proposed systems fall within the biopharma & health pillar

Description of the prototype

The prototype of smart T-shirt integrates, in technical fabrics for workers, innovative sensors for physical, chemical and biological agents, based on nanotechnology and nanomaterials (graphene, ZnO nanostructures, nanoparticles and polymeric films with high biocompatibility, Bragg grating -FBG-functionalized fibers) with a wearable multi-sensory modular platform that through a wireless communication protocol is always connected with mobile devices (smartphones) and through bio-operational algorithms allows to assess the risk of injury of the individual worker. In addition, the proposed solution has characteristics of high wear ability, ease in washing, and cost and functionality that make it suitable for different scenarios, as a device for individual protection and risk mitigation in typical work environments in production and process sectors, as a system for monitoring sports performance. Further added value is related to communication with mobile first-interface media (smartphones) and contextual data transfer to a remote server (cloud) to build a data repository to be used later for subsequent analysis.

Figure 2 -wearable t-shirt with Bluetooth systems for physiological monitoring

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
4/7	Prototype	Experimental development	Product

Type of collaboration / engagement needed

Support for industrial scale up from TRL 4/5 to TRL 7 through collaboration with companies in the textile, computer and electronics industries.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

- - - BP- Sapienza- 1

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Diagnostic procedure for the determination of the Nox2 protein

Working group (reserchers/enterprise)

Roberto Carnevale[1], Cristina Nocella[2], Simona Bartimoccia[1], Isotta Chimenti[1], Pasquale Pignatelli[2]
[1]Department of Medical-Surgical Sciences and Biotechnologies, Sapienza University of Rome, Latina, Italy;
[2]Department of Clinical, Internal, Anesthesiologic and Cardiovascular Sciences, Sapienza University of Rome, Rome, Italy

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

BioPharma & Health (FP4)

Description of the prototype

We developed an ELISA method for the evaluation of Nox2 activity by the analysis of soluble Nox2-derived peptide (sNox2-dp) released after the activation of the enzyme. We obtained a European patent n° EP3495821A1, Title: Diagnostic procedure for the determination of the Nox2 protein.
We will realize a prototype of the Nox2 ELISA Kit and related RUO certification for the analysis of sNox2-dp in biological samples.
Moreover, we will perform a clinical trial study on a large cohort of subjects with or without cardiovascular disease.

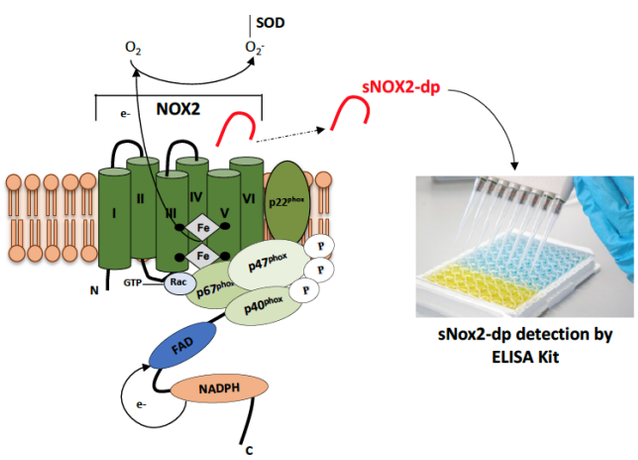

Figure 3 - Nox2 activation and detection

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
3/6	Prototype	Industrial development	Product

Type of collaboration / engagement needed

Manufacturers and distributors of ELISA kit.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

- - - BP- Sapienza- 2

Contacts

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

ECoBioM - ElectroChemical sensor for the characterization of Bioactive Molecules.

The unit of Electronics for Sensor Systems of "Università Campus Bio-Medico di Roma" has developed the prototype of a chemical sensor for liquids capable of characterizing bioactive molecules present in different contexts (food, pharmaceuticals, etc.). The system's peculiarity will lie in its ability to be trained to recognize different bioactive molecules and provide a concentration value for them.

Working group (reserchers/enterprise)

Marco Santonico, Università Campus Bio-Medico di Roma (researcher)
Alessandro Zompanti, Università Campus Bio-Medico di Roma (researcher)
Giorgio Pennazza, Università Campus Bio-Medico di Roma (researcher)

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

BioPharma &Health; FP 7

Description of the prototype

The ECoBioM device features are: 48 MHz ATSAMD21G18 ARM Cortex M0 Processor microcontroller running on 3.3 V logic, enabling Bluetooth low-energy connectivity for real-time wireless communication; a 3.7 V 500 mAh battery pack and a 100 mA LiPo battery charger, fully portable for field use. The Electronic Interface produces an input signal for an electrochemical cell, consisting of three electrodes (working (WE), reference (RE), and counter (CE)). This setup automatically manages the current at the CE via an operational amplifier, ensuring signal stability and enhancing sensor response reproducibility. The electrochemical cell's applied current induces an oxidation/reduction reaction, altering conductivity and producing a corresponding electrochemical signal. This signal is initially converted from current to voltage by a transimpedance amplifier, then proceeds through the acquisition chain: amplification, filtering and ADC conversion. Data can be transmitted via USB or BLE to paired devices, with a cloud-based interface for visualization, analysis, and local data storage.

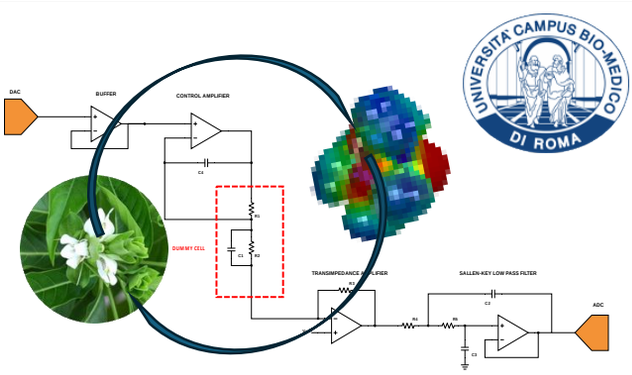

Figure 4 - Schematic overview of the electronic interface for the sensor system, with a graphical rendering of its capability in analyzing bioactive molecules from plant source.

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
3 - 5	Prototype	Experimental development	Product

Type of collaboration / engagement needed

The collaborations requested are in the context of pharmaceutics, nutraceutics and cosmeceutics farm, to develop a sensor to monitor and optimize the production of bio-active molecules. The sensor could be specialized to be included in the line production of specific farm.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

BP- UCBM- 3: ECoBioM prototype not only demonstrates significant versatility across various analytical applications but also holds promising potential for seamless integration into industrial processes, facilitating advanced technological transfer and enhancing operational efficiencies.

Contacts

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Smart Plasters for HEalthcare and Respiratory Evaluation (SPHERE)

The goal of the project is to develop and prototype cutting-edge wireless health monitoring systems. These systems will utilize epidermal sensors designed specifically for monitoring biophysical parameters, mainly focusing on respiratory diseases, offering a minimally invasive solution for patients as breathing patterns, body temperature, and skin pH, can be assessed without the need for intrusive instrumentation.

Working group (reserchers/enterprise)

Research team: Prof. Gaetano Marrocco, Dr. Giulio Maria Bianco, Eng. Federica Naccarata, Eng. Alessio Mostaccio, Eng. Francesco Lestini, Eng. Francesca Maria Chiara Nanni. Industrial collaborations: Radio6ense srl, MIR Spa.

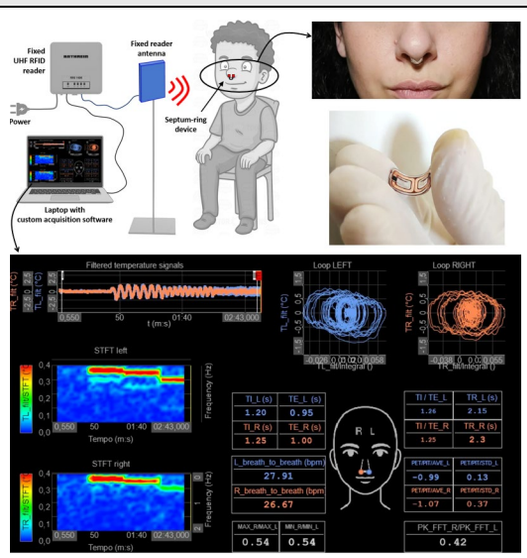
Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

Reference Pillar: BioPharma & Health. FP topic: FP4, Development, innovation and certification of medical and non-medical devices for health.

Description of the prototype

The in-nostrils breath sensor is designed for comfortable adherence to the nasal septum, enabling continuous, non-invasive respiratory monitoring in both stationary and mobile scenarios. Equipped with embedded temperature sensors, it wirelessly transmits data using RAIN-Sensors technology.

The developed real-time dashboards visualize and analyze respiratory data, providing detailed insights such as breathing frequency, nasal respiration metrics, and statistical trends. They also highlight nostril imbalances and allow customization for healthcare professionals to tailor monitored parameters to specific needs. Tested in realistic scenarios, the dashboards have proven to be an essential component of the project's respiratory monitoring platform.



Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
Current TRL: 6-7	Pilot	Experimentation and validation in operational environment; Industrial research	Product

Type of collaboration / engagement needed

Collaboration with clinicians to (a) carry out real-world evaluation and validation of the effectiveness of the epidermal sensors and the associated dashboards by comparing the performance of the system against current golden standard technologies, and to (b) extend the technology to other areas of healthcare, such as wearable monitoring for chronic diseases and neonatal care.

Collaborations with industrial partners to drive the commercialization of the solution to make it ready for market integration.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

BP - UTV -1

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

PHYGITAL TWIN TECHNOLOGIES FOR INNOVATIVE SURGICAL TRAINING & PLANNING. TL1: Advanced Medical Design and Engineering for Physical Anatomic Phantom. The project aims to develop Phygital Phantoms for surgical simulation capable of replicating an anatomical segment both from a physical point of view, through Additive Manufacturing, and digitally, through the simulation of 3D models. TL1 aims to develop and prototype Physical Anatomical Phantoms for basic and advanced surgical training and planning, useful both for teaching surgical anatomy and for experimenting with surgical techniques and procedures.
Starting from the development of protocols for the acquisition of diagnostic images via MRI and CT for the generation of parametric 3D models and exploiting Additive Manufacturing technologies, the Physical Anatomical models will be able to faithfully simulate the anatomical complexity of the affected portion both in morphological terms and physical characteristics of color, consistency and elasticity of the tissues, with the aim of reproducing exactly the same proprioceptive feedback that a live operation would provide to the surgeon

Working group (reserchers/enterprise)

The research group is made up of 12 researchers divided into the following key competences: MEDICAL ADVANCED DESIGN & BEHAVIORAL SCIENCE ANALYSIS (n°3); INNOVATIVE SURGERY & PRECISION MEDICINE (n°5); BIO-ENGINEERING & PRODUCT-SERVICE SYSTEMS (n°4).

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

The Project is consistent with the FP4 (Development, innovation and certification of medical and non-medical devices for health) and the two Smart Specialization Strategic areas of the Rome Technopole: Digital Transition and BioPharma & Health.

Description of the prototype

The objective of the project is to develop a prototype of a Physical Anatomical Phantom for basic and advanced surgical training and planning, useful both for teaching surgical anatomy and for experimenting with surgical techniques and procedures. The prototype will be able to faithfully simulate the anatomical complexity of the affected portion both in morphological terms and in physical characteristics of color, consistency and elasticity of the tissues, with the aim of reproducing the same proprioceptive
feedback that a live operation would provide to the surgeon. The prototype will also be submitted for an international patent.

Figure 6 - V.1 Prototype of the Physical Anatomic Phantom - Chassis and internal structures.

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
2/6	Prototype	Experimental Development	Product

Type of collaboration / engagement needed

The project seeks collaborations with advanced research labs, universities, and industry partners to foster innovation within the Joint Lab for Phygital Twins Technologies. We are interested to develop collaborations with: Bio-pharma Companies interested in the manufacturing production of the Phantom; Hospital Surgical Divisions interested to test the Phantom; academic Research Units with expertise in the field of Bio-manufacturing.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

BP-DT - Sapienza -1: PHYGITAL TWIN TECHNOLOGIES FOR INNOVATIVE SURGICAL TRAINING & PLANNING. TL1: Advanced Medical Design and Engineering for Physical Anatomic Phantom

Contacts

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

PHYGITAL TWIN TECHNOLOGIES FOR INNOVATIVE SURGICAL TRAINING & PLANNING. TL2: Augmented Reality, System engineering and Deep Learning for Digital Anatomical Phantom. The project aims to develop Phygital Phantoms for surgical simulation capable of replicating an anatomical segment both from a physical point of view, through Additive Manufacturing, and digitally, through the simulation of 3D models. TL2 aims (1) to "augment" the experience of the surgeon's interaction with the Physical Phantom using the information obtained from the digital twin during the performance of the procedure; (2) to build virtual environments for training and simulation of the surgical procedure that include the Digital Phantom, the virtual surgical instruments, possibly supported by robotic systems, 3D viewers, and haptic interfaces to command the virtual instruments and receive physical feedback from the virtual interaction.

Working group (reserchers/enterprise)

The research group is made up of 9 researchers divided into the following key competences: ROBOTIC SYSTEMS MODELLING AND CONTROL (n°3); AI AND MACHINE LEARNING (n°3); 3D MODELLING (n°3).

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

The Project is consistent with the FP4 and the two Smart Specialization Strategic areas of the Rome Technopole: Digital Transition and BioPharma & Health.

Description of the prototype

The prototype that the project hopes to develop concerns a Digital Twin (namely, Digital Phantom) of the Physical Anatomical Phantom for basic and advanced surgical training and planning, useful both for teaching surgical anatomy and for experimenting with surgical techniques and procedures. The Digital Phantom will be developed to reproduce high-fidelity interaction, also by the means of haptic interfaces. Moreover, the Digital Phantom should also track surgical tools operating on the Physical Phantom, in order to reproduce them on the Digital Phantom. Now, some of the components have been designed and they are currently in the implementation phase. A novel methodology for real-time simulation of deformable objects has been proposed and is currently under validation.

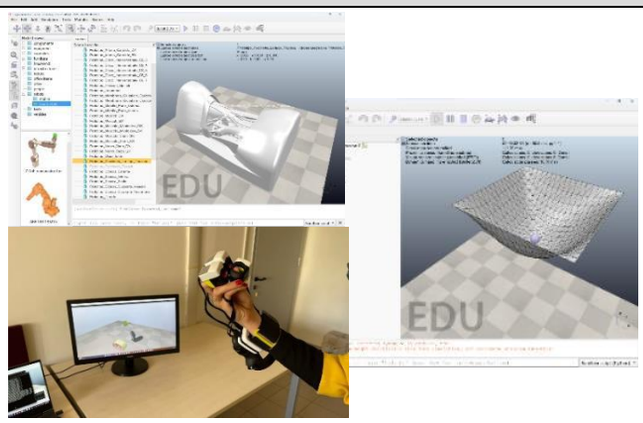

Figure 7 - Components of the prototype of the Digital Phantom. 3D model, simulation of deformable surfaces and haptic feedback

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
3/7	Prototype	Experimental Development	Product

Type of collaboration / engagement needed

We are interested to develop collaborations with: Bio-pharma Companies interested in the manufacturing production of the Phygital Phantom; Hospital Surgical Divisions interested to test the Phygital Phantom; academic Research Units with expertise in the field of high-fidelity digital twins.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

This is the digital counterpart of the physical anatomic phantom “BP-DT – Sapienza -2 ” product in the Rome Technopole Innovation Ecosystem Catalogue. An extremely interesting connection with product DT – Sapienza 1 “Artificial intelligence, virtual reality and digital twin for advanced engineering and aerospace: Tissue biomechanics and advanced materials” could lead to the realization of personalized patients phantoms for surgical planning.

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Virtual Interactive Twin for cardiovascular surgicAL planning (VITAL)

In collaboration with RBF Morph and LivGemini, Tor Vergata is developing an advanced virtual simulator based on numerical simulations and Digital Twin technology. This innovative project aims to support cardiovascular surgeons in planning and executing complex cardiac and aortic procedures with enhanced precision and predictive insights.

Working group (reserchers/enterprise)

Tor Vergata leads the computational analysis for Digital Twin preparation, while RBF Morph develops mesh morphing methods and augmented reality algorithms for the Twin consumption. LivGemini focuses on image analysis and clinical validation. This collaboration, supported by Policlinico Tor Vergata, aims to evaluate clinical outcomes and enhance surgical planning accuracy.

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

VITAL belongs to the Health pillar with a strong focus on Digital Transition

Description of the prototype

VITAL: the prototype enables the extraction of patient-specific anatomy from medical images using neural networks. Through advanced AI algorithms, a reduced-order model, previously created from a compressed dataset, is automatically adapted to the anatomy under study, allowing real-time simulation of the surgical task. The entire simulation is displayed within an augmented reality environment, offering an interactive and intuitive experience for surgical planning and training. This approach allows the surgeon to test various medical devices and sizes, studying their interaction with the specific patient's anatomy. Ultimately, this provides precise, responsive tools to improve clinical decision-making and enhance surgical outcomes. At the end of the project, the technology will be available to the cardiovascular surgery team at Policlinico Tor Vergata for testing in a simulated operational environment.

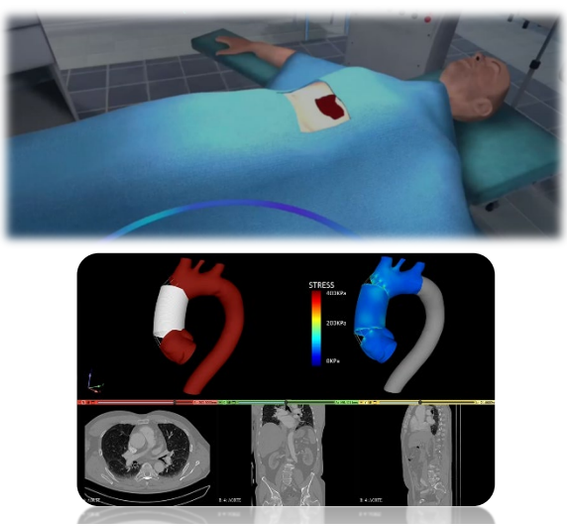

Figure 1: The surgery room and the prototype

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
Current TRL: 5 Target TRL: 7	Prototype	Experimental Development – Refining the prototype through testing in realistic environments for further validation.	Product: software module

Type of collaboration / engagement needed

We seek support for Software as Medical Device (SaMD) CE certification, prototype industrialization, and deployment in clinical environments. This includes guidance for regulatory compliance, scaling for production, and integration into hospitals and private clinics for real-world testing and feedback.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

BP-DT-UTV- 1: VITAL drives high-value healthcare innovations, enhancing international competitiveness and merging research with clinical applications to reinforce the regional innovation ecosystem.

Contacts

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Controlled System for Dermatological Follow-up imaging (TARGET).
The project involves the development of a web application, assisted by an artificial intelligence algorithm, dedicated to skin imaging standardization. The system, by its nature, will be usable with any smartphone, tablet, or PC camera, making it easier, faster, and more reproducible for dermatologists to acquire skin images over time, allowing them to track the evolution of skin lesions.

Working group (reserchers/enterprise)

The proposal is submitted by **Dermatology Myskin** Srl, a healthcare facility that carries out activities as a specialist medical and surgical outpatient clinic and engages in digital health development. The team is composed by: **Alessandro Martella**: specialized in Dermatology and Venereology with expertise in skin imaging for the acquisition and processing of skin lesions for diagnostic purposes; **Alberto De Prezzo**: software architect with skills in software analysis, design, implementation of functional tests, and software integration. **Rocco De Marco**: IT systems management and software development (UI and UX) and functional analysis; **Giulia Castorina**, modeler, and data scientist for the image registration model development.

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

TARGET belongs to BioPharma & Health pillar

Description of the prototype

TARGET has developed a web prototype for dermatological follow-up image registration (figure 1). The final tool will be integrated in telemedicine systems or released as a standalone app. We can define advantages for each element of the figures involved: **The dermatologist subscribing to the app:** i) Expanded user base; ii) Reduced time in follow-up management; iii) Precise, rapid, and easily archivable follow-up; iv) Continuous connection with patients. **The patient accessing the App:** a) Reduction in travel; b) Examination performed at the desired time; c) Certain and rapid results. **Territory where the app is used:** 1) Reduced patient travel support; 2) General practitioners and/or pharmacies that could subscribe to the app services, directly benefiting from direct dialogue with a territorial reference dermatologist specialist.

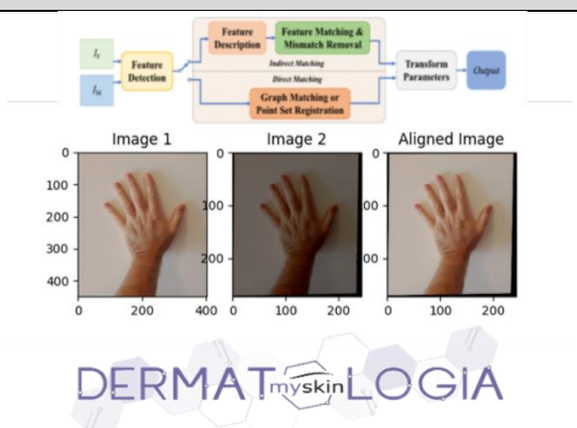

Figure 5 - Target feature-based image registrations prototype

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
TRL3/TRL6	Prototype	Experimental development	Product

Type of collaboration / engagement needed

The final tool will be integrated in telemedicine systems (by the different system owners) or released as a standalone app. In this last case the app will be developed by Dermatologia Myskin team supported by ICT professionals.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

DT - Dermatologia Myskin: Controlled System for Dermatological Follow-up imaging (TARGET).

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Artificial intelligence, virtual reality and digital twin for advanced engineering and aerospace: Tissue biomechanics and advanced materials.

Objectives: Development of novel testing devices for the characterization of the dielectric properties of cells and tissues for the noninvasive early identification of pathological conditions.

Working group (reserchers/enterprise)

Emanuele Rizzuto, Sapienza University
Livio D'Alvia, Sapienza University

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

Digital Transition. FP6

Description of the prototype

A novel microwave-based sensor for the measurement of skeletal muscle's dielectric properties has been designed with CST-Microwave Studio Software. The sensor was designed to test murine skeletal muscles from control and pathological models.

The dielectric characterization can take place thanks to the interaction of the electric field of the sensor with the tissue under examination. The operating principle is based on the ability to detect changes in the dielectric properties of the tissue, which influence the capacitive coupling between the two Split Ring Resonators (SRRs). Indeed, these modifications are translated into changes of the electric field which, in turn, involves variations of various parameters, including the resonance frequency.

A first prototype has been realized and preliminary tests showed the potential of the sensor to discriminate among muscle types and mouse strain.

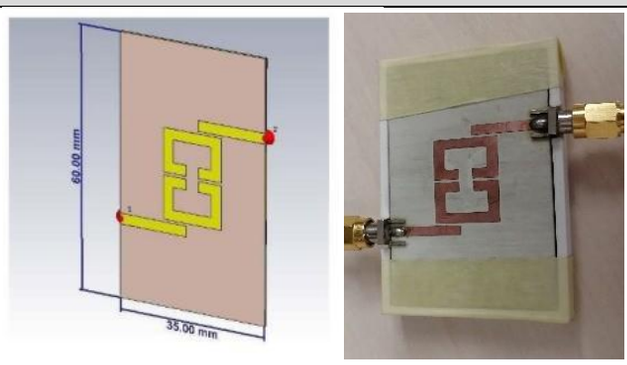

Figure 1 - Design (left) and prototype realization (right) of the microwave- based sensor for muscle testing

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
2/4	Prototype with pilot study ongoing	Experimental development / Industrial research	Product

Type of collaboration / engagement needed

Support to fill the gap between laboratory testing and widespread use

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

DT- Sapienza- 1: The prototype is connected to the Section 1: PRODUCTS IN THE ECOSYSTEM.
Digital transition and BioPharma&Health. FP6

Contacts

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Mode division multiplexing of QKD and classical channels on multimode optical fiber (MULTIQKD)
The prototype will demonstrate the possibility to multiplex both quantum channels and classical channels into the same multimode fiber, by using modal multiplexers and demultiplexers based on the multi-plane light conversion (MPLC) technology.

Working group (reserchers/enterprise)

Stefan Wabnitz, Mario Zitelli, Gonzalo Carvacho, Danilo Zia, Fabio Sciarrino, Francesco Basso Basset

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

Digital Transition (FP 5)

Description of the prototype

In classical communication scenarios, space division multiplexing systems are widely used to transmit information through fibers over long distances. In our prototype, multiplexing by the MPLC technology is exploited to couple multiple single mode fiber inputs to a single multimode fiber, allowing for multiple signal transmission in a single fiber, before demultiplexing at the receiver into different single mode fiber outputs. Our objective is to develop prototype apparatus (Figure 1) for secure communications based on transmitting both quantum or QKD and classical signals in the telecom window around 1550 nm, by combining both mode division multiplexing and wavelength division multiplexing, to ensure a sufficiently low crosstalk among classical and quantum channels.

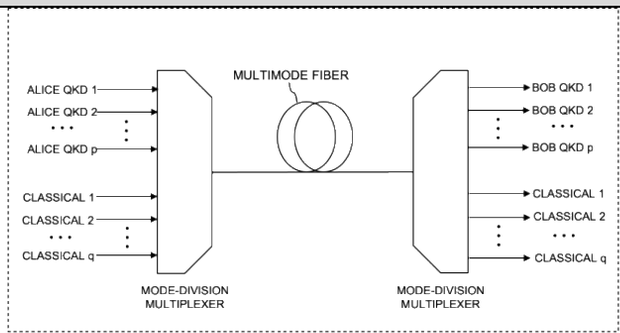

Figure 8 -Mode division multiplexing of classical and QKD channels on multimode optical fiber

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
3/5	Prototype	Experimental development	Product

Type of collaboration / engagement needed

External partners are sought for a field trial of our QKD MDM system. The idea will be to perform QKD over an installed LAN. We envision using as a testbed for a field trial the facility of the Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNIT), i.e., the National Laboratory of Advanced Optical Fibers for Photonics, based on the INCIPICT project multimode fiber infrastructure in the city of L'Aquila.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

DT - Sapienza -2: Mode division multiplexing of QKD and classical channels on multimode optical fiber (MULTIQKD)

Contacts

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Automated design of industrial plants through AI and Digital Twins.

The project aims to develop a software tool to support the scheduling of industrial plants. A Digital Twin of the plant, along with its scheduling policy, is used to evaluate a given scheduling policy, whereas AI-based methods are used to efficiently explore millions of policies in a reasonable amount of time. This synergic use of Digital Twin and AI technologies allows for effective optimization of the scheduling policy.

Working group (reserchers/enterprise)

Mario Catalano[1], Edoardo Frattini[1], Gianluca Graglia[1], Giovanni Morabito[1], Luca Petrucci[1], Benigno Ansanelli[2], Toni Mancini[2], Enrico Tronci[2]
[1]Thales Alenia Space
[2]Computer Science Department, Sapienza University of Rome

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

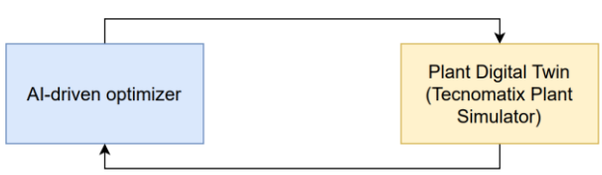
Reference pillar: Digital Transition
Flagship 6: Artificial intelligence, virtual reality, and digital twins for advanced engineering and aerospace

Description of the prototype

The project aims to develop a software tool to support the scheduling of industrial plants.

A Digital Twin of the plant is used to evaluate and design plant scheduling policies. In our implementation, we use the Siemens Tecnomatix Plant Simulator to model the plant, the scheduling policy, as well as Key Performance Indicators (KPIs) evaluating the scheduling policy.

Black-box Optimization is the main AI technique used to efficiently explore millions of possible plant scheduling policies in order to select the one that optimizes the given plant KPIs.



Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
4/6	Prototype	Experimental development	Product

Type of collaboration / engagement needed

We are interested to develop collaborations with: Bio-pharma Companies interested in the manufacturing production of the Phygital Phantom; Hospital Surgical Divisions interested to test the Phygital Phantom; academic Research Units with expertise in the field of high-fidelity digital twins.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

DT - Sapienza -3: Automated design of industrial plants through AI and Digital Twins

Contacts

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Benigno Ansanelli: benigno.ansanelli@uniroma1.it

Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Multifunctional graphene-based smart coatings for EMC and Sensor Applications

Working group (reserchers/enterprise)

Prof. Maria Sabrina Sarto; Prof. Alessio Tamburrano; Prof. Alessandro Giuseppe D'Aloia; Researcher Fabrizio Marra; Researcher Hossein Cheraghi Bidsorkhi; Researcher Marco Fortunato

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

The proposed systems. The proposed systems fall within Digital Transition pillar in particular in the FP 6 "Artificial intelligence, virtual reality and digital twin for advanced engineering and aerospace "within the biopharma & health pillar

Description of the prototype

The graphene-based multifunctional smart coating prototype was developed from an international patent owned by La Sapienza University: "Water-based piezoresistive conductive polymeric paint containing graphene for electromagnetic and sensor applications" (2016) PCT/IB2016/0699.
The proposed technology can be applied as protective coatings of composite laminates for aviation use; such a system has been developed to provide combined sensing and electromagnetic shielding properties, to be used for distributed structural monitoring and reduction of electromagnetic interference related to natural phenomena, such as direct lightning strikes, or man-made phenomena, such as aircraft interaction with antenna systems.
Such coatings are produced by spray deposition of a polymer matrix aviation paint containing graphene-based nanostructures.

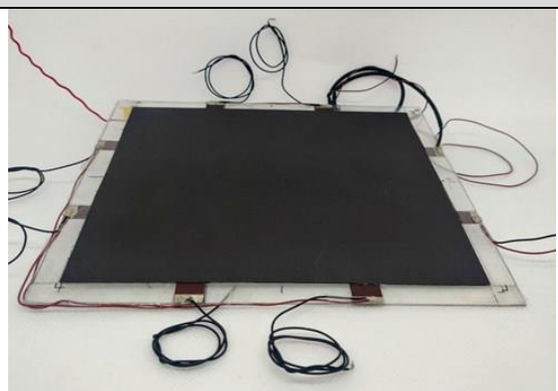

Figure 9 - Structural monitoring systemassembled with EMI interference solution

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
4/7	Prototype	Experimental development	Product

Type of collaboration / engagement needed

Support for industrial scale up from TRL 4/5 to TRL 7 through collaboration with aviation company and paint manufacturer based in the Lazio region.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

DT - Sapienza -4: Multifunctional graphene-based smart coatings for EMC and Sensor Applications

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

4T perovskite Si demo

Working group (reserchers/enterprise)

Solertix srl

Reference pillar (Energy Transition) and FP topic

Description of the prototype

The device is a tandem solar module in which two different submodules (perovskite- and Silicon- based) absorb two portion of the light spectrum to maximize the power conversion efficiency. In the configuration used here, also called 4 terminal, the two devices are fabricated independent and laminated together to avoid changes in the production process of the silicon solar module. By using this tandem approach we can boost the efficiency of a silicon solar cell at a low additional cost, for a total efficiency of 30+%

Classification of prototype

TRL (current/target)	Scale (Prototype)	Action needed (i.e. experimental development/industrial research/other)	Type (Product)
4/6	15x15 cm2	experimental development and scaling up fabrication facilities	

Type of collaboration / engagement needed

Further optimisation and improvement in the fabrication reproducibility

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

A Robust Explainable Artificial Intelligence Approach for Measurement and Verification of Energy Efficient solutions. (MeterXAI).

The project develops a comprehensive AI-based approach for M&V in energy-efficient infrastructure. Our unique framework leverages all relevant data (pre and post-ECM) to create robust and explainable AI models for estimating energy savings. These models are integrated into the EnergyMONitor (EMON) framework, which already operates for ECM in industrial systems.

Working group (reserchers/enterprise)

The proposal is submitted by Tecno Energy, an engineering and energy services company, operating since 2009. Its dynamic team is guided by **Giuseppe Mevoli**, Electrical Engineer, Energy Management Expert, Certified Measurement and Verification Professional, and composed by: **Laghezza Vincenzo**, Civil Engineer, Energy Management Expert, Senior Researcher; **Romanazzi Domenico**, Industrial Technical Expert, Junior Researcher; **Pilagatti Francesco,** data analyst and mechanical engineer.; **Romanazzi Caterina,** administrative coordinator, automation engineer. She will be responsible for the administrative and financial aspects of the project.

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

MeterXAI belongs to Digital transition pillar, with the goal of create M&V plans created by explainable AI algorithms.

Description of the prototype

We designed the first 3 layer of the **MeterXAI** tool: **Input layer.** Currently, Tecno Energy collects data from 20 industrial clients through the installation of 700 different devices, which gather data every minute. **Data layer.** In the database, this raw data is stored as-is for 10 years, resulting in more than 60,000 time series stored across 4 clusters. The compressed data on disk currently occupies more than 400 GB. **Model layer.** The current model is intentionally built solely on the data measured by the sensors installed by the company or on data calculated from them. This approach ensures that the model does not depend on external sensors or control units (e.g., weather data) whose proper functioning cannot be directly controlled. From this electrical data, the equivalent impedance value is calculated using a standard electrical formula, **Impedance[ohm] = (ActivePower[kW]*1000)/(3*cosfi*ApparentCurrent[A]^2).**
With electrical raw data and the calculated impedance, we can build the baseline model and after the ECM we can compare the real active power distribution and the baseline estimated one and calculate the cumulative residues to calculate the energy savings (as shown in figure 1).

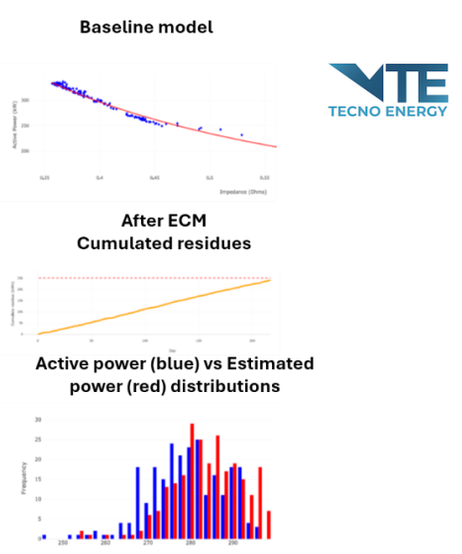

Figure 10 -MeterXAI first prototype

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
TRL5/TRL7	Prototype	Experimental development	Product

Type of collaboration / engagement needed

The final tool will be integrated in Emon platform currently developed for data storage and visualization. The MeterXAI tool will be integrated in Emon in collaboration with the company that has developed the current services.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

DT - Tecno Energy: A Robust Explainable Artificial Intelligence Approach for Measurement and Verification of Energy Efficient solutions (MeterXAI).

Contacts

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

The project **Spot The Mistake (STM)** seeks to significantly advance quality control processes by addressing the critical challenge of detecting surface defects that may compromise a product's structural integrity or aesthetic value, thereby affecting its market viability. Central to this initiative is the development of an innovative Augmented Reality (AR) solution, aimed at transforming quality control procedures. This application, rigorously designed and developed based on real-world case studies, serves companies that require precise inspections within production processes and seek to monitor changes throughout routine maintenance intervals.
Our solution ensures that any non-compliant products are identified prior to market release, thereby upholding high quality standards across a diverse range of materials and product types, while also fostering greater reliability and customer satisfaction.

Working group (reserchers/enterprise)

Participating in the project are the company TransTec Services SRL and the University of Rome Tor Vergata, which have formed a Temporary Association of Companies (TAC)

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

This project falls within the scope of Industrial Research and Experimental Development regarding the sector of: "Aerospace", "Security", "Sustainable Automotive and Mobility"

Description of the prototype

Our prototype features a clear and intuitive interface designed to enhance user experience and operational efficiency. On-screen buttons facilitate the customization of parameters essential for effective defect detection, allowing operators to tailor the settings to their specific needs. Once the parameters have been configured to their satisfaction, the operator can initiate the detection process by simply pressing the "Take a Photo" button.
Upon completion of the detection, the results are promptly displayed on-screen, clearly indicating the presence or absence of defects. This immediate feedback empowers operators to make informed decisions quickly, enhancing workflow efficiency and ensuring that only high-quality products are released to the market.

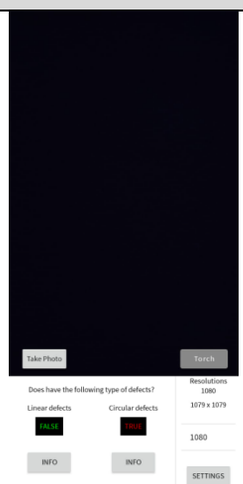

Figure 11 -App interface

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
Current level of TRL 3/ Target level of TRL 7	Prototype	Technology to be validated in the laboratory	Product

Type of collaboration / engagement needed

We would like to test the solution and are searching for opportunities to do this for example in a production environment or in a laboratory, possibly in more than one in order to verify different application models.
We also look for possible business contacts in order to show and promote our solution/product to potential clients and partners.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

DT - TransTec Services: Spot The Mistake (STM)

Contacts

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Design and testing of a lab-scale smart hydrogen microgrid connected to a domestic end-user

Development of a hybrid test bench for domestic power generation integrating hydrogen, battery, and supercapacitor technologies.

Working group (reserchers/enterprise)

Borello Domenico, Rispoli Franco, Palone Orlando, Cava Carmine, Cosentini Carlotta

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

Digital Transition, Energy Transition – FP1

Description of the prototype

The lab-scale microgrid consists of several key components: a polymer electrolyte membrane (PEM) water electrolyser for hydrogen production, metal hydride tanks for hydrogen storage, two PEM fuel cell stacks for converting hydrogen into electricity, LiFePO4 batteries, and an electronic load to simulate different operating conditions for the end user. Renewable electricity powers both the electrolyser and hydrogen storage systems, as well as the batteries. The fuel cell systems and batteries supply the required energy to meet user demands, such as powering homes or mobility devices. A monitoring station, developed in LabVIEW, tracks and classifies critical parameters, including hydrogen mass flow, pressure, temperature, current, and voltage. An "optimal" algorithm in Simulink is also under development to manage the distribution of electricity between the electrolysers and batteries during charging, as well as to balance the power output to fuel cells or batteries when end users require electricity. A binary logic (true/false) was selected for actuator control, with time-adjustable parameters for power distribution from fuel cells and batteries. The balance of plant (BOP) devices will be controlled by a second-level control logic, based on the outputs from the primary control system.

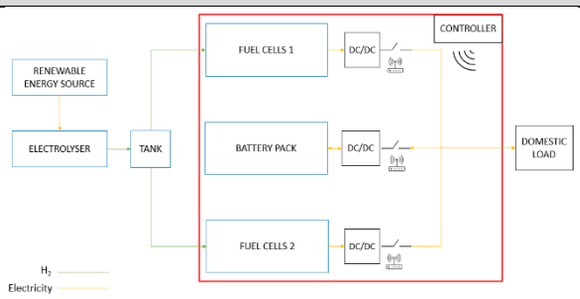

Figure 13 - Simplified scheme of hybrid system

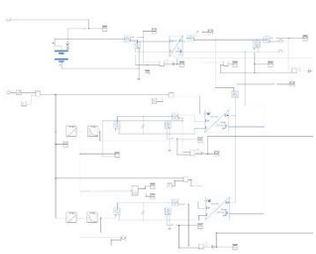

Figure 2 – Simulink model system

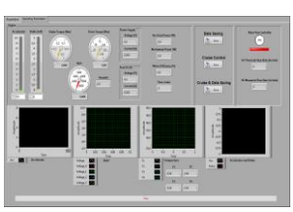

Figure 3 – LabVIEW control system

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
4/5	prototype	Experimental assessment (current), industrial research (next year)	Product

Type of collaboration / engagement needed

Optimisation of control logic. Applications to final uses. Supercaps to be included in the optimal scheme.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

The prototype is part of the Catalogue *DT-ET - Sapienza -1*

Contacts

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Water Tunnel for Fluid Dynamics Visualization

This water tunnel will be primarily used for educational purposes in schools and demonstrations at events and interviews. However, it will also hold considerable scientific value for research purposes.

Working group (reserchers/enterprise)

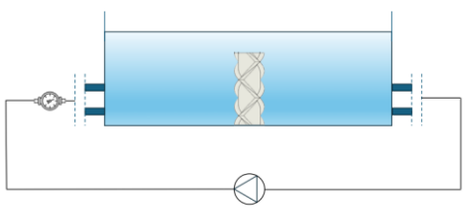
Prof. Eng. Giacomo Falcucci (University of Rome Tor Vergata - Critical Mass, Spoke 2, Flagship 2)
Dr. Giovanni Erme (University of Cassino – Spoke 4)

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

Digital Transition
Energy Transition

Description of the prototype

Water tunnels are usually bulky and very expensive systems, used for research purposes. They are unparallelly useful in evaluating the fluid dynamic performance of complex system, capitalizing on the water large density and reduced kinematic viscosity, compared to air. This allows to use smaller models to reproduce the complex phenomena under investigation. The main aim of this prototype is to create a novel device for educational purpose, but the new apparatus will hold considerable scientific value for research purposes, as wel
l.



(a)

(b)

Figure 14 - (a) sketch of the water tunnel; (b) assembly of the first prototype.

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
Current level: TRL 4/ Target level: TRL 7	Prototype - 1:1	Experimental test and Industrial development	Product

Type of collaboration / engagement needed

The project rises from a collaboration between the University of Rome Tor Vergata and the University of Cassino. We have realized the first prototype. For a large-scale production, we need partners that operate in the field of glass processing and assembly, basically for the production of aquariums. We need also providers of scientific instruments for the evaluation of the flow speed and flow rate, as well as for the particle tracking systems.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

DT- ET- UTV- 1: This new product is developed to test the fluid dynamic performance of the novel energy systems for the Green transition, with particular focus to the fluid dynamic performance of the phase change materials for hydrogen storage based on metal hydrides.

Contacts

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Pop-Up Structures for Culture The prototype is a virtual and augmented reality app that enables users to explore the construction and lifecycle of a temporary pavilion, named 8½, created by studio orizzontale in the courtyard of the MAXXI Museum for the YAP programme in 2014. Through an immersive experience, the app illustrates the pavilion's sustainable construction methods, including its reuse of materials, like discarded, empty beer kegs. Additionally, it showcases how the pavilion was used for cultural activities at the museum and how its elements were later repurposed into other structures, such as a stage, a foyer, and a lamp.

Working group (reserchers/enterprise)

Gianluca Capurso, Tullia Iori, Silvia Aloisio, Lidia Alessandra Zianna, Lorenzo Grieco/ GSNET

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

Digital Transition / Energy Transition

Description of the prototype

This app was developed as part of the Strutture Pop-up per la Cultura: Analisi e Documentazione per la Sostenibilità del Futuro project, led by Principal Investigator Gianluca Capurso from the Department of Civil Engineering and Computer Engineering at the University of Rome Tor Vergata. Funded by the Italian Ministry of Culture's Directorate-General for Contemporary Creativity under the Architetture Sostenibili X grant, the app represents a collaborative effort aimed at fostering sustainable architectural practices. It was designed in partnership with GSNET, a digital reality company, with the participation of critical collaborators from the Rome Technopole, including Tullia Iori and Lorenzo Grieco, who contributed their expertise from IDALLtv, Rome Technopole's innovative teaching lab.

This app not only celebrates sustainable construction but also explores the pavilion's role in cultural programming and the creative afterlife of its materials, embodying a new vision for sustainable architecture and cultural engagement.

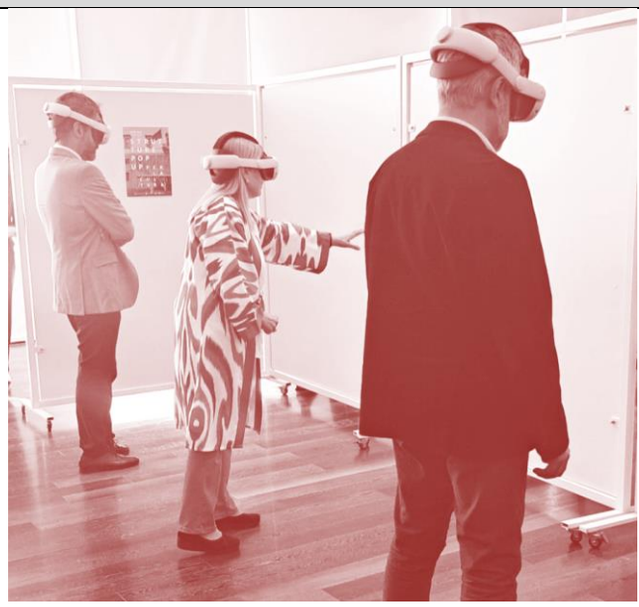

Figure 12 -Use of the prototype during a public event

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
TRL 7	Pilot	Documentation and dissemination	Product

Type of collaboration / engagement needed

The collaboration for this project involve three key partnerships: with the enterprise GSNET, the Rome Technopole, and the wider academic and cultural community.

The collaboration with GSNET involved regular coordination between the research team and GSNET's developers, UX/UI designers, and VR/AR specialists. The enterprise provided technical expertise in digital visualisation, ensuring that the app achieved an engaging, immersive user experience that effectively showcases the pavilion's construction and reuse.

Rome Technopole contributed critical research and educational expertise to the project, particularly through its IDALLtv lab, which focuses on innovative learning methodologies.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

- - - DT- ET- GSNET

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Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Building Information Modeling (BIM) and energy consumption management. The development of a digital twin in the context of Building Information Modeling (BIM) merged with VR tools, by harnessing the power of AI algorithms and IoT technology to collect and analyze the information needed to optimize energy consumption management.

Working group (reserchers/enterprise)

Working group 7 "Energy Efficiency with AI techniques"
Nicola Fantasia, Fernando Chiarello, Fabio Previtali, Andrea Mattera, Matteo Sperandio, Valter Santellocco, Armando Mennini, Marco Merlin, Parise Orania, Pier Paolo Valentini, Cristina Cornaro, Ilaria Giannetti.

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

Energy Transition - Artificial intelligence, virtual reality and digital twin (FP6)

Description of the prototype

The BIM platform is an innovative technology for digital management of 3D data and models of buildings. It consists of a no-code and fully customizable user interface and configurator, supports standard data formats such as, which facilitates the exchange of data between different disciplines and software applications used in the building life cycle. In addition, the platform obtains data CDE from building stock and extends it to include all the documents and files related to the buildings, such as estimates, maintenance work, efficiency upgrades etc. The energy management component is designed to monitor and visualize building energy consumption data in real time, integrating with IoT sensors. The user can have an overview of dashboards describing the behaviour of the buildings stock and can drill down to the individual building visualizing energy consumption over historical periods, and forecasts of future consumption, as well as having the ability to do specific analyses such as heatmaps. The Extended Reality application in VR mode allows you to navigate the building in 3D through Meta Quest Pro viewers. The objective was to create a multiplayer experience in which multiple users enter and collaborate to carry out maintenance and energy efficiency procedures. Users move within the environments with simplified jumping systems on the walkable areas and interact with the electrical systems located inside, such as light bulbs and electrical panels. The system is completed with the integration of VoIP technology to allow users to communicate via voice.

Figure 15 - Multiplayer function.

Figure 2 – Overview dashboard

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
2 / 6	Prototype	Experimental development	Product

Type of collaboration / engagement needed

For the project is requested a collaboration with architectural studio to provide BIM and Digital model from projects, survey and point cloud, with XR reality group for VR component and AI group for training algorithm based on energy data.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

ET - Almaviva -1: Building Information Modeling (BIM) and energy consumption management

Contacts

Almaviva – The Italian Innovation Company www.almaviva.it;
Università degli Studi di Roma "Tor Vergata" web.uniroma2.it

Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

New voltage regulators to support active users that include controllable loads, RES and storage systems in electric smart grids: Innovative LV Regulation Devices (LVRD)

Technological transfer aiming at the realization of a new Low Voltage Regulation Device to support the operation of active users that include controllable loads, renewable energy resources and storage systems.

Working group (reserchers/enterprise)

Reserchers: Giovanni M. Casolino, Mario Russo, Andrea Danzo (Technologist).
Enterprise: REPL ITALIA S.r.l. (Gruppo REPL®), D.A.C. Engineering & Research S.r.l. (Startup).

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

Reference pillar: Energy Transition.
FP topic: Decarbonization and digitalization in research on new green energy sources.

Description of the prototype

Prototype of a single-phase two-winding transformer that can change its configuration through static switches to ensure proper power supply at the Point of Common Coupling.
It maintains the voltage within a range of ±5% of nominal value, against a supply voltage variation from -10% to +15%, exploiting three operating modes: boost, buck, and neutral.
REPL s.r.l. has realized the first pre-series devices in view of the field tests, which feature smaller dimensions and new components. New tests were carried out on the industrialized device in real operating conditions, to verify its compliance with the required specifications. To speed up the testing procedure in view of series production, part of it was automated.
The study and the development of a multi-step regulation device with two transformers and a new control logic are currently underway. It will bring to an improved voltage accuracy and a higher regulation capacity.
Future developments will concern extension from single to three-phase device with also voltage balancing ability.

Figure 16 -LV Regulation Device

Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
6 / 7	Prototype	Industrial research	Product

Type of collaboration / engagement needed

Optimisation of control firmware; development of communication architecture for remote management functions in compliance with IT security and technical specifications of DSO.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

ET - UNICAS -1: New voltage regulators to support active users that include controllable loads, RES and storage systems in electric smart grids: Innovative LV regulation devices

Contacts

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Rome Technopole Tor Vergata Task Force: rometechnopole.taskforce@uniroma2.it

Section: PROTOTYPES IN THE ECOSYSTEM

Name and acronym of the TT prototype with short presentation

Virtual Factory for engineering education

This prototype, developed within the Rome Technopole ecosystem, consists of a series of 3D simulation models designed to enhance the undergraduate course in Manufacturing Systems Engineering. By leveraging Virtual Reality (VR), the goal is to provide students with an immersive experience that aids in understanding the key operational and management principles of an industrial plant.

Working group (reserchers/enterprise)

Professor Vito Introna and Dr. Annalisa Santolamazza from Tor Vergata University of Rome, Department of Enterprise Engineering

Reference pillar (Digital Transition / Energy Transition / BioPharma &Health) and FP topic

Digital Transition – FP 6

Description of the prototype

The prototype is composed of interactive 3D models that replicate key components and processes of a real industrial plant, creating a realistic digital environment. Based on Digital Twin principles, the system enables detailed simulation of operational flows and plant dynamics, offering a direct view of production cycles and key parameters such as OEE and its components.

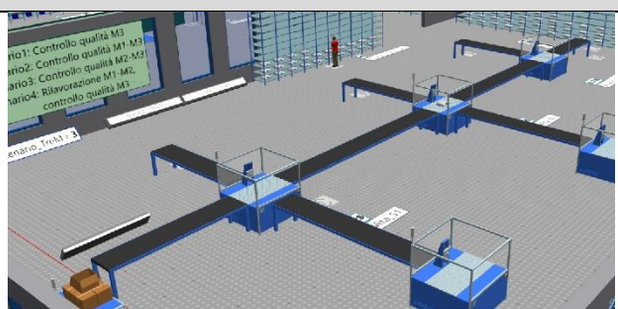
We conducted a series of tests with a group of students, whose feedback has been used to improve the learning experience and implement optimizations in the models.

Starting next semester, the Manufacturing Systems Engineering course will be delivered in this new immersive format, allowing students to:

Explore the plant in VR as if they were physically present

Interact with simulated components to experience operational scenarios

Identify how different management choices impact the operational performance of the plant



Classification of prototype

TRL (current/target)	Scale (Prototype/Pilot)	Action needed (i.e. experimental development/industrial research/other)	Type (Product/Process)
6/7	Prototype	Experimental development in educational contexts	Product

Type of collaboration / engagement needed

Seeking industrial and academic partners interested in contributing to the refinement and further expansion of the project, with additional testing and feedback to achieve smoother integration into educational settings.

Further information (Connection to the Technology Transfer Products in the Rome Technopole Innovation Ecosystem Catalogue)

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Contacts

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Spoke 2

Technology transfer, new entrepreneurship, business incubation and acceleration

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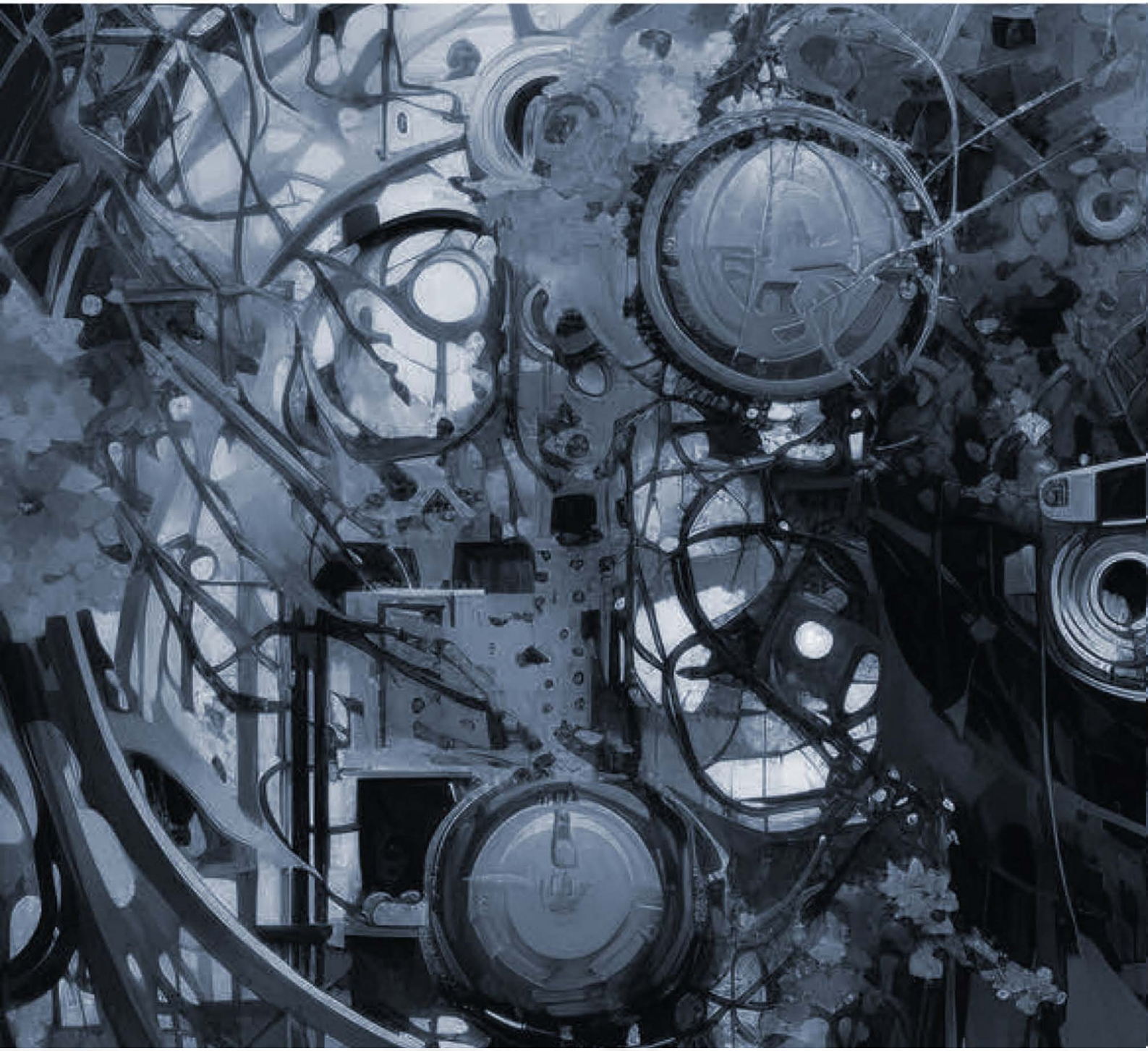
ROME TECHNOPOLE INNOVATION ECOSYSTEM



ROME TECHNOPOLE SPOKE 2: LEADER UNIVERSITY OF ROME TOR VERGATA

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