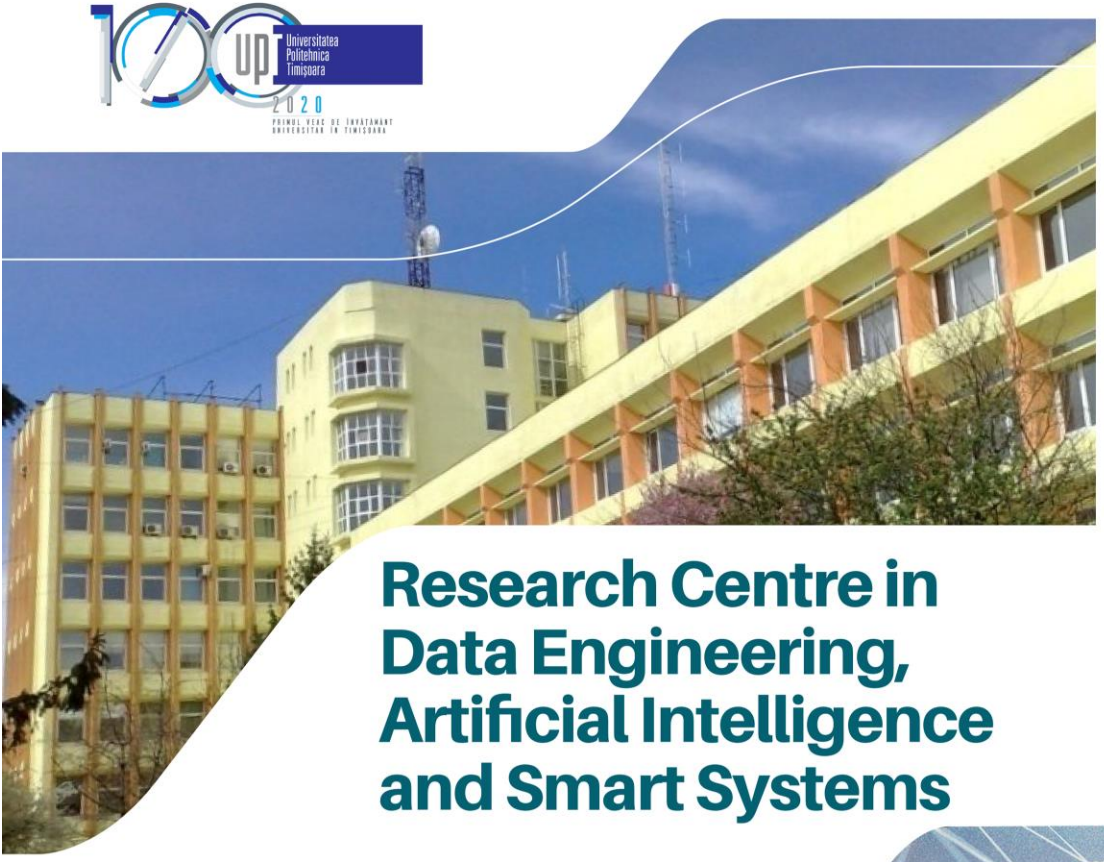


# Research Centre in Data Engineering, Artificial Intelligence and Smart Systems

The first process of university-industry research co-design in Romania

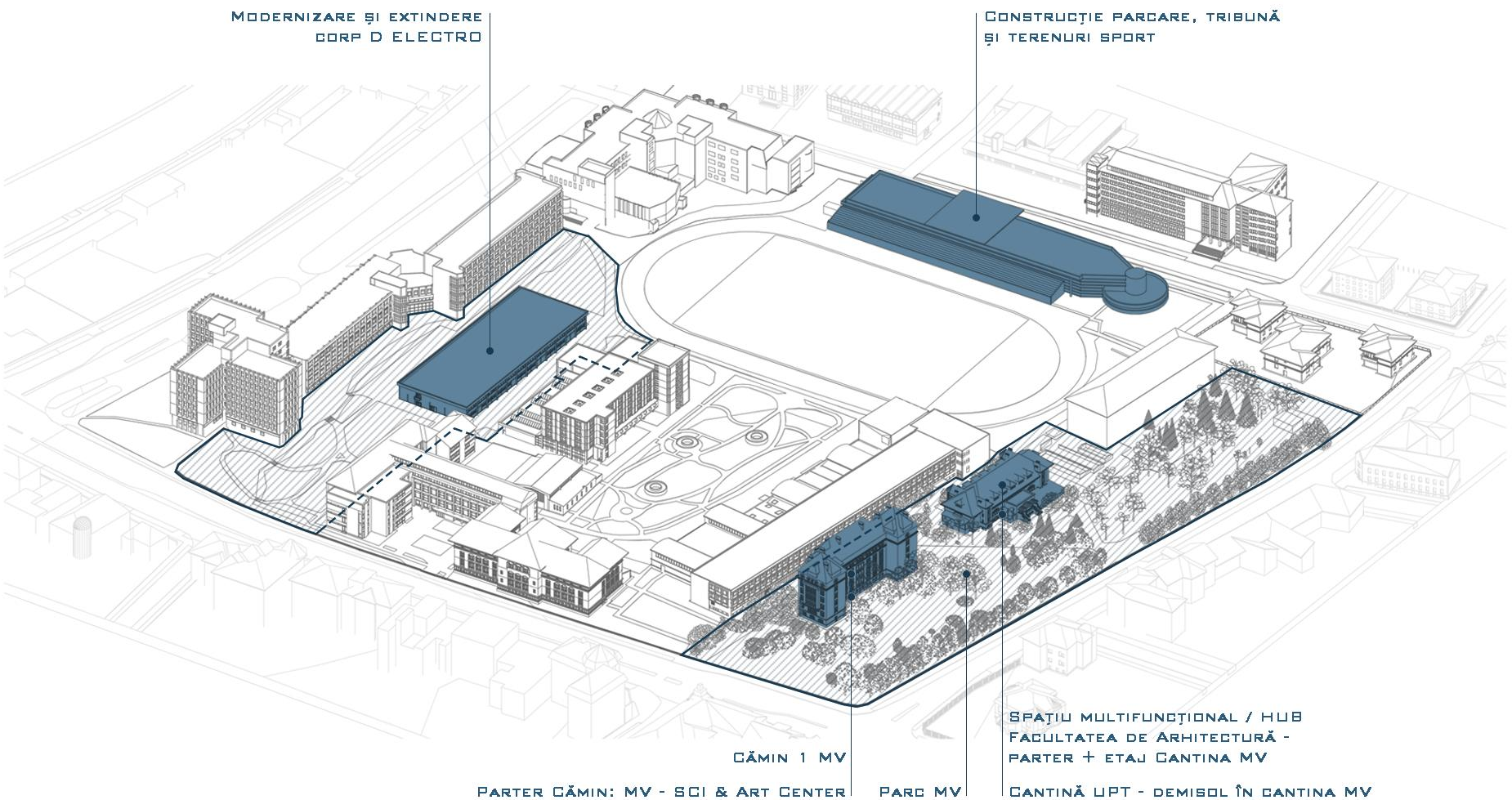
13.04.2021

**Florin Drăgan, Rector**
**Politehnica University of Timișoara**

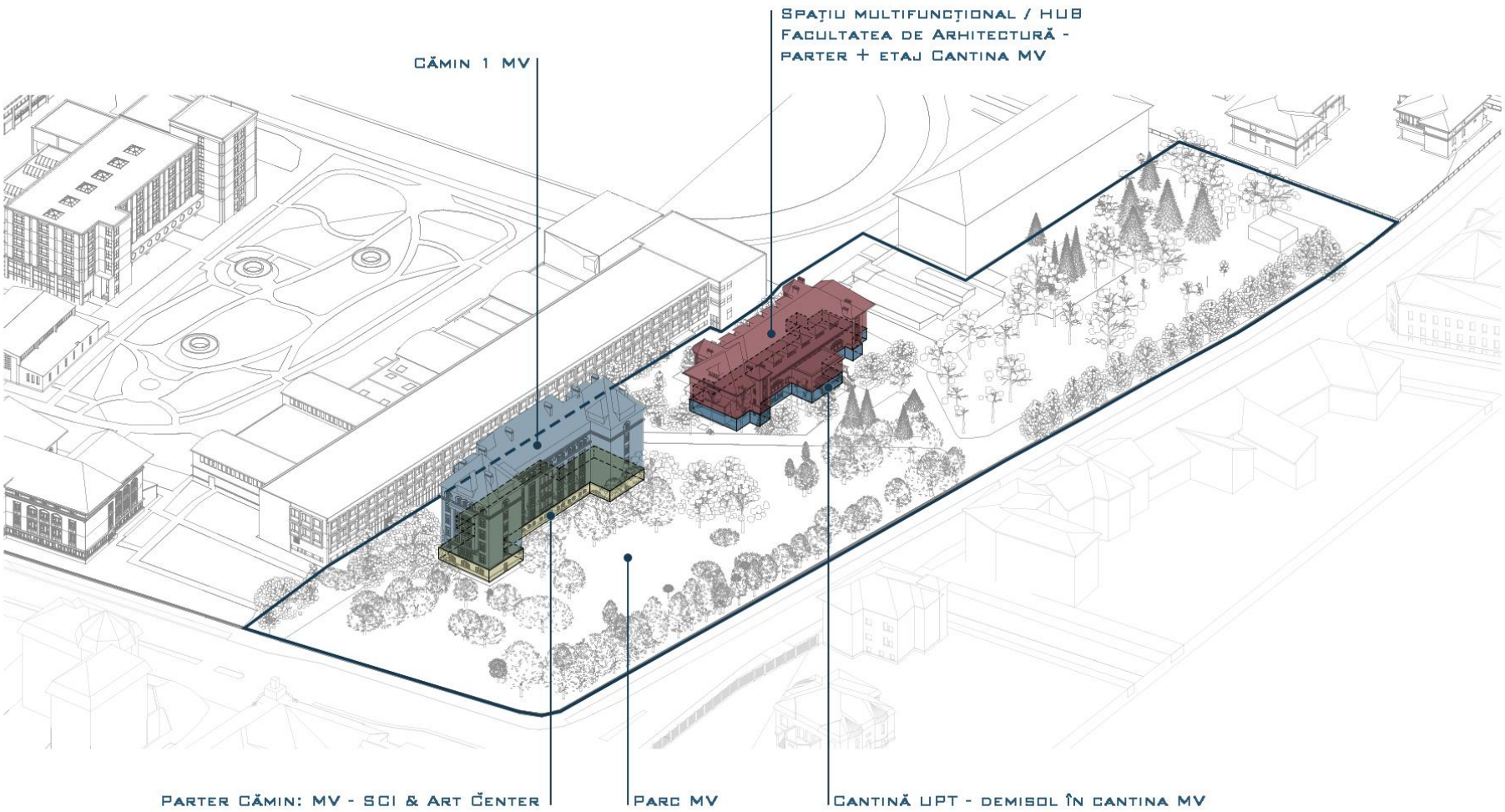
# 01 VISION

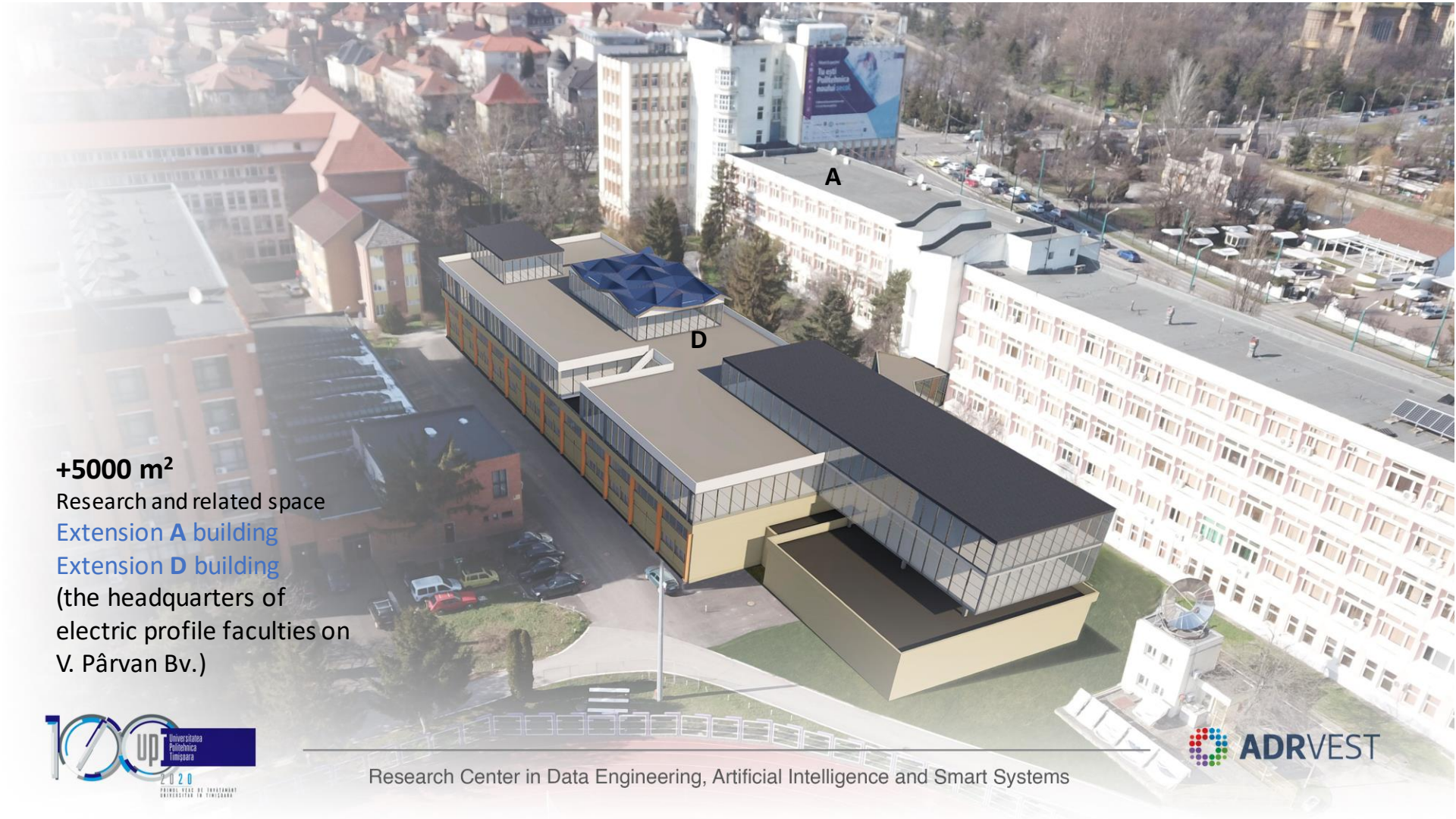
Building applied research programs in data engineering, artificial intelligence and smart systems to support theoretical and technological developments of the future and to respond to societal challenges generating new businesses, services and jobs

# Politehnica University of Timișoara Campus



# Politehnica University of Timișoara Campus






**+5000 m²**
Research and related space
Extension **A** building
Extension **D** building
(the headquarters of electric profile faculties on V. Pârvan Bv.)

## NEW MASTER PROGRAMS

Artificial Intelligence
Cloud Computing & IOT
Cyber Security
Data Engineering

## RESOURCES


### Artificial Intelligence

A team formed around the Machine Learning master program, with a minimum of 50 students per year and with the possibility to continue such studies within the Ph.D. School.

### Cloud Computing

The human resource is provided through the training of students at the Cloud Computing and Internet of Things master programs, followed by the possibility to enroll for doctoral studies.

### Cyber security

A master program dedicated to security in cyber systems, to which 30-40 students are to be admitted each year. At the Faculty of Automatics and Computers, there is currently a group of nine researchers - 3 seniors and 6 Ph.D. students) on topics such as cyber security, mobile systems and communication interfaces.

### Robotics and smart control

It takes place around the research groups in the areas of IT, programming and automatic control. It is centered on multi-disciplinarity and it involves several faculties from the Politehnica University, through their master or doctorate programs.

Preliminary research fields:

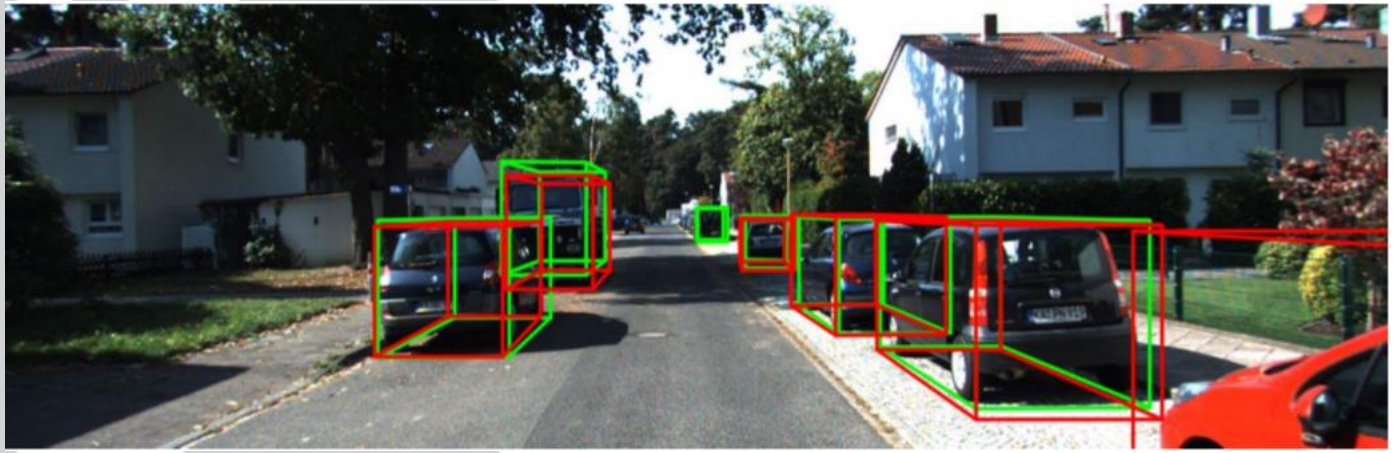
| Artificial Intelligence | Cloud Computing | Cyber Security | Robotics and smart control |
|---|---|---|---|
| ▪ Development of artificial intelligence systems for **autonomous driving**.<br>▪ Research with applications in the **retail industry**<br>▪ Applications of artificial intelligence **in medicine**<br>▪ **TBD industry**<br>▪ **TBD industry** | ▪ **IaaS/PaaS/SaaS.**<br>▪ **Modular** software<br>▪ **Sustainable/environment friendly** cloud computing<br>▪ **TBD industry**<br>▪ **TBD industry** | ▪ Information security in **smart mobile systems** and their ecosystems<br>▪ Information security in cyber systems with a focus on **security in automotive**<br>▪ **TBD industry**<br>▪ **TBD industry** | ▪ **Collaborative Robots**<br>▪ Development of **specialized robots**<br>▪ **TBD industry**<br>▪ **TBD industry** |

# Artificial intelligence/Machine learning

- **Research in artificial intelligence with applications in the retail industry**
  - Human action recognition, 2D and 3D human pose estimation, 3D hand pose estimation, human-object interaction recognition, 6D object pose estimation, person re-identification in images from multiple cameras, 3D human tracking
- **Applications of artificial intelligence in medicine**
  - Detecting lung cancer or strokes based on CT scans, assessing the risk of heart diseases based on electrocardiograms and cardiac MRI images, classifying skin lesions (benignant/malignant) in skin images, finding indicators of diabetic retinopathy in eye images

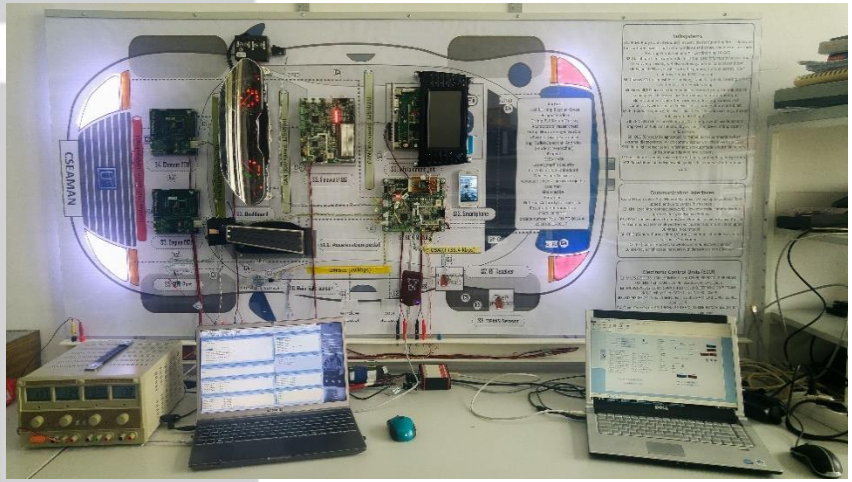
# Artificial intelligence/Machine learning

- **Development of artificial intelligence systems for autonomous driving**
  - High-precision mapping
  - Vehicle environment recognition can be done using cameras, with the specific problems: lane detection, traffic lights detection, semantic segmentation of exterior scenes, depth perception in exterior scenes, 3D traffic participants' detection and tracking (cars, pedestrians, etc.), traffic participants' motion prediction



# Cyber Security

- **Security for smart mobile devices and their ecosystems**
- Smartphones are currently interacting with access control systems inside houses, cars and workplaces while modified versions of their operating system are now as well running inside cars, i.e., Android Automotive, offering comfort and increasing usability but at the same time introducing new security challenges.
- **Security for cyber-physical systems with a strong focus on vehicle security**




A car-on-bench setup built at Politehnica Univesity Timisoara for the CSEAMAN project

# Cloud Computing

- **CloudPUTing project**

- **Clustering platform BigTim**

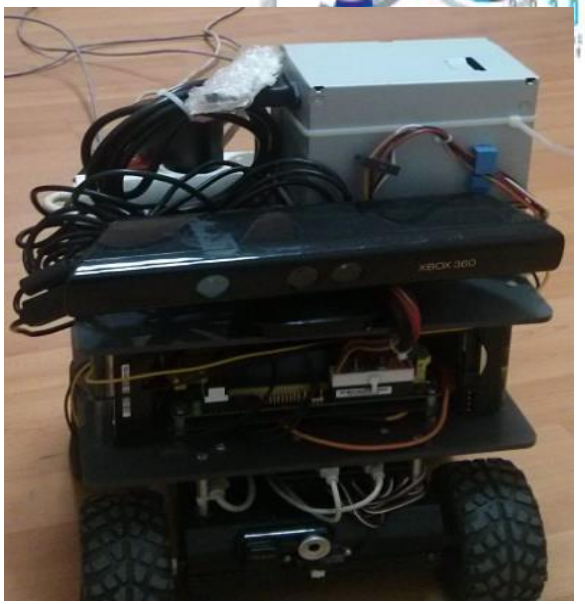
**On the Architecture of a Clustering Platform for the Analysis of Big Volumes of Data**

**Centroid Update Approach for K-means algorithm**

**Parallel Implementation of K-Means Algorithm Using MapReduce Approach**

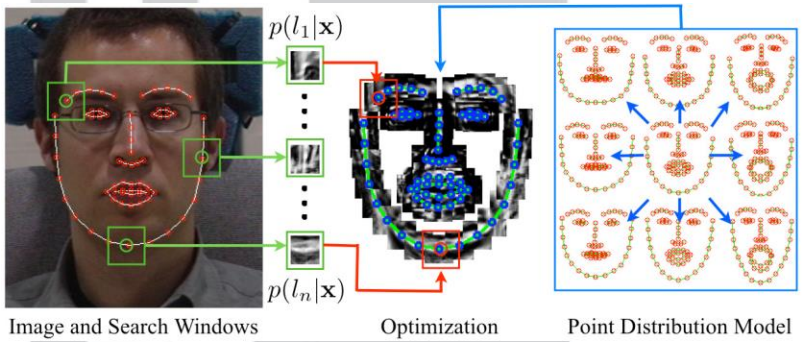
**Implementing a Platform to Run Clustering Algorithms Using Distributed Computing**

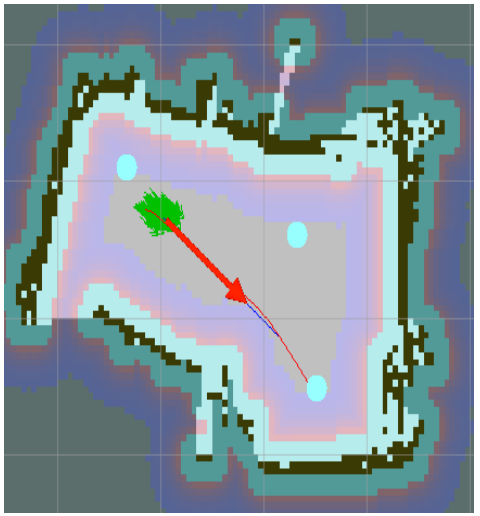
# Colaborative Robots



ROS-Based Robot Navigation and Human Interaction in Indoor Environment

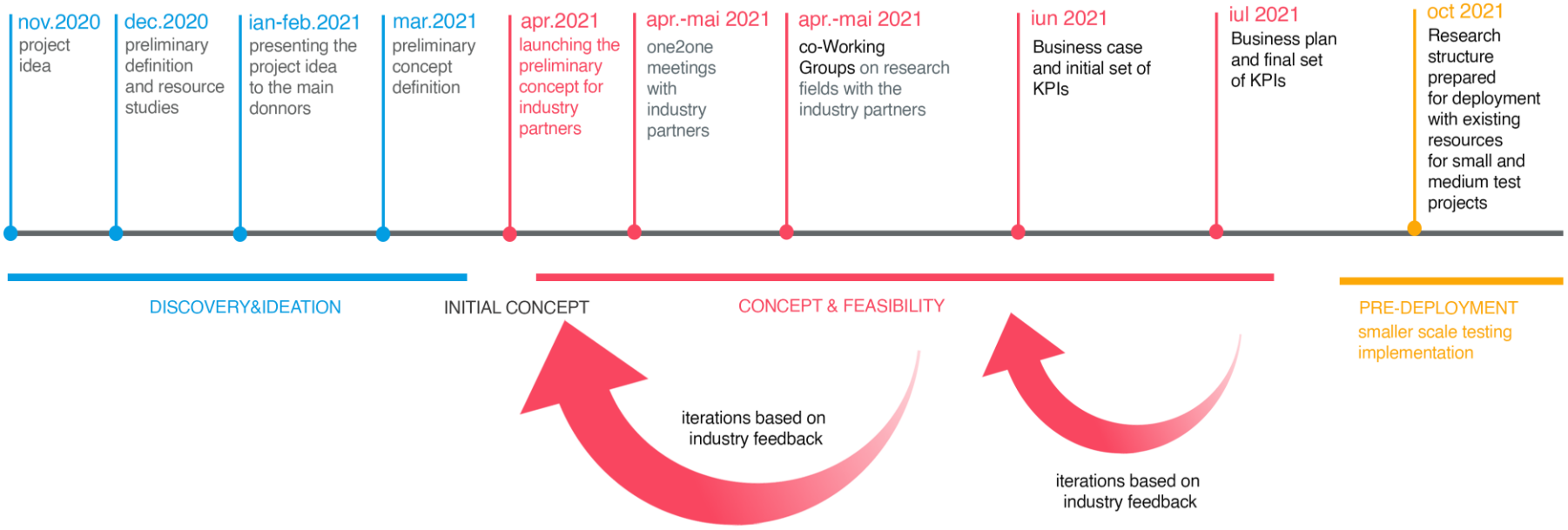
Facial Expression Recognition System Based on a Face Statistical Model and Support Vector Machines



TIMELINE - MILESTONES

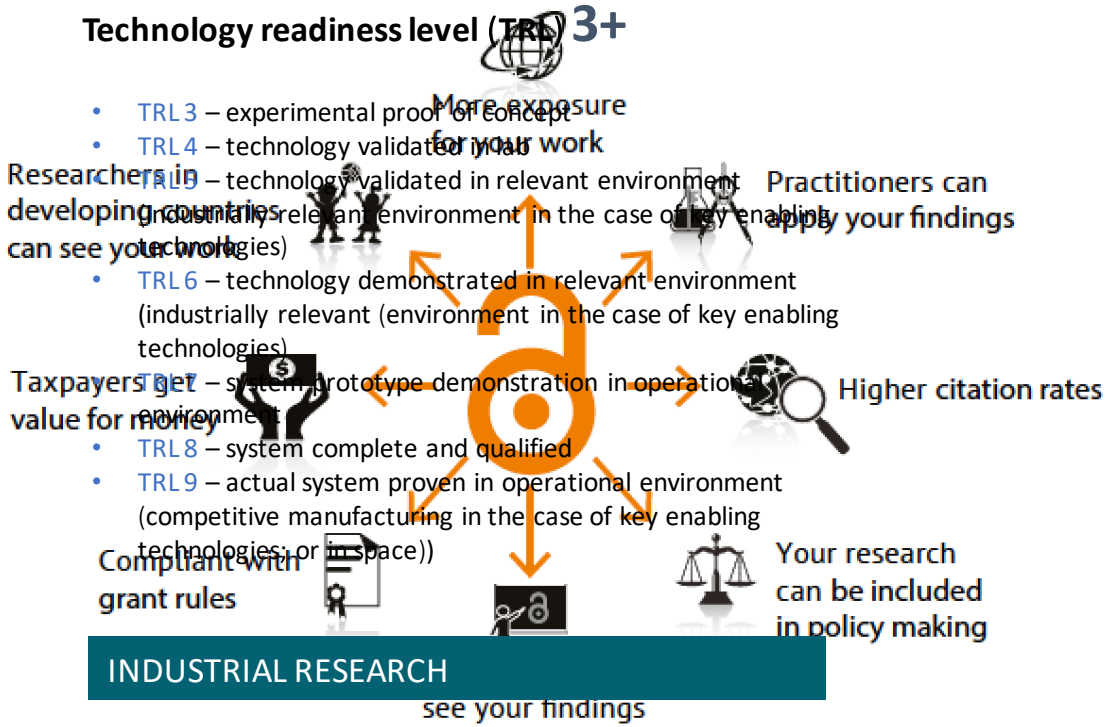
Concept & StartUp Phase



# Benefits of Open Access

**Technology readiness level (TRL) 3+**

- TRL 3 – experimental proof of concept
- TRL 4 – technology validated in lab
- TRL 5 – technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 6 – technology demonstrated in relevant environment (industrially relevant (environment in the case of key enabling technologies)
- TRL 7 – system prototype demonstration in operational environment
- TRL 8 – system complete and qualified
- TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space))




- The structure, the governance, the processes are open for industry
- Collaborative process
- Co-creation

# STUDIED MODELS OF IMPLEMENTATION VEHICLE

1

## NGO : Foundation :)

### PROs

Flexibility in relation to industry
- Incentives and breaks in the field of taxation, profit, etc.
- Clearer funding model in terms of university operation fee, and contributions.
- More flexible procurement system for private contracts
- More flexible employment policy
- The possibility to attract talents and to offer more significant financial benefits
- Ability to manage intellectual property elements more easily and flexibly
- Possibility to attract other public or/ private structures in the association
- Eligibility for funding projects addressed to NGOs / public sector

### CONs

- Uncertain financial behavior regarding VAT compensation
- More complex support / administrative structure (all financial, administrative, legal, HR services will have to exist at foundation level)
- Same type of procurement when it comes to public funds
- The partnership with public structures insufficiently defined in the legislation
- Difficult association of research results, especially publications, with the university - affecting the ranking of the university
- Public utility is obtained after at least three years of activity and depends on political will

## COMPANY : Joint Stock )

### PROs

- Flexibility in relation to industry
- Easier recovery of taxes, VAT included.
- More flexible procurement system for private contracts
- More flexible employment policy
- The possibility to attract talents and to offer more significant financial benefits
- Ability to manage intellectual property elements more easily and flexibly
- Eligibility for funding projects addressed to companies
- Flexibility in SpinOffs creation

### CONs

- Complex and debatable models in terms of covering some operation costs from the University budget
- More complex support / administrative structure (all financial, administrative, legal, HR services will have to exist at company level)
- Same type of procurement when it comes to public funds
- State aid limitations
- The partnership with public structures insufficiently defined in the legislation
- Difficult association of research results, especially publications, with the university - affecting the ranking of the university
- Non eligible for public research funding

## UNIVERSITY

### PROs

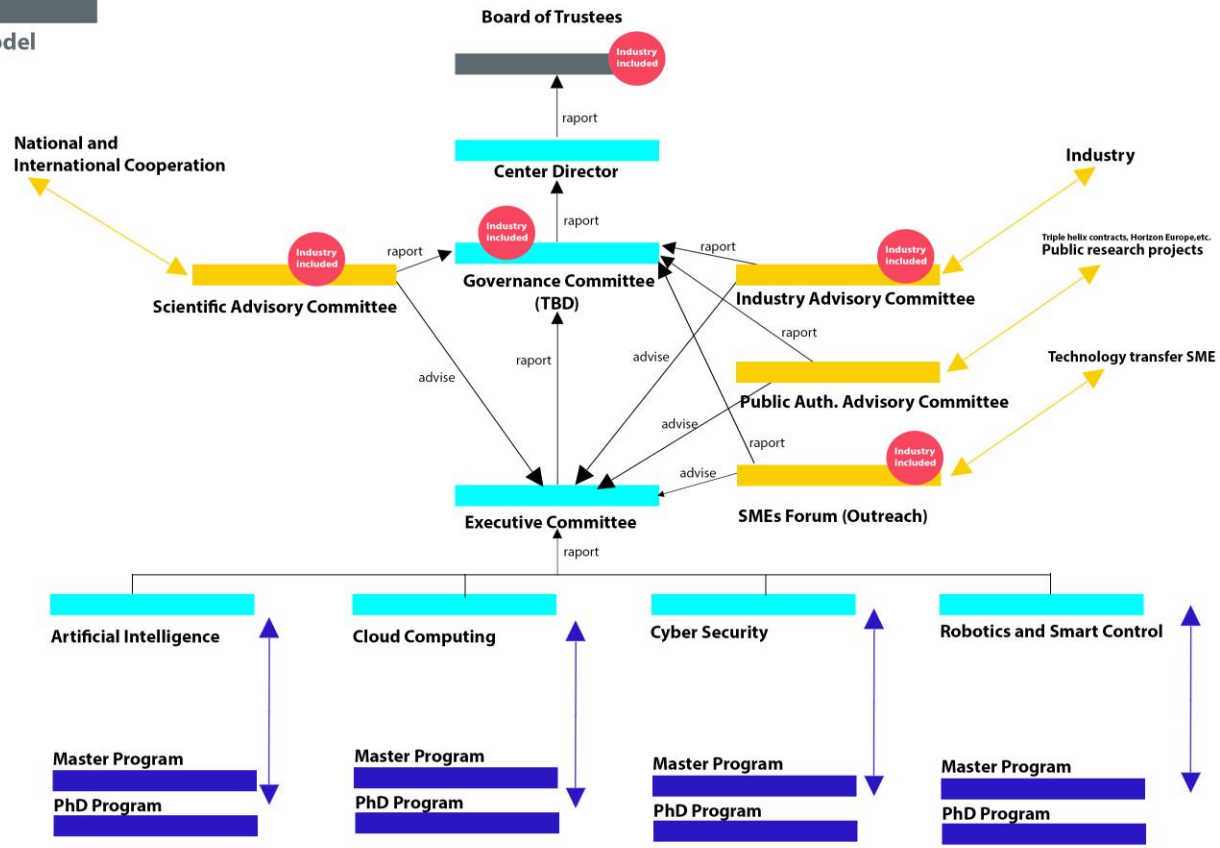
- Clear and predictable funding from the university
- Clear and predictable funding from national and European research funds
- Coherent legislation with public structures
- Uses university support structures (administrative, financial, HR, etc.)
- More coherent control by the university management
- Direct association of research results with the university

### CONs

- Inflexible procurement system for private contracts
- Strict and unattractive employment policy
- Impossibility to attract talent through providing more significant financial benefits
- Cumbersome and inflexible management of intellectual property elements *
- Impossible association with other public / private structures - except advisory structures
- Ineligible for a whole range of funding mechanisms for the private or non-governmental sector
- Uncertain financial behavior regarding VAT compensation

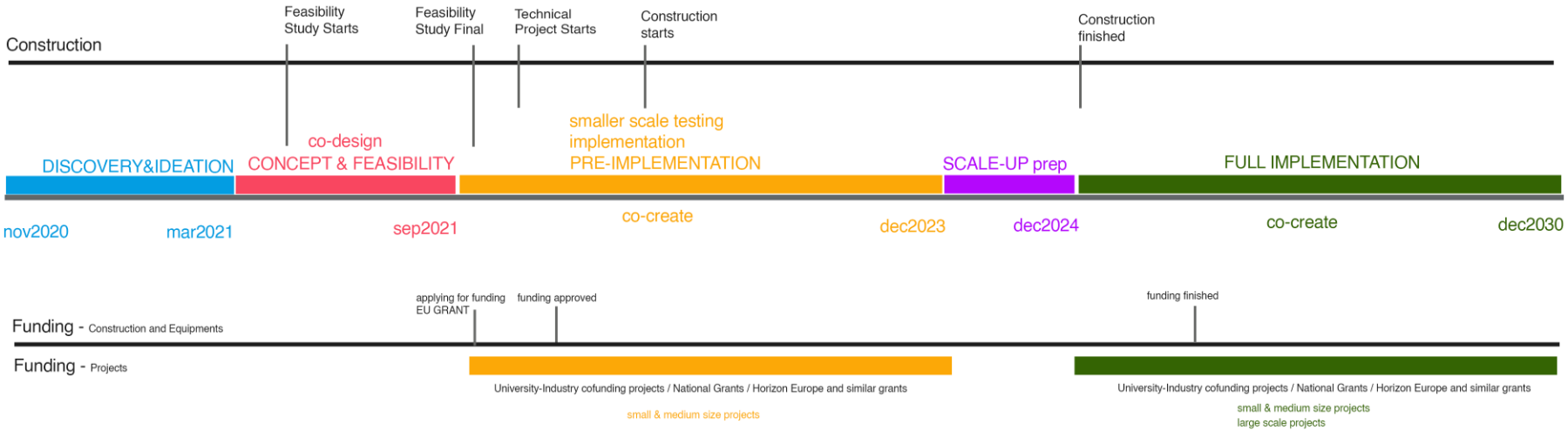
# OPEN SCIENCE

## Proposed Governance Model



TIMELINE - MILESTONES

The Center



## TYPES OF UNIVERSITY-INDUSTRY RESEARCH CONTRACTS

- Industrial research contract
- Joint research lab: Research spaced focused on one company including researchers from both the university and the company and specific equipment
- Triple Helix research projects: Common research projects that include industry, university and the public authorities
- Horizon Europe or other European funded projects: Common research projects that include the industry, university and international partners
- National research grants: Common research projects that include industry, university and that are financed through competitive grants from the national budget or recovery facility

BUDGET (preliminary): Center Development – construction works, equipment and operating costs for two years ~ **19 mil. EUR**

- Design, construction, building related equipment: ~ **7 mil. EUR** – 38%
- Equipment for the 4 research fields: ~ **7,5 mil. EUR** – 42%
- Operation costs – 2 years full deployment: ~ **4,5 mil. EUR** – 20%

- Estimated operational costs (researchers, administrative costs, maintenance, licensing etc.): : ~ **2,5 mil. EUR** – year

# Steering Committee of Politehnica