UNIVERSITATEA TEHNICĂ
DIN CLUJ-NAPOCA

CESTER

crp Conference of Rectors and Presidents of European Universities of Technology

New trends in medical robotics

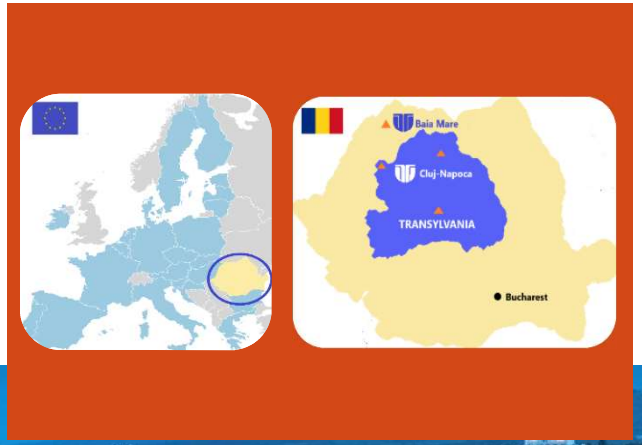
Bogdan GHERMAN, PhD

Technical University of Cluj-Napoca
Research Center for Robots Simulation and Testing
Memorandumului 28, RO-400114 Cluj-Napoca, ROMANIA
E-Mail: doina.pisla@mep.utcluj.ro

21.09. 2024

CLUJ-NAPOCA

(Kolozsvar, Klausenburg)



- **500.000** inhabitants in the metropolitan area
- **6** public universities with a total of **80.000** students
- **Romania's leading** hub of technology & innovations
- Significant **city's workforce** employed in IT

STATE UNIVERSITIES

IN CLUJ-NAPOCA

Babes Bolyai University

★ **THE TECHNICAL UNIVERSITY OF CLUJ-NAPOCA**

Iuliu Haţieganu University of Medicine and Pharmacy

University of Agriculture Science and Veterinary Medicine

Gheorghe Dima Academy of Music

Ion Andreescu Academy of Visual Arts

TUCN'S STRENGTHS

Regional dimension

TUCN is recognized as a highly qualified human resource provider for the Northwest region of Romania through its 2 main campuses and 4 subsidiaries, providing multiple links within the regional innovation and entrepreneurship ecosystem for a connected social and inclusive HE system.

Innovation and research

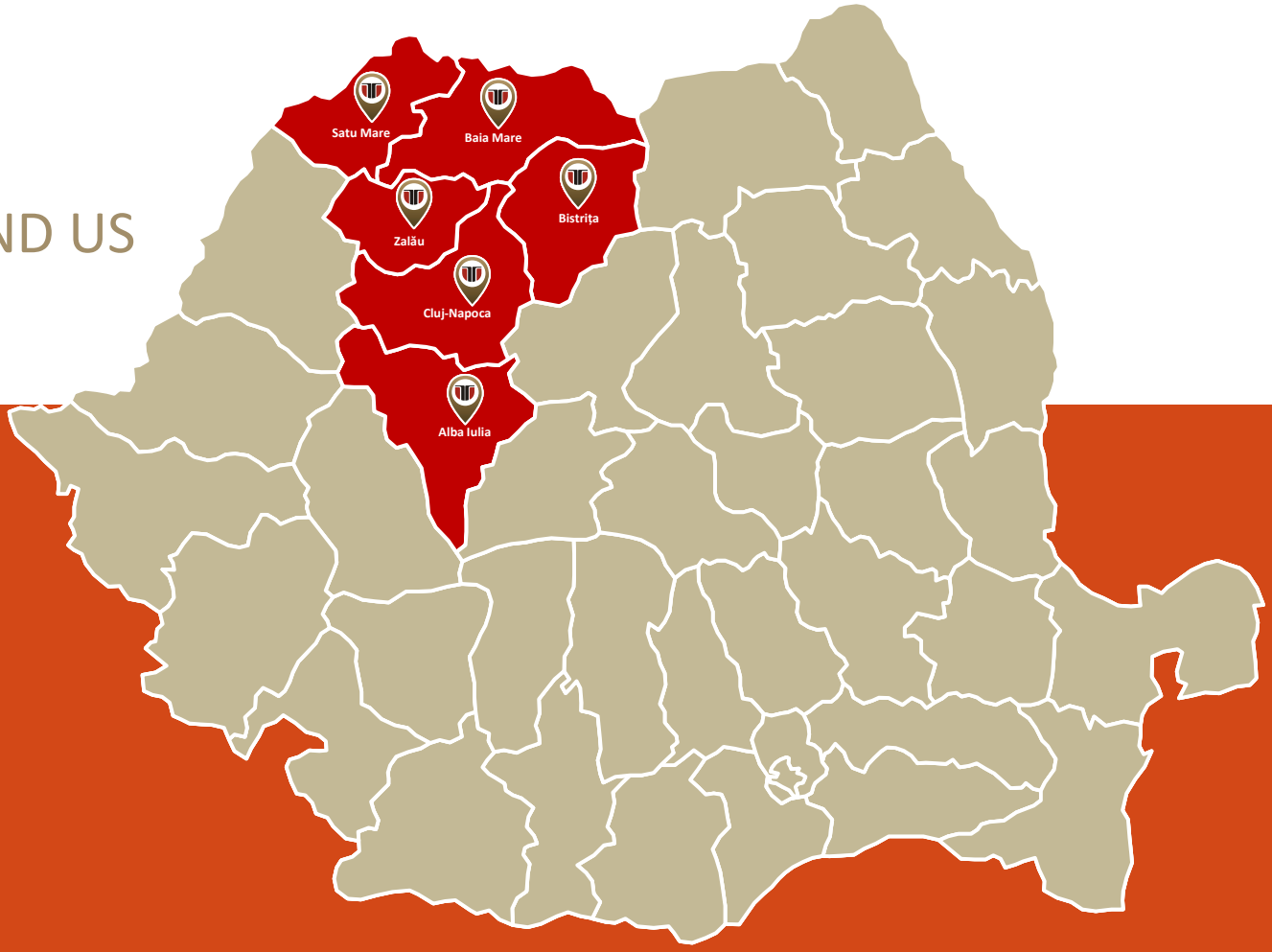
TUCN is on the third position in terms of funds attracted through the Horizon 2020 and Europe programs, among the 48 state universities from Romania.

Trust and reliability

In 2023 the Romanian Agency for Quality Assurance in Higher Education, awarded the institution the "Highest Degree of Trust in HE". In 2019 TUCN received the status of international university of excellence (4 stars), following the external audit conducted by QS Stars Rating System (UK).

WHERE

YOU CAN FIND US



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UNIVERSITATEA TEHNICĂ
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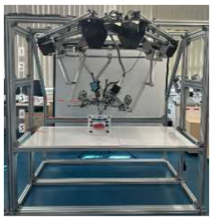
Research Center for Industrial Robots Simulation and Testing - CESTER

- Innovative development of intelligent robotic systems
- Medical robotics, Tele-robotics, Service robotics
- Advanced design
- Mathematical modeling
- Prototyping
- Advanced control and automation
- Artificial Intelligence
- Virtual and augmented reality



Innovate
Experiment
Progress
Success

Medical Collaborators:

- ✓ Surgery
- ✓ Oncology
- ✓ Urology
- ✓ Medical rehabilitation

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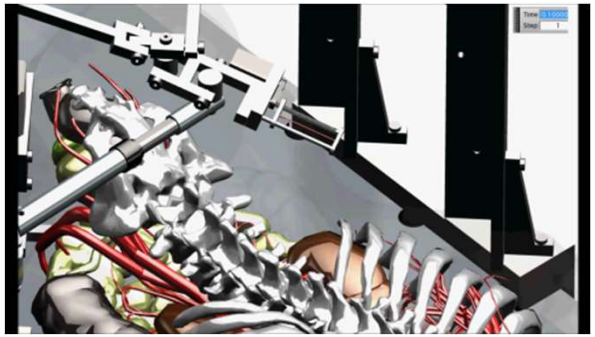
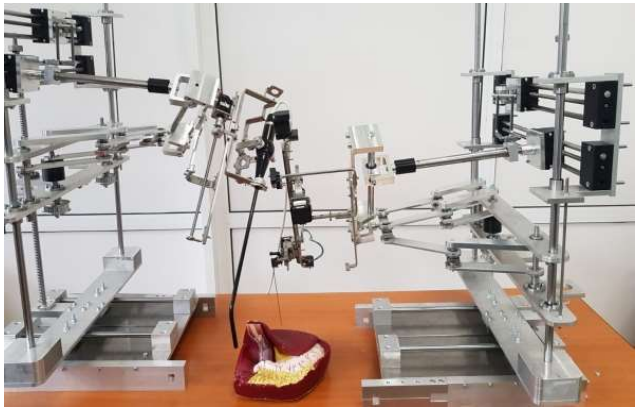
Applications in Medical Robotics - Achievements





- ✓ **15** **Patents** and **over 20** major national and international **Research Projects** in the medical robotics field.

Overview of Medical Robotics

Consistent with the Multi-Annual Roadmap, there are three main subdomains that can be approached in Medical Robotics:

- **Rehabilitation robotics** - robotics for rehabilitation and prosthetics, whereas the increased life expectancy and the growing number of elderly persons make it a highly potential domain.

- **Clinical Robotics -** robots for surgery, diagnosis, and treatment robotics, where a common characteristic refers to the minimal invasiveness of the procedure.

- **Assistive robotics** - specialist support and assistive robots whereas the most relevant challenges refer to systems for carer support, patient manipulation (lifting and displacing), and biomedical and laboratory robots for medical investigation.

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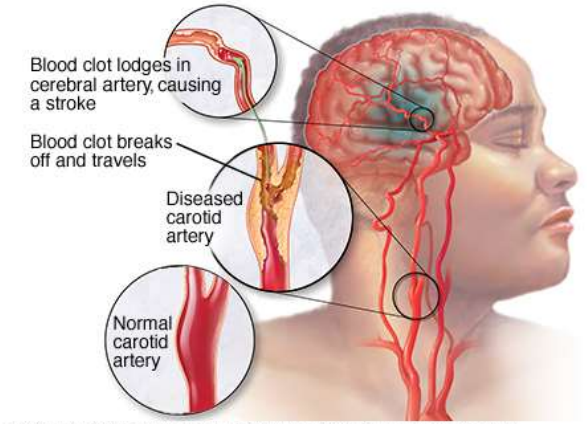
Robotic rehabilitation: Why and How?

- **Stroke** is one of the major diseases which **targets especially the elderly population**
- Cerebro-vascular attacks (**stroke**) have a 75% survival rate, one year after the incident 1.1 million suffer a stroke each year in Europe alone
- **Stroke incidence will increase** with the increase of average life span of the population
- Most common stroke sufferers are people aged **65 and older**
- **80%** Stroke survivors suffer from paresis of the upper limb
- In less than 20 years the medical system will be **unable to supply sufficient medical personnel** to attend stroke patients;
- There are very **few devices** specialized in the acute post stroke rehabilitation.



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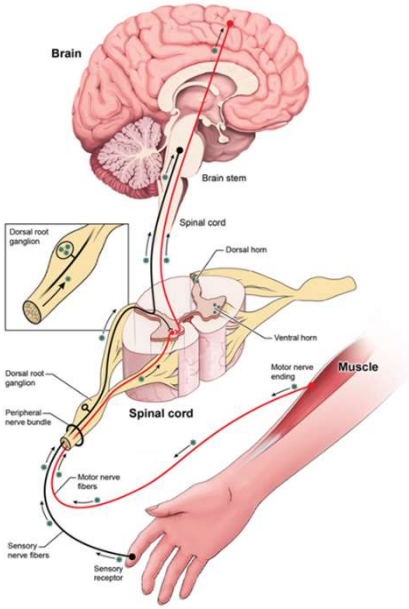
The problem



Number of patients

589.000 people are left with post-stroke disabilities every year in Europe, **75%** continue to experience upper extremity functional limitations even 15 years later.

Costs

Most institutions and the population at large cannot afford to access available robotic assisted rehabilitation solutions,

Number of caregivers

Shortage of caregivers (United Kingdom approx. **77.000**, France approx. **19.000**, Belgium approx. **7.500**),

Proposed solution

ROBOTIC SYSTEMS which allow physical therapists to **develop patient-oriented rehabilitation programs** that can maximize the therapeutic effects aiming towards an **increased quality of life** in the framework of Activities of Daily Living (ADL).

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THE REHABILITATION ROBOTS FUNDAMENTAL REQUIREMENTS

- Adequate control
- **Safety**
- Modularity
- Compactness and flexibility

Safe behavior in all configurations

Advanced control

FAIL SAFE MEDICAL ROBOT

Reconfigurable settings option

Monitored workspace

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INNOVATIVE APPROACHES REGARDING REHABILITATION AND ASSISTIVE ROBOTICS FOR HEALTHY AGEING

AgeWell

Patents


ROMÂNIA

DUPLICAT

ELIBERAT INVENTATORULUI
In baza Art.34 alin.(2), din Legea nr.64/1991 republicată

OFICIUL DE STAT PENTRU INVENȚII ȘI MĂRCI

BREVET DE INVENȚIE

Nr. 132233

Acordat în temeiul Legii nr.64/1991 privind brevetele de invenție, republicată în Monitorul Oficial al României, Partea I, nr.613, din 19 august 2014.

Titular: UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA, CLUJ-NAPOCA, CJ, RO

Titlul invenției: ROBOT SFERIC PENTRU RECUPERAREA MEDICALĂ A ZONEI PROXIMALE LA NIVELUL MEMBRULUI SUPERIOR

Inventatori: VAIDA LIVIU CĂLIN, COMUNA FLOREȘTI, CJ, RO; PLITEA NICOLAE, CLUJ-NAPOCA, CJ, RO; PÎSLĂ DOINA LIANA, CLUJ-NAPOCA, CJ, RO; CARBONE GIUSEPPE, VENAFRO, IT; GHERMAN-BOGDAN GEORGE, CLUJ-NAPOCA, CJ, RO; ULINICI IONUȚ-MIHAI, BISTRIȚA, BN, RO; PÎSLĂ ADRIAN, CLUJ-NAPOCA, CJ, RO

Descrierea invenției, revendicările și desenele la care se face referință în acestea, fac parte integrantă din prezentul brevet de invenție.
Durata brevetului de invenție este de 20 ani, cu începere de la data de 14/06/2017, cu condiția plății taxelor anuale de menținere în vigoare a brevetului.

Confirm că de mai sus prin semnarea și aplicarea ștampilei
Director General

București, Data eliberării 30/03/2020


ROMÂNIA

DUPLICAT

ELIBERAT INVENTATORULUI
In baza Art.34 alin.(2), din Legea nr.64/1991 republicată

OFICIUL DE STAT PENTRU INVENȚII ȘI MĂRCI

BREVET DE INVENȚIE

Nr. 132234

Acordat în temeiul Legii nr.64/1991 privind brevetele de invenție, republicată în Monitorul Oficial al României, Partea I, nr.613, din 19 august 2014.

Titular: UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA, CLUJ-NAPOCA, CJ, RO

Titlul invenției: SISTEM ROBOTIC PARALEL PENTRU RECUPERAREA MEDICALĂ A MEMBRULUI SUPERIOR

Inventatori: GHERMAN BOGDAN GEORGE, CLUJ-NAPOCA, CJ, RO; PÎSLĂ DOINA LIANA, CLUJ-NAPOCA, CJ, RO; PLITEA NICOLAE, CLUJ-NAPOCA, CJ, RO; VAIDA LIVIU CĂLIN, COMUNA FLOREȘTI, CJ, RO; CARBONE GIUSEPPE, VENAFRO, IT; PÎSLĂ ADRIAN, CLUJ-NAPOCA, CJ, RO; BĂNICĂ ALEXANDRU VLAD, BAIA MARE, MM, RO

Descrierea invenției, revendicările și desenele la care se face referință în acestea, fac parte integrantă din prezentul brevet de invenție.
Durata brevetului de invenție este de 20 ani, cu începere de la data de 14/06/2017, cu condiția plății taxelor anuale de menținere în vigoare a brevetului.

Confirm că de mai sus prin semnarea și aplicarea ștampilei
Director General

București, Data eliberării 30/03/2020


Ministero dello Sviluppo Economico

Direzione generale per la tutela della proprietà industriale

Ufficio Italiano Brevetti e Marchi

ATTESTATO DI BREVETTO PER INVENZIONE INDUSTRIALE

N. UB201800004216

TITOLARE(I):

DOMICILIO:

INVENTORE(I):

TITOLO: Robot sferico per il recupero dell'arto superiore dello spalla

CLASSIFICA: A61H1

DATA DEPOSITO: 12/06/2018

Roma, 13/07/2020

Il Dirigente della Divisione


ROMÂNIA

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ELIBERAT INVENTATORULUI
In baza Art.34 alin.(2), din Legea nr.64/1991 republicată

OFICIUL DE STAT PENTRU INVENȚII ȘI MĂRCI

BREVET DE INVENȚIE

Nr. 133814

Acordat în temeiul Legii nr.64/1991 privind brevetele de invenție, republicată în Monitorul Oficial al României, Partea I, nr.613, din 19 august 2014.

Titular: UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA, CLUJ-NAPOCA, CJ, RO

Titlul invenției: ROBOT PARALEL PENTRU RECUPERAREA MOBILITĂȚII MEMBRULUI INFERIOR

Inventatori: PÎSLĂ DOINA LIANA, CLUJ-NAPOCA, CJ, RO; RĂILESCU IOSIF, BRAȘOV, BV, RO; VAIDA LIVIU CĂLIN, COMUNA FLOREȘTI, CJ, RO; GHERMAN BOGDAN GEORGE, CLUJ-NAPOCA, CJ, RO; TUCAN PAUL GEORGE MIHAI, CLUJ-NAPOCA, CJ, RO; CARBONE GIUSEPPE, VENAFRO, IT; PLITEA NICOLAE, CLUJ-NAPOCA, CJ, RO

Descrierea invenției, revendicările și desenele la care se face referință în acestea, fac parte integrantă din prezentul brevet de invenție.
Durata brevetului de invenție este de 20 ani, cu începere de la data de 04/06/2018, cu condiția plății taxelor anuale de menținere în vigoare a brevetului.

Confirm că de mai sus prin semnarea și aplicarea ștampilei
Director General
Marian - Catalin BURCESCU

București, Data eliberării 29/10/2021


ROMÂNIA

DUPLICAT

ELIBERAT INVENTATORULUI
In baza Art.34 alin.(2), din Legea nr.64/1991 republicată

OFICIUL DE STAT PENTRU INVENȚII ȘI MĂRCI

BREVET DE INVENȚIE

Nr. 133815

Acordat în temeiul Legii nr.64/1991 privind brevetele de invenție, republicată în Monitorul Oficial al României, Partea I, nr.613, din 19 august 2014.

Titular: UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA, CLUJ-NAPOCA, CJ, RO

Titlul invenției: ROBOT PARALEL PENTRU RECUPERAREA MEDICALĂ A MEMBRELOR INFERIOARE

Inventatori: PÎSLĂ DOINA LIANA, CLUJ-NAPOCA, CJ, RO; GHERMAN BOGDAN GEORGE, CLUJ-NAPOCA, CJ, RO; NADAȘ IULIU ADRIAN, CLUJ-NAPOCA, CJ, RO; POP NICOLETA MARIA, COMUNA MARCA, SJ, RO; CRACIUN CRISTEA FLORIN, CLUJ-NAPOCA, CJ, RO; TUCAN PAUL GEORGE MIHAI, CLUJ-NAPOCA, CJ, RO; VAIDA LIVIU CĂLIN, COMUNA FLOREȘTI, CJ, RO; CARBONE GIUSEPPE, VENAFRO, IT; BÎLEȘCU OSIF, BRAȘOV, BV, RO; PLITEA NICOLAE, CLUJ-NAPOCA, CJ, RO

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Durata brevetului de invenție este de 20 ani, cu începere de la data de 27/06/2019, cu condiția plății taxelor anuale de menținere în vigoare a brevetului.

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Director General
Marian - Catalin BURCESCU

București, Data eliberării 29/10/2021

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Research results: 9 (nine) new robotic structures

No.	Name	Targeted limb	Targeted limb areas	Robot architecture	Development stage
1	**ASPIRE**	**Upper limb**	**Shoulder and elbow**	**Spherical robot with parallel architecture**	**Prototype**
2	**PaRReEx**	**Upper limb**	**Elbow and wrist**	**Modular robot with parallel structure**	**Prototype**
3	ReExRob	Upper limb	Elbow and wrist	Modular robot with serial structure	Concept Design
4	**RAISE**	**Lower limb**	**Hip, knee and ankle**	**Modular robot with parallel structure**	**Prototype**
5	**RECOVER**	**Lower limb**	**Hip, knee and ankle**	**Modular robot with parallel structure**	**Prototype**
6	**CUBE**	**Lower limb**	**Knee and ankle**	**Wire-based modular robot**	**Prototype**
7	DualEx	Upper limb	Elbow and wrist	Dual-arm exoskeleton	Mechanical Design
8	CableBot	Upper limb	Elbow	Wire-based modular robot	Concept Design
9	RAISE 2	Lower limb	Hip and knee	Spherical robot with parallel architecture	Concept Design

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From Theory to Practice

Prototypes of Robotic systems for post-stroke rehabilitation

AgeWell

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Upper limb rehabilitation robots

ASPIRE

Parallel rehabilitation robot based on a spherical architecture:

- 3-DoF robotic system for:
  - ❖ Shoulder flexion/extension, abduction/adduction
  - ❖ Forearm pronation/supination
- Modular design
- Subject to clinical trials

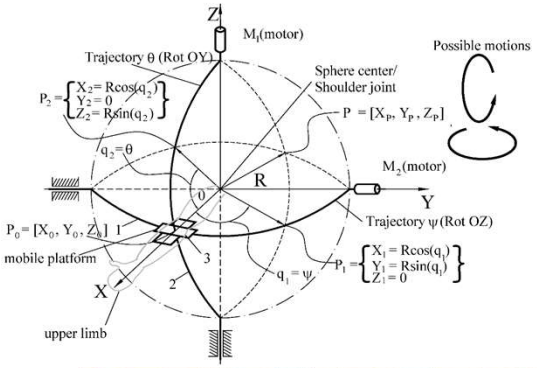
ParReEx

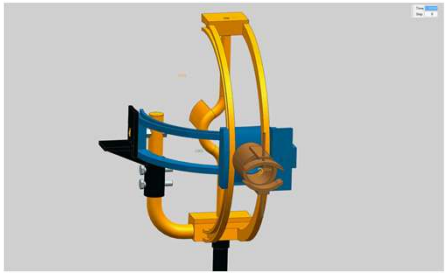
Parallel rehabilitation robot with two uncoupled modules:

- Elbow module with 2-DoF for:
  - ❖ Elbow flexion/extension, abduction/adduction
- Wrist module with 2-DoF for:
  - ❖ Wrist flexion/extension, abduction/adduction
- Modular design
- Subject to clinical trials

Development of ASPIRE robotic system

Kinematic scheme and CAD simulations

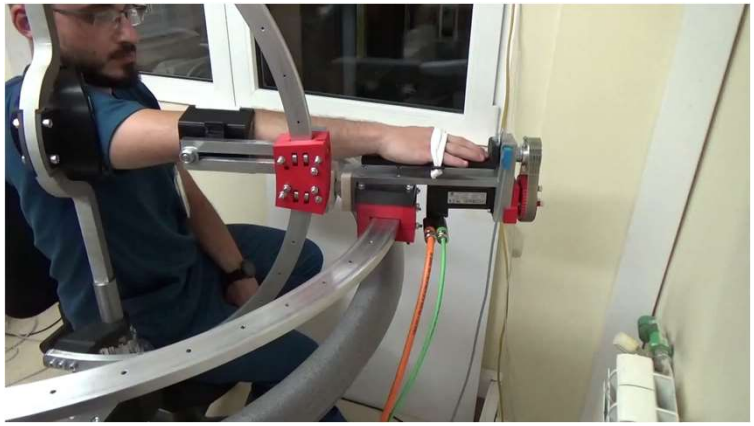




Final design

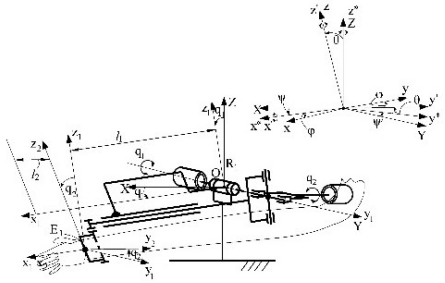
Experimental model

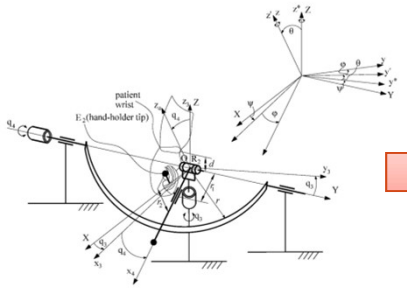
Clinical trials



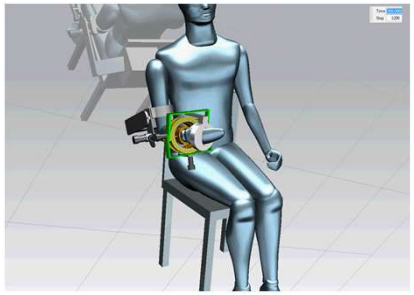
Development of ParReEx wrist and ParReEx elbow

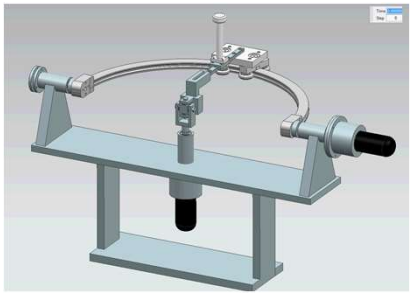
Kinematic schemes





CAD models simulations

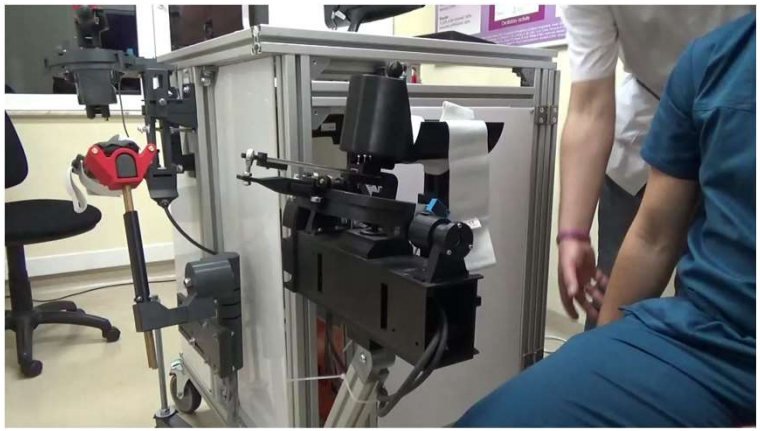




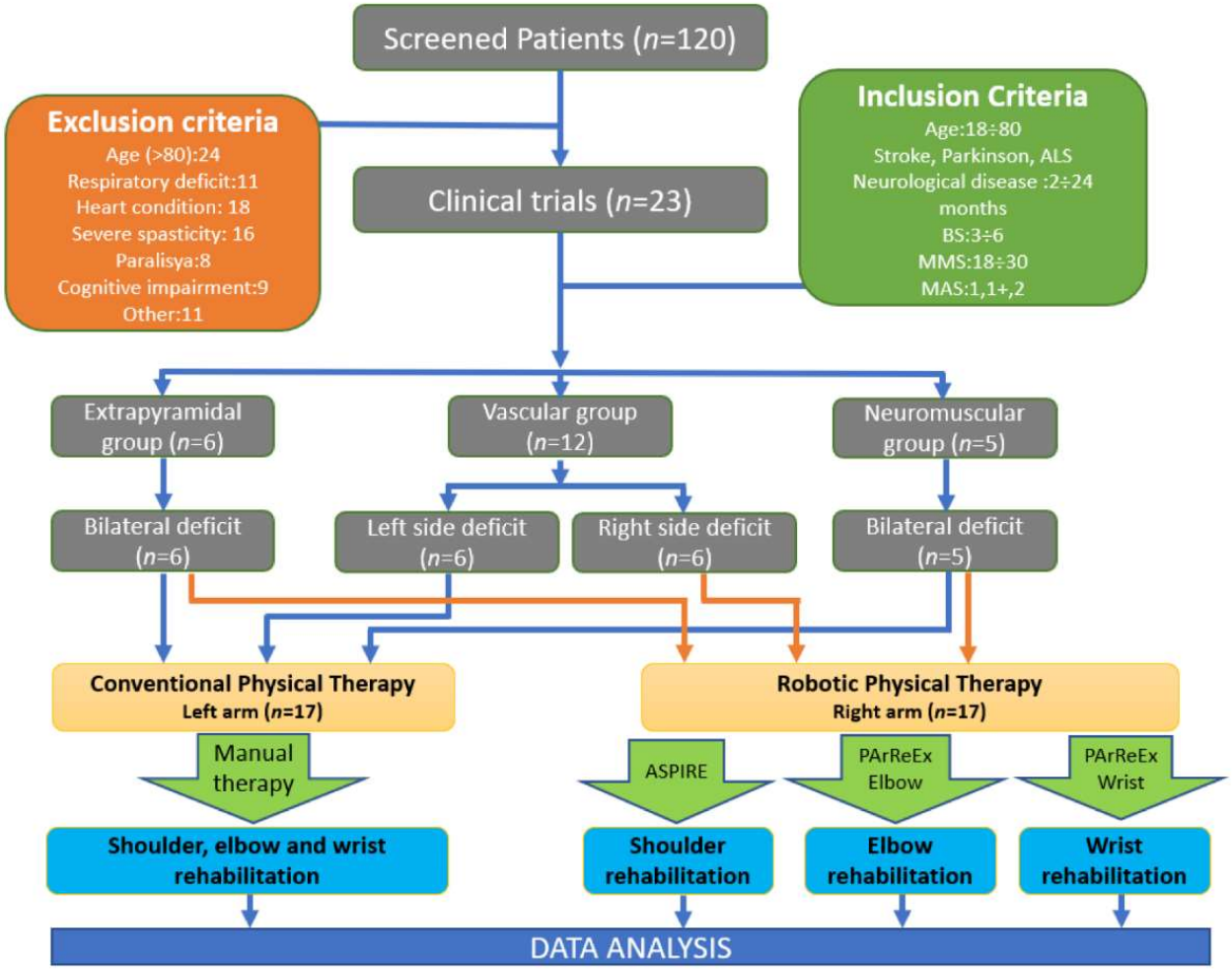
ParReEx Elbow

Clinical trials

ParReEx Wrist



Clinical trials



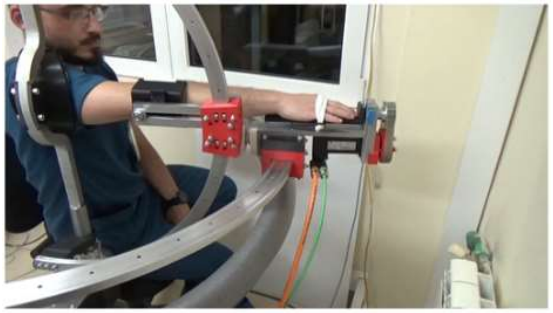
Clinically tested robotic system

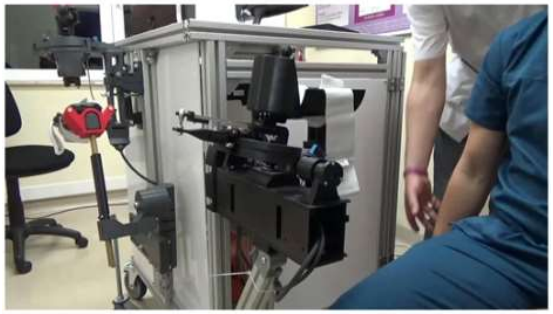
24 patients feedback

50 clinicians feedback

15 engineers feedback

Clinical trials





ASPIRE

ParReEx-wrist

ParReEx-elbow

Clinical validation – proof of feasibility

24 patients

Clinical study

International Journal of *Environmental Research and Public Health*

MDPI

Article

The Impact of Robotic Rehabilitation on the Motor System in Neurological Diseases. A Multimodal Neurophysiological Approach

Zoltán Zsigmond Major [1,2], Calin Vaida [3], Kinga Andrea Major [4,*], Paul Tucan [3], Gábor Simori [2], Alexandru Banica [3], Emanuela Brusturean [2], Alin Burz [3], Raul Craciunas [2], Ionut Ulinici [3], Giuseppe Carbone [3,5], Bogdan Gherman [3], Iosif Birlescu [3] and Doina Pisla [3,*]

1 Research Center for Advanced Medicine "MedFuture", University of Medicine and Pharmacy "Iuliu Hatieganu" Cluj-Napoca, 400000 Cluj-Napoca, Romania; zoltan.major@eeg-emg.ro
2 Neurology Department, Municipal Clinical Hospital Cluj-Napoca, 400139 Cluj-Napoca, Romania; simorigabor@gmail.com (G.S.); emabrusturean@yahoo.com (E.B.); raul_rullz@yahoo.com (R.C.)
3 Research Center for Industrial Robots Simulation and Testing, Technical University of Cluj-Napoca, 400114 Cluj-Napoca, Romania; calin.vaida@mep.utcluj.ro (C.V.); paul.tucan@mep.utcluj.ro (P.T.); alexandru.banica@omt.utcluj.ro (A.B.); alin.burz@mep.utcluj.ro (A.B.); ionut.ulinici@omt.utcluj.ro (I.U.); giuseppe.carbone@unical.it (G.C.); bogdan.gherman@mep.utcluj.ro (B.G.); iosif.birlescu@mep.utcluj.ro (I.B.)
4 Second ICU, Neurosurgery Department, Cluj County Emergency Clinical Hospital, Strada Clinicilor 3–5, 400000 Cluj-Napoca, Romania
5 DIMEG, University of Calabria, Via Pietro Bucci, 87036 Arcavacata, Italy
* Correspondence: majorkinga@yahoo.com (K.A.M.); doina.pisla@mep.utcluj.ro (D.P.)

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check for updates

Abstract: Motor disability is a key feature of many neurological diseases, influencing the social roles of affected patients and their ability to perform daily life activities. Current rehabilitation capacities are overwhelmed by the age-related increase of motor dysfunctions seen, for example, in stroke, extrapyramidal or neuromuscular diseases. As the patient to rehabilitation personnel ration increases, robotic solutions might establish the possibility to rapidly satisfy the increasing demand for rehabilitation. This paper presents an inaugural exploratory study which investigates the interchangeability of a novel experimental robotic rehabilitation device system with classical physical therapy, using a multimodal neurophysiological assessment of the motor system—quantitative electroencephalogram (EEG), motor conduction times and turn/amplitude analysis. Preliminary results show no significant difference between the two methods; however, a significant effect of the therapy was found on different pathologies (beneficial for vascular and extrapyramidal, or limited, and only on preventing reduction of joint movements in neuromuscular).

Keywords: robotic rehabilitation; physical therapy; stroke; Parkinson's; ALS; qEEG; motor conduction time; turn-amplitude analysis

Agewell clinical trials – patient testimonials

Stroke recovering patient statement after receiving robotic rehabilitation with the ASPIRE system:

"Today I was asked to fill in a form stating my opinion regarding the robotic system that I've been exercising with. But I am a simple man, and I don't know much about technology so it's hard for me to answer all those questions. But I can tell you this: I had a major stroke five months ago which left me with severe hemiparesis and since then I was unable to do many things around the house. But most of all I suffered as I was not even able to hold a pen in my hand and write down my name. After three days spent here with you, I succeeded in signing a form to request to vote for the elections from inside the hospital. So, for me this is the greatest achievement after I had my stroke and I thank you for this."

(Anonymous patient)

Rehabilitation exercise performed on male patient (back view capturing the patient position with his arm stretched).

Agewell clinical trials – patient testimonials

Stroke recovering patient statement after receiving robotic rehabilitation with the ParReEx system:

"When I received the call from the doctors asking me whether I would like to test a new device that would help me in the rehabilitation process I was kind of happy and considered myself very lucky. Going inside the treatment room and seeing the device, my first question to the people in there was: is this from Germany? I was happy to find out that it was made in our city, in Cluj, because it was functioning so well that it could have been also from Germany. I'm glad that people here are thinking about us and are working to find ways to help us get better, so I told both doctors and engineers: I hope I'll see more of these soon also in other hospitals."

(Anonymous patient)

Patient during rehabilitation with ParReEx elbow (top view capturing the patients' lower limb mounted using the anchors).

Lower limb rehabilitation robots

RECOVER

Parallel rehabilitation robot with two coupled modules for gait rehabilitation.

- 3-DoF parallel module for:
  - **Hip** flexion/extension
  - **Knee** flexion/extension
- 2-DoF parallel spherical module for:
  - **Ankle** flexion/extension, inversion/eversion
- Modular design
- Under development

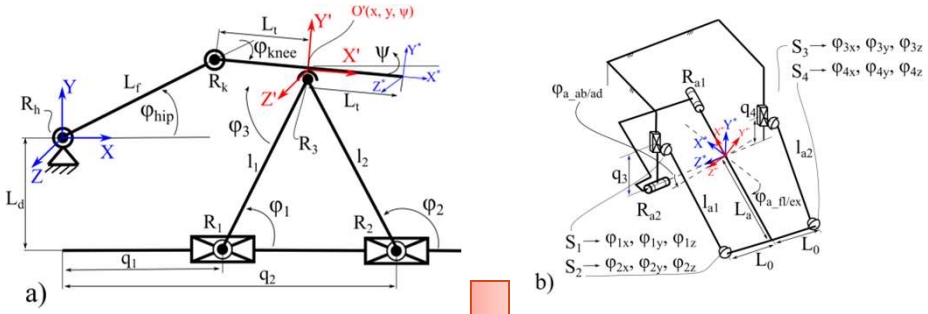
RAISE

Parallel rehabilitation robot with two coupled modules for lower limb rehabilitation.

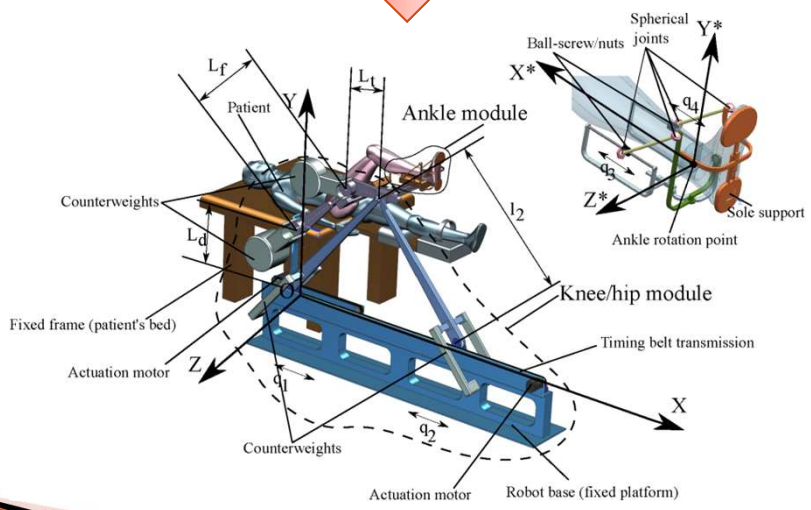
- 3-DoF parallel module for:
  - **Hip** flexion/extension, abduction/adduction
  - **Knee** flexion/extension
- 2-DoF serial spherical module for:
  - **Ankle** flexion/extension, inversion/eversion
- Modular design
- Ensures patient safety and ergonomics
- Tested in the laboratory

Development of RECOVER robotic system for lower limb rehabilitation

Kinematic scheme



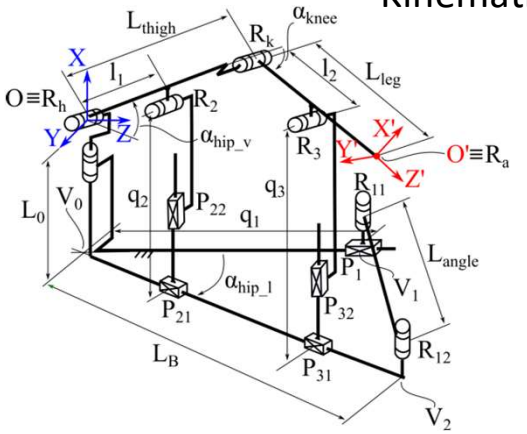
CAD design

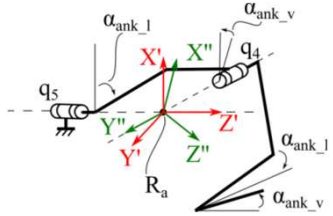


Prototype development

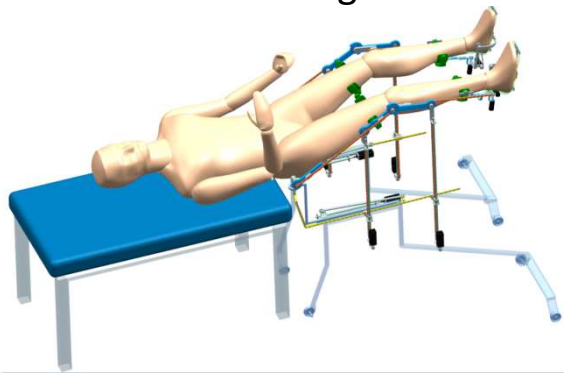
Development of RAISE lower limb rehabilitation system

Kinematic scheme





CAD Design



Experimental testing

Apollo European project

Intelligent telerobotic systems for the personalised treatment of neuromotor deficit to increase the patients quality of life – APOLLO

SITLINE TECHNOLOGY

UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA

(Project funded through Competitiveness Operational Programme 2014-2020, with the support of the European Union, under the **Call Innovative Technological Projects - 2022**)

The first technologic transfer of a medical robot in Romania

Main objective: APOLLO aims to achieve the **technological transfer** of a robotic system for medical rehabilitation in the framework of a private-public partnership, to develop **an innovative technological product – as an intelligent robotic system – that will perform optimal treatment programs for patients with different neuromotor deficiencies using on-line on-site personalized programs under the supervision of medical experts.**

Recent achievements in Surgical Robotics

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- **IMPROVE project - High accuracy innovative approach for the robotic assisted intraoperatory treatment of hepatic tumors based on imagistic-molecular diagnosis,** National Complex Project for Research, Development and Innovation, financed by the Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI), Project code: PN-III-P1-1.2-PCCDI2017-0221, Contract no: 59/1 March 2018, Project duration: 2018-2021 (Manager -Doina Pisla)

- **Heal4Liv project - Innovative robotic system for cancer treatment,** Financed by the European Institute of Innovation and Technology (EIT-Health) through InnoStars, 2020 (Manager – Bogdan Gherman)

- **OnTarget project - Innovative robotic guided instruments for the treatment of malignant tumors,** Experimental demonstration project (PED) financed by the Executive Unit for Financing Higher Education, Research, Development and Innovation(UEFISCDI), Project code: PN-III-P2-2.1-PED2019-4375, 2020-2022 (Manager - Calin Vaida)

- **CHALLENGE project - New frontiers in robotic assisted single port surgery: a novel robotic system with dexterous instruments,** National Exploratory Project, financed by the Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI), Project code: PN-III-P4-ID-PCE-2020-0572-PCE-171, Contract no: 171/2021, Project duration: 2021-2023 (Manager - Doina Pisla)

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Recent achievements in Surgical Robotics

DEVELOPMENT

Our Vision

Development of innovative intelligent robotic systems in the major domain:

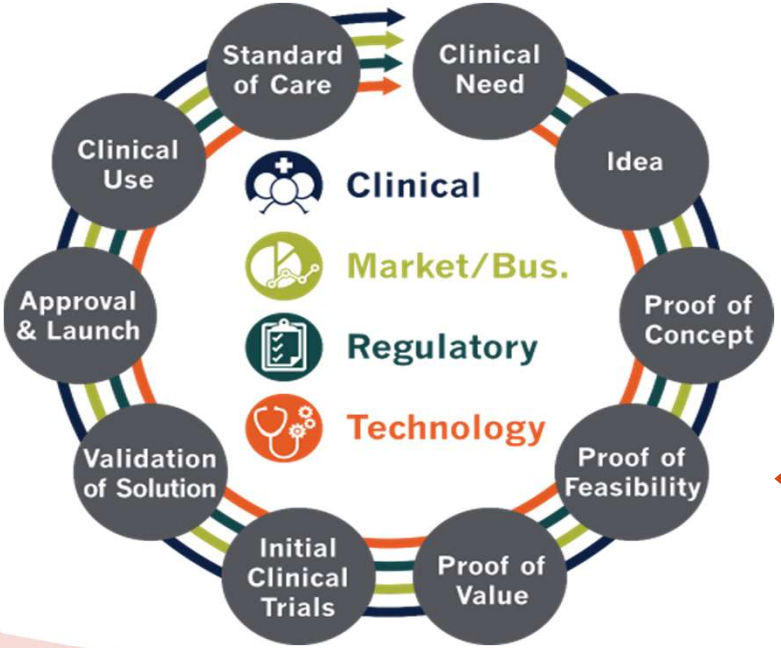
CANCER TREATMENT

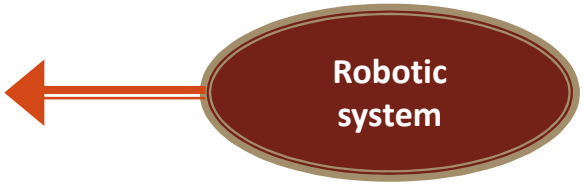
To provide **efficient treatments** in a **human centered design** embedding the needs of the patients to achieve the **increase of the quality of life** in an economically sustainable environment.

What was the proposed solution?

Development of an innovative, modular robotic system for HepatoCellular Carcinoma (HCC) treatment capable of:

- Percutaneous HDR brachytherapy;
- Radiofrequency ablation;
- Targeted intratumoral chemotherapy;





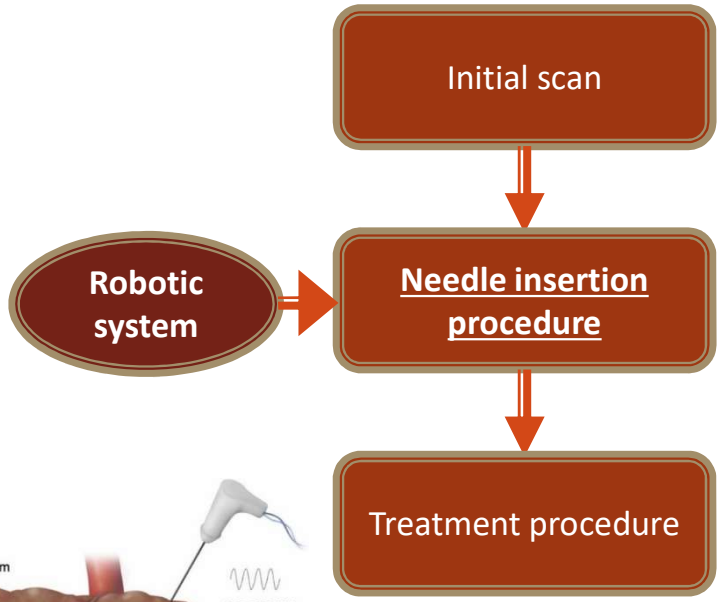
What is the problem that was addressed?

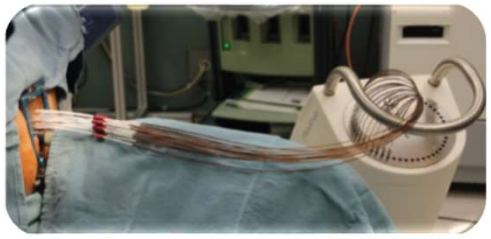
- Hepatocellular carcinoma (HCC) is the most common type of liver cancer, accounting for 80-90% of liver cancer cases, and being one of the top cancer-related causes of death (5th-2012, 4th-2016 3rd-2019).
- Robotic System for Liver Cancer Therapy is Cost-Effective & Fits Current Care Continuum.
- There is a technological limitation in the application of interventional (intratumoral) treatment in HCC.
- The manual insertion of the needles delivering the treatment lacks the required accuracy (in BT 1mm accuracy is required while manual accuracy cannot go below 3.7 mm).
- Accurate real-time imaging techniques (CT, MRI) impose the use of specialized automated devices for needle positioning and insertion.
- The only commercially available solution (XACT Robotics) is only able to insert small needles, which limits its applicability in the case of deeply located tumors.

Brachytherapy needle position

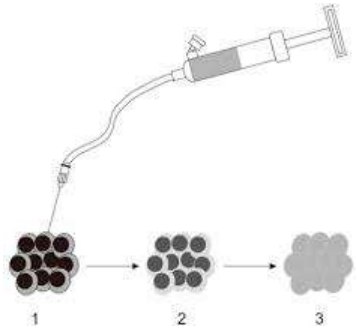
Treatment procedure

The proposed solution is designed for the needle insertion/retraction stages in the oncologic procedures. The therapeutic agents (HDR brachytherapy, radiofrequency ablation or intratumoral chemotherapy) are then delivered through the needles using specialized medical devices.

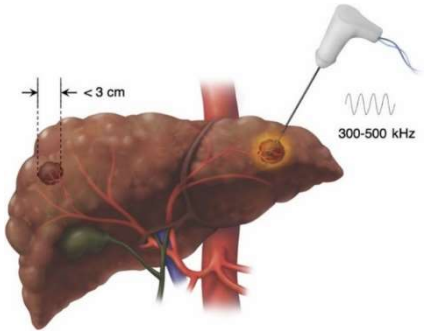




HDR brachytherapy



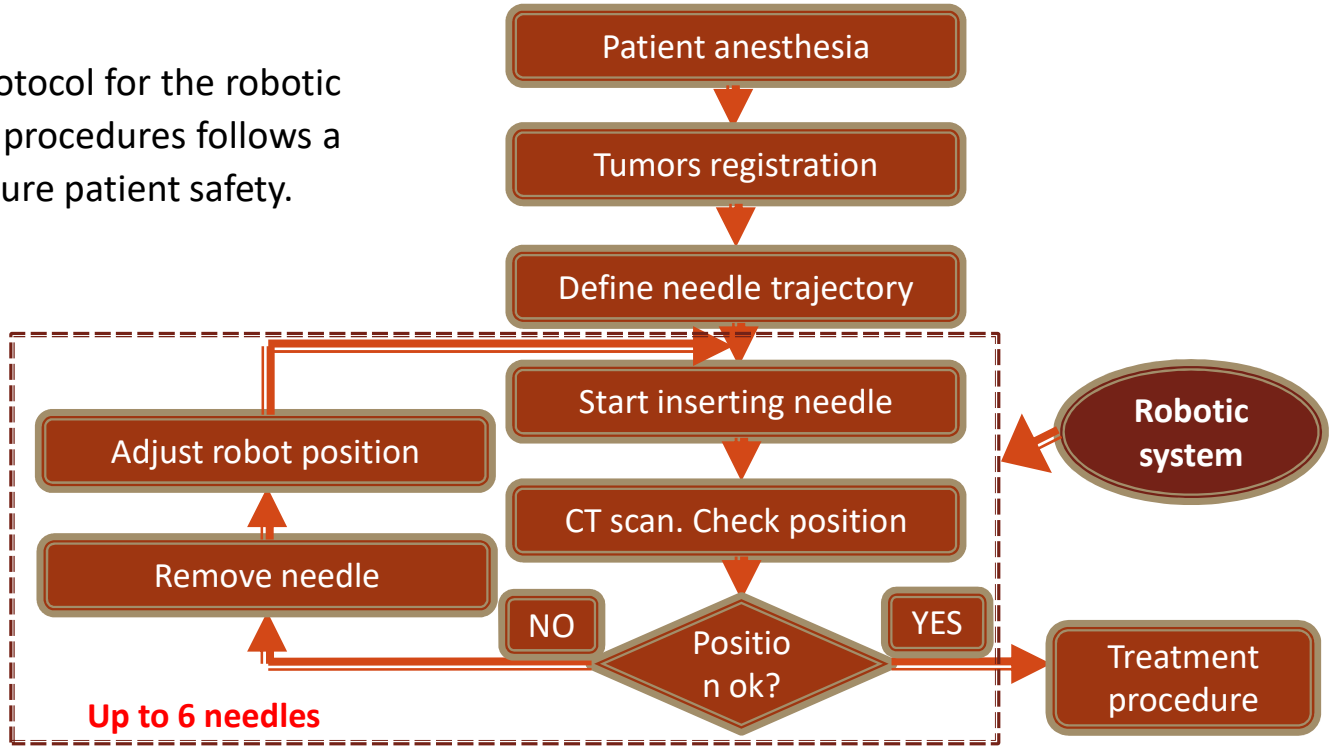
Intratumoral chemotherapy



Radiofrequency ablation

Needle insertion procedure

The medical approved protocol for the robotic assisted needle insertion procedures follows a stepwise approach to ensure patient safety.



EIT Health is supported by the EIT, a body of the European Union

Main achievements

- ✓ More than 40 scientific papers were published in international journals or international conference proceedings
- ✓ 8 patent applications
- ✓ Multiple distinctions and awards within different international innovation fairs
- ✓ Multiple plenary lectures at international conferences
- ✓ 1 habilitation thesis

For more information about the list of publications please visit our project websites:

https://cester.utcluj.ro/improve/en/home_en.html

https://cester.utcluj.ro/heal4liv/en/home_en.html

https://cester.utcluj.ro/OnTarget/en/home_en.html

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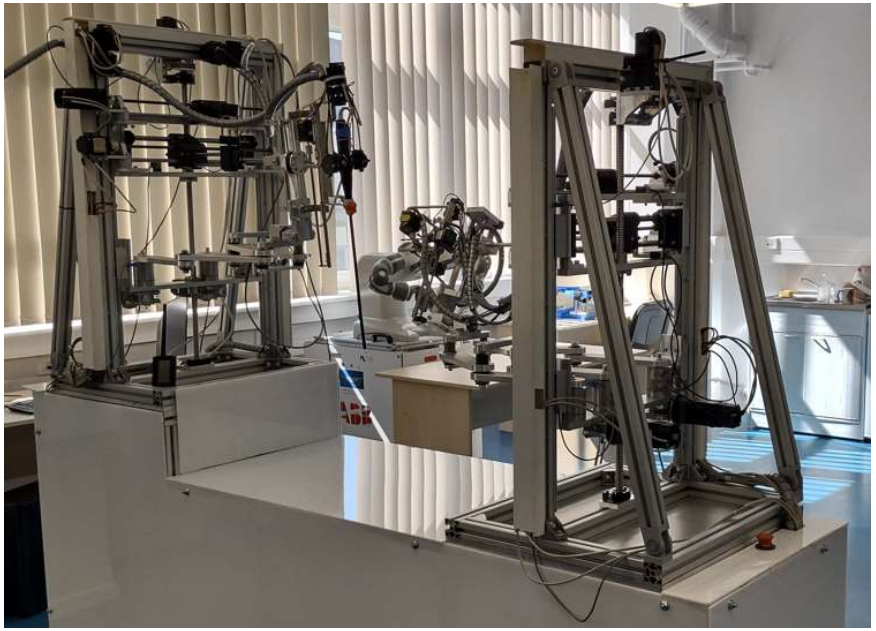
From Theory to Practice

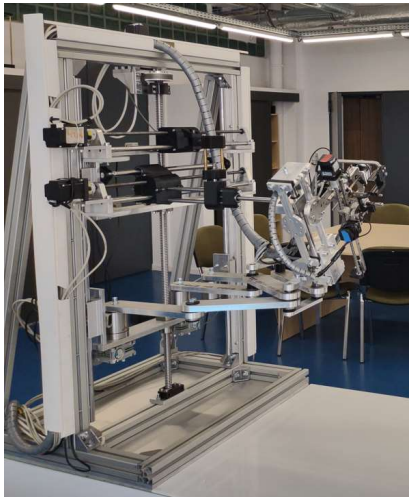
Prototypes of Robotic systems for liver cancer treatment

IMPROVE project
Parallel robotic system for intraoperative treatment of hepatic tumors - PROHEP-LCT (2020)

US guiding module



PROHEP-LCT Robotic system



Needle guiding module

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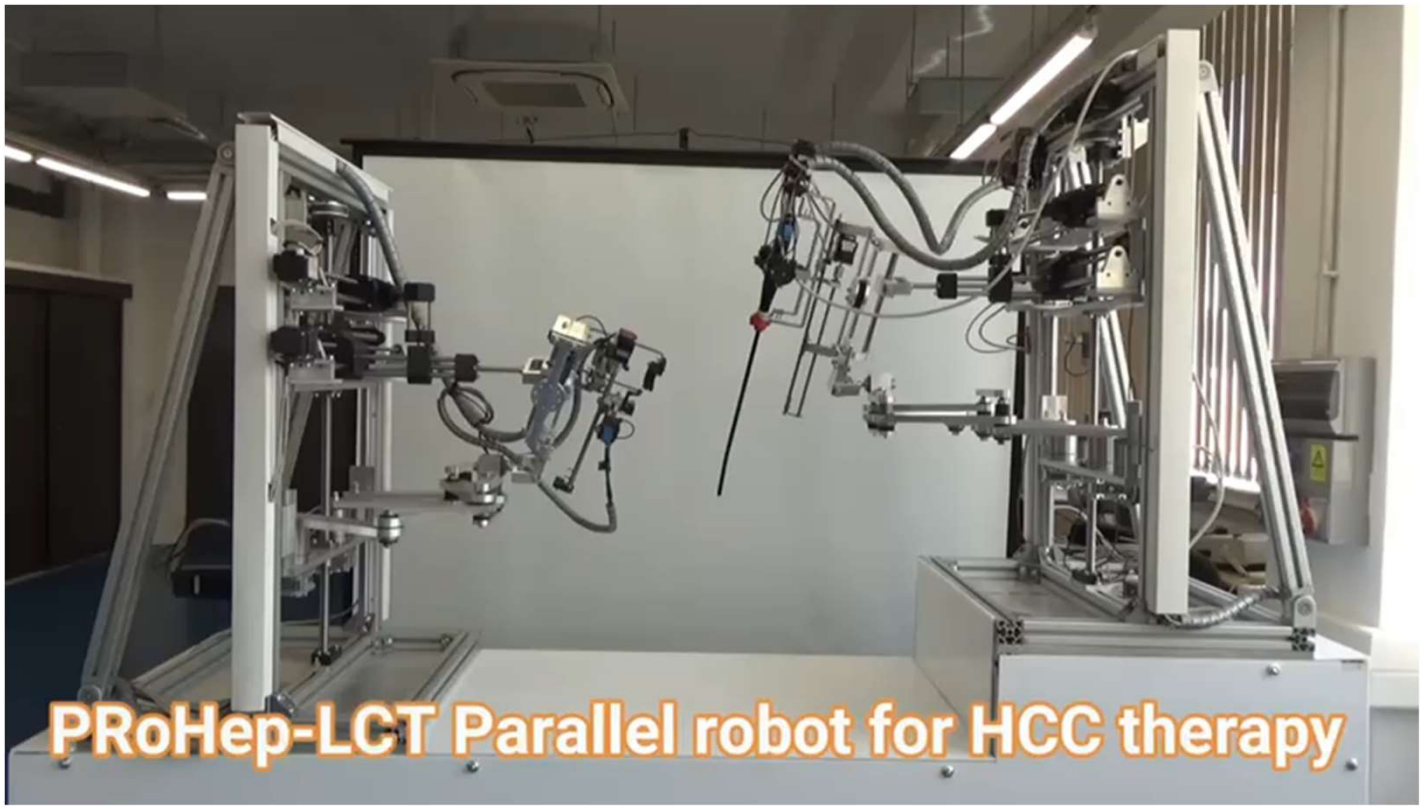
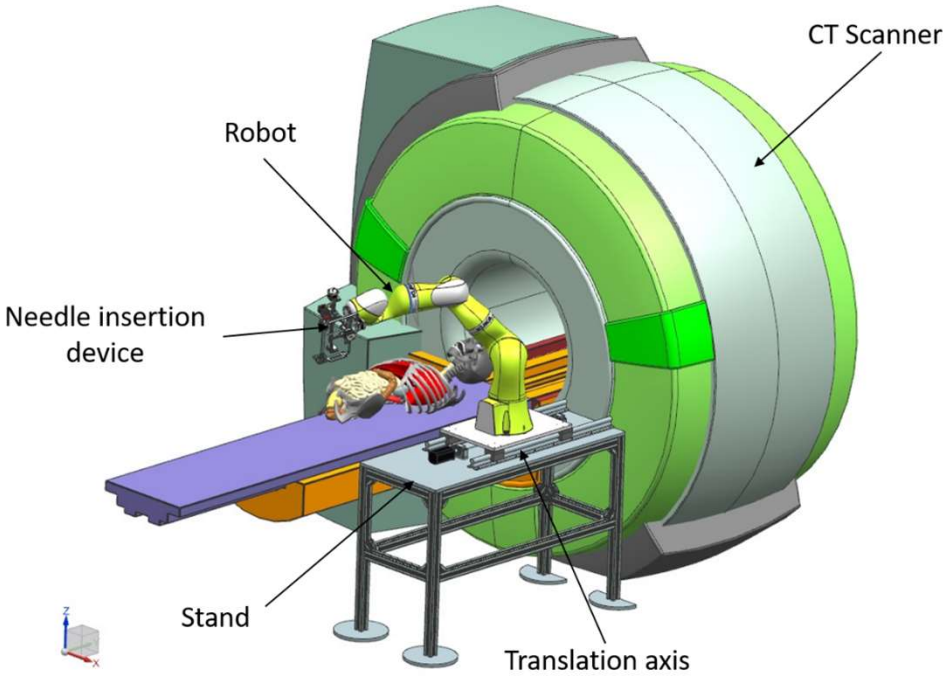
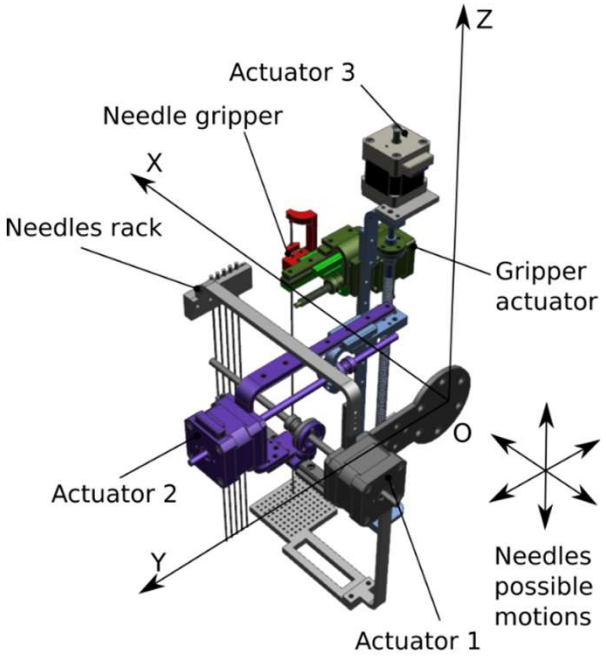
IMPROVE project
Parallel robotic system for intraoperative treatment of hepatic tumors - PROHEP-LCT



HEAL4LIV project
The robotic system under CT guiding

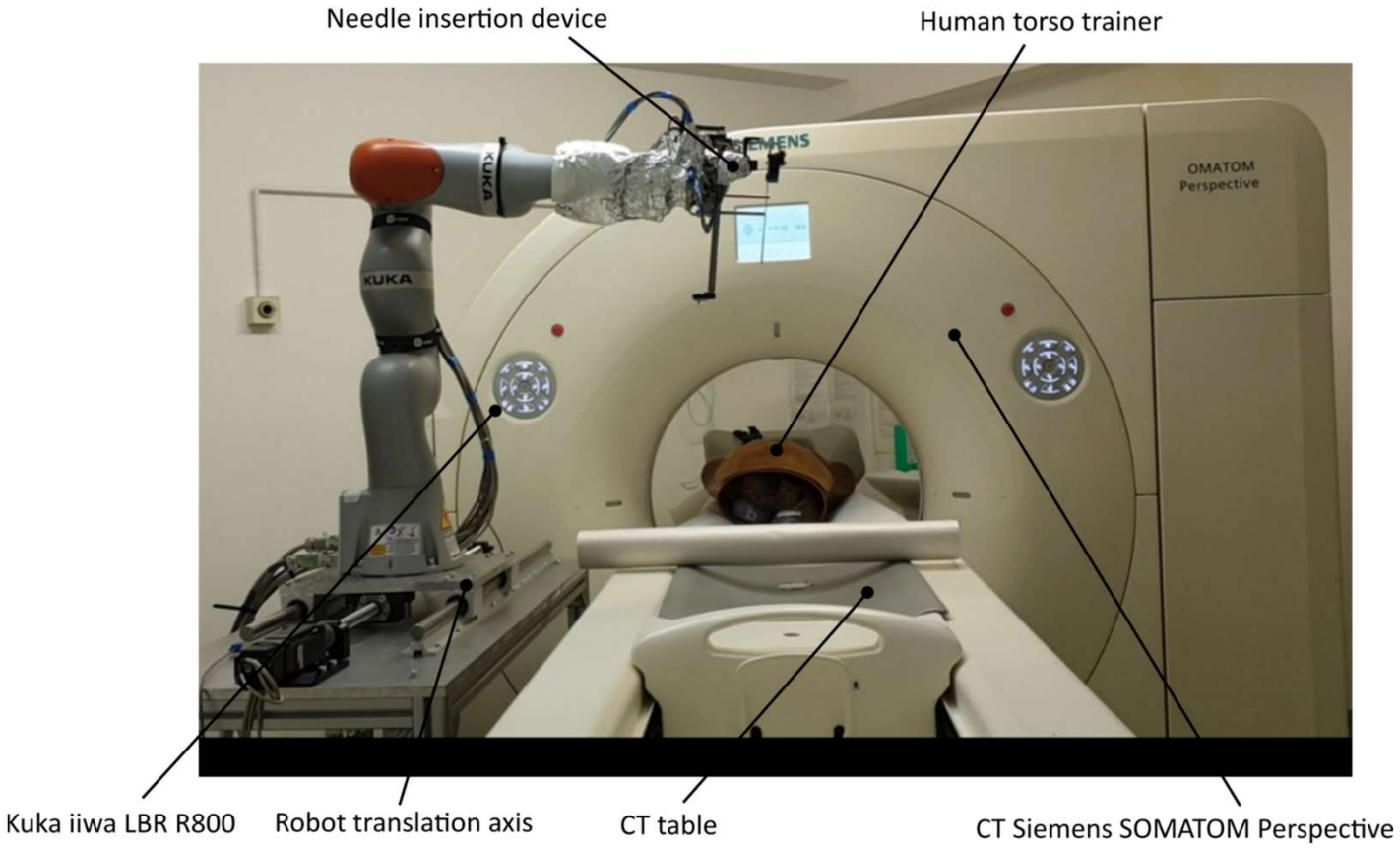




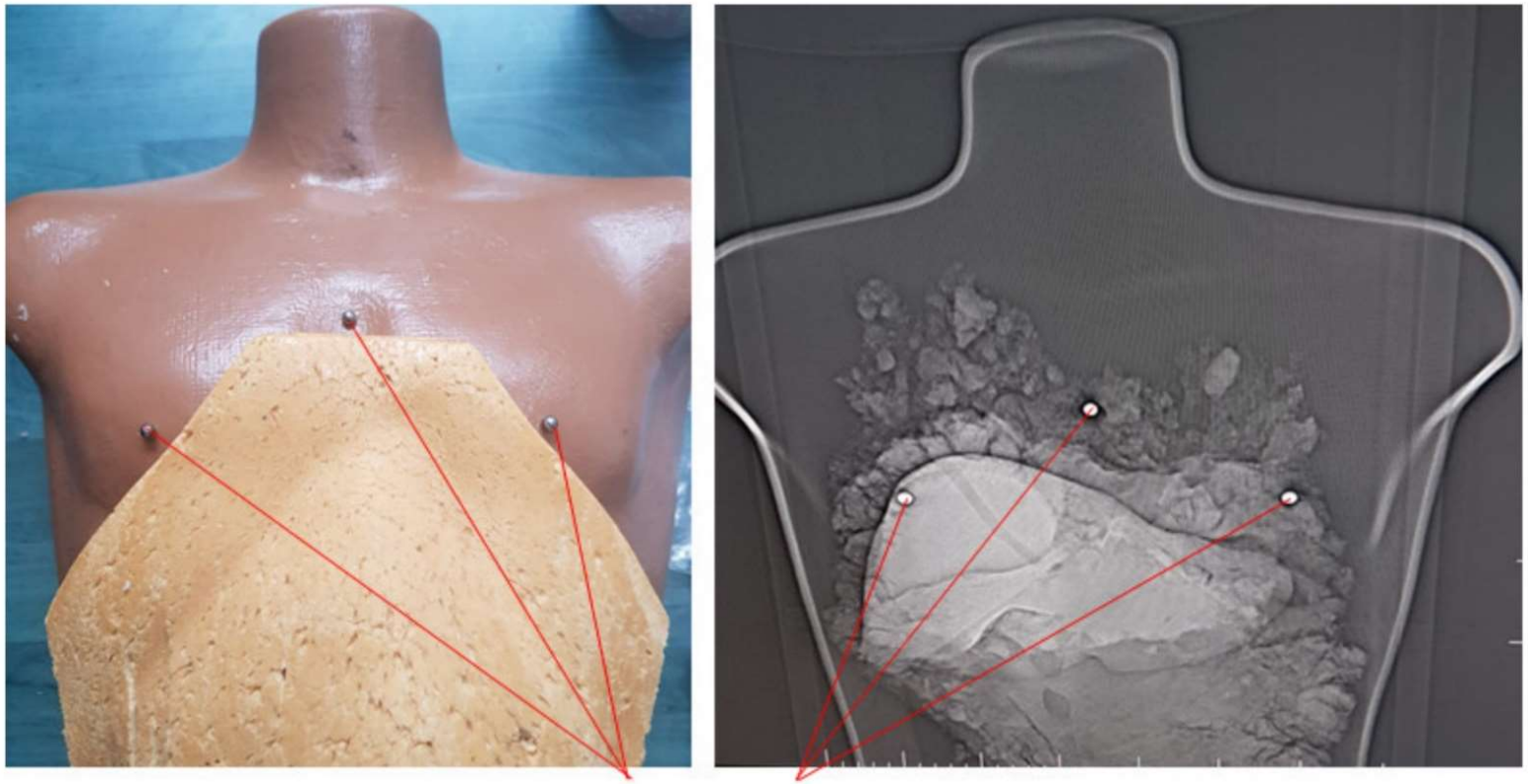
Final CAD design of the automated medical instrument

Patent pending
OSIM, A00806/28.11.2019

HEAL4LIV robotic system under CT guiding (2021)

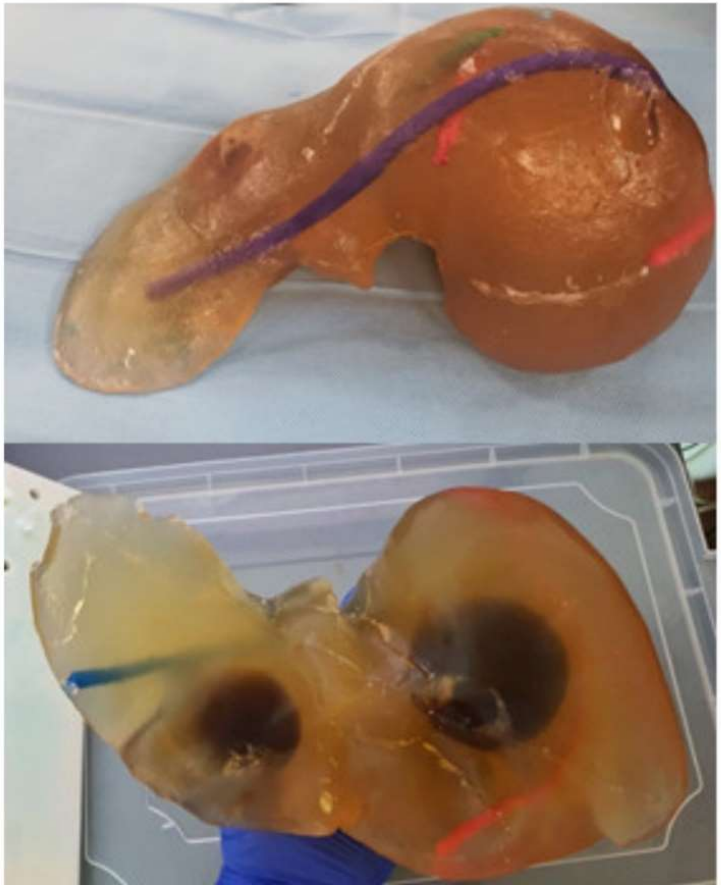


HEAL4LIV robotic system – experimental setup

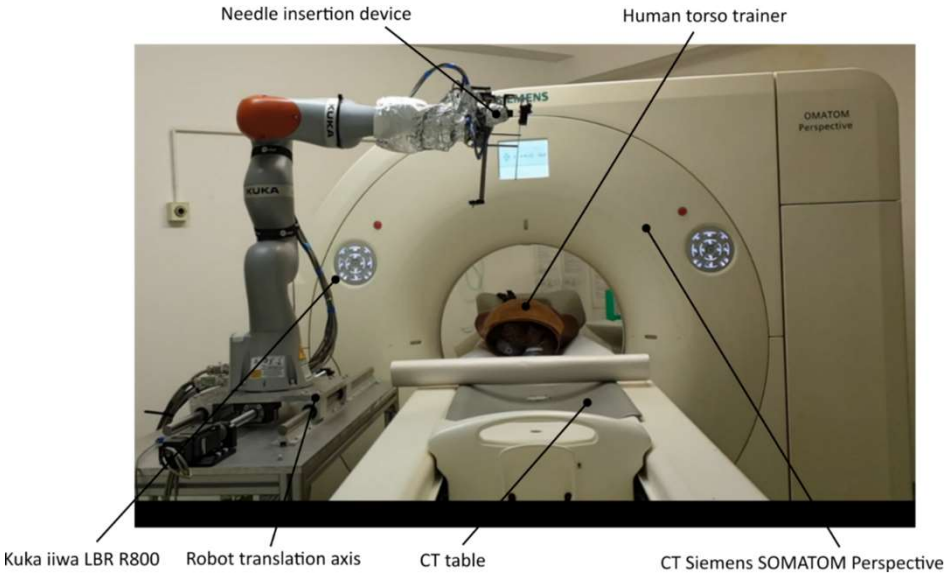


Set of markers highly visible within CT scans

HEAL4LIV robotic system – experimental setup



HEAL4LIV robotic system testing in medical environment (2021)



- The robot is positioned, so that the needle is placed at the insertion point with a predefined trajectory.
- After positioning the robotic system, the insertion tool selects the needle to be inserted.
- The needle is inserted along a linear path to a predetermined depth.
- After inserting the needle, a CT scan is performed for this, the linear axis of translation moves the Kuka robotic system so that the relative position between the Kuka robot and the CT remains constant.
- After confirming the position of the needle through the CT scan, release the therapeutic needle.

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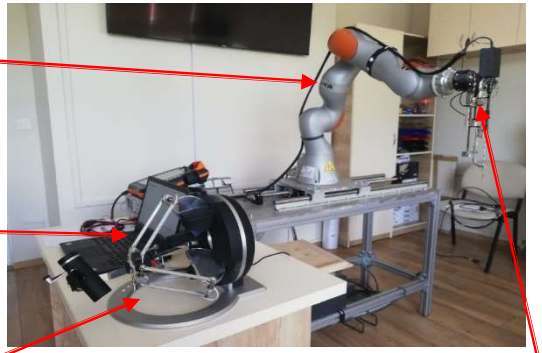
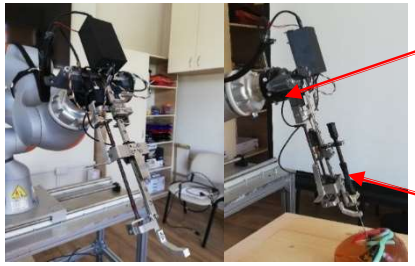
OnTarget project

Teleoperated robotic system for liver cancer treatment (RFA procedure - 2022)



Robotic system components



RFA instrument

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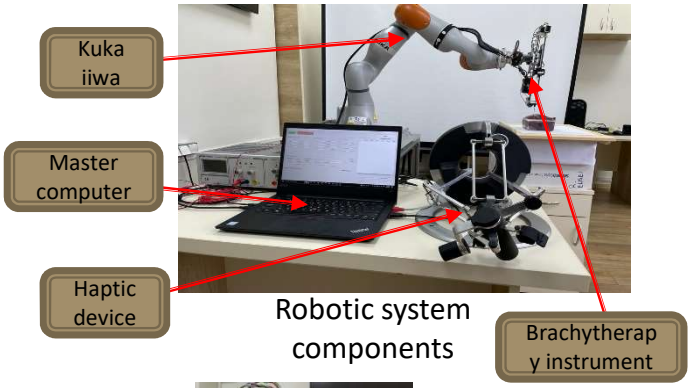
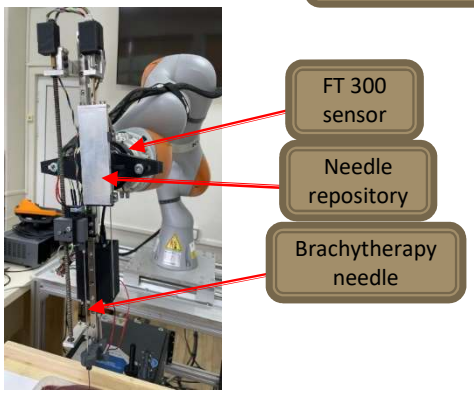
OnTarget project
Teleoperated robotic system for liver cancer treatment
(Brachytherapy procedure -2022)



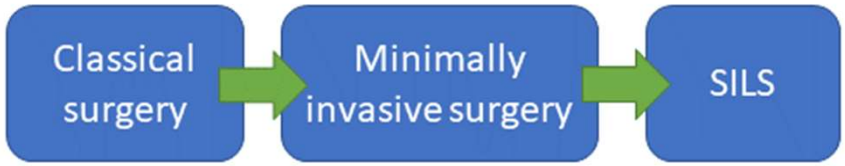
Robotic system components



Brachytherapy instrument

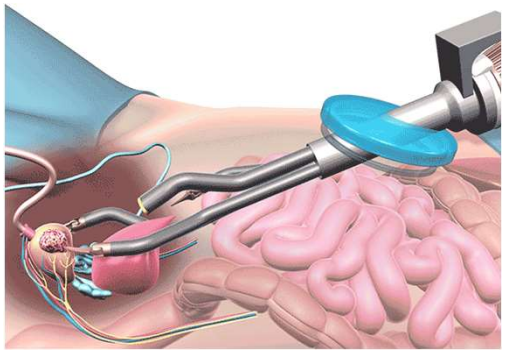
OnTarget project
Teleoperated robotic system used in minimally invasive surgery for liver cancer treatment

CHALLENGE project
Robotic System used in Single Incision Laparoscopic Surgery



Some specific characteristics and advantages of SILS:
Less tissue scarring; Shorter patient recovery time; Reduced bleeding; All instruments are inserted through a single port.

One of its reported drawbacks, namely the limited dexterity of the instruments (due to their proximity) is mitigated in the robotic assisted procedure.



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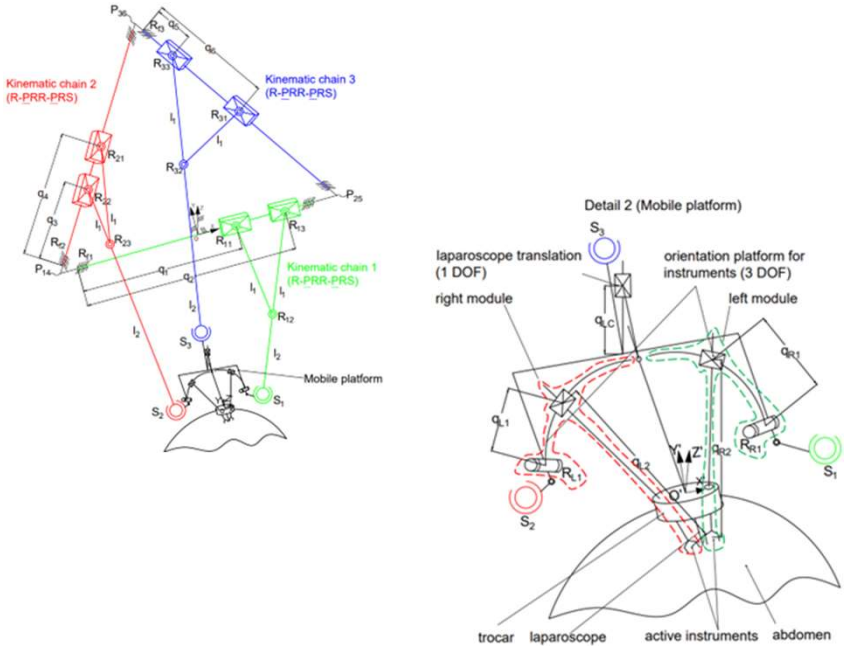
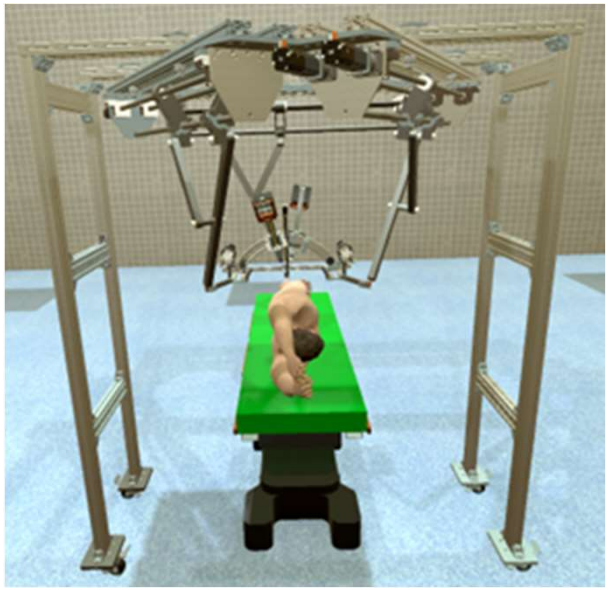
CHALLENGE project
Parallel robotic system for Single Incision Laparosopic Surgery

Kinematic scheme

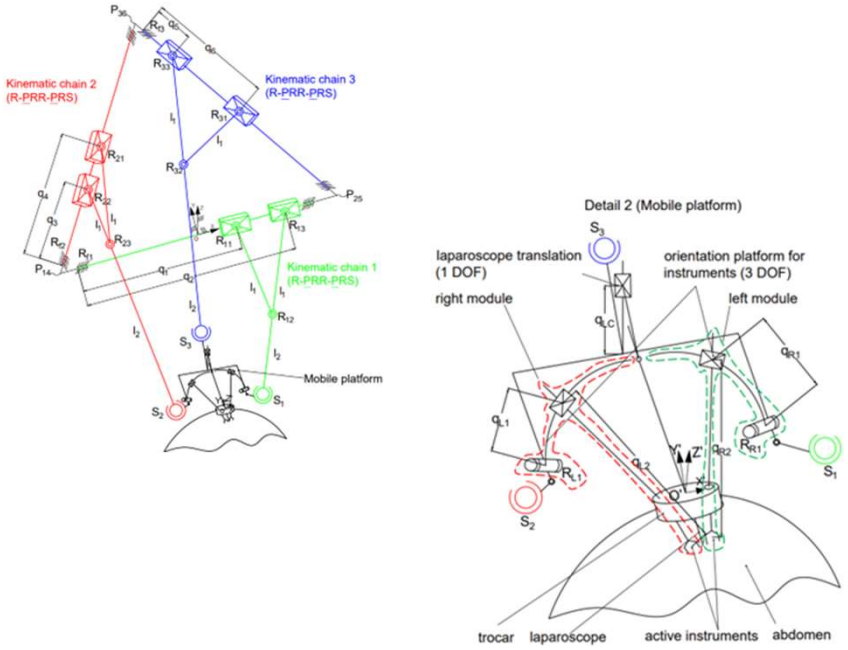


Final design



CHALLENGE project
Parallel robotic system for Single Incision Laparosopic Surgery

Kinematic scheme



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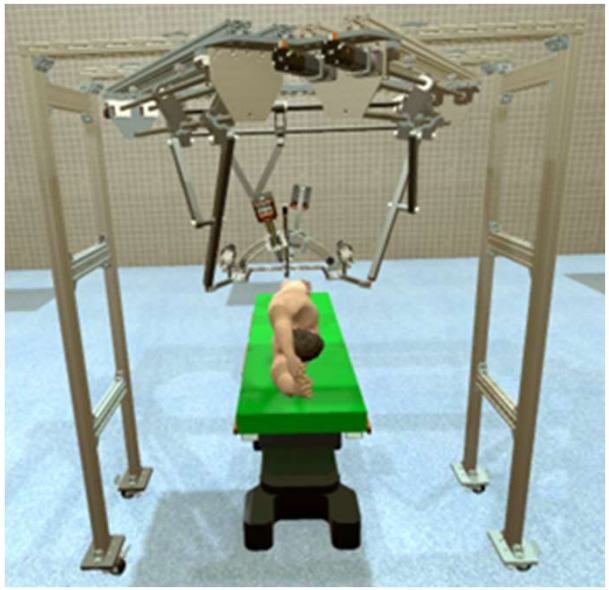

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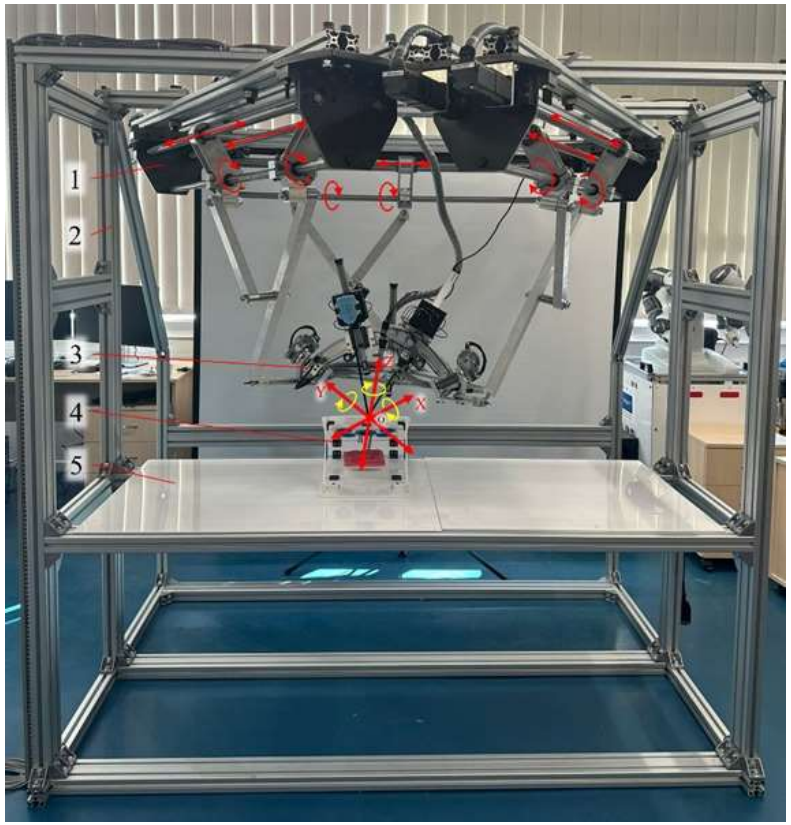
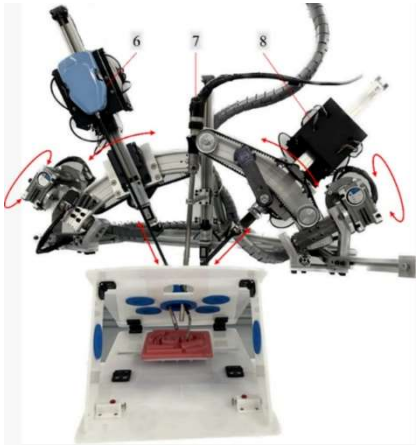
Experimental model
Parallel robotic system for Single Incision Laparosopic Surgery (2023)





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Experimental model
Parallel robotic system for Single Incision Laparosopic Surgery (2023)

CESTER Team












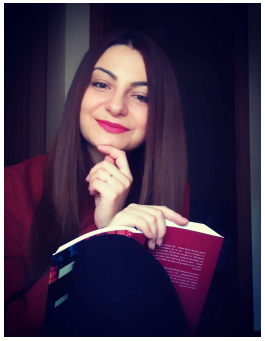

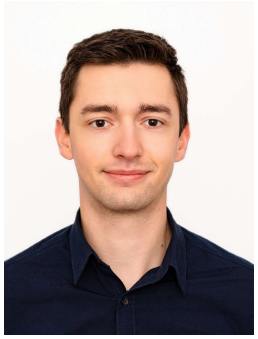


THANK YOU VERY MUCH!

Cluj-Napoca (by night)

Technical University of Cluj-Napoca
Research Center for Robots Simulation and Testing
Memorandumului 28, RO-400114 Cluj-Napoca ROMANIA
E-Mail: doina.pisla@mep.utcluj.ro

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