Robotic Innovations in Support of the Healthcare Workers against COVID-19

DIH-HERO perspective

Asst. Prof. Kosta Jovanović

- email: kostaj@etf.rs
- ETF Robotics Laboratory
- School of Electrical Engineering
- University of Belgrade
• Established 1808 (213 years)
• ~100,000 students
• ~4,800 academic staff
• 31 faculties, 12 research institutes
• ranked between 401st and 500th place (Shanghai University Ranking)

http://www.bg.ac.rs/
University of Belgrade
School of Electrical Engineering

- Established 1948 (73 years)
- ~4,000 students
- ~180 academic staff (105 with Ph.D.)
- ~160 SCI indexed journal papers annually
- ~24,000 graduated students
- B.Sc. 500, M.Sc. 300, Ph.D. 20
  (male : female ratio = 70% : 30%)
- >50 company donations annually

https://www.etf.bg.ac.rs
Research interests:
Physical Robot Collaboration,
Robot Modeling and Control, Soft Robots

Robotic technologies:
Industrial, Service, Medical Robotics
**TOP 3 journal papers in last 2 years:**


**TOP 3 ongoing projects:**

- “A Pan European Network of Robotics DIHs for Agile Production”, Funded by *EU Horizon 2020*, 1/2019 – 6/2023
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TOP 3 ongoing projects:


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About DIH-HERO

- **Project coordinator**: Prof. Stefano Stramigioli

**UNIVERSITY OF TWENTE.**

- **Project duration**: January 2019 – Jun 2023
- **Main project goals**:
  - Support to SMEs in healthcare robotics innovations
  - Create sustainable network of stakeholders in healthcare robotics

[www.dih-hero.eu](http://www.dih-hero.eu)

- **17 Core partners**
- **11 countries**
- **16m € funding**
- **8m € cascade funding**
- **5 (+2) calls for funding**
About DIH-HERO

Project partners:

Clinical innovation triangle:
About DIH-HERO

Cascade Funding for SMEs
Provide funding and mentoring for European SMEs in the open calls.

Business Capital & Incubation
Providing access to public and private funding to help transform innovative ideas into market-ready products.

Testing Facilities & Test Center
Enabling product testing, service testing and validation in specialized labs and/or realistic environments.

Technology
Offering prototyping, research & development, and/or manufacturing expertise to speed-up the development of healthcare robotics.

Certification & Standardization
Helping innovators understand customer segments, regulations and value chains to create a perfect market entry strategy.

Training & Education Services
Providing healthcare professionals and robotic developers access to knowledge resources for competence building.

Cascade Funding for SMEs
Business Capital & Incubation
Testing Facilities & Test Center
Technology
Certification & Standardization
Training & Education Services

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About DIH-HERO

Cascade Funding for SMEs

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DIH-HERO FSTP STRUCTURE

Travel Vouchers
Technology Demonstrators
Technology Transfer Experiments

200x 2€
15x 100€

3 months 3 months 9 months

Cascade Funding
5 (+2) calls for funding

11 countries

12 partners
16m €
8m €
funding

Core partners
funding

From € 6m
Transient to COVID-19 pandemic

- Population lockdown
- Reduced capacities in factories
- Non-Covid-19 hospitals closed
- Clinical rehabilitation impossible
- Surgeries canceled
- Mental challenges due to social distancing
- Everyday activities went digital
- Home = office
- Human-human / human-machine interaction challenges

5 (+2) calls for funding

Provide funding and mentoring of European SMEs in the open call
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Covid-19-related 5 (+2) calls for funding
DIH-HERO open call for industrial projects for robots fighting COVID-19

• Up to 10 projects - 100,000€ funding per project (100% funding rate)

• Call opening: April 10th 2020

• Call deadline: April 17th 2020 (only 1 week!)

• Duration of project: maximum 2-3 months

• 2 main requests from the proposed robotic solutions:
  
  Must clearly state the relevant clinical demand and the healthcare problem related to COVID-19 to be solved by the intended robotic solution

  Must be an already existing technology that is in the later stages of development and deployable by the healthcare end-users in the fight against COVID-19 in project timeframe
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146 applications from 30 different European countries
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Lesson learned:

**technology pull + emerging scenario are key drivers to innovations**
Major application domains

- **Diagnostic Robotics**: human function analysis and signal monitoring; automated medical imaging; AI-based decision making
- **Interventional Robotics**: surgical robotics; doctor and patient side interfaces
- **Rehabilitation Robotics**: exoskeletons; stationary or mobile training devices; prosthesis and orthosis
- **Robotics supporting patients**: robot assistants; functional support robots; communication and social robots
- **Robotics supporting healthcare professionals**: cleaning and disinfection robots; robots in logistics and hospital workflow optimization
COVID-19 industrial projects per robotics application domains

- Diagnostic Robots
- Rehabilitation Robots
- Robots supporting Healthcare Professionals
- Interventional Robots
- Robots supporting Patients
COVID-19 industrial projects per robotics application domains

- Diagnostic Robots: 29
- Rehabilitation Robots: 1
- Robots supporting Healthcare Professionals: 1
- Interventional Robots: 1
- Robots supporting Patients: 1

64 submitted, 7 granted
COVID-19 industrial projects per robotics application domains

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<tr>
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<td>Autonomous robots for disinfection (ARODIS)</td>
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**Lesson learned:**

Technology that requires immediate human-robot interaction can not be quickly deployed with current safety and regulation measures.
Diagnostics robotics in COVID-19

**Expected applications:**

- autonomous operations of the diagnostic equipment
- robotic laboratory setup (diagnostic samples handling)
- robots for vital signs monitoring

**Prospective impact to healthcare:**

- reduce workload of healthcare professionals
- increase performance
- reduce physical interaction

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Impact to COVID-19 treatment timeline:

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Severe Covid-19 Treatment Timeline

Diagnostic Robots

29 applications
0 grants

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Interventional robotics in COVID-19

Expected applications:

• robotics surgery
• robotics vaccination
• (semi-)automated ventilation

Prospective impact to healthcare:

• less invasive surgery
• shorten recovery time
• reduce physical interaction (remote interventions)
• reduced pressure to hospitals

impact to COVID-19 treatment timeline:

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Severe Covid-19 Treatment Timeline

Interventional Robots
Rehabilitation robotics in COVID-19

**Expected applications:**

- home training and rehab devices
- tailored exercise programs and devices with remote monitoring
- training for recovery of severe COVID-19 patients

**Prospective impact to healthcare:**

- prevention of the virus spreading at rehabilitation centers
- continuation of the rehabilitation activities in lockdown conditions
- continue to overall health, rehabilitation and prevention and reduce pressure to hospitals

**Impact to COVID-19 treatment timeline:**

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Severe Covid-19 Treatment Timeline
Robotics supporting patients in COVID-19

Expected applications:

- social robots for isolated patients and nursing homes
- robots for personal assistance / logistics

Prospective impact to healthcare:

- improve emotional well-being of isolated individuals/patients
- reduce workload of healthcare professionals
- reduce physical interaction and virus spreading

impact to COVID-19 treatment timeline:

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Robotics supporting healthcare professionals in COVID-19

Expected applications:

- cleaning and disinfection robots
- hospital logistics robots
- healthcare professional assistance robots

Prospective impact to healthcare:

- reduce workload of healthcare professionals
- reduce virus spreading

Impact to COVID-19 treatment timeline:

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Robotics supporting healthcare professionals in COVID-19

Lesson learned:
Technology adoption depends on the trust of the users much more than the confidence of the technology providers

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COVID-19 industrial projects per robotics application domains

Prevention | Diagnosis | Hospital Admission | Respiratory Intervention | Rehabilitation

Severe Covid-19 Treatment Timeline

Diagnostic Robots

Interventional Robots

Rehabilitation Robots

Robots supporting patients

F&P Robotics

Robots supporting healthcare professionals

Rubedo Sistemos

KELO Robotics

ACCREA Engineering

Alsea Robotics

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Metrallabs

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COVID-19 industrial projects per robotics application domains

Lesson learned:
Robotic technologies are already mature enough to quickly adapt and contribute to all stages of disease treatment: prevention, diagnosis, hospital admission, intervention, rehabilitation.
Robotics has made impact to COVID-19 and vice-versa

Robotics innovations and applications never seen (or seen less important) before COVID-19:

- identification and disinfection of critical environments
- detecting the disease (swab sampling, detecting chemical indicators)
- monitoring social/physical distancing
- providing and monitoring remote care and rehabilitation
- promoting social interaction for isolated patients
- supporting remote work and telepresence
- delivering automated vaccination
- delivering medical supplies to hospitals and goods to persons at remote home
Lessons learned

Application of robots in COVID-19 emerging scenario (reduced-barrier scenario) showcased:

- technology pull + emerging scenario are key drivers to innovations
- technology that requires immediate human-robot interaction can not be quickly deployed with current safety and regulation measures
- technology adoption depends on the trust of the users much more than the confidence of the technology providers
- robotic technologies are already mature enough to quickly adapt and contribute to all stages of disease treatment: prevention, diagnosis, hospital admission, intervention, rehabilitation.

- robots deployment in everyday living environments and operation with unskilled general population, impose challenges that need to be resolved
- robots in the regulated fields of healthcare and public safety raise ethical, safety, and reliability concerns that also need to be carefully considered
Related reading materials


Should you have any further questions, please do not hesitate to contact me!

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11000 Belgrade, Serbia
E-mail: kostaj@etf.rs
Group: robot.etf.rs
Project: www.dih-hero.eu

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